CALIFORNIA
ENERGY COMMISSION

California Energy Commission

STAFF REPORT

Electric Program Investment Charge 2020 Annual Report

Appendices A-C

Gavin Newsom, Governor

April 2021 | CEC-500-2021-029-AP

APPENDIX A:
CEC EPIC Reporting Requirements for 2020

The California Energy Commission (CEC) is committed to full compliance with all EPIC reporting and informational requirements. The following table (A-1) lists all CEC EPIC reporting and informational requirements for Calendar Year 2020.

Table A-1: Energy Commission EPIC Reporting and Informational Requirements for Calendar Year 2020

Energy Commission Requirement	Status	Anticipated Completion Date
A. Annual Report: CPUC D.12-05-037, Ordering Paragraph (OP) 16, requires EPIC administrators to file an annual report each year on February 28, 2013 – February 28, 2020 with the Director of the Commission's Energy Division. This requirement in D.12-05-037 has expired. However, Public Resources Code section 25711.5 (f) continues to require the CEC to prepare and submit an EPIC Annual Report to the Legislature and CPUC D.13-11-025, OP 29, requires the CEC to submit copy of this report to the CPUC. The EPIC Annual Report is due to the Legislature no later than April 30 of each year. Consistent with Rule 16.6 of the CPUC Rules of Practice and Procedure, on February 3, 2021, the CEC submitted a letter to the CPUC Executive Director proposing to submit the 2020 EPIC Annual Report and subsequent EPIC Annual Reports to the CPUC on April 30 of each year, starting on April 30, 2021. This letter was also served on the EPIC proceeding service list. The CPUC Executive Director has granted the CEC's request to submit the EPIC 2020 Annual Report on or before April 30, 2021.	This annual report has been prepared in accordance with applicable CPUC reporting requirements and will be submitted to the CPUC in accordance with D.13-11-025 after CEC adoption at a Business Meeting.	On or before April 30, 2021

Energy Commission Requirement	Status	Anticipated Completion Date
B. Service: CPUC D. 12-05-037, OP 16, requires service of the annual report on all parties in the most recent EPIC proceeding; all parties to the most recent general rate case of each IOU; and each successful and unsuccessful applicant for an EPIC funding award during the previous calendar year.	This annual report will be served on all parties in the most recent EPIC proceeding; all parties to the most recent general rate case of each IOU; and each successful and unsuccessful applicant for an CEC EPIC funding award during the previous calendar year.	On or before April 30, 2021

Energy Commission Requirement	Status	Anticipated Completion Date
C. Information Availability: CPUC D.13-11-025, OP 13, requires EPIC administrators, except when valid reasons exist for confidentiality, to make all data, findings, results, computer models and other products developed through EPIC available upon request consistent with the treatment of intellectual property requirements.	The CEC has and will continue to respond to all requests for information in accordance with any confidentiality requirements and consistent with the treatment of intellectual property requirements. Requests can be sent to erdd@energy.ca.gov.	As requested
D. Project Reporting: CPUC D.13-11-025, OP 14, requires annual reports to include a final report for every project completed during the previous year, including a comprehensive description of the project, detailed findings and results, a summary of all data collected, and how the data may be accessed.	Table 15 in Chapter 3 of this annual report entitled Completed Electric Program Investment Plan Funded Projects in 2020, contains information regarding projects completed in 2020.	On or before April 30, 2021

Energy Commission Requirement	Status	Anticipated Completion Date
E. Awards: CPUC D. 13-11-025, OP 15, requires annual reports to identify the use of noncompetitive awards.	Appendices B and C to this report identify the use of any non-competitive awards.	On or before April 30, 2021
F. Project Reporting: CPUC D.13-11-025, OP 17, requires annual reports to include project-level information on the number of bidders passing the initial pass/fail screening; the rank of the selected bidder; and if the selected bidder was not the highest scoring bidder, the project status report must also explain why a lower scoring bidder was selected.	Appendices B and C to this annual report contain project-level information on passing/failed bidders, rank of selected bidder, and an explanation if selected bidder was not highest scoring bidder.	On or before April 30, 2021
G. Project Reporting: CPUC D.13-11-025, OP 18, requires a justification for contracts or grants exempted from competitive bidding. Additionally, CPUC D. 18-10-052, pages 22-23, states that administrators should include a detailed explanation for the use of non-competitive processes.	Appendix B to this annual report includes a justification for any non-competitive awards for active or approved projects in 2020.	On or before April 30, 2021

Energy Commission Requirement	Status	Anticipated Completion Date
H. Annual Report: CPUC D. 13-11-025, OP 22, requires that the annual report follow the outline specified in Attachment 5 thereto.	This annual report follows the outline as specified in D.13-11-025, Attachment 5.	On or before April 30, 2021
I. Annual Report: CPUC D. 13-11-025, OP 23, requires the information in Attachment 6 thereto to be included as an electronic spreadsheet to report on projects described in section 4.b. of the annual report outline in CPUC D. 13-11-025, Attachment 5.	A project status report electronic spreadsheet detailing the information required under CPUC D. 13-11-025, Attachment 6, is included as Appendix C to this annual report and will be filed and served in electronic spreadsheet format as well.	On or before April 30, 2021
J. Annual Report: CPUC D. 13-11-025, OP 27, requires the annual report to identify the metrics used for each project, either from CPUC D. 13-11-025, Attachment 4, or additional metrics where appropriate.	Appendices B and C to this annual report identify the applicable metrics used for each project.	On or before April 30, 2021

Energy Commission Requirement	Status	Anticipated Completion Date
K. Information Availability: CPUC D. 13-11-025, OP 29(b), requires that, at the CPUC's request, the CEC give the CPUC full access rights to all EPIC research, development, and demonstration, reports, intellectual property (IP), and data to which the CEC has access, with appropriate protections for proprietary data and IP against public disclosure.	The CEC remains able and willing to comply with any CPUC requests pursuant to this requirement. Requests can be sent to ERDD@energy.ca.gov.	As requested.
L. Information Availability: CPUC D. 13-11-025, page 64, encourages the CEC to make its annual reports accessible to the public on its EPIC webpage and through its public advisor.	The CEC posts its EPIC annual reports on its EPIC webpage and makes its reports available through its public advisor's office.	On or before April 30, 2021
M. Project Reporting: CPUC D. 15-04-020, OP 6, requires the identification of any specific CPUC proceedings addressing issues related to each EPIC project.	Appendix B of this annual report identifies applicable CPUC proceedings for each project.	On or before April 30, 2021

Energy Commission Requirement	Status	Anticipated Completion Date
N. Joint Project Reporting: CPUC D. 15-04-020, OP 24, requires that if there are joint IOU and CEC projects, the IOU shall report the project title and amount of IOU funding used for the joint project(s) and the CEC shall be responsible for all other substantive reporting.	Appendix C provides all substantive reporting for CEC EPIC projects, including any joint IOU and CEC projects.	On or before April 30, 2021
O. Project Reporting: CPUC D. 15-04-020, page 53, requires that if an IOU administrator chooses to be a necessary partner on an CEC EPIC project, the IOU may use its EPIC funds for in-house costs and the IOU's reports shall identify the CEC project title and amount of IOU funding used, but the CEC shall be responsible for all other substantive reporting as with all its other projects.	Appendix C provides all substantive reporting for CEC EPIC projects, including any projects where an IOU is a necessary partner.	On or before April 30, 2021

Energy Commission Requirement	Status	Anticipated Completion Date
P. Annual Report to Legislature: Public Resources Code § 25711.5(f) requires an annual report to the Legislature. The annual report must contain all information as described in § 25711.5(f)(1)-(7) as follows: (1) A brief description of each project for which funding was awarded in the immediately prior calendar year, including name of the recipient, award amount, a description of how the project is thought to lead to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals, and a description of why the project was selected. (2) A brief description of each EPIC funded project that was completed in the immediately prior calendar year, including recipient name, award amount, and project outcomes. (3) A brief description of each funded project for which an award was made in the previous years but that is not completed, including recipient name, award amount, and a description of how the project will lead to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals. (4) Identification of award recipients that are California-based entities, small businesses, or businesses owned by women, minorities, or disabled veterans. (5) Identification of which awards were made through a competitive bid, interagency agreement, or sole source method, and any action of the Joint Legislative Budget Committee for each award made through an interagency agreement or sole source method. (6) Identification of the total amount of administrative and overhead costs incurred for each project. (7) A brief description of the impact on program administration from the low-income and disadvantaged community allocations required under Public Resources Code § 25711.6, including any information that would help the Legislature determine whether to reauthorize those allocations beyond June 30, 2023.	This annual report identifies the required information in Public Resources Code § 25711.5(f)(1)-(7) and will be provided to the Legislature after CEC adoption at a Business Meeting.	On or before April 30, 2021

Energy Commission Requirement	Status	Anticipated Completion Date
Q. Annual Report to Legislature: CPUC D.13-11-025, OP 29, requires that the annual report prepared and submitted to the Legislature pursuant to Public Resources Code § 25711.5, also be submitted to the CPUC.	The annual report prepared and submitted to the Legislature pursuant to Public Resources Code § 25711.5(f) will be submitted to the CPUC upon submittal to the Legislature.	On or before April 30, 2021
R. Follow-on Funding Reporting: The Budget Act of 2020 (Senate Bill 115, Committee on Budget and Fiscal Review, Chapter 40, Statutes of 2020) requires the annual reports for 2020 and 2021 identify the projects that received follow-on funding, the amount of follow-on funding each project received, and the method and criteria that was used for their selection.	This annual report identifies requirements per the Budget Act of 2020 (SB 115). The report will be provided to the Legislature and CPUC after CEC adoption at a Business Meeting.	On or before April 30, 2021

Source: California Energy Commission

APPENDIX B:
CEC EPIC Project Write-Ups for 2020 Active, Completed, or Terminated Projects

Appendix B provides project write-ups for the projects that had the following status during 2020: active, completed, or terminated (with EPIC funds spent). Each project write-up includes and expands upon the following information required in Attachment 5 to CPUC Decision 13-11-025:

- Investment Plan Period (included in Investment Plan)
- Assignment to Value Chain
- Objective (included in Project Description)
- Scope (included in Project Description)
- Deliverables (included in Project Description)
- Metrics
- Schedule (included in Project Term)
- EPIC Funds Encumbered
- EPIC Funds Spent
- Partners (if applicable)
- Match Funding (if applicable)
- Match Funding Split (if applicable)
- Funding Mechanism (if applicable)
- Treatment of Intellectual Property (if applicable)
- Status Update

Additional items provided in each project write-up include:

- Program Area and Strategic Objective
- Issue
- How the Project Leads to Technological Advancement or Breakthroughs
- CPUC Proceedings Addressing Issues Related to this EPIC Project
- Total Budgeted Administrative and Overhead Costs
- Number of Initial Passing Applicants/Bidders
- Rank of Selected Applicant/Bidder
- Explanation of selection if not highest scoring applicant/bidder

Project Name: 300-15-004 - Optimizing Hydropower Operations While Sustaining Stream Temperatures and Ecosystem Functions

Recipient/Contractor: The Regents of the University of California on behalf of the Merced Campus

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 4/1/2016 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

California has traditionally depended heavily on hydropower as a flexible generation source. However, a warming climate will alter the magnitude and timing of precipitation and runoff, decreasing hydropower generation. Optimization models have been used as a tool to explore ways to maximize hydropower generation and revenue. However, these models do not address the realities of a warming climate and other generation constraints, such as required downstream water temperatures or flow levels. This project is developing an optimization model that addresses the economic and environmental constraints on hydropower generation, as well as the legal limitations on these operations.

Project Description:

This project is part of the U.S.-China Clean Energy Research Center for Water-Energy Technologies (CERC-WET), co-funded by the U.S. Department of Energy and China. This project is one of several EPIC-funded research endeavors addressing sustainable hydropower under a warming climate. The project develops an optimization model to ensure efficient hydropower operations, but this model will differ from existing models by taking into account different climate scenarios and environmental and regulatory constraints.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Prior studies of the trade-offs between electricity generation and environmental protection have been based on models that do not take real-world policy constraints such as legal and regulatory limitations into account. Additionally, this research will create models to optimize hydropower generation that account for changes in precipitation and runoff due to a warming climate while sustaining downstream environments. These tools will inform decision-making in the context of trade-offs of electricity generation and environmental protection under both a changing climate and relevant legal and regulatory constraints.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed> Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Strategies and Guidance for Climate Change Adaptation: R.18-04-019 Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 2a, 3a, 3f, 4d, 5c

Lower Costs: Hydropower generation in California represents a low-cost source of clean energy and ancillary services. Reduced levels of hydropower generation forces investor owned utilities to rely on more expensive energy sources; these costs result in upward pressure on electricity rates. The model developed through this project can assist hydropower operators to maximize electricity generation (and revenue) while addressing environmental requirements in light of reduced stream flows due to a warming climate.

Greater Reliability: As noted above, hydropower is a low-cost source of clean electricity. Maximizing hydropower production while ensuring environmental protection in a warming climate can reduce the state's reliance on other sources of electricity that are more expensive, have greater greenhouse gas emissions, and are potentially less reliable. In addition, greater penetration of renewable energy in California's electricity grid relies in part on ancillary services from hydropower. Maximizing hydropower production while ensuring environmental protection can facilitate greater penetration of renewable energy into the state's grid.

Environmental Benefits: Hydroelectricity is a critical element of the state's electricity system because it is a low cost, flexible source of electricity. The negative effects of hydropower dams and reservoirs on aquatic environments, however, are well-documented. A critical environmental requirement that directly affects hydropower generation is the mandated quality of water discharged downstream to maintain aquatic ecosystems. This project is developing a decision support tool to balance hydropower generation and environmental protection in a warming climate.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$114,054

EPIC Funds Encumbered:

$650,000

EPIC Funds Spent:

$510,163

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

United States Department of Energy: $12,500,000

Leveraged Funds:

$12,500,000

Funding Method:

Non-competitive

Funding Mechanism:

Contract-Interagency agreement (Exempt)

No. of Initial Passing Applicants/ Bidders:

N/A

Rank of Selected Applicant/ Bidder:

N/A

If not the highest scoring applicant/bidder, explain why selected:

This interagency agreement (non-competitive) leveraged significant federal funds.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement 300-15-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The researchers have developed a hydropower optimization-modeling framework that considers institutional and physical constraints placed on hydropower operations. The modeling framework links energy and hydrologic models as well as permit requirements for hydropower facilities in the Upper San Joaquin, Merced, Tuolumne, and Stanislaus rivers under various climate change and management scenarios. In 2020, there has been significant progress in improving this open source model. To identify impacts at a scale relevant to facility operations, the researchers are developing and running sequences of shorter climatic periods to replicate extended droughts and various combinations of wet and dry periods. The researchers are developing and running management scenarios such as meeting flow requirements as well as simulating energy prices for 2009 and 2045. This work is on schedule for completion by March 2021.

Project Name: 300-15-005 - Improving Hydrologic and Energy Demand Forecasts for Hydropower Operations with Climate Change

Recipient/Contractor: The Regents of the University of California, Irvine Campus

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 4/1/2016 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

Hydropower is an important source of clean electricity generation in California. Its significance will grow as it is needed to complement the intermittent nature of wind and solar generation units. At the same time, due to climate change most likely altering the amount and variability of precipitation, there is a need to improve management of hydropower facilities through such tools as improved short-term forecasting.

Project Description:

This project is part of the U.S.-China Clean Energy Research Center for Water-Energy Technologies (CERC-WET), co-funded by the U.S. Department of Energy and China. The main focus of this research project is to develop grid-wide forecasts of inflows and electricity demands based on ground sensors and remotely sensed data, with emphasis on the effects from temperature fluctuations on electricity demands, hydrologic conditions, and grid performance. Furthermore, the project improves the accuracy of an existing near real-time Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks (PERSIANN) product, originally developed at UC Irvine's Center for Hydrology and Remote Sensing.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The advancement of tools for hydropower scheduling and prediction will facilitate power exchanges in the electricity markets, reduce unnecessary consumption of non-renewable energy sources, and increase the reliability of energy generation. California will be the study region, helping inform California utilities in the management of hydropower resources.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Strategies and Guidance for Climate Change Adaptation: R.18-04-019 Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 3f, 5c

Greater Reliability: More accurate and current information on streamflow will contribute to the increased confidence and higher efficiency of hydropower scheduling decisions generated by reservoir and hydropower dispatch models.

Environmental Benefits: The improved accuracy of an existing near real-time PERSIANN tool will enable more efficient management of clean energy resources in California and will lead to improved resilience of water and energy systems to future climate change impacts. Improved hydropower management methodology will incorporate ecologically beneficial metrics for ecosystems to minimize adverse ecosystem impacts from the electricity generation.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$144,000

EPIC Funds Encumbered:

$720,000

EPIC Funds Spent:

$604,475

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

United States Department of Energy: $12,500,000

Leveraged Funds:

$12,500,000

Funding Method:

Non-competitive

Funding Mechanism:

Contract-Interagency agreement (Exempt)

No. of Initial Passing Applicants/ Bidders:

N/A

Rank of Selected Applicant/ Bidder:

N/A

If not the highest scoring applicant/bidder, explain why selected:

This interagency agreement (non-competitive) leveraged significant federal funds.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement 300-15-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Hydropower scheduling, particularly in a short-term time frame is one of the most crucial issues in reservoir operation and clean energy supply. This research project will provide decision makers with information for short-term hydropower scheduling and improve the efficiency and reliability of hydropower forecasts. The research team is continuing work to develop short-term precipitation forecasting framework for key regions in California with a lead time of up to 6 hours. In addition, the team designed a new framework to allow forecasting cloud-top brightness temperatures and facilitate the generation of the spatial-temporal information that can be extrapolated for the future precipitation events. Researchers are currently testing multiple GMT algorithm settings for both benchmark data and real-case studies, and is on schedule for completion by March 2021.

Project Name: 300-15-006 - Optimizing Use of Non-traditional Waters, Drought Proofing the Electricity System and Improving Snowpack Prediction

Recipient/Contractor: The Regents of the University of California, on behalf of the Los Angeles Campus

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 4/1/2016 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

This project addresses three critical needs for the State of California: (1) Non-traditional waters are available in abundant quantities, but they cannot be used for most industrial, agricultural and municipal applications without the development of new approaches to manage contaminants; (2) Impacts of water conservation on power plants reliant on water for operation; and (3) Stream flow forecasts to date are considered inaccurate and pose a risk of misstating California water supply. Research is needed to illuminate which method or combination of methods will substantially improve forecasting skills and can be used in practical applications.

Project Description:

This project funds research to reduce the stress on current water infrastructure in California. Research includes: (1) development of high-volume water recovery desalination processes for non-traditional waters, (2) characterizing the potential for non-traditional water use in California, (3) development of recycled water scenarios for use electricity generators and direct potable reuse(DPR) to offset other water sources, and (4) improving the characterization of California's snowpack.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project develops flexible, integrated approaches that can reduce energy use and costs associated with the use of non-traditional waters, and minimize the volume of wastewater produced from their treatment. In addition, guidance to be provided on the "best-fit" technologies for California based on geographic area, energy resources and water quality available. Additional research will provide reliability benefits including improving water-forecasting scenarios pertaining to recycled water for electricity generation and snowpack forecasting for hydropower operations.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Water-Energy Nexus: R.13-12-011 <Closed> Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1h, 3a, 4a, 4c, 4d, 5a, 5c

Lower Costs: Implementation of project recommendations in the study could provide lower energy costs associated with the treatment of non-traditional waters.

Greater Reliability: This project could provide greater reliability by improving forecasting methods used to predict water resource availability for electricity generation.

Environmental Benefits: By reducing energy costs associated with treatment of non-traditional water, the project could increase use of this currently wasted resource, especially near the generation source. This could reduce greenhouse gas emissions associated with conveyance and transporting of potable water sources to communities.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$198,000

EPIC Funds Encumbered:

$1,130,000

EPIC Funds Spent:

$515,226

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

United States Department of Energy: $12,500,000

Leveraged Funds:

$12,500,000

Funding Method:

Non-competitive

Funding Mechanism:

Contract-Interagency agreement (Exempt)

No. of Initial Passing Applicants/ Bidders:

N/A

Rank of Selected Applicant/ Bidder:

N/A

If not the highest scoring applicant/bidder, explain why selected:

This interagency agreement (non-competitive) leveraged significant federal funds.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement 300-15-006 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Draft report is under development.

- market characterization of non-traditional waters: finalizing assessment of sources of nontraditional waters including identification of water systems affected by drought, and providing a list of treatment technologies and associated energy costs.
- recycled water scenarios for direct potable reuse (DPR): Results show that switching to DPR could increase local treatment energy by a factor of 3 but using DPR to offset more energy intensive water supplies will result in a net savings.
- characterization of snowpack and snowmelt: results are ongoing and information sharing continues; the real-time snow-water-equivalent diagnostic models for the hydropower plants were completed.
- high-volume water recover desalination: completed testing bench-scale membrane performance

Project Name: 300-15-007 - Project 1 - California Sustainable Energy Entrepreneurial Development (CalSEED) Initiative

Recipient/Contractor: California Clean Energy Fund dba CalCEF Ventures

Investment Plan: 2012-2014 Triennial Investment Plan, 2015-2017 Triennial Investment Plan

Project Term: 4/20/2016 to 3/1/2023

Program Area and Strategic Objective:

Applied Research and Development

S10: Leverage California's Regional Innovation Clusters to Accelerate the Deployment of Early Stage Clean Energy Technologies and Companies, S10: Advance the Early Development of Breakthrough Energy Concepts.

Issue:

Clean energy entrepreneurs have trouble securing very early stage funding for potential breakthrough technologies even if those technologies would merit significant follow-on funding after the proof-of-concept is completed. Additionally, entrepreneurs with technology concepts often do not have adequate access to the mentoring, technical consulting, and business services that they need to successfully bring their technology to market.

Project Description:

The CalSEED Initiative helps develop California's next generation of clean energy entrepreneurs, providing seed funding as well as mentoring, technical consulting, and business development services to support energy entrepreneurs and research teams in their quest to develop breakthrough solutions that will benefit electric ratepayers in Pacific Gas and Electric, Southern California Edison, and San Diego Gas & Electric service territories. Entrepreneurs receive funding in two stages. Concept Awards provide funding of up to $150,000 and are conducted through open solicitations; Prototype Awards provide funding of up to $450,000, but are only available to companies who have received a Concept Award.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

By providing inherently low cost, safe, and compact energy storage using only earth-abundant, non-toxic materials, Noon's new battery technology promises an ideal solution to behind-the-meter, long duration storage for California ratepayers and to fulfilling California's state mandate of 100 percent carbon-free electricity by 2045. Noon Energy's new battery uses ultra-low-cost storage media ($1 per kWh capacity) and can match the high energy efficiency of lithium-ion technology. At long storage duration capacity, this new battery enables very low system-level storage cost below $20 per kWh capacity, 80 percent round trip energy efficiency, and double the system-level energy density of today's lithium-ion batteries.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed> Smart grid: R.08-12-009 <closed> Smart Inverter: D.14-12-035 (in R.11-09-011) Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 2a, 3e

Economic Development: The CalSEED Initiative fills important niche in the energy innovation space by providing initial small grant funding to energy entrepreneurs to prove out their technology concept. The results can be used to attract private sector interest and funding for their energy technology venture. In total, CalSEED awardees have leveraged their grants to raise an additional $65.8M in follow on funding from public and private sources.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$1,563,250

EPIC Funds Encumbered:

$30,000,000

EPIC Funds Spent:

$12,077,796

Match Partner and Funding Split:

California Clean Energy Fund dba CalCEF Ventures: $1,367,604 (4.1 %)

Elemental Excelerator: $100,000 (0.3 %)

The Grant Farm, Inc: $267,591 (0.8 %)

Los Angeles Cleantech Incubator: $1,040,000 (3.1 %)

Greenlining Institute: $68,700 (0.2 %)

Umberg Zipser: $552,328 (1.7 %)

Match Funding:

$3,396,223

Leverage Contributors:

U.S. Department of Commerce: $499,608

U.S. Department of Commerce: $250,000

Leveraged Funds:

$749,608

Funding Method:

Competitive

Funding Mechanism:

Contract

No. of Initial Passing Applicants/ Bidders:

5 out of 7 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement 300-15-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, grants totaling over $7 million have been awarded to 34 entrepreneurs throughout the State for a range of projects including a low-cost, high performance hydrogen electrolyzer and a transparent solar control coating that can be painted directly onto rough surfaces and achieve a 50 percent reflection in heat energy. Almost 100 entrepreneurs have been awarded $150,000 small grants under CalSEED - constituting $21,450,000 awarded in total - with $5.4 million of that amount awarded to underrepresented groups. Ten Prototype Awards for an additional $450,000 each have been awarded under CalSEED - given as follow-on funding to CalSEED entrepreneurs whose technologies have the strongest impact and commercial potential.

Project Name: 300-15-009 - Connecting Emerging Energy Technologies and Strategies to Market Needs and Opportunities

Recipient/Contractor: Navigant Consulting, Inc.

Investment Plan: 2012-2014 Triennial Investment Plan, 2015-2017 Triennial Investment Plan

Project Term: 6/13/2016 to 3/31/2021

Program Area and Strategic Objective:

Market Facilitation

S18: Guide EPIC Investments through Effective Market Assessment, Program Evaluation, and Stakeholder Outreach

Issue:

Emerging energy technologies sometimes fail to be commercialized because of difficulty entering the market, inability to find an optimal first customer, and inability to the address what end users actually want. To become viable in the market place, companies need market knowledge and support to develop products that meet customer needs, are cost competitive compared to existing products, and have viable path-to-market strategies that target appropriate early adopters.

Project Description:

This contract will provide market analysis that will address the barriers that hamper commercial development of emerging energy technologies. Tasks under this work authorization contract could include tracking past and current award EPIC technology solutions to monitor successes, more accurately consider future EPIC funding opportunities, inform technology gap analyses, and develop online resources. The deliverables from this project will help prioritize future Energy Commission funding towards technologies that solve the addressed issues.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will benefit California IOU electricity ratepayers through the increased probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. Recommendations resulting from this agreement will help the Energy Commission better direct EPIC Program technologies towards addressing customer needs and becoming widespread, commercially available products.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integration of Distributed Energy Resources (IDER): R. 14-10-003 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 2a, 3e

Economic Development: Market research will provide information to develop technologies, or recommend use of technologies that meet customer needs that will move the technologies to market faster. Moving technologies to market enables job creation, improved business models, and market opportunities for technology developers.

Consumer Appeal: Market research will help better design products and research initiatives to address customer needs, increasing the attractiveness of these products in the marketplace.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$2,714,986

EPIC Funds Encumbered:

$6,937,889

EPIC Funds Spent:

$4,661,775

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Contract

No. of Initial Passing Applicants/ Bidders:

3 out of 4 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement 300-15-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project team has nineteen work authorization projects that are either active, in development, or have been completed. These work authorizations assist Energy Commission staff to appropriately target investments in microgrids, energy efficiency technologies, low-income/disadvantaged community research, and other topics. Additionally, a currently active work authorization has launched an online platform that facilitates tailored connections between investors, entrepreneurs, customer adopters and field test sites, and mentors and community based organizations. Over 400 members have joined the platform in the first two months since launch and they have been able to network with each other to form stronger proposal teams for Energy Commission and non-Energy Commission funding opportunities.

Project Name: 300-15-011 - California Commercial End-Use Survey

Recipient/Contractor: ADM Associates, Inc.

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 6/15/2016 to 3/30/2021

Program Area and Strategic Objective:

Market Facilitation

S18: Guide EPIC Investments through Effective Market Assessment, Program Evaluation, and Stakeholder Outreach

Issue:

A commercial end-use survey (CEUS) is used by energy researchers, including the Energy Commission's Demand Analysis Office, to calculate estimates used in energy forecast models, including: commercial floor space, annual whole building energy use, end-use fuel saturations, and annual whole-building hourly load profiles. Researchers at universities and national labs have indicated interest in having energy-use forecasts with more granularity, disaggregated to the local or regional service territory level. The end-use survey must be properly designed to fully support this level of granularity in order to increase the confidence of the results, and thus, the accuracy of the energy forecasts.

Project Description:

The Energy Commission conducted a CEUS in 2006, since then the energy landscape in California has changed dramatically including the deployment of advanced energy efficiency and renewable generation technologies. This project is updating the CEUS while adding additional granularity by (1) developing a methodology to conduct a survey of the characteristics of commercial utility customers that will serve as a baseline and support the Energy Commission's work on the demand forecast, (2) implementing the survey, and (3) providing an unbiased, comprehensive analysis of the data. When completed, the CEUS will provide a clearer picture of commercial energy end-use which will allow better strategic targeting of policies and incentives which will help facilitate the commercial success and market adoption of technologies, strategies, and other innovations.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The CEUS will provide a more disaggregated sampling of the state's end-uses in the commercial sector, than was historically collected. This level of granularity will lead to more accurate energy forecasts which can assist in keeping rates low as forecasts are used to determine infrastructure needs in long term procurement planning by the CPUC. Furthermore, the data can assist the state in achieving the energy efficiency reduction goals outlined in Senate Bill 350 by supporting the identification and accurate characterization of opportunities for demand-side management, energy efficiency program planning, load shifting, and demand response.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Resource Adequacy (RA) 2016 and 2017 Compliance Years: R.14-10-010 <Closed> Long-Term Procurement Proceeding (LTPP): R.13-12-010 <Closed>

Applicable Metrics: CPUC Metrics- 1c, 2a, 5c

Lower Costs: This project can support reduced costs by leading to a more accurate demand forecast for the commercial sector. This can provide more certainty on base-line end-use consumption and provide a better input into the CPUC's Long-Term Procurement Planning efforts so that only the generation that is truly needed will be planned and procured.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$3,426,324

EPIC Funds Encumbered:

$7,990,063

EPIC Funds Spent:

$7,990,054

Match Partner and Funding Split:

ADM Associates, Inc.: $100,893 (1.2 %)

Match Funding:

$100,893

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Contract

No. of Initial Passing Applicants/ Bidders:

4 out of 4 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement 300-15-011 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

For 2020, ADM continued implementing the commercial survey. Surveys in the investor-owned utility (IOU) electric service territories were scheduled to be finalized during this time, coinciding with the expiration of EPIC funds. However, shelter in-place restrictions stemming from COVID-19 impacted the schedule and prevented the team from finishing on time. The CEC was able to get an extension for the EPIC funding and the team plans to finalize the surveys in early 2021. ADM started drafting the final report, focusing on the IOU results as a priority for EPIC. Once all survey work is concluded, ADM will submit a report with the final results for the entire statewide survey, including the publicly owned utility and gas service territories.

Project Name: 300-17-003 - Distributed Energy Resources (DER) Roadmap

Recipient/Contractor: Navigant Consulting, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/29/2018 to 9/30/2020

Program Area and Strategic Objective:

Market Facilitation

S21: Inform Investments and Decision-Making Through Market and Technical Analysis.

Issue:

To help ensure that EPIC funds are strategically focused to make advancements on the most significant technological challenges, new analysis is needed that identifies and prioritizes RDD&D gaps to achieving California's goals for integrating high penetrations of distributed energy resources (DERs). There is a need for assessing the technology cost and performance of emerging technologies that best facilitate greater penetration of DERs into the grid, as well as for identifying the data needed to advance DER policy and increase the availability of financing.

Project Description:

This project developed, in consultation with stakeholders and subject matter experts, a research roadmap that identified, described, and prioritized key RDD&D needs to enable high penetration of distributed energy resources (DERs). The roadmap assessed the current status of DERs in California; assessed current research efforts, including those at the state and federal level; identified performance and cost targets and research needs; estimated rates for technology performance improvement, cost reduction, and adoption; developed a methodology for prioritizing research needs in the near-, mid-, and long-term; apply the methodology to research gaps to prioritize near, mid-, and long-term research needs; and identified critical cost and performance indicators of success and methodology to estimate research benefits. Finally, the roadmap identified the type and amount of data needed to advance DER policy and availability of DER financing, particularly for low-income customers; conducted public workshops; and documented the roadmapping process.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project informed the strategic and effective targeting of future EPIC investments to maximize the use of public research and development investments. The resulting roadmap identified and prioritized research on the most critical RDD&D technology gaps to enable transformation of the grid to increasingly integrate DERs. The results of the analysis provided further detail in the integration into utility planning and operational policies that are critical to the technological improvements and physical connections to the grid.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Alternative Fueled Vehicles: R.13-11-007 <Closed> Self-Generation Incentive Program: R.12-11-005 <Closed> Energy storage: R.15-03-011 <Closed> Distribution Resources Plans (AB 327): R.14-08-013 Demand Response (DR): R.13-09-011 Streamlining Interconnection of Distributed Energy Resources and Improvements (Rule 21): R.17-07-007 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 2a

Lower Costs: This project identified the areas of EPIC-funded research that will provide the greatest benefits at the lowest cost to ratepayers.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$242,382

EPIC Funds Encumbered:

$499,065

EPIC Funds Spent:

$424,657

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Contract

No. of Initial Passing Applicants/ Bidders:

5 out of 5 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement 300-17-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The California Energy Commission (CEC) staff conducted a workshop to summarize the DER Research Roadmap in May 2020. The roadmap identified key research priorities needed to enable high penetrations of DERs. The workshop provided an overview of the project approach, reviewed the screening and prioritization process, and presented the project results. Guidehouse Inc. completed and submitted the final roadmap report in September 2020.

Project Name: 300-17-004 - Measuring Innovation Progress to Guide Future Investment: Evaluation of EPIC Benefits Methodology

Recipient/Contractor: Industrial Economics, Incorporated

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/29/2018 to 2/16/2021

Program Area and Strategic Objective:

Market Facilitation

S21: Inform Investments and Decision-Making Through Market and Technical Analysis.

Issue:

The primary goal of the EPIC program is to provide benefits to electric ratepayers of California investor-owned electric utilities. However, evaluating ratepayer benefits of EPIC-funded projects presents many challenges. First, the EPIC project portfolio is diverse and complex, spanning many different technology areas in various stages of research. Second, there is often a significant lag between a research investment and the realization of tangible benefits, as it often takes several years for an innovation to be adopted in the market or utilized in practice. Finally, some of the intangible benefits of research such as knowledge gained are important, but difficult to quantify.

Project Description:

This project will provide guidance and independent analysis to develop a robust, standardized methodology to evaluate the electric ratepayer benefits attributable to EPIC-funded projects based on best-in-class methods, data, and analytical tools. This methodology will help the Energy Commission better evaluate how well the EPIC program is meeting its goals and removing barriers to further implementation of advanced technologies to meet the state's energy and climate policy goals.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the state's statutory energy goals by developing tools to quantify the benefits of EPIC projects and identifying technologies that are likely to have the greatest impacts.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 continued in 20-05-003: R.16-02-007

Applicable Metrics: CPUC Metrics- 3e

Economic Development: This project will help the Energy Commission better understand the benefits to ratepayers resulting from projects funded by the EPIC program and will help the Energy Commission make more efficient and effective use of future EPIC funds.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$1,716,826

EPIC Funds Encumbered:

$3,000,000

EPIC Funds Spent:

$2,970,595

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Contract

No. of Initial Passing Applicants/ Bidders:

3 out of 3 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement 300-17-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, the project team completed a suite of tools and methodologies for evaluating EPIC's benefits to ratepayers and conducted a number of case studies demonstrating the application of the tools; the case studies estimate benefits from a selection of EPIC projects including energy efficiency and renewable generation technologies. The project team presented the suite of tools, methodologies, and results to CEC staff as well as at a public workshop hosted by the CEC. EPIC staff will conduct the final review of the projects tools, methodologies, and results to provide feedback as the project team finalizes their deliverables and final reports due in the first half of 2021.

Project Name: 300-17-005 - Research Roadmap for Cost and Technology Breakthroughs for Renewable Energy Generation

Recipient/Contractor: Energetics Incorporated

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/4/2018 to 5/29/2020

Program Area and Strategic Objective:

Market Facilitation

S21: Inform Investments and Decision-Making Through Market and Technical Analysis.

Issue:

This research roadmap initiative arose from the need to help achieve California's forward-leaning goals for ramping up the generation of renewable power and reducing emissions of greenhouse gases contributing to global climate change. The development of a roadmap for strategic investment in renewable energy RDD&D through the Electric Program Investment Charge (EPIC Program) helps prioritize needed scientific and technological advancements, set appropriate technology development milestones, leverage available resources to accelerate the delivery of effective products and practices, and encourage uptake of these technologies to attain state energy and environmental goals.

Project Description:

This project aims to develop a research roadmap to strategically frame research priorities, potential partnerships, and critical technology milestones to support EPIC portfolio decisions and accelerate progress toward more cost-competitive, flexible and reliable renewable energy generation, operation, and storage.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This Research Roadmap aims to strategically frame research priorities, potential partnerships, and critical technology milestones to help inform EPIC research development, demonstration, and deployment (RDD&D) portfolio decisions and accelerate progress toward more cost competitive, flexible and reliable renewable energy generation, operation, and storage. A roadmap is an effective tool for laying out RDD&D pathways. A robust roadmap considers a spectrum of technology complexity, the current state of the art, rapid expansion of scientific knowledge, competition for RDD&D funding, dynamic customer expectations, and the cost and risk of research.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed>

Applicable Metrics: CPUC Metrics- 2a

Lower Costs: Cost is a significant barrier to greater renewable energy penetration in the California grid. This Research Roadmap aims to strategically frame research priorities, potential partnerships, and critical technology milestones to help inform EPIC RDD&D portfolio decisions and accelerate progress toward more cost-competitive, flexible, and reliable renewable energy generation, operation, and storage.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$86,365

EPIC Funds Encumbered:

$338,059

EPIC Funds Spent:

$330,465

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Contract

No. of Initial Passing Applicants/ Bidders:

4 out of 4 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement 300-17-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Through a literature review, expert interviews and surveys, and multiple expert and public webinars, the roadmapping project produced both a Technical Assessment and Research Roadmap. While the Technical Assessment focused on the current state of renewable energy resources and research efforts in both California and nationally, the research roadmap pinpoints recommended initiatives which fill current technology gaps. The roadmap includes 17 recommended initiatives, with supporting background information including generation trends, resource assessment, cost and performance metrics, and technology area considerations. Two research initiatives are recommended for the following technologies: solar PV, concentrated solar power, land-based wind, geothermal, bioenergy, grid integration, and energy storage. The team recommended three research initiatives for offshore wind energy.

Project Name: 300-18-001 - Technology Transfer for EPIC Research Projects

Recipient/Contractor: Gladstein, Neandross & Associates LLC

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/10/2019 to 3/31/2022

Program Area and Strategic Objective:

Market Facilitation

S18: Foster the Development of the Most Promising Energy Technologies into Successful Businesses.

Issue:

Knowledge dissemination is one of the key benefits of publicly funded research programs. Ensuring the project results are made publicly available and are effectively disseminated to energy stakeholders who can act upon these results (including investors, technology developers, customers, local governments, and policymakers) can help accelerate the development and commercialization of new, clean energy technologies. To communicate the project results successfully requires a team with expertise in both the energy sector as well as a proficiency in developing web materials and conducting forums to bring the right stakeholders and experts together.

Project Description:

The purpose of this Agreement is to fund technology transfer services to ensure that the results of EPIC-funded projects are effectively disseminated and communicated to stakeholders. The contractors will work closely with Energy Commission staff to: 1) develop and implement a digital technology transfer strategy for EPIC, including redesigning and increasing the functionality of the Energy Commission-owned Energy Innovation Showcase website to improve its effectiveness and usefulness as a technology transfer tool; 2) conduct up to nine topical forums across the state, discussing key issues affecting the electricity sector; and 3) plan, produce, and manage two EPIC Symposium events.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This Agreement will lead to increased benefits for EPIC ratepayers by accelerating the development and deployment of new emerging clean energy technologies.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Identify Disadvantaged Communities in the San Joaquin Valley and Provide Economically Feasible Options for Affordable Energy: R.15-03-010 Strategies and Guidance for Climate Change Adaptation: R.18-04-019 Renewables Portfolio Standard Program: R.18-07-003

Building Decarbonization: R.19-01-011 Rulemaking to Investigate and Design Clean Energy Financing Options for Electricity and Natural Gas Customers: R.20-08-022 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 2a

Consumer Appeal: This project will ensure the results and lessons learned from EPIC-funded projects are effectively and efficiently disseminated to stakeholders and key decisionmakers. This information is expected to lead to increased and more cost-effective deployment of clean energy technologies, in turn resulting in greater consumer appeal as customers become more familiar with products.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$881,903

EPIC Funds Encumbered:

$3,788,265

EPIC Funds Spent:

$1,814,206

Match Partner and Funding Split:

Larta Institute: $115,372 (2.3 %)

Sensis Agency: $22,889 (0.4 %)

Gladstein, Neandross & Associates LLC: $1,172,307 (23.0 %)

Match Funding:

$1,310,568

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Contract

No. of Initial Passing Applicants/ Bidders:

5 out of 6 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement 300-18-001 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, the team conducted two technical forums and the EPIC Symposium. The first technical forum was held in person in Long Beach (February 25), and focused on energy resilience. Due to COVID-19, the team had to pivot to conduct virtual events. They worked with staff to plan and facilitate a second forum on low-carbon buildings (September 2-4), and the EPIC Symposium (October 19-21). Additionally, Phase I of the new EPIC project website, EnergizeInnovation.Fund, was launched in August. Phase I includes information on the program, project statistics, investment areas, relevant news articles, and links to EPIC events. In 2021, the team will launch Phase II of the site that includes individual project pages, search and sorting functionality, and translation capability.

Project Name: EPC-14-023 - Utility Demonstration of Znyth Battery Technology to Characterize Performance and Grid Benefits

Recipient/Contractor: Eos Energy Storage, LLC

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 5/27/2015 to 8/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S8: Integrate Grid Level Energy Storage Technologies and Determine Best Applications That Provide Locational Benefits

Issue:

Distributed energy storage can provide fast-responding grid services and much needed locational capacity to integrate renewable energy. Despite this great potential, the high cost and short life of current commercial energy storage technologies make their use largely uneconomical. Moreover, safety and energy density limitations have prevented wide-spread deployment of energy storage on a distributed basis. There is minimal experience in integrating these storage systems with traditional utility infrastructure. Safer and more cost-effective energy storage options need to be developed for integration into the electrical grid with input from the electric utilities.

Project Description:

The purpose of this agreement is to further develop an emerging energy storage technology, a zinc hybrid cathode battery (Znyth), and evaluate the performance of this technology for distribution-connected applications in partnership with a utility. The test results of this grant are important to confirm the safety and performance of the system when grid connected.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Eos is the only company offering a zinc hybrid cathode battery. This is an aqueous, zinc-based battery technology that is inherently safer than competing technologies. This technology is non-flammable and non-toxic. In addition to being backed by UL- and ISO-certified quality assurance and control, the manufacturing process involves no toxic or hazardous materials. This demonstration provides information and data to assess the value and cost savings of utility-scale battery energy storage when interconnected to the grid.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed> Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1c, 1i, 2a, 4a, 5b

Lower Costs: This project will determine any cost savings by testing this battery system and determining how well the battery can cost-effectively provide the grid with peak shaving, ancillary services, load following, and frequency regulation. These markets and services may provide a revenue stream for energy storage users.

Greater Reliability: This project will contribute to more efficient battery storage which will ensure greater reliability for the grid as a whole and increase energy storage use.

Increase Safety: This zinc-based battery technology is safer than competing technologies because it is non-flammable and non-toxic. The manufacturing process does not involve toxic or hazardous materials; this also makes transportation and handling much safer.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$691,504

EPIC Funds Encumbered:

$2,156,704

EPIC Funds Spent:

$1,927,382

Match Partner and Funding Split:

Eos Energy Storage, LLC: $1,117,607 (33.6 %)

Electric Power Research Institute, Inc.: $50,000 (1.5 %)

Match Funding:

$1,167,607

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

35 out of 38 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-023 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Following decommissioning of the system at PG&E, Eos installed a 100kW/300kWh system utilizing the subsequent generation of battery technology at SDG&E's Pala Energy Storage Yard. The system achieved full commissioning completion and began daily automatic charge, discharge, and data collection on June 24, 2020. The system was tested primarily in the peak shifting use case: charging in the morning and discharging during the late afternoon peak demand period. The system also responded to four CAISO Flex Alerts for available energy capacity during the rolling blackouts in the week of August 17th, being dispatched without interruption for cycles lasting 3, 4, and 5 hours. The system was decommissioned on October 23 after 75 successful charge-discharge cycles.

Project Name: EPC-14-033 - North Fork Community Power Forest Bioenergy Facility Demonstration

Recipient/Contractor: The Watershed Research and Training Center

Investment Plan: 2012-2014 Triennial Investment Plan, 2015-2017 Triennial Investment Plan

Project Term: 5/15/2015 to 3/31/2022

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Emerging Clean Energy Generation Technologies and Deployment Strategies, S13: Demonstrate and Evaluate Biomass-to-Energy Conversion Systems, Enabling Tools, and Deployment Strategies.

Issue:

Forest biomass fueled bioenergy gasification projects have the potential to be more efficient and cleaner electricity generation than direct combustion systems and can reduce the risk of forest fires and pollutant emissions. The electricity generation is anticipated to be economical in the long-term but is dependent on the ability of developers to achieve necessary operating hours. Due to lack of sufficient data and the absence of commercially operating forest gasification facilities, there is a need to conduct demonstrations and collect technical data that will help advance the economic viability of this technology and attract private investment.

Project Description:

The goal of the North Fork Forest Bioenergy project is to demonstrate a 1-megawatt (MW) forest waste bioenergy gasification-to-electricity facility. The biomass gasification facility is targeted to be a commercial-scale, community-based facility capable of accepting and processing wood waste from forest management that would otherwise create wildfire and air quality challenges, and generating renewable grid-connected electricity. Once the gasification is fully installed and operational, the project team will investigate critical performance parameters and evaluate individual components and protocols to improve performance and reduce operating costs.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This commercial-ready gasification technology has not been previously demonstrated in California. Combined with the producer gas cleanup system, automation and control, and optimized operation, this innovative system will prove distributed, woody biomass-fueled electricity to be economically feasible and capable of operating for 7,000 hours a year. The project will be grid-connected and will provide immediate benefits, including increased renewable generation capacity, expanded technical resources, and community environmental, wildfire, and economic development benefits.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed> SB 1122
Bioenergy feed-in tariff: R.18-07-003, R.11-05-005 <Closed>

Applicable Metrics: CPUC Metrics- 1a, 1c, 2a

Lower Costs: Siting these plants near the forest reduces the cost of hauling biomass from the forest and reduces biomass electricity costs below those of larger, traditional biomass power plants.

Economic Development: This plant will be built and operated by local contractors. In some cases, workers may even be trained to work on site. The plant is owned in part by a local Community Development Council, which will receive profits from the PPA and reinvest them in the community. Additionally, the power plant will anchor a biomass utilization campus, which will expand to include other forest products.

Environmental Benefits: Use of forest restoration by-product will improve air quality over open burning and reduce wildfire risk. Additionally, the gasification system will reduce air pollutant emissions. Placer County Air Pollution Control District (PCAPCD) estimated emissions reductions of 60 percent CO2 and 3 percent CH4 in direct combustion systems with emission control over pile and burn system. Gasification could further reduce the emissions, e.g., from 85 percent to 99 percent reductions in NOx, 76 percent to 98 percent reduction in CO, and 88 percent to 92 percent reduction in VOC compared to typical direct combustion based on some current gasification projects.

Public Health: Disposing of biomass in controlled systems dramatically decreases emissions over pile and burn or wildfire, specifically the Particulate Matter (PM) emissions, which have known impacts on health. The same PCAPCD study estimated an emissions reduction of 41 percent particulate in combustion systems with emission control technologies over an open pile burning system. Gasification technology could further reduce the PM emissions by 84 percent to 99 percent compared to a typical direct combustion system depending on the technology.

Consumer Appeal: Providing jobs, protecting homes, and enhancing the functioning forest ecosystems, increased biodiversity, and decreased wildfire threat are all benefits that this power plant will be able to promote to increase consumer appeal.

Energy Security: This project will rely on California-grown fuel and operates as a baseload plant. Development will also require PG&E and plant owners to invest in the local substation. The availability of local bioenergy power plant that is connected to and supplying power to the grid will increase energy security for the rural community.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$87,680

EPIC Funds Encumbered:

$4,965,420

EPIC Funds Spent:

$3,705,522

Match Partner and Funding Split:

The Watershed Research and Training Center: $22,706 (0.4 %)

Phoenix Energy: $684,144 (10.8 %)

Yosemite Sequoia Resource Conservation and Development Council: $55,500 (0.9 %)

Penn Power Group, LLC d/b/a Western Energy Systems: $253,750 (4.0 %)

North Fork Community Development Council: $180,000 (2.8 %)

USDA Forest Service - Sierra National Forest: $150,000 (2.4 %)

TSS Consultants: $13,260 (0.2 %)

Kamalesh Doshi: $2,000 (0.0 %)

Match Funding:

$1,361,360

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

19 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Group 4: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-033 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project obtained financing which includes Green Bond financing for a total of $10.4M in tax-exempt bonds and $4.7M in taxable bonds, a CalFIRE loan of $1.2M and equity investment of $2.2M from the gasifier company EQTEC. The project has also obtained a PPA with PG&E. Equipment from GE was delivered to the site but was never installed because GE withdrew from its gasifier business and decided not to move forward. Phoenix Energy has since been working with EQTEC; the replacement equipment are being prepared at an EQTEC site and in process for delivery. While site preparations in North Fork have resumed, the project activities were also slowed down by the effects of the COVID-19 pandemic.

Project Name: EPC-14-052 - Community Scale Digester with Advanced Interconnection to the Electrical Grid

Recipient/Contractor: Organic Energy Solutions, LLC

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 6/1/2015 to 3/31/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Emerging Clean Energy Generation Technologies and Deployment Strategies

Issue:

Digester systems have the potential to play an important role in providing renewable electricity while reducing California's greenhouse gas emissions. Despite a regulatory environment encouraging renewable energy production and greenhouse gas reductions, there is a need for technology to lower the system cost as traditional methods require high capital costs to remove organic materials from the wastewater stream to create good quality slurry for an anaerobic digester system.

Project Description:

The project installed and operated an innovative anaerobic digestion system using a high-rate biodigester technology that will process approximately 50 tons per day (TPD) of organic waste from a large supermarket distribution center and 50 TPD (20,000 gallons) of high-strength slurry created by recovering and concentrating organics in wastewater streams. This project is co-located with the Co-West Commodities Wastewater Pre-Treatment Facility - an operation that collects wastewater (carbs, sugar, protein, and fat, grease, and oil) from industrial businesses and pre-treats the material for disposal into the local sewer system.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project demonstrated the use of electrical generation powered by digester gas to provide reliable power to a critical facility during outages on the grid. The electricity from this project will be exported to the SoCal Edison distribution grid through a SB 1122 Bioenergy Feed-in Tariff. The system will also be equipped with islanding capability to support the critical facility during an interruption in the grid.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

SB 1122 Bioenergy feed-in tariff: R.18-07-003, R.11-05-005 <Closed>

Applicable Metrics: CPUC Metrics- 1b, 1c, 2a

Lower Costs: The method developed by this project would lower the system cost, resulting in a significantly lower price of electricity compared to traditional or fossil generation. The estimated LCOE is $122/MWh.

Greater Reliability: This project will provide reliable renewable electricity without the need for standby and backup power and capable of providing power during peak energy demand.

Economic Development: The co-products are 1,226 tons of residual solids for vermicomposting feedstock per year and 1.6M gallons per year of liquid effluent for fertilizer.

Environmental Benefits: The project will divert and use food wastes to generate electricity that will yield reductions in greenhouse gas emissions, with a net offset of 4,125 MT CO2e/year. It will also improve environmental quality by providing clean energy while improving wastewater quality and reducing odor via anaerobic digestion.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$252,977

EPIC Funds Encumbered:

$5,000,000

EPIC Funds Spent:

$4,283,553

Match Partner and Funding Split:

Organic Energy Solutions: $7,700,539 (60.3 %)

CleanWorld: $75,400 (0.6 %)

Match Funding:

$7,775,939

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

19 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-052 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

By the end of the extended term (March 2020), the project team successfully installed, and is now operating, the innovative anaerobic digester system incorporating CleanWorld's high-rate biodigester technology to process organic wastes from a local waste hauler and high-strength slurry. The project demonstrated the capability to produce at least 8,760 MWh of renewable electricity to be sold to Southern California Edison under the SB 1122 Bioenergy Feed-in Tariff. It also demonstrated the concept of load-following power output without excessive on-site storage.

Project Name: EPC-14-079 - Assessing the Ability of Smart Inverters and Smart Consumer Devices to Enable more Residential Solar Energy

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 6/30/2015 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Technologies, Tools, and Strategies to Make Distributed Generation More Affordable

Issue:

Transformers are a key limiting component for the installation of solar generation on California's distribution systems. Transformer constraints together with distributed solar may result in voltage issues or inhibit permitting of solar. Smart inverters can help mitigate these issues. However, it is not known whether multiple inverters can operate side-by-side in stable conditions when each one is performing smart-inverter functions. High PV penetration on a distribution feeder may contribute to local over-voltage, variability, and equipment stress on the customer side, limiting PV deployments and production.

Project Description:

The purpose of this project is to resolve the limiting conditions that occur on California distribution systems when many PV systems are installed behind a single residential distribution transformer by evaluating advanced inverter functionality with the specific goal of enabling higher penetration of photovoltaics on the grid. The project is identifying, implementing, and testing (both in lab and field) optimal methods by which smart inverters can mitigate the issues that otherwise would limit local high penetrations of residential PV. The process will identify how California Rule 21 functions can be used and configured so that multiple smart inverters work in harmony and will also identify how other naturally-occurring consumer devices, such as electric vehicle chargers and other smart loads, can serve to further enable high-levels of solar PV.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

As the penetration of autonomous (Rule 21) inverters increases, their interactions will grow in importance. This project will help provide a clear understanding of inverter characteristics and of their potential interactions that may help preserve the stability and reliability of the grid, benefiting both consumers and operators. Consumers who invest in solar PV systems (and utilities that provide incentives or expect benefits from PV) wish to maximize the power they can realize from their system. Sharing excess PV generation with local loads may increase the utilization of such systems without negatively impacting the distribution grid.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Smart grid: R.08-12-009 <closed> Distribution Level Interconnection (Rule 21): R.11-09-011 <closed> Smart Inverter: D.14-12-035 (in R.11-09-011) Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1b, 3d, 4a, 5a, 5b

Lower Costs: The use of smart inverter functions, together with smart (PV-optimized) behavior of loads, can increase production (KWh) of residential systems by 15 percent. For an affected consumer on a constrained distribution circuit, this means more annual savings.

Greater Reliability: The testing and evaluation of smart inverter functions and smart management of consumer loads under this project can help minimize stress on grid equipment and further improve reliability.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$400,537

EPIC Funds Encumbered:

$1,705,478

EPIC Funds Spent:

$1,504,926

Match Partner and Funding Split:

Electric Power Research Institute, Inc.: $149,452 (5.8 %)

Underwriters Laboratories, Inc.: $78,174 (3.0 %)

Southern California Edison Advanced Technology Organization: $260,000 (10.0 %)

Intwine Connect: $107,758 (4.1 %)

ClipperCreek, INC.: $66,480 (2.6 %)

Sacramento Municipal Utility District: $156,000 (6.0 %)

Pentair: $50,000 (1.9 %)

Emerson Climate Technologies: $8,550 (0.3 %)

A. O. Smith Corporate Technology Center: $15,000 (0.6 %)

Match Funding:

$891,414

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

25 out of 27 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-079 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

This project focused on understanding advanced smart-inverter functions, as defined in California's Rule 21 tariff, to effectively enable higher use of solar PV to customers and on the grid. Specific residential smart load management algorithms and communications architecture were developed for smart loads and inverters to enable higher PV penetration. This approach increases the solar PV value to the homeowners, while adhering to distribution grid requirements.

Field testing demonstrated that optimization of residential smart loads could consume excess solar PV. Solar PV generation capacity and the availability of flexible or demand-responsive loads play a pivotal role in determining the amount of increase in the hosting capacity. Results from this project will help regulators and grid operators evaluate regulatory changes needed to scale deployment of Rule 21-compliant inverters and assess the outcomes that are relevant to their DR programs and reliable grid operations.

Project Name: EPC-14-085 - Demonstration of Community Scale Low Cost Highly Efficient PV and Energy Management System

Recipient/Contractor: The Regents of the University of California, Davis

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 6/30/2015 to 3/31/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Emerging Clean Energy Generation Technologies and Deployment Strategies

Issue:

The intermittent nature of solar energy generation requires special attention when connecting to the grid to ensure balance between energy demand and production. Although energy storage has the potential to serve multiple valuable functions in a microgrid setting, it is currently an expensive resource in the early stages of technology development. Renewable-based microgrids require a control system to support reliability.

Project Description:

This project is demonstrating a combination of advanced PV generation, energy storage, and an energy management system to reduce average daily power and daily peak energy demand by more than 10 percent. The project includes a smart electrical energy storage system that integrates retired electric vehicle batteries. The generator and storage system are controlled by a commercial-grade microgrid controller. The demonstration site is in the Robert Mondavi Institute at the UC Davis campus.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The combination of advanced PV and the energy management system will result in a significant reduction in annual grid electricity consumption - estimated at over 80 percent or a cost savings of roughly $29,000 per year with associated greenhouse gas reductions of about 250 tons per year. Furthermore, the success of this project will provide follow-on benefits to California's large wine industry by proving that winemaking can be carried out with sustainable energy solutions.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed> Smart grid: R.08-12-009 <closed> Smart Inverter: D.14-12-035 (in R.11-09-011) Demand Response (DR): R.13-09-011 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1b, 1e, 1f, 1h, 2a, 3b, 4a

Lower Costs: The project aims to reduce the high costs of energy storage by using second-life electric vehicle batteries and an advanced energy management system. The combination of advanced PV and energy management systems will result in significant reduction in annual grid electricity consumption - estimated at over 80 percent, with electricity cost savings of $29,000 per year.

Economic Development: Proving the concept of a high-penetration renewable microgrid at the Robert Mondavi Institute is expected to lead to adoption of similar concepts at a number of winemaking facilities and breweries across California.

Environmental Benefits: The project will reduce CO2 emission by as much as 250 tons per year. Furthermore, the success of this project will provide follow-on benefits to California's large wine industry by proving that winemaking can be undertaken with sustainable energy solutions.

Consumer Appeal: California's wine and brewery market represents a significant market. The Robert Mondavi institute is a leader in sustainable winemaking and the successful demonstration is expected to encourage adoption elsewhere.

Energy Security: This project is increasing energy security on the UC Davis campus through a microgrid with the potential to function during grid outages.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$124,883

EPIC Funds Encumbered:

$1,238,491

EPIC Funds Spent:

$1,227,762

Match Partner and Funding Split:

UC Davis: $167,262 (8.5 %)

OSISoft, LLC: $479,467 (24.2 %)

Nissan North America: $79,997 (4.0 %)

SMA America: $13,000 (0.7 %)

Match Funding:

$739,726

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

16 out of 22 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 5

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-14-085 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The energy system was installed in December 2018 and commissioned in January 2019. The system has been operating and collecting data since the beginning of 2019 and enabled analysis of the reduction in facility's energy demand. The project's success in utilizing second-life batteries for energy storage led to a start-up company to commercialize the idea. UC Davis has a collaboration with Case Western University to share data from the system to aid in developing battery models used to predict the lifetime of these batteries as well as the life-cycle emissions from electric vehicle batteries. Results indicate up to $2,000 per month in bill savings and up to 3000 kg CO2/month in emissions reductions, with additional savings possible with further controller optimization. The project has hosted a number of tour groups to share the project approach and outcomes. Additionally, the project has provided some reliability support for the electrical grid, including in September 2020.

Project Name: EPC-15-003 - Demonstration of Community Scale Generation System at the Chemehuevi Community Center

Recipient/Contractor: The Regents of the University of California, on behalf of the Riverside Campus

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 10/29/2015 to 3/31/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Emerging Clean Energy Generation Technologies and Deployment Strategies

Issue:

The Chemehuevi Indian Tribe is located in Havasu Lake, CA and connected to Southern California Edison's power grid through a single transmission line. Due to its remote location, the Chemehuevi community faced power reliability issues and was extremely vulnerable to power outages and downtime maintenance. Along with these issues, there was a continual increase in energy, power, and ramping demand by the tribe. To mitigate these issues, a microgrid solution was proposed as a way to increase grid resiliency and reliability, while reducing electricity costs.

Project Description:

The purpose of this project is to demonstrate a community microgrid to improve site power reliability and resiliency. The Chemehuevi Indian Tribe Community Center microgrid incorporates a 90 kW solar PV system, a 25 kW/125 kWh battery energy storage combined and integrated with an energy management system to reduce peak energy demand for the center by utilizing battery storage to shift building and community loads. The system will also provide uninterruptible power for the center and serve as an Emergency Response Center for the tribe during blackouts or loss of power.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will result in greater electricity reliability, lower electricity costs, reduced peak energy demand, and avoidance of failures and outages by integrating a scalable system in both size and quantity and demonstrating the commercial feasibility to deploy many megawatt-hours of dispatchable energy integrated in a photovoltaic-battery storage configuration.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Smart grid: R.08-12-009 <closed> Demand Response (DR): R.13-09-011 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1e, 1g, 1h, 2a, 3f, 4a, 5a

Lower Costs: The system is designed to lower the kW demand by more than 10 percent of the daily average energy demand during peak times. This will result in a reduction of costs associated with procuring additional energy during periods of peak demand. Researchers estimate over $670,744 in energy savings from the solar PV system, $74,463 from energy storage revenue streams, and $38,910 in preventing costs due to sustained interruptions over a 20-year period.

Greater Reliability: Greater electricity reliability is achieved by managing energy use and local generation supported by PV generation and battery storage in daily energy use profiles. This will help reduce failures and outages associated with demand response.

Environmental Benefits: Researchers estimate a carbon reduction of 1,038 tons over the life of the project.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$525,157

EPIC Funds Encumbered:

$2,588,906

EPIC Funds Spent:

$2,051,182

Match Partner and Funding Split:

The Regents of the University of California - Riverside: $77,451 (2.3 %)

OSISoft, LLC: $479,467 (14.1 %)

Primus Power: $143,360 (4.2 %)

Chemehuevi Indian Tribe: $102,200 (3.0 %)

Match Funding:

$802,478

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

16 out of 22 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project executed deployment and demonstration of a microgrid integrating energy storage, solar energy generation, and energy management strategies with the goal of improving resiliency, reliability, and reduce number of power outages at the Chemehuevi Indian Tribe community center. While the battery unit adds additional resiliency to the building as an energy back-up, the energy storage control strategy aims at optimal utilization of renewable solar energy through means of load shifting, peak shaving, and demand response. The site dedicated to this project consists of a single facility with an average energy consumption 100,000 kWh/year. The total annual electricity was reduced by nearly 50 percent.

Project Name: EPC-15-004 - Climate appropriate HVAC Systems for Commercial Buildings to Reduce Energy Use and Demand

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 8/3/2015 to 6/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

Cooling and heating buildings contribute to a large portion of the electricity bills for California ratepayers. Traditional heating, ventilating and air conditioning (HVAC) systems waste energy. Innovations in HVAC systems, such as variable refrigerant flow and advanced indirect evaporative cooling systems are well suited for California climates. However, the full potential of these innovations has not been realized.

Project Description:

This project developed and demonstrated a Climate Appropriate Air Conditioning system for commercial buildings that optimizes occupant comfort and can reduce energy use and peak demand. The project applies a combination of Variable Refrigerant Flow (VRF) technology with Indirect Evaporative Cooling (IEC) integrated and operationally optimized through the building control system. The project also investigated alternative non- Ozone Depleting Potential (ODP) or low global warming (GWP) refrigerants and HVAC system designs that could enable their usage in commercial buildings. This project will benefit small and medium commercial buildings, such as retail stores, offices buildings and food service and could be implemented in existing and new commercial buildings through direct replacement of rooftop packaged air conditioners. It is estimated that the HVAC systems for these sectors use 7,000 GWh and contributes 5 GW of peak demand.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The technology advancement is the intelligent HVAC controller that processes signals from building sensors and system feed-back to maximize system efficiency while also synchronizing operation of the VRF and IEC to reduce energy use and peak energy demand and maximize occupant comfort. The innovative control system utilizes cloud based optimization using weather, grid conditions and occupancy (CO2) as inputs to optimally operate a VRF and the IEC system to reduce both energy and water use. The IEC was set up as a dedicated outdoor air system and incorporated variable speed blower and heat recovery ventilation. These subsystems were

intelligently controlled by the building controller. This project evaluated and provided system designs that use alternative refrigerants that have zero ODP or low GWP.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a

Lower Costs: This project could reduce electricity use for HVAC systems beyond 33 percent. This could mean lower energy costs for commercial building owners or occupants that pay utility bills.

Environmental Benefits: This project tested alternative refrigerants (propane, CO2, ammonia, primary/secondary systems and blends like R-32) that could significantly reduce greenhouse gas emissions. Test results are promising. CO2 system tested has slightly lower cooling COP with slightly higher than average cooling capacity and higher heating capacity and higher heating COP. Further improvement to the capacity and COP of the CO2 unit is possible with increases in COP upwards of 20 percent possible.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$1,088,673

EPIC Funds Encumbered:

$2,834,721

EPIC Funds Spent:

$2,786,826

Match Partner and Funding Split:

Electric Power Research Institute, Inc.: $440,509 (13.4 %)

Match Funding:

$440,509

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 9

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project is complete. The test sites were in San Diego, Aliso Viejo and Davis. Bundgard propane chiller, CO2 system and ammonia chillers were tested. Test results show electric savings of about 33 percent. Minor issues were experienced with new Melrok controller.

Project Name: EPC-15-009 - Workforce Instruction for Standards and Efficiency (WISE)

Recipient/Contractor: California Homebuilding Foundation (CHF)

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 11/30/2015 to 6/30/2020

Program Area and Strategic Objective:

Market Facilitation

S17: Strengthen the Clean Energy Workforce by Creating Tools and Resources that Connect the Clean Energy Industry to the Labor Market

Issue:

California's homebuilding market emerged from the 2007-2009 recession to find that many skilled tradespeople had permanently left the residential construction market. Meanwhile, techniques for constructing high performance attics, walls, and roof assemblies that were once considered "advanced practices" employed by few builders became code requirements for residential new construction. The lack of skilled labor, along with increased demand for high-performance insulation techniques, could disrupt the rate of adoption of these measures or lead to poor installation. This could result in lower than expected energy savings and construction defects imposing safety risks or damage to the building.

Project Description:

This project provided education, outreach, and resources for California's new residential building industry on high performance attics (HPA) and high performance walls (HPW), two new requirements in the state's 2016 Building Energy Efficiency Standards (BEES). The project helped the new residential building industry better understand new requirements and options for compliance and provided them with technical support to enable the transition to the new requirements. Additionally, the project team provided some on-the-job training on the proper installation of insulation and changes to other building systems necessary for meeting the code requirements.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The California Energy Code requires new homes to be constructed with HPA and HPW to meet energy efficiency standards. This project helped overcome market barriers of the measures by providing the industry with on-the-job training and tools on the best available technologies, techniques, and practices for complying with the new requirements.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1c, 1e, 1f, 1h, 2a, 3c, 4a, 4b

Lower Costs: As builders become more familiar with proper installation practices and products are more widely deployed, the costs for installing HPA and HPW will be reduced. Additionally, proper installation will lead to energy savings, further reducing costs for ratepayers.

Increase Safety: Training will improve safety by ensuring builders follow manufacturers' code-compliant installation guidelines to reduce the risk of construction and structural defects.

Public Health: Supplemental ventilation training will ensure indoor air quality is unaffected or improved by changes to construction practices.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$1,667,291

EPIC Funds Encumbered:

$4,431,918

EPIC Funds Spent:

$4,135,877

Match Partner and Funding Split:

APA - Engineered Wood Association: $473,710 (2.4 %)

BASF: $990,000 (4.9 %)

Bayer Material Science: $1,230,290 (6.1 %)

California Building Industry Association (CBIA): $58,110 (0.3 %)

Ensoltis Green Hybrid Roofing: $631,600 (3.1 %)

KB Home: $3,043,501 (15.1 %)

Owens Corning: $2,327,444 (11.6 %)

Panasonic Eco Solutions North America: $265,200 (1.3 %)

PCBC: $151,200 (0.8 %)

QC Manufacturing: $335,220 (1.7 %)

Shea Homes: $2,248,622 (11.2 %)

SIPA - Structural Insulated Panel Association: $303,000 (1.5 %)

SPFA - Spray Polyurethane Foam Alliance: $239,000 (1.2 %)

Taylor Morrison Homes of California, LLC: $1,929,494 (9.6 %)

Tru Team of California: $1,008,684 (5.0 %)

ConSol: $450,000 (2.2 %)

Match Funding:

$15,685,075

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

4 out of 4 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project ended in June and the team submitted a final report. The WISE team provided 141 trainings to the building industry on HPA and HPW practices, including impacts of the 2019 Title 24 requirements on code compliance. Most leading builders of the state's new single-family housing market received training. Additionally, the high school training program (BITA) will provide the new curriculum on HPA and HPW to 1,140 students in the next 3 years. Market trends found the inclusion of HPA built in single-family homes increased from 3 to 45 percent between 2016-2019, and from 0 to 10 percent for HPW. However, the use of 2x6-inch studs in walls (critical for HPW compliance) increased from a tenth of the market to a third. Likely, the temporary solar trade-off option prevented bigger penetration of both measures. The team plans to maintain the WiseWarehouse.org website to offer educational materials and promote certification trainings as a valuable resource to the industry.

Project Name: EPC-15-010 - Expanding Energy-Related Career Pathways in the Electrical Industry: Increasing Workforce Development Opportunities in Disadvantaged Communities and Delivering Training on Automated Demand Response Communication Equipment to Inside Wireman Apprentice

Recipient/Contractor: Center for Sustainable Energy

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 12/8/2015 to 6/30/2020

Program Area and Strategic Objective:

Market Facilitation

S17: Strengthen the Clean Energy Workforce by Creating Tools and Resources that Connect the Clean Energy Industry to the Labor Market

Issue:

Automated demand response (AutoDR) equipment and communications standards have evolved significantly over the past decade. However, these advances and standards have not been adequately translated into training programs to help facilitate the widespread deployment of AutoDR communication equipment. Lack of an adequately trained workforce could limit the benefits provided by demand response to electric customers and the larger grid.

Project Description:

The project recruited workers from disadvantaged communities into apprenticeship programs at California Joint Apprentice Training Centers (JATCs), providing them with comprehensive classroom and on-the-job training on the installation and maintenance of AutoDR communications equipment. By addressing the acute skills gap by producing a workforce qualified to install and maintain cutting-edge AutoDR communications equipment, the project helped enable demand response to be deployed in the market at scale.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The California Energy Code was updated in 2013 to require lighting systems in large buildings to be capable of receiving and automatically responding to at least one standards-based messaging protocol which enables demand response. This project helped ensure a workforce that is trained in the proper installation and maintenance of AutoDR communications equipment exists to meet California Energy Code requirements for commercial buildings.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Smart grid: R.08-12-009 <closed> Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1e, 1g, 1h, 2a, 3f

Lower Costs: Proper installation of AutoDR communications equipment will facilitate greater levels of demand response by reducing the transaction costs for participating customers.

Greater Reliability: Compared to manual response, properly installed AutoDR communications equipment increases customer response to utility or system operator messages about a demand response event.

Economic Development: Training on the proper installation and maintenance of AutoDR communications can provide increased employment opportunities for workers in disadvantaged communities.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$863,874

EPIC Funds Encumbered:

$4,476,189

EPIC Funds Spent:

$2,860,379

Match Partner and Funding Split:

California LMCC IBEW-NECA: $16,165,080 (78.3 %)

Match Funding:

$16,165,080

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

4 out of 4 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project ended in June and a final report was submitted. Development and implementation of the training was a success with all seven partner JATCs providing the new CALCTP-AutoDR course to 4th or 5th year apprentices. Since 2017, 655 electricians completed the in-person training (378 resided in or near DACs). A total of 329 technicians and sales staff passed the online course exam with another 818 pending the final exam. Also, 637 workers residing in or near DACs were recruited into the apprenticeship program. However, challenges prevented efforts to recruit small and medium buildings in DACs to participate in the AutoDR incentive programs and these efforts were discontinued. Most notably were changes in the programs' payment structures, higher overhead, and upfront costs. Overall, the project developed specialized training on load management technologies and created new career paths, building workforce capacity necessary for meeting the Title 24 DR capability requirements.

Project Name: EPC-15-018 - Pilot Testing of Eos' Znyth Battery Technology in Distributed Energy Storage Systems

Recipient/Contractor: Eos Energy Storage, LLC

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 3/22/2016 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S8: Integrate Grid Level Energy Storage Technologies and Determine Best Applications That Provide Locational Benefits

Issue:

Residential, and commercial and industrial (C&I) customer electricity rates are increasing. Also, outages as a result of natural disasters or to prevent wildfire ignition are increasing. Currently available energy storage technologies for these markets are not economical because of their high cost and short life. Also, safety and energy density limitations have prevented wide-spread deployment of energy storage on a distributed basis or at the point of consumption. Additionally, with new requirements for residential solar, the market is expecting a corresponding increase in the desire for safe and effective residential storage.

Project Description:

This project is developing and testing behind-the-meter residential and C&I battery storage applications, on both a stand-alone basis and modeled with solar PV. This project is utilizing several kW-scale, AC-integrated Znyth battery technology storage systems. The project team is developing, modeling, and testing experimental rate designs and evaluating the impact on customer load profiles; developing control algorithms and demonstrating aggregation of multiple storage units to create virtual power plants that maximize the value of behind-the-meter storage to the utilities; and modeling, simulating, and extrapolating the economic impacts of installed systems and quantifying the benefits to California utilities and ratepayers.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project aims to validate the safety, reliability, and performance of a new aqueous, zinc-based battery technology to support customer adoption in behind-the-meter energy storage markets and applications. Behind-the-meter application of energy storage has been identified as a major commercial market for energy storage, which requires detailed field performance data to open up this market for new and emerging energy storage technologies.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed> Distribution Resources Plans (AB 327): R.14-08-013

Applicable Metrics: CPUC Metrics- 1c, 1i, 2a, 4a, 5b

Lower Costs: This project will help lower energy costs for residential and C&I customers by providing behind-the-meter energy storage options that may help offset peak use rates and lower demand charge costs.

Increase Safety: Eos is the only company offering a battery technology that is inherently safer than competing technologies. This technology is non-flammable and non-toxic. In addition to being backed by UL- and ISO-certified quality assurance and control, the manufacturing process involves no toxic or hazardous materials.

Environmental Benefits: Expanding the use of behind-the-meter storage in the residential and C&I markets will reduce overall loads in conjunction with increasing solar PV, which will reduce greenhouse gas emissions, NOx, and SO2 from existing fossil fuel generators.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$218,866

EPIC Funds Encumbered:

$1,894,866

EPIC Funds Spent:

$1,655,433

Match Partner and Funding Split:

Eos Energy Storage, LLC: $1,436,801 (43.1 %)

Match Funding:

$1,436,801

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

35 out of 38 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-018 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Eos completed the installation, commissioning, testing, and data collection at UCSD for the C&I system in June 2020. Eos is nearing completion of testing the residential system at its facility in New Jersey. Eos will finish the data analysis and complete the final report in early 2021.

Project Name: EPC-15-019 - Low Cost, Large Diameter, Shallow Ground Loops for Ground-Coupled Heat Pumps

Recipient/Contractor: The Regents of the University of California on behalf of the Davis campus

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 6/1/2016 to 3/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

Ground-coupled heat pumps (GCHPs) have been proven to deliver heating and cooling at higher levels of efficiency than air-source air conditioners and heat pumps. However, their application in mild climates, like California, is limited by the high cost of conventional ground heat exchangers (GHE), a component of GCHP systems.

Project Description:

This project is researching shallow (20-30 feet deep) and large diameter (2-3 feet diameter) helical coil, ground heat exchanger designs for ground source heat pumps. This project seeks to fill the current informational void with the materials and tools needed to eliminate the risks involved with engineering this new technology into homes. To this end, the project analyzed the performance of different designs of large diameter shallow bore GHEs, produced a calibrated model that can predict the performance of these GHEs and incorporate them into industry-standard design tools, and produced the materials that the industry needs to confidently move forward with the deployment of this technology. Also, a draft compliance option was prepared to facilitate this technology's incorporation into the California Energy Commission's residential energy compliance process. Determining a path of compliance of this technology will allow it to receive proper credit for incentives under the California Advanced Home Program, and will give policymakers the information they need to make policy decisions that will encourage the adoption of this technology

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project spurs the market for high efficiency GCHPs by evaluating and testing an innovative method to reduce the cost, which has been a barrier to more installations. The current method requires costly, specialized deep drilling rigs, that often must be transported from out of state. Using common, locally available drilling equipment for shallow bores, GHE bore drilling can be done at lower cost. This technology will be made ready for commercialization by developing modeling tools needed to properly design, size, and evaluate energy savings and to facilitate use

with Title 24 compliance tools . The team plans to submit a Statewide Utility Codes and Standards Enhancement (CASE) report to the CEC as a pathway to add to their model to future Title 24 models. The project team was able to successfully integrate their model to the Department of Energy's EnergyPlus simulation program.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h

Lower Costs: This project seeks to reduce the cost of GHEs for heat pumps. Affordable GCHPs may result in lower utility costs for heating and cooling, lower maintenance costs, and improved system reliability compared to forced air systems. Estimated annual energy savings is over 67 billion BTU, assuming 40,000 single family homes built annually and 10 percent of new homes equipped with GCHPs. Annual electric savings from cooling efficiency in new homes is roughly 1.2 million kWh. For a 2100 sq ft home and a 2 ton system, and comparing the incremental cost for a GCHP system with conventional HVAC system, the annual cost savings per home is $173, when amortized over 30 years with tax credits.

Environmental Benefits: If ground coupled heat pump systems were installed on all new single-family homes built in 2019, 110,000 homes a year, there would an 8500 MTCO2e GHG reduction.

Consumer Appeal: Increased use of GCHPs would eliminate noisy and visually unappealing outdoor condensing units. Also, GCHPs could improve comfort for residents compared to forced air systems.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$338,049

EPIC Funds Encumbered:

$1,212,186

EPIC Funds Spent:

$1,137,234

Match Partner and Funding Split:

Frontier Energy, Inc.: $18,826 (1.5 %)

Match Funding:

$18,826

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 12

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-019 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project is complete. Current GCHP model is improved by enabling better prediction of fluid temperatures in the bore. The simulated results show good agreement with field and laboratory data. This provides more accurate estimates of energy use for the system. The model was shared at ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) conferences. ASHRAE's guidelines on heat pumps and other measures were considered a primary reference in the industry. The recipient presented its model to the CEC's Building Standards Office and discussed updating Title 24's models. The Building Standards Office will include improved performance maps which could accommodate ground couple heat pumps in future versions of the

Residential ACM Reference Manual. The project team intents to submit a Statewide Utility Codes and Standards Enhancement Report in the next Title 24 update.

Project Name: EPC-15-020 - Intelligent HVAC Controls for Low Income Households: A Low Cost Non-connected Device that Understands Consumer Preferences and Performs Adaptive Optimization

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 3/1/2016 to 3/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

HVAC energy use in low income households, in many cases, is the largest energy end-use. However, efficiency issues associated with HVAC units are largely unaddressed due to cost, ownership and complexity of the systems. By targeting the so called "low hanging fruit", such as control mechanisms, energy savings could be realized with minimal intervention and cost to the tenant. However, further investigation is needed to monitor and verify the potential energy savings and occupant impacts, while also creating a business case for building owners/operators.

Project Description:

This project developed a low-cost smart thermostat with a simplified user interface. It was tested in low-income and senior housing, with the intention of being readily adaptable to other building sectors, including small commercial. The smart thermostat tracked user preferences and managed indoor conditions to optimize energy use. A main feature of the prototype was the ability to function without internet connectivity. By automatically optimizing thermostat settings, this project sought to determine if smart thermostats can be a cost-effective method to address HVAC energy use in sectors where cost-of-ownership boundaries are not well defined.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project bridges a technology connectivity gap in low-income and senior communities. Current smart thermostats are expensive, and a lack of broadband internet access makes these devices a bad fit for the low-income market. Developing a low-cost, internet-independent device creates opportunities to capture energy savings associated with automated controls in hard to reach building sectors without broadband access.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Demand Response (DR): R.13-09-011 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1g, 1h, 3a, 4a

Lower Costs: By developing a low-cost smart thermostat, the project aimed to increase adoption especially in households without broadband internet access. Installation of smart thermostats could reduce HVAC energy use and costs by 10 to 15 percent.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$903,766

EPIC Funds Encumbered:

$2,705,759

EPIC Funds Spent:

$2,476,739

Match Partner and Funding Split:

Electric Power Research Institute, Inc.: $427,072 (13.6 %)

Match Funding:

$427,072

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 11

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-020 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The decision tradeoffs presented challenges during the project, such as the balance between functionality, affordability and usability. During the design development, the recipient conducted field activities including fielding recruitment, tenant surveys and installing a small number of pilot devices. The field activities provided valuable lessons for future device deployment and future implementation. Considering the refinement of the reference design, a working low cost prototype was developed but after field performance and testing was determined to be deficient. However, the recipient has developed a future-state design that considers lessons learned from development and testing. The intent is to be able to provide this future-state design and potential design improvements in a manner that an interested party can take the lessons learned and incorporate it into its existing thermostat design and/or pick up where this project left off.

Project Name: EPC-15-027 - Electric Plug Load Savings Potential of Commercial Foodservice Equipment

Recipient/Contractor: Fisher-Nickel, Inc.

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 5/16/2016 to 6/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

The main barriers preventing adoption of advanced appliances in commercial food service has been a combination of cost, the industry's lack of knowledge and energy data. An equally important barrier to the adoption of optimized energy mode technologies is the operator's apprehension that the appliance will not be ready to use when needed; that the amount of time required to heat the appliance will delay product delivery and hinder the "speed of service" to the customer. Another operator concern is that that product quality will suffer when this type of technology is applied to appliances that are designed to maintain food-safe temperatures.

Project Description:

This project assesses the reduction potential of electric commercial plug load foodservice equipment at 29 different commercial kitchens and demonstrates the potential for reduced energy consumption through the use of pre-commercial appliance designs and control technologies.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project bridges the knowledge gap and supports accelerated adoption of advanced appliances and controls by better understanding operator behavior and operational changes that can be made to successfully use new lower energy appliances. The results of this effort will be used to develop real world case studies of successful implementation of next generation plug load appliances, and provide training to food service operators to maximize energy reduction potential for food service equipment. In addition to food service operators, the research results will assist equipment manufacturers in further product development of energy efficient food service equipment and help justify development of utility incentives for purchasing and installing energy efficient foodservice equipment.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h

Lower Costs: This project could lower energy costs by encouraging the adoption and implementation of advanced design and controls for commercial food service plug load appliances that use less energy than conventional systems. This could save up to $467 in annual energy cost per plug load appliance, with savings up to 65 percent for replacements. Total savings on the equipment could total over $1,500 annually if energy saving controls were optimized for each appliance and the site has a combination of a vertical toaster, food warmer, espresso machine, hot plate, rice cooker, and soup warmer. The COVID-19 pandemic has had a substantial impact on the commercial foodservice market.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$392,763

EPIC Funds Encumbered:

$937,469

EPIC Funds Spent:

$936,072

Match Partner and Funding Split:

Fisher-Nickel, Inc.: $1,377 (0.1 %)

Pacific Gas and Electric Company: $148,623 (13.0 %)

Dalla Corte: $20,000 (1.8 %)

Nuova Simonelli: $18,350 (1.6 %)

Hatco: $4,100 (0.4 %)

NAFEM: $10,000 (0.9 %)

Match Funding:

$202,450

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

19 out of 19 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-027 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project is complete and had demonstrations at 29 different sites. The recipient collected baseline data and installed new, high efficiency electric equipment, such as toaster ovens, soup warmers, rice cookers, and espresso machines at 18 of these restaurants. Cumulative energy savings for all plug load equipment can be substantial. The appliance with the highest average daily energy use and potential for energy savings was the conveyor toaster. It uses more than 20 times the energy on average than the appliance with the lowest average daily energy use, the soup warmer. Frontier also tested induction and conduction cook tops. The COVID-19 pandemic has had a substantial impact on the food service industry and leaving a glut of used equipment on the market. The recipient has pivoted to meet the changing needs of industry by providing on-line webinars and developing virtual tools that focus on energy efficient equipment and low-carbon solutions.

Project Name: EPC-15-030 - San Diego Regional Energy Innovation Cluster

Recipient/Contractor: Cleantech San Diego Association

Investment Plan: 2012-2014 Triennial Investment Plan, 2015-2017 Triennial Investment Plan

Project Term: 7/15/2016 to 3/31/2022

Program Area and Strategic Objective:

Applied Research and Development, Market Facilitation

S10: Leverage California's Regional Innovation Clusters to Accelerate the Deployment of Early Stage Clean Energy Technologies and Companies, S18: Foster the Development of the Most Promising Energy Technologies into Successful Businesses.

Issue:

Clean energy startups face difficulties in making use of the existing programs and resources available in the area, and accessing technology validation facilities, business training, market intelligence, and capital. They also experience increasing challenges navigating regulatory barriers to development and commercialization of entrepreneur's innovations. In order to facilitate the development of new energy innovations and their entry into the market, the various entrepreneurial support services available in the region must be coordinated under one directive, optimizing key services to meet the needs of individual businesses.

Project Description:

This project established the Southern California Energy Innovation Cluster (SCIEN) as a regional incubator program that provides commercialization support services to clean energy entrepreneurship in San Diego, Imperial, Riverside and San Bernardino Counties. This program will leverage the region's universities, industries, businesses, economic development organizations, and other key stakeholder groups to foster collaborations across the private-public-academic landscape and accelerate equitable deployment of clean technology innovations.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is advancing the goals of SB 350 (2015) by accelerating the commercialization of new clean energy technologies that can enable the integration of high-penetrations of renewables and distributed energy resources. This project will increase the probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. Intangible benefits to California ratepayers will result from broader, indirect, and multiplicative economic effects that occur from the successful establishment of California-based technology companies.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed>

Applicable Metrics: CPUC Metrics- 2a, 3b, 3e

Lower Costs: This project will help shorten technology development time and costs by providing a one-stop shop for entrepreneurs to quickly find and access the right services and resources.

Economic Development: This project will help facilitate successful clean energy entrepreneurship, leading to increased private sector investment and local job creation. To date, 50 companies have been accepted into the program and those SCIEN startups are currently employing close to 270 people. Companies have attracted over $51 million in private follow-on funding and $23.5 million in public follow-on funding since being accepted into the program.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$880,681

EPIC Funds Encumbered:

$5,000,000

EPIC Funds Spent:

$3,689,833

Match Partner and Funding Split:

Cleantech San Diego Association: $2,876,060 (35.5 %)

CONNECT: $221,874 (2.7 %)

Match Funding:

$3,097,934

Leverage Contributors:

U.S. Department of Commerce: $749,802

Leveraged Funds:

$749,802

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

6 out of 12 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-030 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, Southern California Energy Innovation Network (SCEIN) expanded the number of active startups to 35-member companies. These companies are developing breakthrough innovations to accelerate building decarbonization, transportation electrification, 100 percent RPS, resiliency, safety and equity. Collectively, these companies have attracted over $51 million in private follow-on funding and $23.5 million in public follow-on funding since being accepted into the program. This combined $74.5 million represents a doubling of the capital that these companies came into the program with, and a 20x ROI on the $3.4 million in total program expenditures to date. A series of 3 SCEIN Public Showcase Events were conducted to support 17 SCEIN member companies that are currently raising an additional $60 million in capital. To cap 2020 off, SCEIN companies Aquacycl, Nuvve (2) and Ivy Energy won 4 of the 5 inaugural California Energy Commission Visionary Awards at the 6th annual CEC EPIC Symposium.

Project Name: EPC-15-031 - Flexible Control Strategies for Plug Loads with Context-Aware Smart Power Outlets to Mitigate Electricity Waste and Support Demand Response

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 5/2/2016 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S1: Develop Next-Generation End-Use Energy Efficiency Technologies and Strategies for the Building Sector

Issue:

Consumer power consumption from electronic and miscellaneous plug loads pose large load profiles. Plug loads are not typically targeted by utility energy efficiency nor demand response programs. Consequently, plug load energy consumption and integrated plug load control strategies are not well-understood or developed. However, California's policies drive the need to better manage the growth.

Project Description:

This agreement develops integrated plug load control strategies for different spaces within multiple types of commercial buildings. The project implements a flexible energy management system (FEMS) to monitor and/or automate switching operation of equipment plugged into outlets. The project's goal was to advance the control strategies to reduce at least 10 percent energy use in assigned spaces (e.g., offices, research labs) as well as common areas (e.g., break rooms, shared equipment areas), and to develop and assess demand response strategies for plug loads with 10 percent demand reduction. The research was conducted by first establishing a baseline period with no interventions. Next, during the treatment period, control strategies were applied to selected equipment, and the impacts of energy and demand savings were calculated.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

In order to reduce plug load energy use and increase the energy efficiency of buildings, load sensing plug load automation strategy was used on workstation equipment and time scheduling automation was used on shared equipment. Also, a trial of a mobile application enabling occupant designation of equipment to opt into demand response strategies during DR events was implemented. The results of this project can potentially reduce electricity use by 10 percent in office buildings and 18 percent in laboratory buildings particularly during low-occupancy times and in user-assigned spaces, thereby achieving lower electricity costs for the ratepayer.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Demand Response (DR): R.13-09-011 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h

Lower Costs: The developed cost-saving plug load control strategies will clarify display designs, control settings and incorporated behavioral considerations. The identified strategies could potentially reduce electricity use by 10 percent from plug loads, particularly during low-occupancy times and in user-assigned spaces. This would lead to a reduction in electricity cost of commercial ratepayers.

Greater Reliability: The developed technology will identify potential demand response strategies through coordinated operation of plug loads in an integrated building system environment. This could help support power and market systems, particularly during critical periods when the grid is stressed or prices are high.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$366,082

EPIC Funds Encumbered:

$1,050,022

EPIC Funds Spent:

$945,018

Match Partner and Funding Split:

Enmetrics Systems: $24,120 (1.7 %)

Ibis Networks: $51,000 (3.7 %)

SkyCentrics: $10,000 (0.7 %)

San Diego Gas & Electric Company: $30,000 (2.2 %)

To Be Determined: $30,000 (2.2 %)

TBD - Technical Writer: $25,000 (1.8 %)

Electric Power Research Institute, Inc.: $165,000 (11.9 %)

Match Funding:

$335,120

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

19 out of 19 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-031 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The team is re-evaluating the M&V period due to the demonstration sites being unoccupied as a result of the COVID-19 pandemic. The term was extended to provide more time to evaluate the demand response capabilities. The research team has developed heat maps at each site. The heat map provides a graphical visualization of user presence and plug load energy usage atop a building floorplan, enabling analyses of relationships between presence and energy usage to inform strategies for deeper savings. This provides charting capability to target equipment and time schedules for automation (e.g., equipment that is used heavily during times of lack of presence). This can be useful for minimizing wasted energy and also understanding which equipment to target for load shifting during demand response events. The team is finalizing the Final Report and is getting feedback from the TAC members.

Project Name: EPC-15-032 - Bay Area Regional Energy Innovation Cluster

Recipient/Contractor: Activate Global, Inc

Investment Plan: 2012-2014 Triennial Investment Plan, 2015-2017 Triennial Investment Plan

Project Term: 5/12/2016 to 3/31/2022

Program Area and Strategic Objective:

Applied Research and Development, Market Facilitation

S10: Leverage California's Regional Innovation Clusters to Accelerate the Deployment of Early Stage Clean Energy Technologies and Companies, S18: Foster the Development of the Most Promising Energy Technologies into Successful Businesses.

Issue:

Clean energy startups face difficulties in making use of the existing programs and resources available in the area, and accessing technology validation facilities, business training, market intelligence, and more. In particular, venture capital investment, the main source of private sector support for early stage technology companies, has declined sharply for hard energy technology in the past several years. Unfortunately, no reliable, alternate source of private capital has emerged, due to the high risks associated with early stage energy technology development.

Project Description:

This project established the Bay Area Regional Energy Innovation Cluster by expanding the Cyclotron Road program to provide commercialization support services to Bay Area entrepreneurs developing breakthrough materials and hardware devices in energy efficiency, energy storage, distribution, grid management, and power generation. Cyclotron Road provides entrepreneurs access to world-class laboratory facilities, and key services, such as business model development, customer discovery, and intellectual property protection to enable energy entrepreneurs in the Bay Area region.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will help advance the goals of Senate Bill 350 (De Leon, 2015) by accelerating the commercialization of clean energy technologies, including energy efficiency, demand response, renewable generation, energy storage, and smart-grid integration. This project will increase the probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. Intangible benefits to California ratepayers will result from broader, indirect, and multiplicative economic effects that occur from the successful establishment of California-based technology companies.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Smart grid: R.08-12-009 <closed>

Applicable Metrics: CPUC Metrics- 2a, 3b, 3e

Lower Costs: This project will decrease the time and costs for new technology development by providing entrepreneurs with the services and facilities they need to commercialize their technology.

Economic Development: This project will help facilitate successful clean energy entrepreneurship, leading to increased private sector investment and local job creation. To date, 30 companies have been accepted into the program and those startups are currently employing close to 135 people. Companies have attracted over $33 million in private and private follow-on funding since being accepted into the program.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$282,411

EPIC Funds Encumbered:

$4,980,000

EPIC Funds Spent:

$2,327,928

Match Partner and Funding Split:

DLA Piper LLP: $90,000 (0.6 %)

Lawrence Berkeley National Laboratory: $4,150,000 (29.7 %)

Activate Global, Inc: $260,000 (1.9 %)

Autodesk, Inc.: $4,500,000 (32.2 %)

Match Funding:

$9,000,000

Leverage Contributors:

U.S. Department of Energy: $928,736

U.S. Department of Energy: $50,000

Leveraged Funds:

$978,736

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

6 out of 12 bidders

Rank of Selected Applicant/ Bidder:

Group 4: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-032 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, Cyclotron Road accepted its sixth cohort of fellows into its program. This latest round of entrepreneurs is developing innovations in areas such as high-efficiency wireless charging, predictive platforms to improve exploration of geothermal resources, and additive manufacturing for high-efficiency electric motors. The fellows will spend the next two years working on bringing their technologies closer to market. Fellows supported by CEC funding have attracted over $33 million in public and private follow-on funding since being accepted into the Cyclotron Road Program. The project team also transferred previously developed in-person curriculum and programing for the fellows into a completely remote experience in response to COVID-19. In 2021, Cyclotron Road will continue to accept a new cohort of fellows.

Project Name: EPC-15-037 - Smart Ventilation for Advanced California Homes

Recipient/Contractor: DOE- Lawrence Berkeley National Laboratory

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 5/13/2016 to 1/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

As California advances zero net energy homes, heating and cooling loads shrink but the need to safeguard indoor air quality remains unchanged. Current approaches to ventilation would result in ventilation contributing a larger fractional load. In addition, current approaches that specify ventilation per hour are not responsive to occupancy or to concentrations of health-damaging air pollutants. Smart ventilation, which involves varying ventilation in response to temperature, occupancy, air pollutant concentrations, may improve indoor air quality while reducing energy demand. Smart ventilation could also help offset demand during peak periods by shifting ventilation loads to off-peak hours.

Project Description:

This study explored how real-time monitoring and automatic controls can be used in home ventilation systems to improve energy efficiency and/or optimize consumption for time-of-day load balancing. Specifically, the study considered optimization of ventilation for indoor air quality for zones (i.e., air quality in different rooms within buildings). The study used computational simulations leveraging multiple well-established platforms to develop and evaluate control schemes for home ventilation systems. Key evaluation criteria were the modeled ventilation-related energy used over a year of operation, and the indoor air quality relative to a minimally code-compliant continuously operating ventilation system.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This work built on efforts of the past decade that have facilitated dynamic ventilation approaches. The project used simulation approaches to determine how energy, indoor air quality (IAQ), peak period demand, and comfort can be optimized using smart ventilation. The results from the project will help smart home automation service providers and their consumers identify effective smart ventilation strategies and provide important, as well as provide information that the Energy Commission could potentially use in the development of future ventilation standards.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 4b, 5d

Lower Costs: The project has the potential to result in reduced electricity consumption and/or peak shifting by developing smart ventilation strategies to optimize system performance.

Public Health: The project has the potential to result in improved air quality in homes that utilize the developed smart systems.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$649,037

EPIC Funds Encumbered:

$1,500,000

EPIC Funds Spent:

$1,500,000

Match Partner and Funding Split:

United States Department of Energy: $1,000,000 (35.7 %)

Aereco S.A.: $200,000 (7.1 %)

Lawrence Berkeley National Laboratory: $100,000 (3.6 %)

Match Funding:

$1,300,000

Leverage Contributors:

U.S. Department of Energy: $1,000,000

Leveraged Funds:

$1,000,000

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

45 out of 45 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-037 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The team completed development of an integrated energy simulation model that enables quantitative evaluation of the energy demand, energy cost (based on time-of-use pricing), and air quality implications of various smart ventilation strategies. The team also developed a range of optimized control algorithms for various home ventilation scenarios. The final report was published in July 2020. Prior to publication of the final report, the team completed several journal publications based on literature review and development of guidelines for indoor air quality (IAQ) metrics. Metrics have been used in a U.S. Department of Energy project to support development of a home IAQ scoring system.

Project Name: EPC-15-038 - BlueTechValley Innovation Cluster

Recipient/Contractor: California State University, Fresno Foundation

Investment Plan: 2012-2014 Triennial Investment Plan, 2015-2017 Triennial Investment Plan, 2018-2020 Triennial Investment Plan

Project Term: 5/16/2016 to 3/31/2022

Program Area and Strategic Objective:

Applied Research and Development, Market Facilitation

S10: Leverage California's Regional Innovation Clusters to Accelerate the Deployment of Early Stage Clean Energy Technologies and Companies, S18: Foster the Development of the Most Promising Energy Technologies into Successful Businesses.

Issue:

While Central Valley entrepreneurs are helping to drive new and effective energy and water innovations, many are still limited by technical and non-technical hurdles on the road to commercialization. On their own, many do not have sufficient resources to fully test their technologies, develop fundable business plans, grow entrepreneurial networks, or transition technologies from trial or demonstration scale to real-world deployment and commercialization. The need to help such entrepreneurs is magnified by the recent drought conditions in the Central Valley that have critically reduced available surface water supplies and increased electricity demand due to increased groundwater pumping.

Project Description:

This project expands access for clean energy entrepreneurs to a region-wide energy-water-food nexus incubator and commercialization services in California's Central Valley and North State regions. The Central Valley Energy Innovation Cluster (a.k.a. BlueTechValley Energy Cluster) provides entrepreneurs with a variety of services, including technology evaluation, proof-of-concept validation and advisory support as well as opportunities to connect with investors, industry leaders and potential customers.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will help lead to technology advancements by providing and coordinating key services, assistance, resources, and infrastructure needed by entrepreneurs and researchers to create and develop advanced energy technologies that will help the state meet the targets set by Senate Bill 350 to increase both renewable electricity generation and energy efficiency to 50 percent by 2030.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Water-Energy Nexus: R.13-12-011 <Closed>

Applicable Metrics: CPUC Metrics- 2a, 3e

Economic Development: This project helps facilitate successful clean energy entrepreneurship, leading to increased private sector investment and local job creation. BlueTechValley (BTV) has accepted and supported 231 companies (an increase of 52 companies this year alone) that employ 1,207 people. These companies received $4.6 million in follow-on private capital and $4.87 million in follow-on public funding in 2020. To date, BTV companies have received $69.3 million in follow-on private capital and $43.8 million in follow-on public funding.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$718,347

EPIC Funds Encumbered:

$5,000,000

EPIC Funds Spent:

$3,513,890

Match Partner and Funding Split:

California State University, Fresno Foundation: $2,350,112 (30.7 %)

Child Family Institute for Innovation and Entrepreneurship - UC Davis: $200,000 (2.6 %)

Schatz Energy Research Center: $35,772 (0.5 %)

Los Angeles Cleantech Incubator: $19,900 (0.3 %)

Kern Economic Development Corporation: $49,900 (0.7 %)

Match Funding:

$2,655,684

Leverage Contributors:

U.S. Department of Commerce: $500,000

U.S. Department of Commerce: $300,000

U.S. Department of Energy: $50,000

Leveraged Funds:

$850,000

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

6 out of 12 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-038 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

BlueTechValley (BTV) has accepted and supported 231 companies (52 companies in 2020) which received $4.6 million in follow-on private capital and $4.87 million in follow-on public funding in 2020. To date, BTV companies have received $69.3 million in follow-on private capital and $43.8 million in follow-on public funding.

In 2020, BTV hosted or supported 135+ events. BTV provided support to entrepreneurs, which included switching quickly from in-person to virtual events (due to COVID-19 challenges) that covered subjects such as grant writing, funding, and legal topics.

In 2021, BTV will focus on four key areas: 1) bolster support to cleantech ventures, especially those affected by COVID-19; 2) create innovative ways to provide virtual programs, events, and support; 3) work closely with Hubs to continue programming and support through sustainable funding; 4) engage with government and private industry to promote connectivity and engagement.

Project Name: EPC-15-039 - Carbon Balance with Renewable Energy: Effects of Solar Installations on Desert Soil Carbon Cycle

Recipient/Contractor: The Regents of the University of California, Berkeley Campus

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 6/24/2016 to 2/28/2020

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

Deserts are impacted by both the development of large-scale solar installations and the temperature changes associated with human induced climate change. The effect of these impacts on the soil organic (biomass) and inorganic (calcium carbonate) carbon budget is unknown. It is crucial to gain quantitative understanding of whether desert ecosystems will lose carbon as a result of both solar field installations and climate change, as well as to identify the environmental costs and benefits of renewable energy development in terms of greenhouse gas (GHG) emissions.

Project Description:

This project installed soil and meteorological sensors at sites with solar installations and in adjacent undisturbed areas to make direct comparisons on the gains or losses of carbon, changes in microclimate and hydrology, and changes in dust generation or capture, and is aiming to predict long term soil and GHG emissions changes based on geochemical modeling. The project addressed the question of whether land alteration and modification during the construction and use of solar installations has a measurable impact on the soil carbon balance, and ultimately on the net carbon savings that solar installations provide during their lifetime

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The research project -- the first of its kind -- determined the impact of large solar arrays on the carbon storage of desert soil ecosystems. Findings can provide insights into the most effective ways to design and manage solar production facilities for maximum net carbon benefits.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Strategies and Guidance for Climate Change Adaptation: R.18-04-019

Applicable Metrics: CPUC Metrics- 2a, 4f

Lower Costs: The research estimates the mass of net carbon change in desert soils due to solar site development and climate change. These metrics for soil carbon gains and losses could be incorporated into renewable energy credits (RECs) and would constitute a direct monetary benefit to California IOU ratepayers.

Environmental Benefits: The research estimates GHG emissions arising from net changes to the natural soil carbon cycle caused by utility scale solar installations, reduces regulatory uncertainty, and facilitates more efficient environmental approval procedures for solar energy companies, which helps to meet the state's renewable energy goals.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$80,312

EPIC Funds Encumbered:

$499,181

EPIC Funds Spent:

$445,659

Match Partner and Funding Split:

The Regents of the University of California, Berkeley Campus: $72,000 (12.6 %)

Match Funding:

$72,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

45 out of 45 bidders

Rank of Selected Applicant/ Bidder:

Group 4: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-039 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The research team continuously collected tropospheric climate and physical and biological soil data at six undisturbed sites within the Mojave National Preserve. Chemical, physical, and organic and inorganic carbon measurements were completed on all soil samples collected from the six sites. Data from the sites has been used to parameterize the DayCent ecosystem process model. Installation and sampling of two in-situ monitoring stations located at a utility-scale solar facility was completed in 2018. Data collection of temperature, water content, and corresponding CO2 concentrations continued through 2019. The final report was published 2020.

Project Name: EPC-15-041 - MarketZero: Taking an existing grocery store to scalable near-ZNE

Recipient/Contractor: Prospect Silicon Valley

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 5/1/2016 to 6/30/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

Supermarkets and grocery stores have the highest energy use among commercial buildings with majority of energy spent on refrigeration and other miscellaneous loads. They are also the most challenging to achieve zero net energy among commercial buildings. This is due to the high process energy use of refrigeration, lighting and commercial kitchen systems.

Project Description:

The project implements a cost-effective energy efficiency upgrade package for a grocery store that uses both mature and innovative energy efficiency technologies with the objective of converting all major gas using equipment to electric.. The project includes LED lighting and refrigeration system improvements to increase energy efficiency, changing refrigeration units to use a lower global warming potential refrigerant (R448A), and installing high-efficiency variable frequency drive compressors. Other improvements include thermal ice packs in the walk-in freezers to reduce compressor run time during the day and help shift electrical load on hot days, variable speed reluctance motors for the supply fans for new efficient heat pumps, and self-contained refrigeration cases to improve the efficiency.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

As grocery store owners are risk averse especially with new emerging innovative technologies, successful demonstration showing the benefits and performance of an all-electric grocery store, could advance these technologies for use in other grocery stores. As profit margins for grocery stores are between 1 and 3 percent, increases in energy efficiency using these advanced technologies will be beneficial to a store's bottom line. Also, these types of improvements pose challenges to grocery stores due to limited space and existing configurations. However, documenting cost, savings and benefits could influence the grocery market to make similar future upgrades. These solutions and design approaches hope to reduce greenhouse gas emissions and decarbonize grocery stores.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h, 4a

Lower Costs: Implementing the energy efficiency upgrade package could lower future energy costs for building owners and operators and is applicable to other grocery stores. Estimated state-wide reduction of about $400 million (based on savings of 2,400 GWh and 15 million therms) across California grocery stores.

Environmental Benefits: Replacing natural gas using systems with high efficiency electric units (e.g., heat pumps) could lead to additional grocery stores decarbonizing in the future to reduce their greenhouse gas emissions. Also, as grocery stores have a high number of refrigeration units, replacing these units with ones using lower global warming refrigerants will result in further reductions in greenhouse gas emissions.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$846,723

EPIC Funds Encumbered:

$2,999,591

EPIC Funds Spent:

$2,962,771

Match Partner and Funding Split:

Whole Foods Market: $650,000 (17.8 %)

Match Funding:

$650,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

39 out of 39 bidders

Rank of Selected Applicant/ Bidder:

Group 5: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-041 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

All projects have been installed and the project is complete. Project results indicate that the demonstration site, Whole Foods in San Francisco, is saving about 40 percent of its original energy use. The store has also installed a sound barrier to address sound levels from the new heat pump system. Whole Food's approach has been to: a) transfer information to others through social media, leverage the Whole Foods Market community and outreach with other stores, 2) leverage project experts and professionals on design considerations, construction operability issues, and methods for integrating emerging technologies gleaned by the team.

Project Name: EPC-15-042 - Zero Energy Residential Optimization - Community Achievement (ZERO-CA)

Recipient/Contractor: California Homebuilding Foundation (CHF)

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 5/1/2016 to 3/31/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S14: Demonstrate the Reliable Integration of Energy Efficient Demand-side Resources, Distributed Clean Energy Generation, and Smart Grid Components to Enable Energy Smart Community Development

Issue:

Although the construction of a number of single (one-off) Zero Net Energy (ZNE) homes has established that achieving ZNE in residential construction is technically feasible, it is less clear whether ZNE construction can cost-effectively be brought to scale from a developers perspective, as any additional upfront costs can lead to a loss in competitiveness . Additionally, the State will need improved methods for estimating and controlling the consumption of unregulated loads in residential buildings, which has grown and is projected to continue growing.

Project Description:

The project serves as proof of concept for large-scale deployment of Zero Net Energy (ZNE) single-family homes in California. The objective is to assess how to construct ZNE homes without creating undue cost burdens on builders, businesses or consumers, and while assuring that changes to home design do not pose health, safety or other risks to occupants. This assessment will be done with a focus on cost control for ZNE construction by developing cost-effective packages of measures that include both commercially available and emerging technologies that meet the requirements of the Building Energy Efficiency Standards (Title 24, Part 6) as well as unregulated measures. In addition to builder cost savings passed to consumers in sales price, the project will assess and optimize actual consumer utility cost savings from ownership of ZNE homes.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Working closely with the builder and subcontractors, technology costs were evaluated and along with a real-world perspective on actual time and labor spent to install and commission each of the new technologies versus only the technology cost. By providing this data and analysis, this project serves as a roadmap on the most effective ways to implement ZNE homes. The information gathered was disseminated through various project participants such as California Building Industry Association (CBIA) events and member newsletters in efforts to promote the potential for cost-effective ZNE to the builder community.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed> Integration of Distributed Energy Resources (IDER): R. 14-10-003 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1h, 3b, 4a

Lower Costs: The project focused on cost control for ZNE construction and developed cost-effective packages of measures that include both commercially available and emerging technologies that meet the requirements of the Building Energy Efficiency Standards (Title 24, Part 6) as well as unregulated measures. Examples of unregulated measures include appliances, and plug load. In addition to builder cost savings passed to consumers in sales price, the project assessed and optimized actual consumer utility cost savings from ownership of ZNE homes.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$1,488,701

EPIC Funds Encumbered:

$4,819,805

EPIC Funds Spent:

$4,462,509

Match Partner and Funding Split:

California Homebuilding Foundation (CHF): $2,611,014 (35.1 %)

Match Funding:

$2,611,014

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

39 out of 39 bidders

Rank of Selected Applicant/ Bidder:

Group 6: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-042 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

A draft final report is in progress and will include data through 2020. Study results indicate that only 7 percent of homebuyers can define what is a ZNE home, but 72 percent believe that energy efficiency is very important. Analysis revealed that the most cost-effective single energy efficiency measure varied by climate zone, and the only measure that consistently performed in the top 10 of being most cost-effective was the heat pump water heater. The study also revealed that all-electric appliances for a home cost $200-$500 less than natural gas appliances when natural gas infrastructure savings are included, such as plumbing and flue vents. These findings, while consistent with other electrification analyses, are not consistent with feedback from builders who report that all-electric appliances are $2,200-$3,500 more expensive due to the need for equipment oversizing to meet heating loads and avoid use of supplemental electric resistance heating. Results to be shared with the industry.

Project Name: EPC-15-045 - Transactive Incentive Signals to Manage Electricity Consumption for Demand Response

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 5/18/2016 to 6/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S2: Develop New Technologies and Applications that Enable Cost-Beneficial Customer-side-of-the-Meter Energy Choices

Issue:

Demand response (DR) has substantial potential to act as either a demand-side or a supply-side resource. However, existing programs and rates do not provide a participation incentive structure that accurately reflects system conditions or system costs, a suboptimal situation that results in higher ratepayer costs, low DR participation and an inability for system operators to regularly utilize demand-side resources. As the state moves toward more distributed generation and intermittent renewable energy generation, integration of those generation resources will further increase costs in the absence of significantly expanded DR resources responding to actual system needs in real time.

Project Description:

This project develops Transactive Load Management (TLM) signals, expressed in the form of proxy prices reflective of current and future grid conditions, and develops and implements software to calculate such signals. These signals are being designed to provide customers sufficient information to optimize their energy costs by managing their demand in response to system needs. The signals are transported via proven and available protocols and networks for use by projects that will test the efficacy of the TLM signals using the demand response projects awarded under GFO-15-311, Advancing Solutions that allow Customers to Manage Their Energy Demand.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project has developed a day-ahead hourly proxy price signal that incorporates system conditions as reflected by wholesale energy markets. The hourly prices are being made available on a publicly-accessible server and are being incorporated as one of the experimental pricing structures being evaluated in EPIC demand response projects funded under GFO-15-311. The experimental pricing structures assessed the potential for a variety of different loads and customer types to respond automatically to a real-time proxy pricing signal, and by extension, the potential of DR being a demand side or a supply side resource for the State. Utilities have realized the potential benefits of TLM that PG&E has recently proposed its own day-ahead hourly rate.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Alternative Fueled Vehicles: R.13-11-007 <Closed> Smart grid: R.08-12-009 <closed> Customer Data Access Program: Applications A.12-03-002, 003, 004. Decisions D.11 Distribution Level Interconnection (Rule 21): R.11-09-011 <closed> Demand Response (DR): R.13-09-011 Net energy metering: R.14-07-002 Resource Adequacy (RA) 2016 and 2017 Compliance Years: R.14-10-010 <Closed> Integration of Distributed Energy Resources (IDER): R. 14-10-003 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 1c, 1d, 1e, 1f, 1g, 1h, 3c, 3e, 3f, 3h, 4a, 5a, 5b

Lower Costs: Demand response lowers costs for both the system and individual customers. Procurement costs are reduced when wholesale energy prices are attenuated by price-responsive demand; customer costs are reduced when they either shift consumption to lower-priced times or receive payment for participating load reduction.

Greater Reliability: High levels of demand can stress grid assets, and increased stress could lead to outages if left unchecked. If the TLM day-ahead hourly price signal that was successfully demonstrated in this project with smart management of consumer loads was adopted, retail customers could optimize their demand load to minimize stress on grid equipment and improve reliability.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$190,201

EPIC Funds Encumbered:

$498,054

EPIC Funds Spent:

$498,053

Match Partner and Funding Split:

Greenlots: $110,450 (18.2 %)

Match Funding:

$110,450

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

19 out of 21 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-045 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

This project was completed on March 31, 2020. The final report has been delivered, returned to the contractor for revision, and resubmitted. It is now going through the publications process. This project successfully developed and demonstrated a TLM price signal system to automate load management strategies. The TLM provided a standard approach to enable supply- and demand-side market DR participation. The TLM price signal delivered hourly and sub-hourly energy prices to reflect real-time grid and market conditions. The price signal enabled grid operators to offer price-based DR programs and allowed customers to participate in those programs when it best fit their cost and operational needs.

Project Name: EPC-15-047 - Powernet - A Cloud Based Method for Managing Distribution Resources

Recipient/Contractor: SLAC National Accelerator Laboratory

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 5/18/2016 to 3/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S6: Develop Technologies, Tools, and Strategies to Enable the Smart Grid of 2020

Issue:

The power grid is changing rapidly. In California, renewables on the utility side of the meter are expected to provide 50 percent or more of the electricity supply by 2030, requiring significant distributed energy resources (DERs) to help integrate those renewables. Additionally, greatly expanded numbers of DERs, such as distributed solar, storage, and EVs, are expected on the customer side of the meter and on the utility side of the distribution grid. There is an urgent need to coordinate all these resources to minimize costs, increase consumer quality of service, preserve grid stability and offer services to the grid.

Project Description:

This project was designed to further develop Powernet, a cloud-based platform for managing energy resources in homes and businesses. Powernet was developed to control and coordinate energy resources both behind the meter and at the distribution system level for residential and commercial ratepayers to: (i) minimize costs, (ii) increase consumer quality of service, (iii) preserve grid stability and (iv) offer services to the grid.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Several significant Powernet system innovations were developed under this agreement: (i) the integration of control, optimization and power electronics enables novel functionality that includes stable connect/disconnect from the grid, local and global power sharing, and grid services including demand response; (ii) the development of a layered system structure that enables the operator to utilize Powernet for a variety of different grid purposes or service offerings; (iii) the design of the system to secure; and (iv) the adoption of open source standards and protocols for the platform to enable scalable engagement of devices in the future.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1g, 2a, 3a, 3d, 3f, 5f, 5h

Lower Costs: There will be economic savings to using Powernet. Every home and business will need to pay only once for installation of the Powernet and can then progressively add DERs on its own. The cost of adding more DERs, at a home or facility, can be reduced by 5 to 10 percent by using Powernet because additional DERs can be easily integrated without extra labor.

Greater Reliability: Powernet will allow for greater control of a diverse set of behind-the-meter resources, which will enable greater reliability of the grid.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$865,939

EPIC Funds Encumbered:

$2,210,720

EPIC Funds Spent:

$2,210,720

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

United States Department of Energy: $3,500,000

Leveraged Funds:

$3,500,000

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

23 out of 29 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-047 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project wrapped up this year. The project team completed large-scale simulations (up to 10,000 buildings), modeling different DER deployment scenarios, markets and levels of penetration of renewables. Researchers quantified the stability and performance limits of the algorithms to guide real-world deployment. The team then deployed Powernet in 11 houses in Fremont, CA to test communication between different devices and the cloud and to validate the algorithms developed in simulations. This demonstration validated the modeling, bringing the system closer to commercialization. The recipient has received follow-on funding from ARPA-E to develop a home hub to coordinate DER technologies and smart appliances and integrate the hub with Powernet.

Project Name: EPC-15-048 - Residential Intelligent Energy Management Solution: Advanced Intelligence to Enable Integration of Distributed Energy Resources

Recipient/Contractor: Alternative Energy Systems Consulting, Inc.

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 5/30/2016 to 3/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S2: Develop New Technologies and Applications that Enable Cost-Beneficial Customer-side-of-the-Meter Energy Choices

Issue:

Increasing amounts of variable solar generation creates challenges for grid operators due to the steep supply increases at sunrise and decreases at sunset. Balancing variable renewable generation with traditional fossil generation offsets some of the GHG savings. Managing loads and utilizing distributed storage has significant potential for balancing variable PV generation.

Project Description:

This project tests and validates an intelligent residential energy management system that is capable of communicating with a variety of distributed energy resources (DER) including solar PV and energy storage in 100 residences in San Diego. The project integrates the use of pilot time-of-use utility rates in conjunction with simulated dynamic pricing signals to optimize grid impact and cost savings.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The key advancements in this project are operational integration strategies developed and tested in the field. These strategies have the potential of achieving widespread deployment throughout the state which could significantly reduce peak demand, reduce annual energy costs, and improve grid operations.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1e, 1h, 2a, 4a

Lower Costs: The energy management system optimizes customer electricity use to minimize customer cost and reduce peak demand based on time-of-use or other dynamic electricity rates. This system incorporates predictive algorithms to forecast customer consumption and electric vehicle charging requirements while accounting for customer comfort levels. In turn, it allows the

system to transparently control distributed energy resources and intelligent loads within predetermined customer constraints.

Greater Reliability: Wide-scale adoption of this residential distributed energy resources management system in California can increase grid reliability by efficiently managing electricity usage in millions of homes. This will improve reliability on multiple feeders and reduce the risks associated with a single point of failure at a large battery-energy-storage farm. It also provides the opportunity to preserve and effectively manage energy use, storage, and load during public safety power shutoff events and other disaster-related outages.

Environmental Benefits: A solution that enables ratepayers/customers to use higher levels of renewable energy generation will help reduce GHG emissions.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$637,870

EPIC Funds Encumbered:

$3,996,560

EPIC Funds Spent:

$3,985,174

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

19 out of 21 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-048 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project has been completed and the final report has been published. Across the 100 homes included in the study, there was an average reduction in consumption during peak hours (4-9 p.m.) of 23 percent (average hourly load reduced from 0.84 to 0.65 kW). Project results show this technology's potential to dynamically adjust the electric grid by functioning as a missing link between rapid load fluctuations and the grid. This dynamic technology has the potential to dramatically flatten the duck curve and balance variable renewable resources. After the project ended, the energy management system was deactivated for study participants. Now that there's real world data of Itron's technology in 100 homes, there's a better understanding of the systems potential which should make it easier for Itron or others to make the case for additional deployments.

Project Name: EPC-15-050 - Winery Water and Energy Savings

Recipient/Contractor: Regents of the University of California, Davis

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 6/30/2016 to 3/31/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

California is the fourth largest producer of wine in the world. The California wine industry is the second largest consumer of electricity in the food and beverage industry and is a significant water consumer. As the wine industry and its associated water and energy use continue to expand, efficiency technologies will become increasingly important. Water supply is limited and energy bills will become a larger portion of operating costs if not contained. Water reuse and novel heat recovery can significantly decrease fresh water and energy use in wine production, but data on technical and economic feasibility is limited.

Project Description:

This project demonstrated two energy and water saving technologies at a winery facility in northern California. The first technology is a water treatment and reuse system to recycle wastewater for indoor barrel washing. The second is a wine-to-wine heat exchanger for the cold-stabilization process -- a process through which white wine is cooled to a low 28 degrees Fahrenheit and then heated back up to 55 degrees Fahrenheit. Both technologies were installed and underwent monitoring and verification testing at the Jackson Family Wines botting facility in Sonoma County.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The demonstrations showed the potential savings and benefits for the wine industry. The water treatment and reuse system uses reverse osmosis to treat water to potable standards. This technology is used in alternative markets, but not at wineries. This project demonstrated that the technology can be used in the winery industry with the treated water used for barrel washing and resulting in average water savings of 75 percent annually and 84 percent recovery when optimized. The second technology is an innovative wine-to-wine heat exchanger for the cold-stabilization of the white wine that recovers the thermal potential of existing cooling and heating streams and reduces the amount of energy used for processing white wine. Cold stabilization is one of the most energy intensive processes in the wine industry and can significantly benefit from the simple wine-to-wine heat exchanger technology.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1h, 2a, 4a, 4c

Lower Costs: Water and energy savings are expected to reduce energy bills, leading to lower operating costs for winemakers and bottling plants. Treating and reusing barrel wash water results in energy savings by reducing electricity costs associated with pumping water from wells. The wine-to-wine heat exchanger technology for the cold-stabilization of wines offers significant electricity and natural gas savings through heat recovery and reuse. The estimated overall annual energy cost savings for this project is $54,418.

Environmental Benefits: This project is expected to reduce the amount of fresh groundwater used for barrel washing by at least 75 percent annually with potential for 84 percent or higher with further optimization. Reuse of the treated wastewater for barrel washing is expected to save 1.4 million gallons of fresh water annually. In addition, the wine-to-wine heat exchanger technology can result in energy savings and greenhouse gas emissions reduction. If optimized, the annual greenhouse gas emissions reduction for the overall project is estimated to be over 35,000 pounds of CO2e, based on electricity, natural gas, and water savings.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$157,088

EPIC Funds Encumbered:

$1,989,201

EPIC Funds Spent:

$1,986,710

Match Partner and Funding Split:

Jackson Family Wines: $404,625 (16.9 %)

Match Funding:

$404,625

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

27 out of 35 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 5

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-050 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The agreement completed in March 2020. This project laid the groundwork for further commercial development. Each technology presented unique opportunities for energy and water savings. The water treatment and reuse system (VSEP) yielded an average of 75 percent water recovery from the raw influent and formal optimization procedures showed even higher potential percent recovery of water achieving up to 84 percent recovery. The second technology, the wine-to-wine heat exchanger system, was able to reduce energy costs by up to 88 percent and has shown that it can operate within the required performance specifications. The demonstration site, Jackson Family Wines is interested in expanding the use of these technologies in its operations and the VSEP technology vendor continues to expand its presence in the wine industry. Information on this project was shared with IOU representatives who expressed interest in the wine-to-wine heat exchanger and could consider the technology for future IOU incentive programs.

Project Name: EPC-15-053 - Customer-Centric Approach to Scaling IDSM Retrofits

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 6/30/2016 to 6/30/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

The California retrofit goal is to reduce 50 percent of existing buildings' energy use by 2030. Disadvantaged, low-income, multifamily communities are one of the most important retrofit targets, yet have no cost-effective pathways to achieve these goals. Multifamily housing is a very difficult market segment to address due to split incentives as retrofits are the responsibility of a property owner but he/she does not pay the energy bill. Limited technical and financial knowledge for owners also plays a role.

Project Description:

This project develops and demonstrates an approach to scale residential retrofits for disadvantaged communities that will focus on customer-centric solutions. This project develops and demonstrates an innovative approach, focusing on energy efficient integrated demand side management (IDSM) retrofit packages that are non-intrusive or do not displace occupants for long periods of time. The measures have the potential of reducing energy use by 30 to 40 percent.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project provides new data, analysis, and designs for cost-effective integrated demand side management retrofits that addresses some of the infrastructure challenges with existing multifamily buildings. The recipient has identified advanced technologies associated with HVAC and water heating that hope to overcome the infrastructure challenges, along with other innovations including smart thermostats, plug load controls, and LED lighting. The project results and monitoring and verification data will determine whether these portfolio of projects can achieve the goal of 30-40 percent reduction in energy use while minimizing tenant disruptions.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a, 5b

Lower Costs: These integrated retrofits could reduce energy use by 30 to 40 percent in multifamily buildings. The project could result in significant savings in energy and operating costs to building owners and residents.

Environmental Benefits: This project has the potential to reduce air and greenhouse gas emissions due to the reduction or elimination of natural gas use for space heating, water heating and cooking. Also, the projects will include the use of solar PV to meet a portion of the electrical needs of the multifamily buildings.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$1,382,796

EPIC Funds Encumbered:

$3,894,721

EPIC Funds Spent:

$3,883,487

Match Partner and Funding Split:

BIRA Energy: $25,000 (0.5 %)

Southern California Edison: $312,572 (6.7 %)

LINC Housing Corporation: $461,987 (9.8 %)

Match Funding:

$799,559

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

39 out of 39 bidders

Rank of Selected Applicant/ Bidder:

Group 5: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-053 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In Ontario: The research team has completed obtained 12+ months of post-retrofit data. The measures that were installed were cool roof, heat pump HVAC, programmable thermostat, thankless Natural Gas WH, Low-E double pane windows, LED interior lighting, low-flow fixtures, variable speed pool pump, and upgraded appliances. The results showed energy savings of 43 percent-49 percent on site and tenant survey was overall positive. In Fresno: Site installation was completed in 2020. The demonstration site installed all 110V PTAC HVAC (heat pump) in all the units. Heat pump water heaters were installed at each building with a large tank that would feed into multiple units. In addition, other measures installed included LED lighting, attic insulation, wall insulation, and upgraded appliances. The project is expected to be completed in early 2021.

Project Name: EPC-15-072 - New Chemical Compounds for Cost-Effective Carbon Capture

Recipient/Contractor: The Regents of the University of California, Davis Campus

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 6/30/2016 to 6/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts

Issue:

Carbon capture and sequestration could play a role in attaining California's ambitious goal of zero-carbon electricity by 2045. Additionally, carbon capture and sequestration could provide a negative emissions pathway for offsetting emissions elsewhere in California's economy if coupled with generation from carbon neutral biomass. However, currently available chemical compounds for capture of carbon dioxide are cost-prohibitive and have several undesirable properties, including large regeneration energies, high production costs, and potentially toxic byproducts.

Project Description:

This project uses computational chemistry to support the identification and characterization of new chemical compounds that can safely and economically capture carbon dioxide (CO2) from the stacks of power plants and other large point source emitters. Specifically, the project screens bioinspired compounds derived from chemicals used by about 25 percent of all plants to capture carbon dioxide from the atmosphere at night and store it for photosynthesis during daylight hours.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project uses innovative ab initio quantum mechanical and molecular dynamics simulations to design and characterize carbon capturing compounds, mimicking processes previously discovered in plants in arid areas. The organic phosphoenolpyruvate (PEP) compounds in these plants store and release CO2 in a similar manner as the currently used inorganic amines. Organic molecules can be modified in a way that adjusts their reaction enthalpy, solubility, viscosity, and reaction rate to be an inexpensive, non-toxic substitute for amines in carbon capture.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Greenhouse Gas Emission Allowance Cost and Revenue Issues: R.11-03-012

Applicable Metrics: CPUC Metrics- 2a, 4a

Lower Costs: Improved solubility of potential carbon capturing molecules in water instead of expensive organic solvents would result in significant cost savings if applied in large-scale carbon capture processes.

Environmental Benefits: A path for a significant reduction of greenhouse gas emissions from fossil fuel burning energy systems could be developed based on successful project results.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$40,000

EPIC Funds Encumbered:

$200,000

EPIC Funds Spent:

$199,998

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

45 out of 45 bidders

Rank of Selected Applicant/ Bidder:

Group 11: Ranked # 9

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-072 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The research team completed simulation and optimization of candidate carbon capturing molecules using a number of complementary molecular dynamics simulations that enable characterization of properties germane to regeneration energy and thus have potential to offer cost-effective approaches to post-combustion capture of carbon dioxide. In 2020, the research team modeled a carbon capture process in a typical electricity producing power plant for chemical compounds identified as promising candidates for improving cost-effectiveness of carbon capture and sequestration. This modeling exercise suggested a high cyclic efficiency (approximately 98 percent) of candidate compounds and suggest promise for further exploration in laboratory settings. A draft final report was submitted in summer of 2020 and is expected to be published by early 2021.

Project Name: EPC-15-074 - Meeting Customer and Supply-side Market Needs with Electrical and Thermal Storage, Solar, Energy Efficiency and Integrated Load Management Systems

Recipient/Contractor: Center for Sustainable Energy

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 5/18/2016 to 6/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S2: Develop New Technologies and Applications that Enable Cost-Beneficial Customer-side-of-the-Meter Energy Choices

Issue:

The State of California has established aggressive goals for incorporating behind-the-meter, customer-sited distributed energy resources (DERs) into the California wholesale energy markets, managed by the California Independent System Operator (California ISO). However, with only limited testing performed to date, the ability of DERs to simultaneously and cost-effectively meet onsite customer electrical needs while providing energy services into the California ISO market is largely unproven.

Project Description:

This project developed co-optimization strategies for distributed energy resources (DERs). The purpose was to maximize customer and system value under existing CPUC-approved retail and California ISO wholesale tariff structures, future market structures and pricing, and the transactive energy pricing signals developed under agreement EPC-15-045. The project tested and configured two DER portfolios: a) one was composed of K-12 schools using battery energy storage, solar photovoltaics, and integrated load management, and b) the other was composed of hotels using passive thermal energy storage, load management, and energy efficiency. The control systems for both portfolios were designed to be part of an integrated load management strategy capable of responding to price and reliability signals. The project team also developed operational strategies for wholesale integration subject to the identified retail and wholesale tariffs and other operational constraints.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project developed and tested strategies that customers, demand response (DR) aggregators, scheduling coordinators, and policy makers can implement to provide demand response that both meets grid needs and is acceptable to customers. The project provided comprehensive recommendations on how to overcome technical, institutional and regulatory barriers to facilitating DER participation in supply-side markets.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed> Energy storage: R.15-03-011 <Closed> Smart grid: R.08-12-009 <closed> Customer Data Access Program: Applications A.12-03-002, 003, 004. Decisions D.11 Distribution Resources Plans (AB 327): R.14-08-013 Distribution Level Interconnection (Rule 21): R.11-09-011 <closed> Demand Response (DR): R.13-09-011 Net energy metering: R.14-07-002 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1c, 1d, 1e, 1f, 1g, 1h, 3e, 3f

Lower Costs: This project has the potential to lower energy costs for individual customers, as well as system costs for all ratepayers. On the distribution circuit, demonstrated demand management capabilities can help defer cost of expensive capacity upgrade investments such as transformer or line upgrades.

Greater Reliability: As the penetration of intermittent resources increases in California, energy balancing requirements increase as well. Behind-the-meter demand response and storage on the distribution system can increase distribution system reliability issues through services such as local overload relief, power quality and ramp-rate mitigation on circuits with high penetration of photovoltaics.

Increase Safety: By deploying, testing, and validating system integration, metering, and telemetry, the project contributes to the safe operation of DER systems in customer-sited locations while maximizing value for these systems to both customers and wholesale market activities.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$746,794

EPIC Funds Encumbered:

$3,960,805

EPIC Funds Spent:

$3,603,645

Match Partner and Funding Split:

Solar City Corporation: $1,449,262 (24.4 %)

DNV GL USA, Inc. Maritime: $2,000 (0.0 %)

Conectric Networks, LLC: $530,000 (8.9 %)

Match Funding:

$1,981,262

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

19 out of 21 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-074 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project demonstrated use cases of two different types of DER resources that participated in the CAISO wholesale electricity market: one consisted of battery energy storage/solar PV systems at five different school sites; the other was a system of smart electricity load sensors and controls in two hotel facilities. While the hotel ownership has changed and they are no longer interested in participating in demand response programs, the school district facilities continue to participate in the CAISO wholesale energy markets. Findings and best practices developed during this study

have been and continue to be communicated to CAISO through the ESDER stakeholder process, and to the IOUs and CPUC through the SGIP and Energy Storage proceedings. The project found that behind the meter DERs can reliably perform DR and ancillary services in wholesale electricity markets and that allowing grid export compensation from behind the meter DERs will likely yield additional GHG reductions.

Project Name: EPC-15-075 - Customer-centric Demand Management using Load Aggregation and Data Analytics

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 5/18/2016 to 6/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S2: Develop New Technologies and Applications that Enable Cost-Beneficial Customer-side-of-the-Meter Energy Choices

Issue:

Load management in buildings has been lagging for decades due to lack of technology that can reliably provide reductions while gaining customer acceptance. As the State moves toward high penetration of customer-sited renewables that increase the management challenges for grid operators, it is imperative that load management for large numbers of small customers become mainstream. The technologies to manage loads are rapidly being developed and deployed, but relying on privately-developed proprietary solutions carries the risk of inconsistent performance as well as customer confusion and dissatisfaction.

Project Description:

This project demonstrated how a large number of small loads, each impacted by and tuned to individual customer preferences can provide load management for both utilities and the ISO in California. The Recipient worked with an extensive spectrum of leading product providers covering all major distributed energy resources, such as Nest (thermostats), ThinkEco (plug loads), Honda, BMW (auto), EGuana (smart Inverter) and Ice Energy (Thermal Storage). A variety of price signals were tested, including the transactive signal developed by EPRI, Time-of-use, Critical Peak Pricing and Demand response rates.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is using low cost off-the-shelf technologies to develop a platform that can manage customer end-use devices according to their preferences, minimize their energy costs, and adapt to evolving tariff structures. By making the task of automating multiple end-use devices easier, less costly, and less of an imposition on customers, the project has the potential to increase demand response participation, with consequent benefits to the electric grid.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Self-Generation Incentive Program: R.12-11-005 <Closed> Energy storage: R.15-03-011 <Closed> Smart grid: R.08-12-009 <closed> Distribution Level Interconnection (Rule 21): R.11-09-011 <closed> Demand Response (DR): R.13-09-011 Integration of Distributed Energy

Resources (IDER): R. 14-10-003 Long-Term Procurement Proceeding (LTPP): R.13-12-010 <Closed> Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1c, 1d, 1e, 1f, 1g, 1h, 5c

Lower Costs: Benefits include statewide residential electricity savings of approximately 1040 GWh per year and small commercial savings of 53 GWh per year for a total of 1093 GWh per year, which translates to estimated statewide CO2e reductions of 397,631 metric tons per year. The total annual bill reduction is approximately $8.21M for commercial facilities and $185M for residential buildings.

Greater Reliability: The project has the potential to increase adoption of demand response programs from the current 15 percent to as much as 60 percent. Managing air-conditioning loads, plug loads, and electric vehicles could provide up to 12 GW of capacity that could be shifted to maximize utilization of renewable resources, provide ramping and other ancillary services, and contribute to greater grid flexibility.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$1,163,894

EPIC Funds Encumbered:

$3,998,587

EPIC Funds Spent:

$3,889,234

Match Partner and Funding Split:

Electric Power Research Institute, Inc.: $979,860 (18.6 %)

InTech Energy, Inc.: $280,452 (5.3 %)

Pedagogy World, Inc.: $10,000 (0.2 %)

Match Funding:

$1,270,312

Leverage Contributors:

U.S. Department of Energy: $60,000

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

19 out of 21 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-075 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project showed the current state of control for behind the meter (BTM) DERs from a practitioner's standpoint and technology opportunities. The work also laid out implementation challenges of integrating BTM DERs, both emerging and currently available, to dynamic rate signals. Community-level (aggregation of the homes in the study) results identified that a "Duck Curve" induced by solar production is evident during the weekdays. This indicates users had not fully adopted the smart technologies into their lifestyles or were not responding well to the indicators of high-price events. Newly-instituted TOU high price periods in the evening coincide with significant increases in customer consumption. In general, the community's load shapes show a distribution of different consumption patterns compared to the code-based energy simulation for the climate zone. The community peaks are large coincident in the 5pm to 9pm timeframe.

Project Name: EPC-15-079 - Advanced Renewable Energy Storage and Recycled Water Project

Recipient/Contractor: Victor Valley Wastewater Reclamation Authority (VVWRA)

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 6/13/2016 to 3/31/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

Several California wastewater treatment plants have on-site power generation systems fueled by biogas. Many of these systems are unable to respond to variable onsite electrical loads, which can result in tripping off a facility's wastewater treatment equipment, which in turn shut down the onsite power generation system. This shutdown results in increased power costs, reliance on grid power, a corresponding reduced ability to produce recycled water. An effective power control system is needed that can reliably collect and store excess renewable electricity generated on site to respond to variable electrical loads to reduce the cost and increase the availability of producing recycled water.

Project Description:

The Victor Valley Wastewater Reclamation Authority (VVWRA), in partnership with Primus Power, University of California Riverside (UCR), and Anaergia, aimed to demonstrate an advanced, pre-commercial flow battery storage and control system at VVWRA's existing Regional Wastewater Treatment Plant, located in a disadvantaged community outside of Victorville. The project planned to deploy Primus Power's ENERGYPOD flow battery system in a 240 kW/1,200 kWh configuration, managed by a UCR-designed controller system that is optimized specifically for management, generation and storage of renewable energy power. The project hoped to alleviate rapid fluctuations in the wastewater treatment plant's power demand that causes disruption of the disinfection system used to treat recycled water to California standards, resulting in the disposal of approximately 2.5 million gallons of water annually.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project hoped to demonstrate an advanced battery storage and control system coupled with on-site renewable energy generation and its ability to control rapid changes in on site power demands. If successful, such an approach could reduce grid power demand and reduce energy costs to wastewater treatment plants and alleviate disruptions in recycled water production due to high variability of on-site power loads which can cause partial treatment shutdowns. The approach could be applicable to other wastewater treatment and industrial plants in California.

The project was not completed due to the flow battery manufacturer inability to deliver all planned batteries.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1h, 3c, 4c

Lower Costs: This project planned to use a battery storage system combined with an advanced controller to enable the wastewater treatment plant to accommodate variable loads, increase onsite renewable power production, and substantially reduce its reliance on grid power. If completed the project could have reduced annual grid power demand by 4.2 million kWh or nearly $473,000 in cost savings to the treatment plant.

Economic Development: Stored power would have been used to meet peak demand on site with 100 percent renewable energy, reducing grid power consumption by an estimated 4.2 million kWh/yr.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$220,423

EPIC Funds Encumbered:

$1,734,059

EPIC Funds Spent:

$1,416,893

Match Partner and Funding Split:

Victor Valley Wastewater Reclamation Authority (VVWRA): $773,014 (29.3 %)

Primus Power Corporation: $129,201 (4.9 %)

Match Funding:

$902,215

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

27 out of 35 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-079 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

December 23, 2020, Primus will still not be delivering the 6 outstanding batteries. Only data on 2 installed batteries was received. An abbreviated draft final report has been received, preliminarily reviewed and has been submitted to publications 11/22/2020. The project was given an extension due to COVID-19 until 3/31/2021. This extension was signed by VVWRA on 5/4/20.

Project Name: EPC-15-084 - Total Charge Management: Advanced Charge Management for Renewable Integration

Recipient/Contractor: Bayerische Motoren Werke of North America, LLC

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 6/30/2016 to 6/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S2: Develop New Technologies and Applications that Enable Cost-Beneficial Customer-side-of-the-Meter Energy Choices

Issue:

Smart charging is a means of managing charging within a particular charging or parking event, usually at work during the day or at home during the night. The future electricity grid will face new balancing needs that change throughout the day and night as utilities and grid operators attempt to align renewable generation with customer load. As the grid becomes more dynamic, optimizing vehicle charging will require moving charging from night to day, from hour to hour, or from one grid location to another. California's steadily increasing electric vehicle deployment with larger capacity batteries combined with the mandates for more renewables require more means for managed vehicle charging.

Project Description:

This project explores the benefits and opportunities of Total Charge Management (TCM), where electric vehicle charging is managed across multiple charging events to maximize vehicle load flexibility. The project tests how flexible electric vehicle load can be if managed across a driver's daily or weekly charge events. This flexibility utilizes several pricing mechanisms to estimate the benefits of the Total Charge Management approach. The research develops and evaluates advanced vehicle telematics for utilities and grid operators to align vehicle battery status, driver mobility needs, and grid conditions. Collaboration between the grid and the driver can yield a charging load profile that minimizes energy costs by aligning daily and weekly charging events to best meet grid needs.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project helps the state advance the flexibility of electric vehicle charging as a flexible grid resource and vehicle charging cost savings to the driver. Optimal charging load patterns will be identified that can capture ratepayer and grid benefits using a variety of grid price signals. The project pioneers demand response and smart charging technology advancement of not only the temporal benefits of controlled charging, but also the possible benefits that can be derived from being able to influence the location of charging.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Alternative Fueled Vehicles: R.13-11-007 <Closed> Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1g

Lower Costs: The cost of Plug-in Electric Vehicle (PEV) ownership is estimated to fall by $300 per year through grid service payments and reduced electricity bills for PEV drivers through managed charging. In total, this would provide $2,400 in savings over the 8-year ownership life of a typical vehicle.

Greater Reliability: Total Charge Management would represent a resource of over 10,000 MWh per day. If 40 percent of that load could be flexibly managed, the following benefits would be realized every day: 3,000 MWh of solar-following load (enough to accommodate 4 million additional solar panels on the grid), and 1,200 MWh of wind-following nighttime load.

Environmental Benefits: Aligning vehicle charging with renewable energy generation has the potential to reduce carbon emissions associated with vehicle charging by as much as 660,000 metric tons per year, at a scale of 1.5 million vehicles.

Energy Security: Greater energy security comes from having more diverse distributed resources able to respond to grid needs. The Total Charge Management approach helps utilities and CAISO get more functionality out of electric vehicle load as a grid resource, which contributes to energy security.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$330,779

EPIC Funds Encumbered:

$3,999,900

EPIC Funds Spent:

$3,771,576

Match Partner and Funding Split:

Kevala, Inc.: $16,773 (0.4 %)

BMW of North America, LLC: $339,158 (7.6 %)

Bertrandt Consulting: $39,000 (0.9 %)

Sulzer US, LLC: $50,000 (1.1 %)

Match Funding:

$444,931

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

19 out of 21 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-084 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

This project was completed in March 2020. This project demonstrated an average $46 annual charging cost savings per vehicle at a single charging point from shifting charging to the lowest practical time period while still maintaining driver mobility needs. The average annual savings increases to $56 per vehicle when charging is allowed at multiple locations. Shifting charging across multiple locations and time also resulted in a 300 metric tons of GHG annual savings per vehicle and integration of an additional 1,200 kilowatt-hours annually per vehicle. BMW is currently developing a larger pilot with another California IOU to expand the TCM project, and also applying for additional grants through the CEC and U.S. DOE that advance innovative vehicle charging solutions for the local built environment and specific use cases.

Project Name: EPC-15-085 - San Diego Libraries Zero Net Energy and Integrated Demand Side Management Demonstration Project

Recipient/Contractor: Center for Sustainable Energy

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 6/30/2016 to 3/31/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

California's ZNE goals set a requirement of 50 percent of municipal buildings to be ZNE by 2025. There is a need to test and demonstrate technologies in a ZNE to create a replicable blueprint for local governments to achieve ZNE buildings for continued growth.

Project Description:

Through a partnership with the Center for Sustainable Energy (CSE) and the City of San Diego, the project demonstrates a BertBrain pre-commercial plug load technology integrated into the building management systems to serve as a blueprint to local governments. The project also improves energy efficiency by installing LED lighting, enhanced building automation, and controls at three City libraries. The research created community outreach by creating energy kiosk displays that allow the public to visualize each library's energy consumption, solar generation, and energy savings.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The commercial sector, and local governments in particular, tend to be risk averse. This project demonstrated an integrated approach by testing and installing a precommerical plug load technology, and other energy efficiency measures without disrupting municipal operations, which is key to encouraging greater adoption of the technologies. The successful implementation of technology can encourage local governments and the commercial building industry to budget, plan and prioritize these types of projects for existing building ZNE upgrades leading up to the state's 2030 requirements.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Demand Response (DR): R.13-09-011 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h

Lower Costs: The project reduced energy by integrating a package of energy efficiency measures with a pre commercial technology. It is estimated that the project could save the City of San Diego approximately $36,000 annually, collectively at the three public libraries, not including solar generation savings.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$725,052

EPIC Funds Encumbered:

$2,715,516

EPIC Funds Spent:

$2,702,963

Match Partner and Funding Split:

San Diego Gas & Electric Company: $60,000 (1.8 %)

City of San Diego: $482,000 (14.8 %)

ABM Electrical and Lighting Solutions Inc: $744 (0.0 %)

US Green Building Council - Los Angeles Chapter: $1,568 (0.0 %)

Match Funding:

$544,312

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

39 out of 39 bidders

Rank of Selected Applicant/ Bidder:

Group 5: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-085 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The team continues has finalized replacement of defective LED light fixtures under warranty. The energy dashboard is being finalized for kiosk displays at each site to educate the community about the benefits of reducing energy consumption and ZNE buildings. The agreement has ended but is finalizing under revised TCs that include liquidated damages clause to obtain an updated final report and 2nd final meeting, scheduled for March 2021. This project aims to serve as a blueprint for the City to consider incorporating emerging technology measures, maximizing energy efficiency and reducing the carbon footprint of municipal and small commercial buildings to achieve ZNE goals. Project updates are posted at their website https://sites.energycenter.org/sdzn3.

Project Name: EPC-15-087 - Cooling Tower Water Treatment using Vortex Process Technology for Energy and Water Savings

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 6/30/2016 to 6/30/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

Chemical water treatment systems used to reduce scaling and inhibit biological degradation have typically been used in large central plants, industrial refrigeration plants, and other large cooling systems. Non-chemical treatment systems have the potential to reduce consumption of water by allowing more cycles of concentration in this equipment, as well as reducing the quantity and toxicity of discharge to wastewater treatment plants. The Vortex Process Technology has the potential to increase energy efficiency and reduce water use but there are uncertainties associated with long term performance, effectiveness, energy savings and cost effectiveness.

Project Description:

This agreement is funding the full-scale deployment demonstration of the Vortex Process Technology in cooling towers of commercial buildings. This technology has been used successfully in Europe and will be testing in California to address state specific goals for water and energy savings.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Non-chemical water treatment has the potential to reduce water use, improve quality of water discharged to wastewater stream, reduce scaling in condenser water piping, and increase energy efficiency of chilled water plants. The Vortex technology removes calcium carbonate from recycled cooling water and improves viscosity. By removing calcium carbonate physically it reduces the amount of chemicals used in calcium removal methods.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Water-Energy Nexus: R.13-12-011 <Closed>

Applicable Metrics: CPUC Metrics- 1f, 1h, 4c, 4d, 4e

Lower Costs: This project has the potential to reduce energy and water costs in commercial buildings. The energy savings is due to improved cooling tower efficiency and heat transfer in cooling equipment. This project is estimated to reduce electricity use by 3 to 5 percent, excluding

embedded energy savings from reduced water pumping and water treatment. The water savings is due to allowing higher cycles of concentration and supply water usage.

Increase Safety: Reduces use of hazardous chemicals, thereby reducing exposure of maintenance personnel.

Environmental Benefits: As less chemicals are used in the treatment of the water in cooling towers, this could reduce discharge of toxic materials into wastewater stream.

Public Health: Reduces exposure to toxic chemicals related to their manufacture, transport, handling, and disposal or use.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$485,121

EPIC Funds Encumbered:

$1,999,995

EPIC Funds Spent:

$1,974,185

Match Partner and Funding Split:

Electric Power Research Institute, Inc.: $324,990 (13.3 %)

Cypress LTD: $125,000 (5.1 %)

Match Funding:

$449,990

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

27 out of 35 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 6

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-087 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

As of December 23, 2020 the final report has been received has been being revised into ADA compliant version and submitted to publications 11/22/2020 The final meeting has been completed. Report has not been published as of this date.

The PI on the project passed away unexpectedly in mid-February. Though a draft final report was submitted in January, more time is needed to complete the final report. The report was submitted mid-summer and submitted to publications 11/22/2020.

Project Name: EPC-15-088 - Biofiltration as an Advanced Primary Treatment Method to Achieve Substantial Energy Savings

Recipient/Contractor: Kennedy/Jenks Consultants, Inc.

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 6/30/2016 to 3/31/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

The secondary biological wastewater treatment process method is accomplished by aerating wastewater and is very energy intensive, typically accounting for 40 to 60 percent of the total wastewater treatment plant (WWTP) electricity consumption. Achieving a higher amount of removal of organic material before the aerated activated sludge process provides a breakthrough opportunity to reduce electrical power demand. Biofiltration as an advanced primary treatment method is an emerging technology for removal of total organic load, both soluble and particulate material, however it has never been implemented at full scale at WWTPs.

Project Description:

Conventional wastewater primary treatment uses clarification for solids removal and activated sludge treatment for secondary treatment to remove organics. Biofiltration is an emerging advanced primary-treatment technology that more efficiently and economically removes particulate and soluble material than the conventional primary method of clarification that removes only particulate material. In a biofiltration system, particulate material is removed mainly through filtering, and soluble organic material is removed by using microorganisms to capture and biologically degrade the pollutants. This project demonstrated that biofiltration is a technically viable and commercially attractive approach to achieve significant electrical energy savings at wastewater treatment plants with a full scale demonstration at Linda County Water District plant.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Biofiltration as an advanced primary treatment method could reduce the aeration electrical energy needed for secondary treatment, increase energy production in the anaerobic digester from the removed organic material and increase existing secondary treatment capacity and forestall the need for future treatment plants. Based on pilot studies outside of California, biofiltration has the potential to decrease aeration power by 45 to 60 percent, increase gas production from 25 to 40 percent and increase treatment capacity by 50 percent.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h, 4c

Lower Costs: Aeration power requirements are estimated to decrease by approximately 45 to 60 percent compared to conventional treatment methods. Assuming 25 percent implementation of the technology, it is estimated that the annual electrical energy and cost savings for the wastewater treatment plant operators in California will be 110,000,000 kWh and $12,900,000 per year, respectively.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$442,698

EPIC Funds Encumbered:

$1,306,185

EPIC Funds Spent:

$1,287,122

Match Partner and Funding Split:

Professor George Tchobanoglous, Ph.D., P.E.: $12,000 (0.8 %)

WesTech, Inc.: $194,050 (12.3 %)

Linda County Water District: $24,700 (1.6 %)

Kennedy/Jenks Consultants: $41,000 (2.6 %)

Match Funding:

$271,750

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

27 out of 35 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-088 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Biofiltration generates energy savings by removing more organic load, which in turn reduces aeration electricity consumption in the downstream biological treatment and increases digester gas energy production from the diverted organic material. This project quantified an electrical energy reduction between 15 to 20 percent achieved by biofiltration based on demonstration results at the Linda County Water District plant. The biofiltration demonstration proved the technology to be a feasible alternative to conventional primary wastewater treatment processes.

Project Name: EPC-15-090 - Integrated Distributed Energy Resources Management System (iDERMS)

Recipient/Contractor: The Regents of the University of California (UC Riverside)

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 6/22/2016 to 1/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S6: Develop Technologies, Tools, and Strategies to Enable the Smart Grid of 2020

Issue:

The number of distributed energy resources (DER), such as solar photovoltaic panels, electric vehicles, energy storage devices, and flexible loads has increased exponentially in the past few years. Traditional distribution automation systems designed under a centralized control scheme can no longer handle the task of coordinating the control of thousands of heterogeneous devices. Better control solutions are needed to enable greater grid reliability as DER deployment increases.

Project Description:

This project developed an Integrated Distributed Energy Resource Management System (iDERMS) to coordinate the operation of a large number of DERs. In normal grid operations, the system would aggregate multiple DERs consisting of flexible loads, renewable resources, and energy storage systems. The DERs would be coordinated to optimize power flow and respond to a distribution system operator electricity market. In an emergency situation, the system would provide any needed reactive power support to the distribution grid with smart inverters. Additionally, the system would coordinate DERs on the distribution system to help restore the grid in the event of an outage.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will develop controls to create virtual generators by aggregating DERs. The aggregated virtual generators would be capable of providing energy shifting, frequency regulation, and flexible ramping services to mitigate the uncertainties brought by renewable generation. The iDERMS has the potential to increase renewable penetration, reduce GHG emissions and make virtual generators cost competitive with centralized power plants.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1g, 3a, 3f, 5a

Lower Costs: The project team estimated that the iDERMS will yield annual electricity savings of 4,840 GWh, distribution system peak reduction of 450 MW, and quantifiable electricity cost reduction of $360 million per year in California.

Environmental Benefits: The project team estimated this project will yield annual greenhouse gas emission reduction of 2.2 million metric tons in California by more efficient use of DERs.

Public Health: As virtual aggregation of DER increases, the DER can be coordinated to provide functions of fossil fuel power plants and reduce the use of fossil fuels, which will result in lower emissions and cleaner air. This will lead to improvement in health for California residents.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$97,356

EPIC Funds Encumbered:

$1,119,437

EPIC Funds Spent:

$1,083,420

Match Partner and Funding Split:

PetaPower, Inc.: $149,524 (9.1 %)

University of California, Riverside: $380,868 (23.1 %)

Match Funding:

$530,392

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

23 out of 29 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-090 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

This project concluded successfully on January 31, 2020. The project team completed the iDERMS platform and all the associated software modules. The Recipient met with several technology vendors, utilities, and research institutions to disseminate the knowledge gained with possibility for technology vendors to adopt iDERMS in advanced distribution management system platforms. Interested parties include SCE, SMUD, LLNL, PNNL, CAISO, GE, Siemens, and Opus One Solutions. The project team will continue to disseminate the knowledge learned and technology developed in this project by engaging industry vendors and publishing technical papers.

Project Name: EPC-15-092 - Low Energy Biofiltration System with Low Backwash Rate for Groundwater Contaminant Removal

Recipient/Contractor: Tomorrow Water dba BKT United

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 6/30/2016 to 3/31/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

Many of California's groundwater aquifers are unused for drinking water due to contamination by nitrate and/or perchlorate. Existing groundwater treatment methods generate a concentrated brine stream that requires disposal measures rendering it unsuitable for inland sites. Existing biological treatment alternatives do not generate a brine stream but are very energy intensive. A cost effective, low energy treatment option for contaminated ground water resources is needed for inland communities in Central and Southern California to increase water supply and resiliency.

Project Description:

The project demonstrated a biofiltration system that uses 70 percent less energy when compared to conventional technology used to treat contaminated water to meet drinking water standards or for use in industrial and/or agricultural applications. The technology was demonstrated in the City of Barstow with the focus on removal of nitrate, perchlorate and turbidity from the wastewater. The project included water testing to attempt to secure Conditional Acceptance as a Title 22 drinking water treatment technology from the State Water Resources Control Board.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project technology offers a lower energy alternative for treatment of the most common contaminants preventing use of ground water resources in California and could enable the development of new water supplies in many of the drought challenged regions of the state. Local treatment of impaired groundwater provides additional energy benefits by eliminating the cost associated with transporting clean water from distant sources. The biofiltration treatment technology has the potential of efficiently treating contaminated water in an energy efficient manner while generating no waste brine.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Water-Energy Nexus: R.13-12-011 <Closed>

Applicable Metrics: CPUC Metrics- 1f, 4a, 4d

Lower Costs: The biofiltration system in this project yields cost savings through reduced energy use because the media used in the system is backwashed by gravity rather than pumping. Additionally, recirculation pumping, common in other biofiltration systems that use activated carbon, requires regular interval replacement. The recipient's biofiltration technology uses a floating media and does not require regular replacement. The recipient achieved a 70 percent reduction in electricity costs and a 20 percent reduction in operating costs compared to typical up-flow treatment systems (e.g., fluidized bed reactors) at equivalent or lower capital costs.

Environmental Benefits: This low energy system treats contaminated water for use as drinking water supply. This can provide a source of local drinking water and eliminates the need to transport clean water from distant sources. The system also does not generate brine which is a byproduct waste which typically require landfill disposal.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$1,722,072

EPIC Funds Spent:

$1,722,067

Match Partner and Funding Split:

Kana Engineering Group, Inc: $100,000 (4.7 %)

City of Barstow: $75,000 (3.5 %)

Khalil Kairouz Consulting: $5,000 (0.2 %)

Eurofins Eaton Analytical: $49,860 (2.3 %)

Tomorrow Water dba BKT United: $172,637 (8.1 %)

MWH: $15,000 (0.7 %)

Match Funding:

$417,497

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

27 out of 35 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-092 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The Tomorrow Water Biofiltration system simultaneously removed nitrate, perchlorate, and turbidity from groundwater to below state-mandated maximum contaminate levels. and reduced energy consumption by 70 percent when compared with a conventional fluidized bed reactor. Both contaminants were treated until each MCL (maximum contamination level) reached the project goals of 10 mg/L for nitrate and 6 ug/L for perchlorate based on California's Title 22 drinking water standard. However, the Title 22 testing phase the project was forced to stop due to a change in regulation regarding the handling of potentially percolate contaminated effluent streams. While the project did not achieve a Title 22 certification due to the lack of an acceptable real-time perchlorate measurement, the recipient continues to seek approval with the Regional Water Board regarding real-time perchlorate data.

Project Name: EPC-15-094 - Demonstration of Affordable, Comfortable, Grid Integrated Zero Net Energy Communities

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2012-2014 Triennial Investment Plan, 2015-2017 Triennial Investment Plan

Project Term: 6/15/2016 to 3/30/2022

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S14: Demonstrate the Reliable Integration of Energy Efficient Demand-side Resources, Distributed Clean Energy Generation, and Smart Grid Components to Enable Energy Smart Community Development, S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

California's zero net energy and global climate change goals will require a huge increase in building and end-use system efficiency. The immediate goal of all new homes to be zero net energy by 2020 will require a better understanding of cost effectiveness, technical feasibility and operational performance. Large scale field demonstrations that show integrated technology pathways in multiple climate zones are needed to demonstrate cost effectiveness, monitor and verify energy and cost savings and other benefits, and evaluate new technology and integration strategies, such as community solar and impacts on the distribution grid.

Project Description:

This project is demonstrating cost-competitive ZNE design strategies that combine occupant needs with technology solutions to create new pathways for residential ZNE communities. The strategies will be demonstrated in single and multifamily buildings. The project's goals are cost effectiveness for the customer, affordability, overcoming customer apprehension, establishing a track record of new technology for builders, enabling distribution grid integration, creating a planning process for ZNE communities, evaluating community solar and evaluating the impact of future changes to ZNE cost effectiveness. This project also aims to understand the operation and energy use of the unregulated loads.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This research provides new methodologies for integrating occupant and technology needs into a cost effective and scalable zero net energy (ZNE) strategy. The project analyzes and defines the savings and market barriers in residential communities and provides new, valuable performance data and models from the demonstrations. The products from this research will identify the successes and barriers to meeting the ZNE goals for residential communities.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1h, 2a

Lower Costs: Zero net energy (ZNE) homes could result in significant savings in money, resources, operation and maintenance, energy, and greenhouse gas emissions. Both ratepayers and customers benefit from implementing ZNE residential communities. The estimated cost savings related to the energy savings is $1,242/home/year. Over a 50-year life of a ZNE home, this would translate to a net present value of nearly $80,000 in realized value for the homeowners.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$1,460,838

EPIC Funds Encumbered:

$4,942,809

EPIC Funds Spent:

$2,800,444

Match Partner and Funding Split:

Electric Power Research Institute, Inc.: $676,007 (11.2 %)

Fresno Housing Authority: $200,000 (3.3 %)

LINC Housing Corporation: $233,475 (3.9 %)

Match Funding:

$1,109,482

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

39 out of 39 bidders

Rank of Selected Applicant/ Bidder:

Group 6: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-094 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project is emerging from COVID-19 restrictions, and making progress on all four construction sites. 1) Belmont: construction is complete and PV and storage expected to be operational early 2021. 2) Compton: the installation of all sensing devices are complete and data is being collected and analyzed. Resident surveys are underway. Recipient will submit a draft M&V plans in early 2021. 3) Fresno: construction on the four story housing project broke ground September 2020. 4) Pomona: Site access was denied due to COVID-19 shutdown and now resolved. The project team have installed all monitoring systems and now validating accuracy of incoming data such as hot water heating energy use, water consumption. The PV and storage system is now interconnected and operating. Due to COVID-19 restrictions, all projects were delayed and the recipient is requesting a one year time extension.

Project Name: EPC-15-096 - Demonstrating Innovative Leakage Reduction Strategies: Correlating Continuous Acoustic Monitoring, Satellite Imagery and Flow Sensitive Pressure Reducing Valve System

Recipient/Contractor: American Water Works Company, Inc.

Investment Plan: 2012-2014 Triennial Investment Plan

Project Term: 6/30/2016 to 3/30/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Demonstrate and Evaluate the Technical and Economic Performance of Emerging Energy Efficiency and Demand-Side Management Technologies and Strategies

Issue:

Water utilities across the country struggle with aging pipe infrastructure, resulting in water loss from leaks. Delivery of potable water to customers requires substantial energy associated with treatment and conveyance-- the embedded energy in water-- and the loss of water in distribution lines means energy is being wasted. The longer a pipeline leak goes unidentified, the more treated water is wasted, along with the energy used to produce and convey that water. Eliminating leaks would reduce water loss but underground water leaks are difficult to detect and manage.

Project Description:

This project demonstrated three leak detection technologies to reduce the amount of water lost from pipeline leaks along with the amount of embedded energy wasted due to these leaks. The technologies include satellite imagery leak detection (SILD), correlating continuous acoustic monitoring (CCAM), and flow sensitive pressure reducing valves (FSPRV), which were tested at site demonstrations in four Southern California cities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project advanced the technical knowledge of detecting underground water leaks and estimated the energy savings associated with the water leak detection/prevention strategies. Identifying and demonstrating tools to help water agencies monitor, assess, and manage their water distribution systems conserves water resources, increases water system reliability, lower emergency and repair costs and reduces water and electricity costs for ratepayers. These benefits were quantified through the volume of water saved and the embedded energy in the saved water.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Water-Energy Nexus: R.13-12-011 <Closed>

Applicable Metrics: CPUC Metrics- 4c

Environmental Benefits: The technologies demonstrated in this research project provides information to water agencies on leak detection technologies and impacts of water leaks on overall energy use due to the embedded energy associated with treating and transporting water.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$222,664

EPIC Funds Encumbered:

$1,517,780

EPIC Funds Spent:

$1,382,316

Match Partner and Funding Split:

American Water Works Company, Inc.: $311,641 (16.3 %)

Hazen & Sawyer: $3,000 (0.2 %)

Echologics: $76,820 (4.0 %)

Match Funding:

$391,461

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

27 out of 35 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 7

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-096 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The correlating continuous acoustic monitoring and satellite imagery leak detection were estimated to save approximately 149,000 to 419,000 kWh of embedded energy and reduce around 3 to 9 percent of the total system's energy use if leaks were discovered and fixed. However, results will vary depending on the number of fixable leaks found per year. The flow sensitive pressure reduction valves proved effective in preventing catastrophic leaks and was deployed in three cities

The correlating acoustic monitoring devices are ready for broad adoption on metal piped systems, but need to adapt to plastic. The satellite imagery leak detection service needs improvement in narrowing down the areas of interest and education for the utilities to increase awareness of this method of leak detection. The flow sensitive pressure reduction valves are a work in progress and barriers associated with software advancement and increased data transmission reliability need to be resolved.

Project Name: EPC-15-097 - Achieving Zero Net Energy in Multi-family Buildings

Recipient/Contractor: Franklin Energy Services, LLC

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 7/1/2016 to 3/30/2021

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

There is a critical need for more research and evaluation of zero net energy multifamily design and construction approaches and practices. Many key design issues remain poorly understood in the multifamily sector, particularly for emerging all-electric heating, ventilating and air conditioning and domestic hot water technologies. These include the performance and economic trade-offs of technology solutions, lack of agreement between design and actual performance for key emerging technologies, and a lack of understanding of how these technologies will impact tenants and property managers.

Project Description:

This project demonstrates the potential of breakthrough electric water heating and space conditioning technologies as a pathway to zero net energy. The project explores the complex, interdependent systems in multifamily buildings and how they work together to achieve zero net energy status for the buildings in a cost-effective manner. Four multifamily buildings, designed to be affordable, are to be evaluated in various stages of design and development. These buildings share a goal of all electric zero net energy construction with 100 percent renewable energy generation, and utilize innovative new heat pump technologies to serve the buildings water heating and/or space conditioning needs.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project demonstrates the technical and economic feasibility of zero net energy design for large multifamily projects and establishes design and installation best practices that minimize risks for developers. This includes documentation of best practices to ensure that energy and cost benefits of zero net energy are fully realized and identified, including the trade-offs between technology solutions, capital costs, operating and maintenance costs, environmental benefits and grid impacts.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 1f, 1h

Lower Costs: This project helps developers make more informed zero net energy design decisions which may reduce construction costs for multifamily buildings up to $2,000 per apartment and lower future operating (e.g., energy) costs for building owners and occupants.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$180,555

EPIC Funds Encumbered:

$1,955,811

EPIC Funds Spent:

$1,797,407

Match Partner and Funding Split:

Corporation for Better Housing: $245,000 (10.9 %)

MidPen Housing Corp.: $45,090 (2.0 %)

Match Funding:

$290,090

Leverage Contributors:

Pacific Gas and Electric Company: $350,498

Leveraged Funds:

$350,498

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

39 out of 39 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-15-097 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project is in its final phase. After delays due to the pandemic, there was difficulty accessing the buildings to retrieve the monitoring equipment. In October 2020, the project team was able to retrieve all monitoring equipment and SD cards from the sites. Data is now being analyzed. The recipient is working on the final report.

Project Name: EPC-16-001 - Measure Results from Affordable Zero Net Energy Homes

Recipient/Contractor: Institute of Gas Technology dba Gas Technology Institute

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 7/30/2016 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

To help achieve the goal of having all new residential construction in California will be zero net energy, demonstrated proof of measured field performance of new and emerging technologies is needed to help overcome skepticism about the magnitude of energy savings potential and cost-effectiveness.

Project Description:

The project implements lessons learned from previous high performance housing research and measures the results in two new homes being built in partnership with Habitat for Humanity. Both houses include advanced architectural design features, high performance enclosures, advanced heating, ventilating and air conditioning systems, and low-cost water heating systems. One all-electric home and one mixed fuel (combined electric and natural gas) home will demonstrate the respective cost-effectiveness of each set of features. In addition to measuring results from actual occupancy, the project is developing a guide to affordable residential zero net energy design and construction, a training curriculum, and offers training opportunities based on project efforts. The houses are in a disadvantaged community in Stockton.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project uses innovative construction approaches that couple advanced energy efficiency measures with integrated project design and delivery (IPD) in a cost-effective manner. These approaches reduce structural framing to minimize heat paths through the walls, improve wall and attic insulation, increase equipment efficiency, reduce air infiltration levels, and improve water heater and HVAC performance. The approaches emphasize minimum energy use, high indoor air quality, robust and appealing architectural design, solid structural integrity, and practical, low cost construction. If successful, these innovative approaches could become standard construction practice leading to widespread deployment of affordable ZNE homes.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h, 2a

Lower Costs: The advanced integrated energy efficiency packages included in this project could reduce annual energy costs for homeowners by up to 50 percent.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$325,815

EPIC Funds Encumbered:

$1,000,000

EPIC Funds Spent:

$649,081

Match Partner and Funding Split:

Southern California Gas Company: $160,000 (13.7 %)

Pacific Gas and Electric Company: $8,500 (0.7 %)

Match Funding:

$168,500

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

39 out of 39 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-001 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Progress has been slow in 2020 due to COVID-19 which delayed construction of the two ZNE homes. Progress in 2020 includes finishing installation of HVAC, water heating, and drywall at both homes. The team is aiming to complete construction and collect performance data in 2021.The project team also finalized an eBook which details the innovative energy efficient construction practices being utilized in the ZNE homes and conducted builder training seminars. The recipient offered a series of training webinars on building affordable zero net energy homes in November 2020. Additional seminars will be held in the future. These webinars were a direct result of the research project.

Project Name: EPC-16-003 - Pilot-Scale Evaluation of an Integrated Building Control Retrofit Package

Recipient/Contractor: Regents of the University of California, Davis

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 7/18/2016 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

The traditional approach to building automation consists of a collection of independent control systems, one for each building end use, with limited or no communication among the individual devices. Several research efforts during the past decade were aimed at improving electric lighting or fenestration control methods, increase system reliability and reduce lighting energy use. However, few efforts accounted for the interdependence of lighting, fenestration and space conditioning systems and the consideration of the latter in an integrated approach to optimize whole building energy efficiency via a single, unified control platform.

Project Description:

This project tests an integrated building control package that maximizes energy efficiency for existing commercial buildings. The project refines novel control algorithms that utilize shared device state and environmental data for lighting, fenestration and heating, ventilating and air conditioning (HVAC) systems. Sharing data from multiple device types will further improve overall, sustained, system performance and operation. Control algorithms prioritize lighting or heating/cooling savings based on climate and building design. HVAC system management leverages passive ventilation through windows and skylights and dynamic adjustment of HVAC set point dead bands. The goal of this project is to reduce electricity use by 20-30 percent. The project team's mission is to partner with manufacturers throughout the critical development and demonstration phases to give products the best chance for market success. The research team will leverage multiple advocacy tools to make the knowledge gained, experimental results, and lessons learned from this effort available to the public and key decision makers.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project seeks to improve sensor-controlled lighting and air conditioning systems by integrating and sharing information from multiple sensors, resulting in better quality indoor spaces with reduced energy cost. This research focuses on refinement and testing of an Integrated Building Control Retrofit Package. The includes the refinement of novel control algorithms that utilize shared device state and environmental data among lighting, fenestration

and HVAC devices. This is a breakthrough because most lighting and HVAC controls operate independent of each other and this project hopes to integrate both.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1h, 3e

Lower Costs: This project could lower energy bills to commercial building owners that implement these control retrofits for HVAC, lighting and fenestration in their buildings.

Consumer Appeal: This project develops systems which improve the functionality of lighting and heating, ventilating and air conditioning controls, and integrates operations with automated shading, natural ventilation, and air conditioning systems, to create more and comfortable indoor environments.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$349,266

EPIC Funds Encumbered:

$1,999,089

EPIC Funds Spent:

$1,673,585

Match Partner and Funding Split:

Regents of the University of California, Davis - California Lighting Technology Center: $267,363 (11.8 %)

Match Funding:

$267,363

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

39 out of 39 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The recipient is finalizing installation of the smart controls with the windows shades, thermostats, and lighting at the demonstration site at the Barn in UC Davis. Due to COVID-19 and the shelter in place the building has been unoccupied. The research team is coming up with solutions on to simulate occupancy presence in the building to provide theoretical savings. The project is expected to end 3/31/2021.

Project Name: EPC-16-004 - Integrated Whole-Building Zero Net Energy Retrofits for Small Commercial Offices

Recipient/Contractor: DOE- Lawrence Berkeley National Laboratory

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 7/30/2016 to 3/31/2022

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Small commercial offices in California consume about 3,500 GWh of electricity annually. This usage is projected to increase due to increasing use of office electronics and decarbonization driven fuel-switching of space and water heating systems. As a result, the need for deep reductions in electricity usage is needed. However, this sector faces a number of barriers to achieving these energy reductions, including uncertainty about how to achieve energy targets and integrated solutions, and lack of affordable access to engineering and auditing services that help maximize energy savings. Energy efficiency tools and services currently involve high costs on a per-square-foot or kWh-saved basis.

Project Description:

This project develops and evaluates cost-effective packages of pre-commercial integrated energy efficiency measures and controls to achieve zero net energy (ZNE) performance for small commercial offices in California. The project team is utilizing Lawrence Berkeley National Laboratory's FLEXLAB to test whole-building integrated systems under varied climate and use conditions, with additional testing to be conducted at a retrofitted office building in Berkeley, CA. The team is aiming to achieve a minimum of 50 percent energy savings over baseline conditions at the retrofit site to achieve ZNE. Data on energy, occupant comfort, and occupant behavior are being analyzed to identify best practices that can be replicated elsewhere in the State.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project develops and validates integrated whole building retrofit packages using pre-commercial underutilized technologies and controls with the goal of reducing energy use in small commercial offices by at least 50 percent. The project also aims to increase system reliability by reducing peak energy loads and potentially supporting automated demand response implementation. The energy efficiency and demand reduction components of the project provide a path towards meeting the State's energy efficiency and climate goals along with a means to replicate these strategies.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h, 2a, 4a

Lower Costs: The project aims to reduce energy use by at least 50 percent in small commercial offices.

Environmental Benefits: Assuming 5 percent of small commercial buildings (less than 30,000 square feet) in California adopt the proposed retrofit measures (including on-site renewable energy generation) by 2030, greenhouse gas emissions could be reduced by 83,238 metric tons per year.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$781,092

EPIC Funds Encumbered:

$2,000,000

EPIC Funds Spent:

$1,760,556

Match Partner and Funding Split:

Northern California test site partner: $2,000,000 (50.0 %)

Match Funding:

$2,000,000

Leverage Contributors:

Strategic Growth Council: $1,000,000

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

39 out of 39 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Progress was slow in 2020 due to COVID-19, which delayed the ZNE retrofit construction effort. The team is now making good progress and anticipates completing ZNE retrofit and begin collecting and analyzing performance data in 2021.

Project Name: EPC-16-005 - Energy Efficient HVAC Packages for Existing Residential Buildings

Recipient/Contractor: Regents of the University of California, Davis

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 8/1/2016 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

To meet California's long term energy efficiency plan, existing buildings must be retrofitted for energy efficiency to bring them on par or exceed current California efficiency building standards. Specifically, cooling of single-family homes will account for more than 5,700 GWh annually by 2024. While several new heating, cooling and ventilation (HVAC) technologies exist for improving energy efficiency, research and development is needed to create cost-effective retrofit packages for existing buildings, and to identify opportunities to encourage widespread adoption of these packages.

Project Description:

This project demonstrates innovative pre-commercial, cost-effective retrofit packages for cooling and ventilation for single family homes. Energy savings, occupant behavior and indoor air quality (IAQ) are to be measured for two specific retrofit packages that each includes three innovative technologies: (1) building envelope sealing, (2) two variants of smart mechanical ventilation that include pre-cooling strategies, and (3) mostly compressor-free evaporative air-conditioning. Furthermore, barriers and opportunities towards adoption of such retrofits are to be identified through stakeholder interviews.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

To address the current issues with indoor air quality and energy efficiency in existing homes, this project evaluates two residential retrofit packages that incorporate advanced technologies for achieving both of these goals. Better envelope tightness combined with a dedicated ventilation system and highly efficient evaporative cooler will increase indoor air quality, reduce energy use for air conditioning and reduce overall peak demand. Additionally, the technology could reduce energy costs for building owners/occupants.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1h, 2a

Lower Costs: This retrofit package could reduce HVAC energy costs in existing buildings by over 30 percent through the use of compressor-less cooling technology. The project also hopes to identify opportunities to encourage widespread adoption of the attic package by promoting to utilities and builders, thus potentially reducing deployment costs.

Environmental Benefits: The demonstration packages could reduce energy consumption and thus reduce greenhouse gas emissions, especially during peak demand hours. The energy savings is estimated to reduce greenhouse gas emissions by 56,000 metric tons per year by 2024 assuming a limited 5 percent adoption rate throughout the State. Also the evaporative cooling system provides an alternative to vapor compression cooling that reduces the usage of refrigerants are known to contribute to global warming.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$366,421

EPIC Funds Encumbered:

$1,200,000

EPIC Funds Spent:

$611,873

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

Western Cooling Efficiency Center - UC Davis: $126,000

Leveraged Funds:

$126,000

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

39 out of 39 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Field monitoring was completed with the Smart Vent and Night Breeze systems along with the sub wet bulb evaporative cooling and DX coil. Both sites received aerosol envelope sealing, and a sub wet bulb indirect evaporative cooling (IDEC) with a fresh air vent system. A small add-on direct expansion coil was added to each IDEC unit to allow for extra cooling during summer temperatures. Indoor air quality measurements monitored CO2 and PM 2.5. Initial results show that the home with the single cold water coil in the attic from the IDEC met the home's temperature requirements, but the home with the multiple mini-splits system supplied by the IDEC was unable to keep occupants comfortable. Recipient is currently testing the following systems in the laboratory to optimize the performance: attic coil system, the sub wet bulb evaporative cooler (SWEC) mini-split, and the hybrid mini-split (using a small compressor in conjunction with the SWEC).

Project Name: EPC-16-006 - Low Energy, Zero Liquid Discharge Adsorption Technology to Remove Contaminants and Recover Source Water

Recipient/Contractor: ES Engineering Services, LLC

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 7/28/2016 to 3/23/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

In California, many groundwater sources cannot be used for drinking water because of arsenic, chromium and other contaminants. Current technologies to treat contaminated drinking water, such as reverse osmosis, are expensive, complex, and energy intensive. Other factors driving costs higher for conventional treatment include the need for expensive chemicals, daily management of high volume of waste laden with contaminants, and active process control, monitoring and adjustment. An alternative treatment system is needed that can effectively remove heavy metal contaminants from water, minimize energy, operation and waste disposal costs and meet California drinking water standards.

Project Description:

The project tested an innovative, low energy, zero liquid discharge water treatment system that uses an adsorption process to remove arsenic and other contaminants from a groundwater reservoir. A demonstration-scale water treatment system was developed and tested to determine operational costs, energy and water savings of the single use adsorption system. The demonstration validated the reduction in spent adsorption media through natural dehydration to further save energy and water associated with residual solid waste handling.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The hydrogel adsorption process offers benefits of being simple, with its minimal amount of equipment required and can save water that would normally be too difficult to treat. This technology is an innovative approach to treat water with high amounts of metal contaminants using a low energy treatment method to restore impaired drinking water sources. This treatment method is especially suitable for small inland treatment systems, where liquid backwash and brine disposal may be cost prohibitive or infeasible.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Water-Energy Nexus: R.13-12-011 <Closed>

Applicable Metrics: CPUC Metrics- 1h, 4c, 4d

Lower Costs: This adsorption technology could lower the cost of treating water contaminated with heavy metals and allowing it to be reused. The energy reduction compared to conventional technologies is estimated to be 20-30 percent when applying this new, low energy technology.

Environmental Benefits: Resurrecting groundwater wells that have been removed from operation due to contamination offers energy and cost savings by avoiding the need for additional drilling and construction of new wells. Additionally, this project can improve water resources by removing heavy metal contaminants from water.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$986,262

EPIC Funds Spent:

$786,630

Match Partner and Funding Split:

Enova Water LLC: $65,000 (5.5 %)

AQUAlity Engineering, Inc.: $15,474 (1.3 %)

Khalil Kairouz Consulting: $4,000 (0.3 %)

Municipal Management Group, Inc.: $5,000 (0.4 %)

ES Engineering Services, LLC: $105,430 (8.9 %)

Match Funding:

$194,904

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

27 out of 35 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-006 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The demonstration was completed and the technology successfully removed arsenic and some other contaminants from ground water. The technology is most suited for continuous flow applications. Due to inconsistent flow rates, the demonstration site, City of Cerritos, did not continue to use the technology following the end of the project. The recipient is working to adapt their technology to handle other contaminants including selenium.

Project Name: EPC-16-007 - Optimization of Energy Efficiency to Achieve Zero-Net Energy in Multifamily and Commercial Buildings

Recipient/Contractor: Regents of the University of California, Davis

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 8/1/2016 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

The technical feasibility of achieving Zero Net Energy (ZNE) in many building types in California has been documented, but the optimal cost-effective strategy to reduce net electricity consumption toward ZNE goals remains unclear. The number of building types and technologies are too numerous to address performance and cost-effectiveness questions through field studies and the available open-source software tools and analysis methodologies are not comparable. Aligning their results and reliably monetizing impacts would require coordination among competitors. In addition, they are they not being developed or funded in competitive markets.

Project Description:

This is a modeling study. The recipient uses EnergyPlus, a building energy modeling tool, to analyze the cost-effectiveness of various electricity saving/generation measures for multifamily and commercial buildings in California. Each building type and climate zone will receive a cost-benefit analysis for each measure individually and an optimized package of measures to achieve as close to zero net energy as is cost-effectively possible

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will accelerate the adoption of cost-effective electricity saving and generation technologies, equipment, materials and construction practices in California multifamily and commercial buildings by providing a rapid-assessment tool. This tool will help stakeholders identify and prioritize energy efficiency measures/technologies based on their cost-effectiveness.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1h, 3e

Lower Costs: This project could influence construction practices in California and promote the development of affordable energy efficiency in commercial and multifamily buildings. This project

will provide optimized recommendations for cost-effective electricity saving solutions for a wide variety of California's building portfolio in all 16 climate zones. Detailed modeling of building energy modeling packages will allow for accurate determination of cooling and heating loads, enabling right sizing of equipment which could extend equipment life for building owners. Equipment right sizing would provide lower costs due to smaller equipment sizes and potential for lower maintenance costs.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$151,821

EPIC Funds Encumbered:

$1,000,000

EPIC Funds Spent:

$879,180

Match Partner and Funding Split:

Electric Power Research Institute, Inc.: $25,000 (2.3 %)

Regents of the University of California, Davis: $80,000 (7.2 %)

Match Funding:

$105,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

39 out of 39 bidders

Rank of Selected Applicant/ Bidder:

Group 4: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The recipient has provided the details of their modeling approach and the cost database that will be used in the final cost-effectiveness analysis. They have also built the necessary hardware set-up for running simulations and generating impact data for the final report. The final report is expected to be delayed for about six months due to COVID-19-related delays in delivery of a simulation equipment and staff unavailability. A COVID-19-related term extension request had been initiated.

Project Name: EPC-16-010 - Improving Water and Energy Efficiency in California's Dairy Industry

Recipient/Contractor: The Regents of the University of California on behalf of the Davis campus

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 10/1/2016 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Milk is the most valued agricultural commodity in California. Approximately one of five dairy cows resides in California. Heat stress remains a major cause of diminished milk production and increased disease among lactating dairy cows, with annual losses directly related to heat stress exceeding $800 million. Current methods of reducing thermal stress require significant amounts of energy and water. Evaporative cooling is typically used with water sprayed on the cows using feed line soakers. These approaches require large amounts of energy to pump water and move air in sufficient quantities to reduce heat stress. The resulting hot, moist environment promotes bacterial growth.

Project Description:

This project evaluates the viability and effectiveness of new cooling technologies for dairy cattle. Cow cooling is critical to livestock health and milk production. Conventional livestock cooling methods, such as fans and sprinkling cows with water, require significant amounts of electricity and water. The new technology developed under this project combines conduction and convection cooling methods, and it has the potential to reduce water consumption by up to 86 percent and electricity consumption by up to 38 percent. The novel cattle cooling approach developed during the initial stage of this project is currently being demonstrated at a dairy in Tulare, California.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project advances management strategies for reducing thermal stress in dairy cows while also reducing energy and water use. There are two methods of reducing thermal stress in cows: (i) lowering the cow's heat exposure and (ii) increasing the cow's ability to get rid of excess body heat. Current practice includes use of evaporative cooling with water sprayed on the cows using feed-line soakers, and cooling is enhanced by convective heat transfer via large overhead fans. This project will test and demonstrate an innovative approach that seeks to optimize the cow's

ability to remove excess body heat by utilizing more efficient cooling technologies, which have the potential to significantly change the way dairy cows are cooled.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Water-Energy Nexus: R.13-12-011 <Closed> Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h, 4a, 4c

Lower Costs: By optimizing cow cooling operations this project could reduce water use by up to 86 percent and energy use up to 38 percent. By reducing energy and water usage the dairy owners will see reduced utility, operating and maintenance costs. The conduction cooling approach has the potential to reduce water consumption by 73 percent and electricity consumption by 38 percent compared to the baseline. The targeted convection cooling approach has the potential to reduce water consumption by 86 percent and electricity consumption by 28 percent compared to the baseline.

Environmental Benefits: This project could reduce greenhouse gas emissions by integrating novel energy efficiency cow cooling technology at dairies. This technology could reduce energy and water use over traditional cow cooling methods and thus reduce greenhouse gas emissions associated with avoided capacity needed at the generation and associated with the embedded energy in water. In addition to saving electricity, this technology has the potential to increase milk production due to reduced heat stress as well as reducing disease among lactating cows.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$191,936

EPIC Funds Encumbered:

$1,000,000

EPIC Funds Spent:

$951,141

Match Partner and Funding Split:

Regents of University of California, Davis: $164,710 (14.1 %)

Match Funding:

$164,710

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

27 out of 35 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

Process/ Method/ Technique Patent

Description of New Intellectual Property Developed Under this Project:

Patent Application with U.S. PTO (Appl. No. PCT/US2020/052924): Method and Apparatus for Optimizing Energy and Water Used for Cooling Livestock.

Update:

Installation and testing of the full-scale system has been completed in Pixley, CA. Data collection on the "ducted" strategy has been completed. The second trial of testing and measurement of cow performance during the baseline and optimized baseline cooling methods was finalized during the summer of 2020. In addition to completing the data collection, the recipient has conducted several interviews with the diary managers and provided a Behavioral and Market Analysis Report in October 2020. The team is currently preparing the draft final report.

Project Name: EPC-16-013 - Integrating Smart Ceiling Fans and Communicating Thermostats to Provide Energy-Efficient Comfort

Recipient/Contractor: The Regents of the University of California on behalf of the Berkeley campus

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 9/8/2016 to 3/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Conventional thermostat-based control strategies for heating, ventilating and air conditioning systems use a narrow range of temperatures year-round that are prescribed by building operators, based on an assumed occupancy schedule. Operators and occupants typically do not optimize these schedules based on actual occupancy or actual occupant preferences for thermal conditions. At low speeds, ceiling fans may reduce heating energy use by de-stratifying room air temperatures. However, architects, engineers, and owners do not understand the effects of air movement from ceiling fans to predict energy and comfort impacts that might result from new and innovative approaches to comfort.

Project Description:

This project develops an optimal system configuration for smart comfort controlled ceiling fans integrated with learning thermostats. This system is to be tested and evaluated for energy performance and occupant acceptance in low income multi-family residential and small commercial buildings in disadvantaged communities in California. This research and development advances the solution's technology readiness level and support market adoption acceleration. A design guide and energy code language are to be developed to facilitate widespread adoption.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Air movement, such as through ceiling fans, can cool a person indoors in a similar manner as lowering the temperature, but uses only a tiny fraction of the energy required by HVAC systems. New smart ceiling fans, using only 1-8 watts (compared to 2000-3500 watts for the typical 1.5-3 ton air conditioning system) and producing 1.5 to 2 mph air movement near building's occupants, can offset a 6 degree Fahrenheit increase in indoor air temperature. This improves the occupant's comfort and perceived air quality while substantially decreasing energy consumption. Allowing higher indoor temperatures reduces a building's total HVAC energy by an average of 5 percent per degree Fahrenheit, and even greater in climate zones where natural ventilation or evaporative

cooling systems are used instead of compressor-based cooling, or where there are a large number of airside economizer hours (such as California).

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h, 3a, 3e, 4a

Lower Costs: Developing cost-effective configurations and best practices will reduce the cost of adoption and operation while reducing the simple payback, thus enabling building owners to invest in the technology at lower risk. The recipient estimates that the integrated solution can provide energy savings up to 37 percent in cooling and 15 percent in heating, which could add up to 985 GWh of annual energy savings for California or approximately $148,000,000. The solution is a key component for passive heating and cooling design which supports CA zero-net energy (ZNE) goals and is demand-response ready.

Environmental Benefits: Energy savings could add up to 719 million pounds of greenhouse gas emissions reduced assuming a 15 percent market penetration. Also, ceiling fans are enabling technology for compressor-free cooling with passive and/or radiant systems because they provide comfort at higher indoor temperatures, thereby reducing refrigerant purchase, use and disposal.

Consumer Appeal: Automated learning controls make the technology operation easier for the customer and likely resulting in wider user acceptance. User acceptance is key to achieving broad adoption and meeting energy savings targets.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$188,176

EPIC Funds Encumbered:

$1,888,683

EPIC Funds Spent:

$1,803,208

Match Partner and Funding Split:

Regents of the University of California, Berkeley (Center for the Built Environment): $112,726 (5.1 %)

BIG ASS FANS: $203,200 (9.2 %)

Match Funding:

$315,926

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

39 out of 39 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project is complete. The research team developed guidelines and online tools to help architects, engineers and builders to properly integrate smart automated ceiling fans into their HVAC system design. In 2020, and as a result of this project, multiple buildings in California and other states are installing automated ceiling fans in their buildings such as the SFO airport new offices, Laguna Honda hospital in San Francisco and others.

Project Name: EPC-16-014 - A New Solution to California's Energy and Water Challenges: Reducing the Cost of Desalination and Increasing Water Reuse

Recipient/Contractor: Lawrence Livermore National Security, LLC

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 9/1/2016 to 12/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Desalination is currently the primary method of removing salt from industrial and municipal wastewater for reuse. However, this technology is energy intensive and expensive. Industrial processes and household activities continuously add salt to water, and as a result, the salt content of industrial and municipal wastewater is often too high for reuse. The salt content of this wastewater must be reduced to enable recycling and to avoid ecological damage, however a more energy efficient technology compared to current practice is needed.

Project Description:

This project is demonstrating a flow-through electrode capacitive desalination (FTE-CD) technology to reduce the energy used to remove salt from wastewater. This advanced technology removes salt from water by applying an electric field to two porous electrodes. The electrodes act like a magnet for salt while the field is applied and remove the salt from water that flows through the electrodes using less energy and less costly than reverse osmosis (RO). Energy use of an FTD-CD system is projected to be 50 percent less compared to the energy use for an RO system. The recipient is partnering with two water districts to test the use of FTE-CD devices to desalinate wastewater from industrial and municipal sectors and determine how this small, flexible device can improve the energy and operating efficiency of wastewater treatment solutions for communities. Energy use and performance are being measured, while fouling and other operation issues are being identified.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The FTE-CD technology has the potential to reduce the cost and energy associated with desalinating low to moderate salt content water and will represent an advancement over current RO technology. This technology has the potential to increase water recycling and reuse at the community or industrial level, which reducing the need to procure and transport fresh water sources. The advanced FTE-CD technology is small, flexible, and can be customized to the scale

needed for each community or industry, thereby increasing a community's water reuse potential and drought resilience for the state.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Water-Energy Nexus: R.13-12-011 <Closed> Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1h, 4d

Lower Costs: By reducing the cost of desalination by 30 percent or more, the cost of water reuse may become attractive compared to the cost of purchasing water and disposing of wastewater.

Environmental Benefits: By reducing the cost of desalination by 30 percent or more, the cost of water reuse may become attractive compared to the cost of purchasing water and disposing of wastewater. An increase in reuse means that less potable water overall is used, increasing drought resilience.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$448,176

EPIC Funds Encumbered:

$999,040

EPIC Funds Spent:

$999,040

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

27 out of 35 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 6

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-014 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Recipient developed and tested a new operation mode of electrodes (called batch mode) and cell modules before deployment to Delta Diablo. Preliminary testing shows the potential to meet salt removal and productivity targets, while reducing flow efficiency losses caused by undesired mixing of desalted water and feed water. Using the optimized electrodes, the recipient demonstrated the ability to achieve desalination targets of 500 parts per million(ppm) total dissolved solids (tds) removal with more than 70 percent water recovery on Delta Diablo water samples. The recipient evaluated a novel charging circuitry design that takes advantage of the large inherent capacity of the cells to eliminate the need for AC-DC converters, thus simplifying the design and lowering cost. The pilot testing at demonstration site is delayed due to COVID-19 and agreement is extended to 12/31/2021.

Project Name: EPC-16-015 - Los Angeles Regional Energy Innovation Cluster

Recipient/Contractor: Los Angeles Cleantech Incubator

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 8/17/2016 to 3/31/2022

Program Area and Strategic Objective:

Market Facilitation

S18: Foster the Development of the Most Promising Energy Technologies into Successful Businesses.

Issue:

The Los Angeles region lacks the necessary coordination of technical, business, and social support services for clean energy researchers and entrepreneurs to develop clean energy innovations and the business opportunities resulting from them. This lack of organizational support prevents the Los Angeles region from clearly understanding the best direction for its clean energy economy. A coordinated effort is needed to determine regional energy needs, foster the size and strength of its current clean energy ecosystem, and provide a full, curated range of technical and commercialization services that are currently not available for clean energy entrepreneurs.

Project Description:

This project establishes the Los Angeles Regional Energy Innovation Cluster to act as a regional hub of the clean energy ecosystem and to give promising clean energy entrepreneurs in Los Angeles, Orange, Santa Barbara, and Ventura counties direct access to the region's top technical, business, outreach, and commercialization support services. This project assesses and addresses the region's energy needs by making use of and expanding resources for entrepreneurs and startups, including facilities, coaching, business support, speaking and networking engagements, and information about funding opportunities, all through connections facilitated by the Los Angeles Cleantech Incubator.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will benefit California IOU electricity ratepayers through the increased probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. This project will also support technologies based on the regional energy market needs and engage a diverse group of clean energy stakeholders to provide the support, network, and resources needed for accelerated clean energy commercialization.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integration of Distributed Energy Resources (IDER): R. 14-10-003 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 2a, 3e

Lower Costs: This project will reduce the time and cost of new energy technology development by providing entrepreneurs with access to facilities, resources, and services needed to commercialize their innovation.

Economic Development: The services provided by this cluster will support the development of local companies and job creation, and further develop the clean energy economy throughout the Los Angeles region. To date, a total of fifty-eight startups employing over 320 employees have engaged with this program, with these startups receiving $32,384,500 in private follow-on funding and $10,227,834 in public follow-on funding.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$541,645

EPIC Funds Encumbered:

$4,999,247

EPIC Funds Spent:

$2,368,673

Match Partner and Funding Split:

Los Angeles Cleantech Incubator: $165,290 (1.9 %)

Los Angeles County Office of Sustainability: $2,104,712 (24.3 %)

Southern California Edison: $300,000 (3.5 %)

California State Polytechnic University Pomona: $24,625 (0.3 %)

CSU Dominguez Hills: $24,625 (0.3 %)

California State University, Long Beach Research Foundation: $24,625 (0.3 %)

CSU Los Angeles: $24,625 (0.3 %)

CSU Water Resources and Policy Initiatives: $5,000 (0.1 %)

California State University, Northridge: $24,625 (0.3 %)

Sustain Southern California: $597,998 (6.9 %)

CSU Channel Islands: $49,500 (0.6 %)

LA Business Technology Center: $99,000 (1.1 %)

Los Angeles Cleantech Incubator: $99,000 (1.1 %)

Economic Development Corporation of Los Angeles County: $99,000 (1.1 %)

Community Environmental Council: $15,474 (0.2 %)

Match Funding:

$3,658,099

Leverage Contributors:

U.S. Department of Energy: $600,000

U.S. Department of Energy: $50,000

Leveraged Funds:

$650,000

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

2 out of 2 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-015 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, the LA Regional Energy Innovation Cluster accepted its fifth cohort of portfolio companies to receive services, for a total of fifty-eight startups who have engaged with this program to date. The program will continue to provide important technical and business services such as speaking and networking opportunities, access to business development resources, awareness of funding opportunities, and connections to local energy stakeholders. The program also recently off-boarded startups from its first cohort. The program helped these startups meet critical milestones, including advancement in technology readiness, expanded customer base and partnerships, increased staff, and follow-on funding. As of June 2020, startups receiving services from this program have received $32,384,500 in private follow-on funding and $10,227,834 in public follow-on funding.

Project Name: EPC-16-017 - Maximizing Energy Efficiency and Reducing Bio-solids Waste from New Anaerobic Wastewater Treatment Technology

Recipient/Contractor: Silicon Valley Clean Water

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 11/10/2016 to 3/1/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

Based on 100-year--old technology, wastewater treatment has consumed abundant water, energy, and land, and fails to capture the significant energy resource value of wastewater. The result are systems that: 1) are energy-intensive, consuming 3 percent of electricity nationwide and generating significant amounts of greenhouse gas emissions, 2) produce large quantities of biosolids with high energy, greenhouse gas emissions, and monetary disposal costs, 3) neglect the value of wastewater as a reliable local water supply, nutrient resource, and energy supply, and 4) are at the end of their design life.

Project Description:

This project is demonstrating the elimination of aeration and its high energy demands as part of secondary water treatment at the Silicon Valley Clean Water wastewater treatment facility using a novel staged Anaerobic Fluidized Bed Membrane Bioreactor (SAF-MBR). This System is projected to generate 30 percent less bio-solids than conventional systems that require aeration. This project also seeks to demonstrate the potential for development of a new high-quality local water supply through non-potable and advanced potable reuse treatment trains that eliminate process steps that normally precede the use of reverse osmosis.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project has the potential to lower energy costs of wastewater treatment and water recycling. The advanced technology used in this project is the Staged Anaerobic Fluidized Bed Membrane Reactor (SAFBMR) which eliminates the aeration stage of wastewater treatment. The aeration stage is one of the most energy intensive steps in wastewater treatment. The SAFBMR also has the potential to reduce operation and maintenance costs because bio-solids waste, which typically requires off-site disposal, is reduced, and the effluent does not require the typical microfiltration pre-treatment step prior to the reverse osmosis systems.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Water-Energy Nexus: R.13-12-011 <Closed>

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a, 4c, 4e

Lower Costs: The technology has the potential to lower facility operating costs due to the removal of the aeration step from processing wastewater, the reduction of bio-solids that must be disposed, and the increased yield of methane biogas - a potential fuel source for on-site energy generation. The recipient estimates that a 1 million gallon per day treatment facility could achieve annual electricity savings of up to $185,000 from both efficiency and renewable energy generation over a 20-year life cycle. In addition, the technology is also estimated to result in 10 percent lower cost in capital and operation and maintenance cost compared to existing processes.

Environmental Benefits: The lower energy use combined with onsite renewable energy production will reduce greenhouse gas emissions. The technology will reduce biosolids waste that is typically trucked for off-site disposal. Additionally, the project will also produce higher quality water for potential potable uses.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$327,386

EPIC Funds Encumbered:

$1,999,962

EPIC Funds Spent:

$288,685

Match Partner and Funding Split:

Leland Stanford Junior University: $400,000 (12.4 %)

Santa Clara Valley Water District: $100,000 (3.1 %)

GE Water: $210,000 (6.5 %)

LG Water Solutions: $10,000 (0.3 %)

Silicon Valley Clean Water: $499,943 (15.5 %)

Match Funding:

$1,219,943

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

8 out of 8 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-017 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Construction of the Staged Anaerobic Fluidized Bed Membrane Reactor (SAFBMR) system began in January 2020, but it has been delayed as a result of the COVID-19 pandemic. In October 2020 the reactor, biogas holdup tank, and piping were installed and the system is starting the testing phase. In December the team won funding opportunities from USBR and the Water Board to begin investigations on the second phase of the SAF-MBR technology to treat to potable reuse levels. The lead PI for this next phase of work is Professor Bill Mitch and Dr. Criddle. Dr. Tilmans will be there to help operations go smoothly. This section of the project ends around the 2023/2024 timeframe. The project is on schedule. (1/22/2021)

Project Name: EPC-16-018 - Biological Double-Efficiency Process as an Advanced Wastewater Treatment Method to Achieve Substantial Energy and Water Savings

Recipient/Contractor: BDP Technologies

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 11/21/2016 to 3/31/2022

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

The most common secondary wastewater treatment process for nutrient removal is the activated sludge process. Most activated sludge processes are energy and land/space intensive as they include separated anoxic and aerobic tanks with secondary clarifiers. The infrastructure requires high capital, land footprint, and embedded energy and operation and maintenance costs. The current challenge for wastewater treatment plants in California is to meet the demand from population growth, increasingly stringent regulations and aging infrastructure while potentially reducing the energy and water consumption.

Project Description:

This project is demonstrating an efficiency technology that targets one of the major energy using steps in wastewater treatment. The Biological Double Efficiency Process (BDP) combines state of the art, easy to maintain aeration technology, airlift circulation/dilution technology, and an integrated all-in-one bioreactor technology to replace the separate anoxic and aerobic tanks associated with secondary clarifiers. The BDP is based on simultaneous nitrification and denitrification principles.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The innovative BDP technology has the potential to provide substantial energy savings to wastewater treatment plants, including reducing 50 percent of the aeration required for secondary treatment, thus decreasing electrical energy requirements and greatly improves oxygen transfer efficiency to 48-52 percent compared to 20-30 percent in conventional technologies.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Water-Energy Nexus: R.13-12-011 <Closed>

Applicable Metrics: CPUC Metrics- 1f, 1h

Lower Costs: The BDP technology could reduce energy and water consumption and costs at wastewater treatment plants while also meeting California's growing water and wastewater needs. In addition, the BDP technology could provide advantages of reduced energy and land use, carbon footprint (CO2 emissions), waste sludge generation, and operation and maintenance costs. The technology has the potential benefits of substantial 50 percent energy reduction, 30 percent less capital, 50 percent less land required, 50 percent reduction in operation and maintenance costs, and water savings opportunities.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$15,486

EPIC Funds Encumbered:

$1,565,400

EPIC Funds Spent:

$1,429,015

Match Partner and Funding Split:

BDP Technologies: $330,904 (17.4 %)

Match Funding:

$330,904

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

8 out of 8 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-018 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

There was a substantial period of inactivity due to COVID-19, therefore the agreement was extended to 3/31/2022. The recipient supervised equipment delivery and inspection in August. Due to Stay in Place orders, no on- site construction could occur in August. In late October 2020, the recipient did a project site condition checkup. The recipient intends to accomplish the following prior to the end of the year: complete electrical installation, complete leak repair and redo hydrostatic testing, complete equipment installation, complete laboratory setup, and continue leak repairs.

Project Name: EPC-16-021 - High-Resolution Imaging of Geothermal Flow Paths Using a Cost Effective Dense Seismic Network

Recipient/Contractor: Lawrence Berkeley National Laboratory

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 2/13/2017 to 12/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S4: Improve Power Plant Performance, Reduce Cost, and Accelerate Market Acceptance of Existing and Emerging Utility-Scale Renewable Energy Generation Systems.

Issue:

In operating geothermal fields, there is a need for imaging the movement of water and steam in three-dimensional space and over time. Tracer tests provide ground truth information about inter-well connectively, but they do not directly reveal the flow paths in the regions between the wells. Microseismicity mapped in three-dimensions can provide valuable information about fluid movement, but it is possible for water and steam to move through the fractured rock mass without triggering microseismicity, as well as for microseismicity to be triggered without fluids.

Project Description:

This project advanced the technology for imaging subsurface flow paths, barriers, and heterogeneity in operating geothermal reservoirs through an integrated approach that combines the recent development of low-cost, dense seismic networks together with established state-of-the-art micro-earthquake imaging algorithms and rock physics concepts. The technical advancement of this project is the integration of these components into a system that can be cost-effectively, reliably and routinely deployed in operating geothermal fields to image the movement of fluids in space and time with high-resolution and fast-turnaround time from data collection, to processing, to imaging, to rock physics interpretations.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project provided tools to help geothermal operations to be more productive. It demonstrated the advantages of a micro-earthquake imaging system that uses a dense network of seismic stations and automated processing to perform fast-turnaround, high-resolution imaging of fluid movement in producing geothermal reservoirs.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 1c, 2a, 3a, 3b

Lower Costs: A better understanding of the subsurface flow paths will allow optimization of production activities and improve well targeting to drill more productive wells. Drilling wells with a 5-10 percent efficiency increase (whether in steam production or water injection wells) is a reasonable assumption with improved well targeting. At a 10 percent efficiency increase, 1 well in 10 could be eliminated from the drilling program while maintaining production levels. The Geysers well drilling program generally includes, at minimum, the equivalent of 10 deep wells and 5 shallow wells in 5 years. Deep wells cost approximately $6,500,000, while shallow wells cost approximately $3,000,000 to drill.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$678,255

EPIC Funds Encumbered:

$1,672,639

EPIC Funds Spent:

$1,672,639

Match Partner and Funding Split:

Jarpe Data Solutions: $50,000 (2.9 %)

Match Funding:

$50,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

29 out of 32 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-021 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Over 17,000 earthquakes were detected and analyzed, yielding high-resolution images of the heterogeneous structure of the reservoir. The images delineated regions with high concentrations of steam and water. Most of the results of the 3D seismic imaging were corroborated by the information contained in Calpine's 3D reservoir model, thereby demonstrating the successful application of the technology in an operational geothermal reservoir. The 91-station network remains in place and continues to collect data.

Project Name: EPC-16-022 - Comprehensive Physical-Chemical Modeling to Reduce Risks and Costs of Flexible Geothermal Energy Production

Recipient/Contractor: Lawrence Berkeley National Laboratory

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 2/13/2017 to 12/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S4: Improve Power Plant Performance, Reduce Cost, and Accelerate Market Acceptance of Existing and Emerging Utility-Scale Renewable Energy Generation Systems.

Issue:

The increased use of intermittent renewable energy (primarily wind and solar) increases the inherent variability and uncertainty in electricity generation and resource availability, and thus drives the need for operational flexibility of other renewables such as geothermal energy. Converting production from baseload to flexible production may result in significant changes to the system related to corrosion and mineral deposition (scaling) in wells and mechanical fatigue damage to well components or the reservoir. A better understanding of the impacts of flexible-mode production on the reservoir-wellbore system is needed to ensure safe and sustainable production.

Project Description:

This project seeks to address the specific challenges of baseload and flexible-mode geothermal production, including wellbore and reservoir integrity, scaling, and corrosion. An improved model is being developed and applied to better understand these issues. Flexible mode production typically includes daily cycles in production rate that result in extraordinary stress on the wellbore and reservoir system. The modeling and assessment are being conducted to predict short- and long-term impacts of flexible-mode production on liquid-dominant geothermal reservoir systems representative in California as well as on the site-specific vapor-dominated Geysers Geothermal Field.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will lead to technological advancement by providing modeling tools that can be used by geothermal operators to better understand the impacts of flexible-mode production on the reservoir-wellbore system. This knowledge will allow the development of power plant and control technologies to enable geothermal power plants to operate in different variable modes, and to be both a baseload and flexible renewable resource.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Resource Adequacy (RA) 2016 and 2017 Compliance Years: R.14-10-010 <Closed> Long-Term Procurement Proceeding (LTPP): R.13-12-010 <Closed>

Applicable Metrics: CPUC Metrics- 2a, 3a, 5a, 5f

Greater Reliability: Switching base-load production to flexible-model production for an existing geothermal power plant will allow for increased use of intermittent renewable resources. The installed capacity of geothermal power plants in California is sufficiently large to have a significant impact on electricity reliability.

Increase Safety: The project will quantify effects of flexible-mode production on the well integrity, including corrosion and potential mechanical well failure. This leads to increased confidence on how to safely operate in a flexible production mode.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$480,995

EPIC Funds Encumbered:

$999,032

EPIC Funds Spent:

$810,000

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

29 out of 32 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-022 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The modeling tools have been completed. The project team completed modeling simulations for baseload and flexible production for liquid dominant geothermal systems. The project team also modeled site specific conditions of the vapor dominated resource at The Geysers and validated the model using pilot test data. The project team will conduct further sensitivity studies to develop recommendations regarding well designs, cement properties, and production schedules to allow geothermal power plants to operate in different variable modes.

Project Name: EPC-16-026 - Develop and Pilot Test Flexible Demand Response Control Strategies for Water Pumping Stations and Industrial Refrigeration Plants

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/15/2017 to 1/31/2022

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

During periods of peak electrical usage, matching supply and demand for the electric power grid has become increasingly challenging due to increasing penetration of variable renewables into the supply mix. Demand response (DR) provides an opportunity to mitigate grid instability and the high cost of purchasing electricity at critical times. California's industrial sector has the potential to provide fast and flexible DR through the development of control strategies.

Project Description:

The project develops technologies with the potential to achieve at least 20 percent demand reduction or adjustment for fast and flexible demand response (DR). The pilot demonstrations are at 2 different end use sectors: 1) a water pumping station and 2) commercial refrigerated food warehouse. The control strategies demonstrated can be replicated to show plant managers a way to integrate control strategies to reduce and adjust demand, to achieve new levels of operational reliability and efficiency.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project develops technology that will enable industrial customers to provide automated DR service to the grid including fast ramping, operating reserves, frequency regulation, and peak load reduction in support of California's goals for DR and energy efficiency as well as renewable integration and greenhouse gas emissions reduction. For refrigerated warehouses, the ability to shed load during periods of grid stress will be important, especially during summer heat waves like those experienced in 2020.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Demand Response (DR): R.13-09-011 Water-Energy Nexus: R.13-12-011 <Closed> Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1g

Lower Costs: The project has the potential to reduce demand for a variety of grid use cases including fast ramping, operating reserves, frequency regulation, and peak load reduction. This can result in lower demand charges and energy costs to the customer.

Greater Reliability: Supporting fast and flexible demand response helps to augment power system reliability and results in less stress on the grid by reducing peak loads. These services can help with maintaining system reliability.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$888,920

EPIC Funds Encumbered:

$3,000,000

EPIC Funds Spent:

$1,299,268

Match Partner and Funding Split:

Southern California Edison: $300,000 (8.7 %)

San Diego Gas & Electric Company: $15,000 (0.4 %)

Electric Power Research Institute, Inc.: $150,000 (4.3 %)

Match Funding:

$465,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 27 out of 28 bidders

Rank of Selected Applicant/ Bidder:

Phase 1 Group 2: Ranked # 5

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-026 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The refrigeration site team has nearly completed the data analytics. The team is making sure the data are all correct and analyzing energy consumption from miscellaneous (non-refrigeration) loads. The water site team has resolved the issue of tank cycling constraints and is adding corresponding software requirements and the user interface to include new information. The water team is now testing the software prior to a demonstration of the demand response tool for California Water Service.

Project Name: EPC-16-027 - Facilitating On-farm Participation in Energy Demand Management Programs

Recipient/Contractor: Irrigation for the Future, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 4/3/2017 to 3/31/2022

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Irrigated agriculture represents a significant source of energy-use and peak demand in California. California's level of irrigation management is advanced relative to the rest of the country, with 40 percent of irrigators using some form of scientific irrigation management when deciding when to irrigate. To reduce energy and water use further, partial irrigation timing strategies, such as deficit irrigation, are needed. Partial irrigation strategies can reduce energy use or shift demand times while maintaining or increasing farm profits, but these benefits are not well documented.

Project Description:

This project is developing a management tool for optimizing irrigation at ten farms in California. The sites have varied water requirements, growing a mix of almonds and alfalfa. The project is validating a pre-commercial water management system that allows irrigators to have more flexibility over when they irrigate and use energy. Instead of adding water whenever the soil is dry, this system will manage plant stress so that water can be delivered when needed by the plant and when electricity costs are low. The irrigation management technology enables irrigators to participate in utility demand response, time-of-use, and automated demand response incentive programs offering cost savings benefits to customers who can shift their energy demand.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project results in testing an irrigation management system to facilitate use of partial irrigation strategies, enabling flexible energy load control. This will allow irrigators to participate in utility demand response and time of use programs, providing grid flexibility.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Demand Response (DR): R.13-09-011 Water-Energy Nexus: R.13-12-011 <Closed>

Applicable Metrics: CPUC Metrics- 1b, 1e, 1f, 1g, 2a, 4c

Lower Costs: This project could lower energy costs and demand through participation in utility incentive programs for time-of-use, demand response, and automated demand response. It could also reduce water use and cost by 15 percent per farm.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$153,035

EPIC Funds Encumbered:

$1,588,872

EPIC Funds Spent:

$914,640

Match Partner and Funding Split:

Irrigation for the Future, Inc.: $126,663 (7.4 %)

Match Funding:

$126,663

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 27 out of 28 bidders

Rank of Selected Applicant/ Bidder:

Phase 1 Group 2: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-027 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The research team continues to collect in-season measurement and observations at the cooperating farms in preparation for the third season field trial of the automated irrigation management system, Irrigation Management Online (IMO). This system employs automated data integration that can generate updated irrigation schedules which is sent to the grower on-demand via the updated IMO interface. The IMO system informs the growers of the water use and yield reduction consequences of participating in any demand response (DR) or Auto DR event.

Project Name: EPC-16-028 - Irvine Ranch Water District Load Shifting and Demand Response Pilot Project

Recipient/Contractor: Advanced Microgrid Solutions, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 4/7/2017 to 12/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Water agencies operate within strict health, safety, and reliability and ratemaking constraints. Participation in demand response programs is not part of the core mission of water agencies and funding to increase demand response participation is not supported in the rate design. Electricity tariffs for water agencies intended to reduce peak demand are often at odds with the operating requirements of water and wastewater treatment facilities. Smart load control and demand response technologies are needed to automatically reduce peak demand, usage, and optimize cost, within existing tariffs and operational constraints of water agencies.

Project Description:

This project develops, tests, and validates a load-shifting optimization platform to reduce energy use and demand charges in the water sector. The platform advances pre-commercial demand response technologies to reduce: peak demand, energy use, and operational costs. The platform integrates advanced real-time monitoring, automated load shifting control, energy storage, and a pre-commercial cost optimization platform. Data generated by the project will validate the approach and identify best practices for increasing water sector participation in demand response programs.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project integrates several pre-commercial and commercial technologies into a platform that enables operational equipment and energy storage resources to respond automatically to energy price signals. The integrated approach promotes greater participation in demand reduction events, including the ability to participate without prior-day notice.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1e, 1f, 1g, 1h, 4a

Lower Costs: The project fulfilled its purpose of advancing, testing, and validating a load shifting optimization platform, but had mixed results in achieving the goal of lower costs. Three of the six sites experienced a decrease in the average on-peak demand, while the remaining three experienced an increase in the average on-peak demand. The total on-peak energy use decreased at all sites. Despite this, only half of the sites achieved positive bill savings, while the other half saw an increase in the total utility bill. The bill reduction ranges from 0.4 percent to 4 percent. The remaining three sites experienced a bill increase ranging from 1.6 percent to 3.4 percent.

Greater Reliability: The project validates the ability of water agencies to participate in demand response events on an automated basis, enable a more rapid response, and allow for greater load reduction. This project has the potential to increase grid reliability by increasing participation in demand response programs and providing dispatchable load reduction.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$832,615

EPIC Funds Encumbered:

$1,403,465

EPIC Funds Spent:

$560,886

Match Partner and Funding Split:

Advanced Microgrid Solutions, Inc.: $760,427 (35.1 %)

Match Funding:

$760,427

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 27 out of 28 bidders

Rank of Selected Applicant/ Bidder:

Phase 1 Group 2: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-028 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Battery energy storage systems (BESS) were installed at six sites and enrolled in the Local Capacity Requirements (LCR) program with a total capacity of 6.5 MW/35 MWh. The systems were controlled by the Platform which optimized the BESS operation to maximize value of demand charge management (DCM) and demand response (DR) programs. Performance data was used to evaluate project performance according to six key performance indicators, peak demand and peak usage reduction; DR performance; bill reduction; GHG reduction; and tariff impact. The BESS effectively reduced on-peak energy use and curtailed consumption during LCR events. However, this did not translate into lower operating costs. Bills increased by 1-2 percent. GHG emissions and electricity consumption were also higher post-BESS, likely due to battery round-trip inefficiencies. Varied performance with regard to on-peak demand and global peak demand reduction reflects the complexity of co-optimizing BESS for DCM and DR participation.<span

Project Name: EPC-16-030 - Enabling Energy Efficient Data Centers in Smart Power Distribution Systems

Recipient/Contractor: The Regents of the University of California, on behalf of the Riverside Campus

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 4/8/2017 to 6/30/2021

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Data centers consume an estimated 2 percent (100 billion kWh) of total U.S. electricity with a cost of around $10 billion. The peak demand of data centers represents over 2 percent of peak load in California and is expected to grow 4 percent annually in the next ten years. Therefore, it is critical to develop energy efficiency technologies for data centers in California.

Project Description:

This project is researching and testing technologies that improve data center energy efficiency at three different levels in a smart power distribution system. The technologies include increasing server energy efficiency, through coordinated deep sleep and dynamic voltage-frequency scaling (DVFS); data center workload balancing through phase and load balancing across multiple servers in a data center; and geographical workload balancing through phase/load balancing in a single or multiple power distribution network or feeder.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Data centers are a major consumer of electricity. In the PG&E service territory, peak demand of data centers is around 500 MW, representing 2.5 percent of peak load consumption. The energy use from data centers is expected to increase by 4 percent annually in the next 5-10 years. The development of agile energy efficiency solutions for data centers is needed. This project provides unique software-based solutions, rather than hardware solutions, to reduce electricity consumption by data centers through deep sleep and dynamic voltage frequency scaling, peak efficiency scheduling and spatial workload scheduling. If successful, potential electricity savings of up to 35 percent could result to data centers in California.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Demand Response (DR): R.13-09-011 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1g, 2a

Lower Costs: Much of the technology being developed by this project is software based that has the potential to lower data center processing energy usage and the costs associated with it. The recipient estimates that implementation of three proposed techniques could annually save data center operators over 1,000 GWh, resulting in estimated cost savings of $173 million if implemented at a 100 percent adoption rate.

Environmental Benefits: If the three proposed techniques are implemented with 100 percent adoption, it is estimated that data center operators can save 1,000 GWh annually and reduce 365,863 metric tons of CO2 equivalent.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$306,631

EPIC Funds Encumbered:

$1,783,118

EPIC Funds Spent:

$1,277,942

Match Partner and Funding Split:

The Regents of the University of California (UC Riverside): $265,567 (12.8 %)

San Jose State Research Foundation: $31,497 (1.5 %)

Match Funding:

$297,064

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 27 out of 28 bidders

Rank of Selected Applicant/ Bidder:

Phase 1 Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-030 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project team has completed the modeling of the Peak Efficiency Scheduling Algorithm and have preliminary average results of approximately 15 percent overall energy usage reduction. The project team is now working on the development of load migration and demand response algorithms. Early examples show nearly perfect compliance. The servers can effectively move their demand within milliseconds. Due to COVID-19, project progress has slowed since students are not allowed on campus. The project was granted a 9-month no cost time extension. The final report is in progress.

Project Name: EPC-16-032 - Leading in Los Angeles: Demonstrating Scalable Emerging Energy Efficient Technologies for Integrated Facade, Lighting and Plug Loads

Recipient/Contractor: New Buildings Institute, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/15/2017 to 6/30/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

The Los Angeles basin is in drastic need of energy and carbon reductions in the wake of the Aliso Canyon natural gas leaks. Deep building energy retrofits can realize large energy and carbon savings in existing buildings. However, barriers such as cost-effectiveness, unknown savings potential, and scalability have limited implementation of large scale building retrofits that would provide a significant impact.

Project Description:

The recipient is demonstrating and validating new retrofit package solutions from laboratory pre-testing through field demonstrations in existing government-owned commercial buildings. The solution sets, dubbed "INTER", are comprised of shading products from Rollease Acmeda and lighting and plug load systems and integrated controls, including HVAC systems, from Enlighted. The technologies can be combined and customized to suit a variety of building types and spaces, resulting in an estimated whole building energy reduction of 20 to 32 percent. Beginning in the Los Angeles basin, the team is leveraging existing market connections to increase and accelerate market adoption of these retrofit solution sets to maximize the potential energy and carbon savings, first in the region and ultimately, throughout California.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project creates a holistic, low-barrier integrated retrofit solution for significant energy savings. The scalable energy retrofit solution will be demonstrated in municipal government buildings but is also applicable to other commercial and residential buildings and to new construction and existing buildings. Installation does not require specialized training. The integration of technologies can produce higher savings than individual technologies operated in isolation. Creating building retrofit solutions that are least disruptive to building occupants while solving energy, occupant and owner issues are key to providing solutions that will support California's statewide zero net energy and existing building goals.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1h

Lower Costs: The project could reduce annual energy use in a typical large office building by 32 percent. The lighting control system is demand response capable. If this suite of technologies is implemented statewide in existing buildings over the next 15 years, estimated savings include 2,692 GWh $421 million, and 639,000 metric tons of CO2e, assuming a retrofit rate of just 3 percent annually.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$1,767,847

EPIC Funds Encumbered:

$4,981,000

EPIC Funds Spent:

$4,562,177

Match Partner and Funding Split:

Rollease Acmeda, Inc.: $670,000 (10.0 %)

Delos: $25,500 (0.4 %)

Southern California Edison: $150,000 (2.2 %)

Lawrence Berkeley National Laboratory: $50,000 (0.7 %)

CSU Dominguez Hills: $200,000 (3.0 %)

BeMO USA Corp: $300,000 (4.5 %)

City of Santa Ana: $30,000 (0.4 %)

Daintree: $300,000 (4.5 %)

Match Funding:

$1,725,500

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 8 out of 10 bidders

Rank of Selected Applicant/ Bidder:

Phase 1 Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-032 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Installation of automated shades, HVAC controls and all lighting retrofits were completed in both the City of Santa Ana and CSU Dominquez Hills buildings. Preliminary findings from the integrated retrofit indicate energy savings of 62 percent in the winter and 76 percent in the summer, relative to the existing building baseline. In 2020, the recipient received a no cost time extension due to COVID-19. The added time is needed to revise the M&V plans based on reduced occupancy, and to update the Technology Transfer strategy in light of the changes due to the pandemic.

Project Name: EPC-16-033 - Internet of Things and Ubiquitous Sensing in University Building Energy Management: Design Optimization and Technology Demonstration

Recipient/Contractor: CSU Long Beach Research Foundation

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 4/30/2017 to 3/22/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

There is a research gap in the number of demonstrations and pilots, including market awareness and education that can address building owners resistance to embracing new technologies for existing buildings. Even though new energy management technologies can reduce energy use and operating costs, there is reluctance to try new state-of the art technologies.

Project Description:

This project is demonstrating and assessing a pre-commercial integrated energy management system based on internet of things (Iot) to achieve control of lighting HVAC and plug loads in a building on the CSU Long Beach campus.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project aims to remove barriers to achieve widespread deployment of state-of-the-art energy management technologies. The project provides California IOUs, academic institutions (universities, including 22 CSU campuses), energy management technology developers, and other stakeholders with an IOT-based energy management platform. Additionally, the project provides a comprehensive example of the potential for large scale deployment, including technical considerations, building performance, energy savings, and non-energy benefits.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Demand Response (DR): R.13-09-011 Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1g, 1h

Lower Costs: The use of IOT-based controls is projected to reduce on-peak energy demand of HVAC by 100 kW and the peak demand of lighting and plug loads can be reduced by 125 kW. The total annual electricity and thermal savings are estimated at 570,000 kWh and 1,600 therms or approximately $163,000 annually. The IoT capabilities give more control in saving money on energy bills

Environmental Benefits: Reduction in on-peak energy demand and electricity consumption could reduce the need to burn fossil fuels for electricity generation and result in an estimated 137 metric tons of CO2e reduced. Being able to shift electric loads anytime during DR events provides flexibility to the electric grid and the potential for increase renewable energy use during periods of over-generation.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$78,271

EPIC Funds Encumbered:

$2,509,946

EPIC Funds Spent:

$1,847,337

Match Partner and Funding Split:

Enlighted Inc.: $411,500 (11.5 %)

ControlWorks, Inc.: $88,500 (2.5 %)

Regents of the University of California, Riverside Campus: $163,400 (4.6 %)

CSU Long Beach Research Foundation: $319,606 (8.9 %)

Wayne State University: $89,952 (2.5 %)

Match Funding:

$1,072,958

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 8 out of 10 bidders

Rank of Selected Applicant/ Bidder:

Phase 1 Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-033 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The recipient chose not to extend the agreement to 2022, A shorter term extension date of May 31, 2021 was sent to CGL for approval on Feb 2, 2021. The team expects to be able to complete the deliverables by the revised end date. They continues to evaluate the building's ability to participate in Demand Response (DR) . The campus has been closed since March 2020 due to pandemic. The team has completed more than 5 months of data from the normal operation of the HVAC system. They also have HVAC system data after March 2020 and until December 2020, which satisfied the 9 months of data, but with a different occupancy than baseline. The team analyzed the overall building energy consumptions from September 2019 until December 2020. The results show that the new technologies consistently reduce the building energy consumptions by more than 20 percent. CSU system suggests there are plans to repopulate the campuses at greater percentages will be in the fall of 2021.

Project Name: EPC-16-034 - Automated Cloud-Based Continuously Optimizing Building Energy Management System

Recipient/Contractor: Zero Net Energy Alliance, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 4/1/2017 to 1/3/2022

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

Current building energy management systems (BEMS) are typically programmed and set to a predefined schedule to ensure set points are reached. However, most BEMS fail to optimize energy use because predetermined settings become rapidly obsolete. In addition, energy management systems do not detect when buildings and energy systems degrade over time, creating "drift" in the months and years following commissioning. Even state-of-the-art BEMS require regular reprogramming to achieve and sustain a high degree of energy efficiency.

Project Description:

This project develops a software platform that helps building energy management systems run more effectively. The Automated Cloud-based Continuously Optimizing Building Energy Management System (ACCO-BEMS) automates and optimizes control of building systems and devices. It is being implemented at Pomona College in 10 buildings on campus, half of which will have ACCO-BEMS as a new building energy management system, the other half will have ACCO-BEMS integrated with the existing system.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Energy performance monitoring and fault detection diagnostics software is a key technology that must be further enhanced and deployed to overcome barriers to achieving ZNE buildings. A principal barrier to real-time management of energy systems is the many, often incompatible, protocols and interfaces used by energy devices and sensors. These have long represented a barrier to the integration of discrete systems, sensors and actuators necessary to automatically assess and control energy use. This project uses an internet-of-things gateway to communicate with the various energy using devices in the building using their native protocol and interface. The platform uses machine learning to assess real-time building performance and automatically adjust individual devices. The technology eliminates building drift and negates the need for expensive reprogramming or optimization measures.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Demand Response (DR): R.13-09-011 Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a

Lower Costs: The project has the potential to reduce electric demand and enable real-time automated demand response (ADR). The technology is being demonstrated at two Southern California college campuses and is estimated to enable 1 MW of ADR with projected annual energy savings of 1,600 MWh or $250,000 per year. The target market for this technology is educational, non-grocery retail and office buildings--which represents 43 percent of the total statewide electric use. Once scaled, statewide annual savings potential is estimated to be 7,269 GWh or an estimated $1.1 billion statewide.

Consumer Appeal: The technology can co-exist with existing systems or can be implemented as a new installation. For retrofits, ACCO-BEMS can connect to existing energy management systems, sensors, controllers, and meters to communicate with each in its native protocol. This allows for use of the technology with existing, installed equipment, avoiding the need for equipment replacement retrofits, or for the customer to learn a new system.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$552,488

EPIC Funds Encumbered:

$2,500,000

EPIC Funds Spent:

$2,295,000

Match Partner and Funding Split:

Zero Net Energy (ZNE) Alliance: $25,000 (0.7 %)

MelRok, LLC: $1,159,891 (31.5 %)

Match Funding:

$1,184,891

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 8 out of 10 bidders

Rank of Selected Applicant/ Bidder:

Phase 1 Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-034 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The ACCO-BEMS platform has been installed at 10 campus buildings, HVAC systems commissioned, and additional sensors and actuators installed. The platform successfully identified a number of problems and retrofitting opportunities that would have required costly manual recommissioning to uncover. The fault detection engines use physics-based rules and artificial intelligence based pattern recognition to detect failures. The project team continues to develop applications to modify HVAC scheduling based on real-time occupancy data. In March, 2020, the campus was closed in response to the COVID-19 pandemic. Uncertainty around when the campus might reopen delayed start of the M&V period. When it became clear the campus would not reopen in Fall 2020, the project team updated their M&V approach in order to proceed with calculating the estimated project savings. A 12-month time extension was approved allowing additional time to complete M&V and final reporting.

Project Name: EPC-16-036 - Thermoelectric Generator Application and Pilot Test in a Geothermal Field

Recipient/Contractor: AltaRock Energy, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/15/2017 to 12/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Growth of the geothermal industry has been limited by the need for large and costly power plants and large-scale infrastructure to produce geothermal electricity economically. Typically, a geothermal project cannot produce electricity economically at a scale less than 5 MW. If smaller geothermal power plants could be economical, this would open up more opportunities to add geothermal power to the mix of supply resources.

Project Description:

Thermoelectric Generator (TEG) technologies have the potential to produce geothermal electricity without as much infrastructure (turbines, steam piping, etc.), thus making small-scale production and geothermal-powered microgrids both practicable and affordable. Small (below 5 MW) geothermal projects could provide consumers with the same distributed power flexibility provided by solar and wind production with the additional benefit of being a more reliable baseload source of electricity. TEG technologies can also allow geothermal heat to provide balancing and grid support. This project is scaling up a TEG from the watt-level in the lab to a 20-kW unit for demonstration in a geothermal reservoir.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will develop a means to expand use of low temperature and stranded geothermal resources by making small scale production both practicable and affordable.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Distribution Resources Plans (AB 327): R.14-08-013 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 1a, 1b, 1c, 2a, 3b

Lower Costs: Many smaller geothermal resources are not currently able to be developed because it would not be economical to build a traditional, large geothermal power plant. Thermoelectric Generator technologies have the potential to help small-scale geothermal power

generation to be more cost-effective by requiring less infrastructure and a streamlined set of mechanical equipment.

Greater Reliability: New baseload and flexible renewable generation technologies will improve the performance and reliability of the electrical grid. Geothermal thermoelectric generators will expand use of low temperature and stranded geothermal resources in the state which have not traditionally been used to produce electricity. The technology can supply peaking power and balancing of intermittent renewable resources at much lower cost than batteries.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$310,473

EPIC Funds Encumbered:

$1,280,000

EPIC Funds Spent:

$723,631

Match Partner and Funding Split:

Leland Stanford Junior University: $5,222 (0.4 %)

AltaRock Energy, Inc.: $112,873 (8.1 %)

Match Funding:

$118,095

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 20 out of 20 bidders; phase 2: 9 out of 9 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-036 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project team deployed two small test units (about 100 and 500 watts each) at the geothermal site as a test run. The lessons learned helped the team make improvements to the design and process. The final phase of this project involves building and deploying the scaled up 20-kW system at the same geothermal site. Demonstrating the technology at this scale will help improve efficiency and cost and bring the technology closer to commercialization.

Project Name: EPC-16-037 - The Amador Water Agency In-Conduit Hydropower Development Project (AWA Project)

Recipient/Contractor: Amador Water Agency

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/15/2017 to 3/31/2022

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

One of the oldest turbine technologies in California is the Pelton turbine, designed for high pressure conduit sites. There are an estimated 62 MW of installed Pelton turbines in California that are nearing the end of their in-service asset life and an estimated 8.2 MW of new small, in-conduit Pelton sites that remain undeveloped due to lack of efficiency and high costs. There is an immediate need to design, test, and demonstrate an improved and more efficient Pelton turbine runner in order to provide a viable retrofit solution for degrading sites and expand small hydropower deployment in new sites throughout California.

Project Description:

The goal of this project is to design, test, and demonstrate a 417 kW in-conduit Pelton turbine runner at an existing Pressure Reducing Station (PSR) site located in Ione, California. The project will demonstrate the ability to maximize the wasted energy captured at the station using an improved design of a higher-efficiency Pelton turbine runner specifically designed for small, in-conduit hydroelectric applications to contribute in the integration of in-conduit small hydropower into the existing state energy mix.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The system developed under this project will recover and maximize the capture of wasted energy in a Pressure Reducing Station (PRS); improve the efficiency, performance, and cost of the Pelton turbine technology to capture wasted energy; provide a viable retrofit solution; and help expand small hydropower deployment.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Water-Energy Nexus: R.13-12-011 <Closed>

Applicable Metrics: CPUC Metrics- 1a, 1b, 1c, 3a, 3b, 4a

Lower Costs: Water agencies throughout the state will have an opportunity to generate additional revenue and offset ever-increasing electricity costs associated with treating, distributing, and collecting water to help reduce costs to investor-owned utility ratepayers.

Greater Reliability: The project will help achieve greater electricity reliability by supporting the generation of 72,000 MWh over a 50-year asset life of distributed, baseload renewable power using rotating equipment.

Environmental Benefits: The ability to maximize and capture the wasted energy at the Pressure Reducing Station (PRS) to generate over 72,000 MWh of renewable power will offset 50,650 metric tons (MT) of CO2-equivalent over the 50-year useful asset life of the project.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$750,000

EPIC Funds Spent:

$596,652

Match Partner and Funding Split:

NLine Energy, Inc.: $108,334 (5.8 %)

Amador Water Agency: $1,006,666 (54.0 %)

Match Funding:

$1,115,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

29 out of 32 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-037 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project completed the design phase and contracted with Gilkes to manufacture the turbine, which was delivered in the spring of 2019. AWA also procured a general contractor, Central Sierra Electric, to construct the project. Construction began in fall of 2018. Installation of the turbine and balancing of the plant began in late spring of 2019 continued through the fall. Due to the COVID-19 pandemic, Gilkes had not been able to travel to the United States for the commissioning and startup. AWA has hired a local firm to assist in the project startup, testing, and commissioning. The battery test report is approved by PG&E and the project team is planning the PG&E PPI (Pre-Parallel Inspection) to test the switchgear. Once the PPI is complete, AWA will be looking for a PTO (permission to operate) letter from PG&E. The project is expected to conclude by March 2022.

Project Name: EPC-16-038 - Use of Indoor Rearing for Head-Starting Desert Tortoises

Recipient/Contractor: The Regents of the University of California on behalf of the Davis campus

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/31/2017 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.

Issue:

Rapid development of utility-scale solar electricity generation facilities in the desert Southwest has resulted in loss of habitat for special status species, such as the Mojave Desert tortoise. Current law and implemented policies require that negative impacts to protected species be minimized or offset. Research is needed to evaluate the efficacy of head-starting as a mitigation tool for offsetting or minimizing impacts to the desert tortoise as well as aiding recovery of the species to streamline future permitting for renewable energy development.

Project Description:

The project has conducted experimental releases of juvenile desert tortoises raised since 2011-2013 and new hatchlings in 2016-2017 to evaluate the trade-offs of head-start duration on post-release survival of desert tortoises. The project team divided new hatchlings into two cohorts, raising half of them exclusively outdoors and the other half under a combination of indoor/outdoor rearing, releasing them as 2 year olds, and comparing their post-release survival. Data on the growth and survival of animals in this study will provide guidance on the minimum duration of outdoor head-starting and whether indoor head-starting should be pursued in future head-starting programs for desert tortoises. Ultimately, the results of the study can inform the extent to which head-starting both indoors and outdoors is a viable solution for mitigating localized impacts to tortoise populations affected by development for solar energy production facilities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The research will be the first to evaluate the trade-offs in duration of head-starting on post-release survival in the eastern Mojave Desert where numerous solar production facilities have been recently constructed. Because longer head-start periods cost more, finding the optimal head-starting duration will help develop more cost-effective head-starting programs. The research will also evaluate indoor-head-starting. If the increase in size also results in an increase in post-release survival compared to outdoor-reared animals, indoor head-starting could dramatically

reduce the costs of rearing animals to releasable size and also increase production of head-starting facilities.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 2a, 3a, 3b, 4f, 4g

Lower Costs: This project will result in the ratepayer benefit of lower costs by making head-start mitigation more cost-effective, reducing obstacles to future renewable energy deployment. It is important to determine the best practice methods for head-starting juvenile tortoises, including reducing time spent in captivity and increasing survival in the wild after release. This will minimize mitigation costs for renewable energy developers, thus reducing the cost of energy to ratepayers.

Environmental Benefits: New scientific knowledge on minimum size required at release while improving survivorship, resource needs, and translocation practices will guide management in the future. Implementation of more effective mitigation practices may increase probability of de-listing the desert tortoise from the endangered species list in the future, making renewable energy development more feasible.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$106,461

EPIC Funds Encumbered:

$493,089

EPIC Funds Spent:

$384,676

Match Partner and Funding Split:

The Regents of the University of California, Davis Campus: $61,119 (11.0 %)

Match Funding:

$61,119

Leverage Contributors:

National Park Service: $200,000

Bureau of Land Management: $200,000

Leveraged Funds:

$400,000

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

14 out of 14 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-038 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The research team produced tortoise hatchlings in 2016 and 2017 and assigned them either to the indoor or outdoor experimental groups. The indoor group was raised indoors in their first year and then transitioned to outdoor pens for the second year of their head-starting. All captive tortoises were measured to track their growth rates in different treatments. In September 2018, the team released 78 juvenile tortoises and began post-release monitoring using radio telemetry; the remainder were released in Fall 2019. Data collection has been completed and data analysis of all captive and released animals is underway. The project team is collaborating closely with a complementary project (EPC-16-053), as well as with U.S. Fish and Wildlife Service and California Department of Fish and Wildlife to develop guidelines and recommendations about the mitigation and recovery strategy.

Project Name: EPC-16-039 - A Life Cycle Assessment of the Environmental and Human Health Impacts of Emerging Energy Storage Technology Deployment

Recipient/Contractor: The Regents of the University of California, Irvine Campus

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/8/2017 to 8/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.

Issue:

Scalable stationary energy storage is a critical component for facilitating the increased integration of renewable resources and meeting California's energy goals. However, the information about environmental and human health impacts of the emerging large-scale energy storage technologies, especially flow batteries, is largely incomplete. A better understanding of the potential issues associated with the life cycle supply chain will enable these technologies to be scaled to the capacity levels necessary for providing widespread grid services without creating negative externalities.

Project Description:

This project investigated whether flow batteries are a viable option for providing grid energy storage at the large scale, either in place of or alongside lithium-ion battery technology. The researchers are examining a life cycle-based characterization of the environmental impacts and resource usage associated with three chemistries of flow batteries (Vanadium Redox (V2O5), Zinc-Bromide (ZnBr), and Iron-Sodium (FeNa)). The research focused on materials use, energy use, and toxic waste outputs of the life cycle phases of each flow battery type, including materials extraction, manufacturing, use, and disposal or recycling as applicable.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project provides guidance for California policymakers and planning agencies for selecting emerging energy storage technologies that can facilitate the increased uptake of renewable resources and decarbonization of California's energy system, helping safeguard the environment and public health. This study is a first of its kind for flow battery technology and provides the knowledge base needed for flow batteries to be deployed in a safe and environmentally sensitive manner.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Smart grid: R.08-12-009 <closed> Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 2a, 3e, 4b, 4c, 4d, 4e, 4f, 5d, 5e

Environmental Benefits: This project provides information that can be used to avoid or reduce environmental and safety issues that could result from the scale-up of energy storage technologies. Environmental impacts of flow battery are driven by the materials chosen in the design stage. Therefore, different system designs may substitute these materials.

Public Health: The project characterizes the human health impacts from different grid-scale energy storage technologies. This research set the groundwork for future projects by providing the data necessary to understand and improve the environmental, human health, and cost impact profile of flow battery energy storage technologies through supply chain reorganization and materials selection or development.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$98,142

EPIC Funds Encumbered:

$600,000

EPIC Funds Spent:

$598,901

Match Partner and Funding Split:

The Regents of the University of California, Irvine: $186,219 (23.7 %)

Match Funding:

$186,219

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

14 out of 14 bidders

Rank of Selected Applicant/ Bidder:

Group 5: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-039 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Results from the life cycle assessment suggest that Vanadium-Redox flow battery exhibited the highest environmental impacts and potential human health hazards, and the highest material cost -- $491/kWh across its life cycle. These impacts are attributable to the carbon emission intensity and high market prices for materials used to produce the vanadium pentoxide electrolyte. Production of the All-Iron flow battery exhibited the lowest impacts according to 6 of the 8 environmental indicators as well as the lowest potential human health hazards, and material costs of $196/kWh. Production of the Zinc-Bromide flow battery exhibited environmental and human health impacts at a level between the other two battery chemistries, and the lowest materials costs of $153/kWh. These results are very sensitive to assumptions about the life cycle inventories and the materials chosen for these specific systems.

Project Name: EPC-16-040 - Assessing Cooling Tower PM2.5 and PM10 Emissions using Advanced Instrumentation, Plume Transects, and Plume Modeling

Recipient/Contractor: The Regents of the University of California, Davis Campus

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/15/2017 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.

Issue:

Concerns over limited freshwater supplies have resulted in state policies encouraging the use of degraded water in cooling towers for recently approved thermal power plants. Cooling towers using degraded water sources, which contain high concentrations of total dissolved solids, will have higher particulate matter (PM) less than 10 micrometers in diameter (PM10) emissions that require the purchase of additional costly PM offsets. These emissions are a significant issue for power plant developers and may discourage the use of degraded water sources for cooling.

Project Description:

Current methods estimating PM emissions from cooling towers are rough approximations at best and most likely overestimate those emissions. This leads to power plant operators pursuing more expensive PM reduction than may actually be required. This project measured PM2.5 and PM10 across the spray drift plume from two power plant cooling towers that use fresh water and brackish water. These measurements are being used to develop and validate a model of power plant PM2.5 and PM10 emissions that will provide power plant operators and air quality agencies a methodology to accurately estimate PM2.5 and PM10 emissions of brackish water use in cooling towers.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The research team is using plume measurements from fresh and brackish water-cooling towers to develop a model of the droplet and particle size distribution changes in cooling tower plumes as a function of cooling water composition, meteorological conditions, and cooling tower operating parameters. The model is based on first principles of chemistry and physics and is being validated using the measurement data. The model supports the use of brackish water instead of expensive fresh water, leading to decreased costs for electric utilities and ratepayers and freeing up more fresh water for use in homes, industry, and agriculture in California.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 1c, 2a, 3a, 4b, 4c

Lower Costs: This project decreases power plant operating costs by enabling the switch from fresh water to brackish water in cooling towers, saving money in facilities operations, since brackish water is less expensive than fresh water.

Environmental Benefits: This project enables the use of brackish water in cooling towers in California, conserving valuable freshwater resources.

Public Health: The modeling work focuses on decreasing the concentration of PM2.5 and PM10 downwind of power plant cooling towers when brackish water is used for cooling, thereby improving air quality in these locations.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$108,004

EPIC Funds Encumbered:

$700,000

EPIC Funds Spent:

$598,457

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

14 out of 14 bidders

Rank of Selected Applicant/ Bidder:

Group 4: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-040 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The research team has completed measuring PM in the cooling tower plume at three operating power plants. A third power plant was added to allow for sampling at a cooling tower with brackish water. The team is currently analyzing the data collected from the plume measurements and is working on developing the model to allow power plant operators and regulatory agencies to accurately estimate PM emissions from cooling towers. The project is on schedule to be completed by March 2021.

Project Name: EPC-16-041 - Benefits and Challenges in Deployment of Low GWP A3 Refrigerants in Residential and Commercial Cooling Equipment

Recipient/Contractor: DOE- Lawrence Berkeley National Laboratory

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/8/2017 to 8/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

California has an aggressive target to phase down high global warming potential refrigerant greenhouse gas emissions by 40 percent by 2030 (SB 1383) from 2013 levels. This includes proposed regulations to ban refrigerants with a global warming potential (GWP) greater than 150 in non-residential refrigeration by 2022, and refrigerants with a GWP greater than 750 in commercial and residential air-conditioning by 2023. A3 refrigerants are a very low-GWP alternative, but in order to utilize them, some redesign and standards development are needed, as well as more well-developed installation, operation, and maintenance practices.

Project Description:

This project develops test procedures and conducts testing for alternative refrigerants to assess flammability and to characterize energy savings. The recipient will also develop a favorability index of end-use market segments and equipment types based on potential GHG savings and commercial adoption feasibility. Results will be shared with the industry through public seminars, technical reports and journals, and conferences. The TAC includes manufacturing, codes and standards, and policy entities to help guide the research.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is evaluating alternative, low global warming potential (GWP) refrigerants that will also result in increased energy efficiency of cooling equipment. This project will identify current barriers and technical issues, and assess the potential for an expanded set of products which could use low GWP A3 refrigerants. The recipient will (1) develop test procedures for alternative refrigerants for flammability and energy savings characterization and (2) develop a favorability index of end-use market segments and equipment types based on potential GHG savings impact and commercial feasibility and adoption. This can help equipment manufacturers with product development and adopt equipment with much lower lifetime GHG emissions. By transitioning to refrigerants with lower GWP, the state will see fewer GHG emissions from commercial and residential buildings over the next 10-30 years.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a

Environmental Benefits: Transitioning to lower-GWP refrigerants for all product types by 2030 and 2050 could reduce refrigerant emissions and greenhouse gas emissions down to an estimated 5 and 6 Mt CO2e, for the refrigeration and air conditioning sector, respectively.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$221,625

EPIC Funds Encumbered:

$500,000

EPIC Funds Spent:

$460,000

Match Partner and Funding Split:

Institute for Governance & Sustainable Development: $500,000 (50.0 %)

Match Funding:

$500,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

14 out of 14 bidders

Rank of Selected Applicant/ Bidder:

Group 7: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-041 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The recipient has started testing room air conditioning units as well as mini-split and packaged terminal air conditioning units. The team is also performing soft-optimization tests of room air conditioning units to determine unit-level efficiency and capacity. The team completed a differential lifecycle cost analysis of low GWP room air conditioner costs with A3 R-290 refrigerant versus R-22. The cost is about 10 percent higher for R-290 due to the need for additional safety equipment and are confident that this is the upper bound on the manufacturing cost difference.

The team will next develop scenarios for room AC adoption and energy, GHG, and cost impacts for California based on their cost analysis and test results for energy efficiency and cooling capacity. Project end date has been extended to August 30, 2021 due to COVID-19-related delays.

Project Name: EPC-16-042 - Low-Cost High-Reliability Thermoelectrics for Waste Heat Conversion

Recipient/Contractor: DOE- Lawrence Berkeley National Laboratory

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/15/2017 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Current commercially available thermoelectric materials can only operate reliably up to 250 degrees C in temperature and have a low efficiency (5 percent). Materials that have been evaluated at higher temperature suffer from reliability issues due to use of lead and oxidation and sublimation problems. Silicon is abundant and stable at high temperature and thermoelectric devices made from Si hold much promise, though bulk Si has a low figure-of-merit. One established strategy for increasing figure-of-merit is to employ nanostructuring to decrease thermal conductivity. Silicon nanowires represent a new, highly-scalable technology that overcomes the limitations of previous efforts.

Project Description:

This project is developing a cost-effective mid- to high-temperature range (400-800 C) thermoelectric material for waste heat recovery using silicon nanowire arrays. The intent is to surpass technologies implementing an organic Rankine cycle or similar processes by having low parasitic losses, compact structure, and ability to be modularized for a broad scale of distributed applications. To achieve the goal, the project will advance the state of the art in nanowire characterization; demonstrate an optimized process for the production of Si nanowire arrays and a process to produce a freestanding array of aligned nanowires; characterize the thermoelectric and mechanical properties of these arrays and single Si nanowire; optimize the fabrication of the Si nanowire arrays; and integrate these arrays into devices capable of heat-to-power conversion. The results of device performance will be used to evaluate the techno-economic impacts of this technology. Taken together, the project will move silicon nanowire technology's Technology Readiness Level (TRL) from 2 to a prototype technology demonstration in a relevant environment (TRL of 5).

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will address principal barriers to the widespread application of current thermoelectric materials by providing a low-cost, reliable, affordable, and mass-producible technology that can

be broadly applied to convert high-temperature heat that is currently wasted at the production and retail levels in California.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Combined heat and power: D.10-12-035., R.08-06-024. <Closed> Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1h, 3h, 4a

Greater Reliability: This project will create a cost-effective Thermoelectric Waste Heat Recovery system that will reduce energy use in the industrial sector, thus benefitting California ratepayers by increasing electrical reliability and lowering electricity costs.

Economic Development: The total waste heat potential in California is 763 megawatts. Assuming a system cost of $1.5/watt and a 10 percent penetration, the estimated levelized cost of electricity is $0.015/kWh. Considering the value of renewable electricity generated and a 20-year asset life, the net present value at 10 percent penetration is estimated at $1.2 billion, with a payback period of just over one year.

Energy Security: Based on the assessment sponsored by Oak Ridge National Laboratory, the total potential net savings in electricity use per year from harvesting waste heat is about 0.022 quads for California. This is based on one-third of the theoretical maximum efficiency limit for heat engines (also known as the Carnot efficiency). Assuming an average source temperature of 800 F and a 10 percent efficiency for the silicone nanowire thermoelectric conversion system, the total potential for this technology is approximately 0.011 quads.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$440,167

EPIC Funds Encumbered:

$2,000,000

EPIC Funds Spent:

$1,375,000

Match Partner and Funding Split:

The Board of Trustees of the Leland Stanford Junior University: $516,502 (20.5 %)

Match Funding:

$516,502

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 20 out of 20 bidders; phase 2: 9 out of 9 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-042 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Stanford University is manufacturing the thermoelectric nanofibers as a new subcontractor to LBNL. To date, individual Si nanowires have been produced and the thermal properties have been measured. Due to the COVID-19 pandemic, DOE and California guidance has restricted or severely limited onsite access to both Stanford and Berkeley Lab facilities. The restrictions to site access have significantly delayed Si nanowire testing and development, and the corresponding and subsequent deliverables. Therefore, a no cost-extension to March 31, 2022 has been requested. To date, Si nanowires have been produced and thermal properties have been measured. Si nanowire fabrication is also being optimized to improve performance.

Project Name: EPC-16-043 - Cost-Effective and Climate Resilient In-Conduit Hydropower and Civil Works Innovation

Recipient/Contractor: Natel Energy

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/1/2017 to 3/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

A 2006 report issued by the CEC estimated approximately 120 MW of low-head small hydropower available in irrigation structures in California. Additionally, hydropower generation is controlled by the irrigation district's delivery schedules and generally suffers outside the irrigation season, greatly affecting the economics of hydropower for many of these opportunities. Innovative strategies to reduce costs through effective equipment or site design, standardization, or increasing the water flows can bring many projects into an attractive return on investment.

Project Description:

This aim of this project was to scale in-canal hydropower retrofits by lowering project footprint and civil works costs. As most drop structures in irrigation canals have a consistent design, the goal was to design and implement a modular powerhouse and standard plant design that can be replicated across irrigation drops in California. Using a simple and more easily scalable design will support the installation of the system across the low-head sites identified across California with in-canal potential. However, this project termed out incomplete.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Greater reliability could be achieved by enabling greater penetration at significant total megawatts of new, distributed baseload renewable energy with predictable generation profiles. The project was designed to significantly reduce the capital cost of installing small hydropower in existing irrigation drop structures by reducing the cost of construction and civil works by an estimated 50 percent when compared with installing custom designed works and equipment for each site.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed>

Applicable Metrics: CPUC Metrics- 1a, 1b

Lower Costs: The over-canal design being pursued in this project is estimated to lower the LCOE of low-head hydropower at irrigation system drop structures to $55/MW by 2019, unlocking approximately 150 MW of baseload renewable capacity in the state.

Greater Reliability: The design enables simplified maintenance by minimizing part counts and directing machine wear to specific, easily replaced parts. The design leads to straightforward and streamlined operation, minimizing scheduled maintenance and prolonging product operating life.

Increase Safety: Natel's California project pipeline is focused on low-head, low-pressure in-conduit or in-canal hydropower projects, auxiliary benefits from which include improving safety. At the bottom of a conventional high or low-head dam that utilizes a stream reach, a hydraulic jump zone similar to an undertow at a beach often develops, which increases drowning risks for project area communities, particularly children. Natel's design incorporates a draft chamber that is comparable to an enclosed stilling basin where any remaining force in the water is diffused and allows water to leave the chamber depowered, further reducing associated attractant flow risks for both humans and animals.

Economic Development: Distributed hydropower is inherently local and thus contributes directly to local construction jobs and improving the financial position of local institutions like irrigation districts. Distributed hydro projects are often integrated into independent grids, the maintenance of which requires skilled technicians and thus also leads to job creation.

Public Health: Although the projects associated with this grant are intended to interconnect to PG&E distribution systems, future projects have the potential for distributed hydropower as an off-grid solution for remote communities. In remote locations where diesel generators are the primary or sole source of electricity, distributed hydropower can reduce the usage of diesel generators and help improve air quality at a cost that is often well below that of diesel generation.

Energy Security: Energy security is enhanced by powering an otherwise unutilized hydrological resource in the form of an existing hydrological structure, reducing both present and future dependences on imported fuel sources. Distributed generating assets can also help reduce the impacts from natural (and man-made) disasters, as they complement and increase the overall resilience of the electricity grid.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$954,715

EPIC Funds Spent:

$97,010

Match Partner and Funding Split:

Natel Energy: $954,715 (50.0 %)

Match Funding:

$954,715

Leverage Contributors:

United States Department of Energy: $1,610,000

United States Department of Energy: $1,000,000

United States Department of Energy: $820,000

Leveraged Funds:

$3,430,000

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

29 out of 32 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-043 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Since its kickoff in July 2017, the project team conducted site surveys, design and agreement development with site hosts and partners. The project team selected two sites for demonstration: Alder Drop in Yolo County, and Murphys Afterbay in Calaveras County. Interconnection applications for both projects were filed with PG&E. CEC staff was informed in July 2019 that the economics of the project as structured was not viable, hence Natel would not be able to move forward with the demonstration. Upon discussion with the R&D Lead Commissioner and Legal staff, and in consideration of the pros and cons of alternatives, a decision was made to keep a Stop Work Order in place until the agreement term expired.

Project Name: EPC-16-044 - Hyper Efficient Pump Motor Unit with Fully Integrated Permanent Magnet Motor and Motor Controls with Combined Liquid Cooling

Recipient/Contractor: Terzo Power Systems, LLC.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/1/2017 to 12/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

The greatest barrier to the adoption of current energy saving technology in hydraulic power systems in industrial sites is high cost and long break-even period. This barrier has not been addressed due to the research and development costs associated with integrating the newest, highest efficiency technology.

Project Description:

During this project, Terzo Power Systems developed an economical and efficient configuration for a novel hydraulic power system with large scale integration and adoption of highly efficient liquid cooled permanent magnet motors, and fully integrated, liquid cooled motor controls. Terzo Power Systems used these technologies to develop a smart hydraulic pump motor unit that can quickly be commercialized and adopted statewide by industrial facilities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The recipient's novel Hyper Efficient Pump Motor Unit developed and demonstrated during this project reduced the energy use and operating cost for hydraulic power systems by integrating an efficient permanent magnet motor, efficient motor controller, and a combined liquid cooling loop. Hydraulic power systems are found in nearly all industrial facilities.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1h

Lower Costs: Project demonstrated an increase of hydraulic pump system efficiency by up to 80 percent. With 100 percent market penetration by 2025, energy costs can be reduced by an estimated $18,974,250 per year.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$99,350

EPIC Funds Encumbered:

$2,311,050

EPIC Funds Spent:

$2,311,031

Match Partner and Funding Split:

Terzo Power Systems, LLC.: $19,589 (0.8 %)

Ansync Labs, Inc.: $126,100 (5.1 %)

Match Funding:

$145,689

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 27 out of 28 bidders

Rank of Selected Applicant/ Bidder:

Phase 1 Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-044 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New

intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project is complete and the final meeting was held in April 2020. The recipient demonstrated that its novel Hyper Efficient Pump Motor Unit can achieve an energy reduction of up to 80 percent, depending on the specific industry application. The integration of an efficient permanent magnet motor, efficient motor controller, and integrated liquid cooling loop along with embedded intelligence enabled the significant energy reduction, while also leading to a more compact and lighter weight system compared to traditional hydraulic systems. Final report submitted to publications 11/2020. Terzo is marketing to and seeking funding from venture capital funds.

Project Name: EPC-16-045 - Development of New Technologies for Agricultural Loads to Participate in Renewables Integration, RTP Programs, and/or New Time of Use Rates

Recipient/Contractor: Polaris Energy Services Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/1/2017 to 12/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Participation in demand response (DR) programs by agricultural customers using irrigation pumps is largely limited to emergency/reliability programs. The potential for irrigation pumps to be managed for more frequent/regular response to dynamic DR programs appears high, but challenges remain that require additional research and demonstration. Research focusing on resolving these challenges and developing effective, replicable strategies--particularly coordinating control systems with crop and operational needs such as sand removal, reservoir charging, and crop response to variation in irrigation schedules--is needed.

Project Description:

This project develops a smart irrigation control system that improves and expands on current remote irrigation pump switching technology. The technologies developed will provide growers with the ability to automate their preferred load control strategies in response to new time-of-use electricity rates. Beyond that basic capability, the systems facilitate automated response to utility and system operator demand response signals, enabling participation in current and future demand response and reliability programs. The system is being deployed and tested on multiple farms and multiple crop types in PG&E service territory in the Fresno area.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

For many electrical utilities, agriculture is a significant component of their peak load. Collectively there are between 160,000 and 170,000 irrigation pumps in the Central Valley. This project addresses the direct electricity cost of irrigation for agricultural customers and the indirect cost to all electricity ratepayers of procuring sufficient resources to meet marginal peak demand, integrating variable renewable energy generation, and building sufficient infrastructure to support agricultural pumping load peaks. The project developed a control system and operational strategies that can adapt to different rate designs--including dynamic and DR-program tariffs--by optimizing pumping loads across large numbers of irrigation pumps.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Smart grid: R.08-12-009 <closed> Demand Response (DR): R.13-09-011 Water-Energy Nexus: R.13-12-011 <Closed>

Applicable Metrics: CPUC Metrics- 1c, 1d, 1e, 1g, 1h, 3f

Lower Costs: The technology facilitates effective response to time of use rates and facilitates participation in demand response programs through the shifting of agricultural irrigation pumping to lower cost time or in response to program incentives, lowering customer costs as well as enabling effective implementation of programs/tariffs designed to reduce system costs and meet state policy goals.

Greater Reliability: The technology could facilitate participation in demand response programs through the shifting of agricultural irrigation pumping to periods of surplus renewable energy, which improves system reliability by matching load to available supply and shedding loads during grid emergencies.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$415,408

EPIC Funds Encumbered:

$2,884,912

EPIC Funds Spent:

$2,819,060

Match Partner and Funding Split:

Polaris Energy Services Inc.: $649,485 (18.4 %)

Match Funding:

$649,485

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 27 out of 28 bidders

Rank of Selected Applicant/ Bidder:

Phase 1 Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-045 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Progress this year includes completing testing, completing the final report, and presenting at the 2020 EPIC Symposium. This research project demonstrated the ability of agricultural pumping load to respond to energy market price signals which can be used to incentivize consumption patterns that help meet California's energy policy goals. The project demonstrated the use of Polaris' platform to schedule irrigation in response to price signals and operate pumping systems through either the Polaris Pump Automation Controller or generic irrigation management systems. Results show that agricultural energy users will respond to clear price signals if they have sufficient automation and financial incentives through rates and/or programs that share the system benefits with customers. In the pilot, participants shifted two thirds of their load from the 4-9 p.m. ramp hours to other times of the day.

Project Name: EPC-16-046 - Pilot Testing of Isothermal Compression

Recipient/Contractor: Institute of Gas Technology dba Gas Technology Institute

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 4/12/2017 to 3/31/2022

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Currently, gas compression is limited by the thermodynamics which causes the gas being compressed to heat up during compression, making it harder to compress. This heating process can also lead to high operating temperatures which can increase the friction and wear of moving components. It is estimated that as much as 90 percent of the mechanical work input into an air compressor results in a loss of energy compared to the useful work output of the compressed air that is used to power an industrial process. Heat of compression is the biggest driver of this energy loss.

Project Description:

Gas Technology Institute (GTI) and Carnot Compression LLC (Carnot) are developing and field testing a novel, near isothermal air compressor which will enable improved efficiency, maintenance and reliability. The unit will be tested at an industrial facility in southern California. This project hopes to reduce the energy consumption in industrial, water, agricultural, and commercial applications that require compression of air and other gases. This project demonstrates a more efficient compressor that will use less electricity to meet the same performance metrics of existing air and gas compressors. If successful, this project could improve the energy efficiency of compressed air/gas systems which are prevalent in all industrial processing facilities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This near isothermal compressor, or Carnot Compressor, solves the heat of compression problem by using a working liquid to compress a gas, while actively removing the heat of compression throughout the compression process. By removing the heat throughout the compression step, the energy required to compress air from near atmospheric pressure to ~100 psig can be reduced by up to 50 percent compared to commercial air compressors, such as piston, screw, and scroll designs. These energy savings are expected to significantly improve the efficiency of industrial air applications.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h

Lower Costs: The technology has the potential to reduce energy consumption from air and gas compressors by up to 50 percent. Once commercialized, the isothermal compression process will deliver significant energy efficiency gains across a broad spectrum of compression applications.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$628,022

EPIC Funds Encumbered:

$2,570,946

EPIC Funds Spent:

$2,192,957

Match Partner and Funding Split:

Carnot Compression Inc.: $238,700 (8.5 %)

Match Funding:

$238,700

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 27 out of 28 bidders

Rank of Selected Applicant/ Bidder:

Phase 1 Group 1: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-046 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The COVID-19 shelter-in-place restrictions have significantly delayed system operations. The project team is working on the installation of new control system to correct airflow meter readings and provide better control of the cooling water balance tank. Project has been granted a one year no-cost time extension for a new project end date of 3/31/2022.

Project Name: EPC-16-047 - California Biopower Impact Project

Recipient/Contractor: Humboldt State University Sponsored Programs Foundation

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/10/2017 to 7/30/2021

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.

Issue:

Biomass is a potentially attractive energy resource that supports California's climate goals. However, there are significant gaps in existing life cycle assessment frameworks and methodologies regarding the climate impact associated with greenhouse gas (GHG) emissions from biomass use for electricity generation. Furthermore, biomass residue extraction has complex environmental and ecosystem impacts (positive and negative), some of which have not been well integrated into current life cycle assessments. Finally, there are significant market barriers to biomass mobilization in the forestry sector that need to be addressed in order for forest biomass utilization for energy to scale up.

Project Description:

This project develops an attributional life cycle assessment framework for various biomass-to-electricity supply chain and end-use scenarios that are specific to California. The research quantifies on a fine geospatial scale the amount of technically recoverable forest and agricultural biomass residue material in California, and it considers future impact projections from different climate change scenarios and fire risk probabilities under various harvest and land management scenarios. Based on the estimates, researchers are developing a detailed life cycle inventory - disaggregated by parcel, supply chain, and end-use characteristics. Results are supporting development of the California Residual Biomass-to-energy Carbon Accounting Tool (C-BREC) that will be made available to the public and could inform policy decisions on the role of biomass residues in California's energy portfolio.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This research project develops a rigorous California-specific lifecycle emissions accounting framework for evaluation of various forest biomass residue mobilization scenarios, quantification of key potential environmental and climate impacts associated with biomass residue mobilization and conversion to electricity, and identification of potential pathways for offsetting biomass residue mobilization costs. The framework and Carbon Accounting Tool (C-BREC) will provide California policymakers with an evidence-based, spatially-disaggregated, and probabilistic analysis to aid in creating policies aimed at managing the environmental performance of bioenergy

systems. Ultimately, the results from this project will provide information on the topic of carbon neutrality of residual biomass-to-energy production.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Greenhouse Gas Emission Allowance Cost and Revenue Issues: R.11-03-012 Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 2a, 3a, 3g, 4a, 4b

Lower Costs: Lower costs may be realized if the ecosystem service payments coupled with value estimates of potential carbon abatement from biopower exceed the internalized average or marginal wholesale cost per MWh of displaced generation.

Greater Reliability: Increased electricity reliability will be brought about by policies that encourage grid resilience through distributed generation facilities powered by biomass that would diversify California's mix of energy resources.

Environmental Benefits: The lifecycle assessment of biomass use for electricity generation will consider specific harvest practices, feedstock collection and handling practices, post-harvest treatments (briquetting, torrefaction, pelletization, etc.), feedstock management pathways, and conversion technologies, and it will provide information on the GHG implications from altered wildfire risk and severity and from altered long-term soil nutrient balance.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$247,784

EPIC Funds Encumbered:

$1,000,000

EPIC Funds Spent:

$853,741

Match Partner and Funding Split:

Sierra Institute for Community and Environment: $78,000 (6.9 %)

Humboldt State University Sponsored Programs Foundation: $53,575 (4.7 %)

Match Funding:

$131,575

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

14 out of 14 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-047 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The research team has conducted a net potential recoverable forest and agricultural residue assessment and compiled a spatially explicit database of these materials. The team has also developed a residual biomass-to-energy life cycle emissions accounting framework that considers various supply-chain and end-use scenarios for California and published a beta version of an interactive accounting tool for GHG and criteria pollutants emissions accounting from woody biomass converted to electricity. Additionally, the research team completed the wildfire risk impact assessment, nearly completed characterization of secondary environmental and climate impacts from woody biomass, and started development of a document with policy recommendations. Because of COVID-19 delays, the recipient has requested a no-cost time extension through July 2021.

Project Name: EPC-16-048 - Development and Testing of an Energy Efficient Ultra-low Charge Ammonia Refrigeration System in a Food Processing Plant

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/5/2017 to 12/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Most ammonia-based cooling systems in use today require large amounts of ammonia and are prone to leakage from the mechanical shaft seal between the motor and compressor, and require special handling. Additionally, most ammonia systems used today are either water cooled or evaporative cooled, which require water, a very limited and precious resource in California due to recent droughts.

Project Description:

This project is pilot testing and demonstrating an air-cooled, low-charge ammonia refrigerant-based, integrated package closed cooling system for an industrial food processing application. The project is demonstrating the effectiveness of a water-saving innovation with the use of a micro-channel, air-cooled condenser. The project is demonstrating the expected energy savings of 20 percent compared to a chiller using hydrofluorocarbon (HFC) refrigerant for similar end use at the same site. This system eliminates the need for water for cooling. The entire system can be prepackaged, factory charged, and brought to site as an integrated package which simplifies field installation and makes it cost effective.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

An air cooled, low-charge, ammonia refrigerant based integrated closed-packaged system with semi-hermetic motor/compressor seal that eliminates the mechanical seal between the compressor and the motor is not available in the U.S market today. As this is a packaged product, the M&V data from this project will help verify the energy savings and benefits and make it easier for industries to understand and implement this new technology and the energy and water savings benefits.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Water-Energy Nexus: R.13-12-011 <Closed> Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h, 2a

Lower Costs: Expected energy savings of at least 20 percent compared to a chiller using hydrofluorocarbon (HFC) refrigerant for similar end use at the same site. This system eliminates the need for water for cooling, which further adds to on-site cost savings.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$804,238

EPIC Funds Encumbered:

$2,406,054

EPIC Funds Spent:

$1,194,069

Match Partner and Funding Split:

TAKARA SAKE USA: $305,000 (10.1 %)

Electric Power Research Institute, Inc.: $300,000 (10.0 %)

Match Funding:

$605,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 27 out of 28 bidders

Rank of Selected Applicant/ Bidder:

Phase 1 Group 1: Ranked # 5

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-048 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The recipient has completed the low-charge, packaged ammonia chiller installation and is operating normally as confirmed by monitoring and verification (M&V) data. Preliminary M&V results show that the ammonia chiller is 38 percent more efficient than the R-507A chiller. Further testing at demonstration site is delayed due to COVID-19. The agreement was extended to 12/31/2021 to collect more real-world data at the demonstration site. The project team is now receiving monthly water treatment reports to track the change in the cycles of concentration for the R507A cooling tower. This allows the project team to compile the amount of water consumed each month (gallons/month) and then determine the number of gallons used per kWh of cooling provided.

Project Name: EPC-16-049 - Ultra-High Power Density Roadway Piezoelectric Energy Harvesting System

Recipient/Contractor: University of California - Merced

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/15/2017 to 12/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Heavy traffic of ground vehicles and pedestrians on highways, streets, and sidewalks provides considerable mechanical energy. There is an untapped opportunity to harvest the mechanical energy with under-pavement piezoelectric generators to exploit the large generation potential from traffic on the nation's highways and in major cities. This project aims to create a piezoelectric energy harvesting system with ultra-high density and efficiency.

Project Description:

This project leverages a multidisciplinary system approach to investigate the energy recovery potential of dual-mode piezoelectric generators to create roadway piezoelectric energy harvesting systems with ultra-high power density and efficiency. The goal is to design and test a piezoelectric roadway energy harvesting system, consisting of multi-layer stack generators and power electronics, to capture over 50 percent of the compression mechanical energy as electricity from passing vehicles. This project will demonstrate electric power generation, in the laboratory and on a 95 feet x 12 feet section of a road at the UC Merced campus, and will determine feasibility for future large-scale demonstrations on highways and streets with piezoelectric under-pavement.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project advances a piezoelectric energy harvesting system with ultra-high density and efficiency. Using an award-winning piezoelectric technology with unique dual-mode and multi-layer generator design and under-pavement installation strategy for smooth drive of passing vehicles and pedestrians, this project will help the ratepayers in California by reducing cost of electricity and reducing emissions related to power generation.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Distribution Resources Plans (AB 327): R.14-08-013

Applicable Metrics: CPUC Metrics- 1e, 3h, 4a

Lower Costs: At commercial scale, electric power density and cost are estimated to be 333 Watts per square foot and $9,010/kW respectively. The levelized cost of electricity is estimated to be less than $0.20/kWh.

Environmental Benefits: This project will reduce approximately 40 metric tonnes of CO2 equivalent. By retrofitting 1 percent of useable roadways, the environmental benefits could include reduction of CO2 emissions by more than 100 kilotons per year.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$310,100

EPIC Funds Encumbered:

$1,270,000

EPIC Funds Spent:

$125,133

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 20 out of 20 bidders; phase 2: 9 out of 9 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-049 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

System Patent

Description of New Intellectual Property Developed Under this Project:

International Patent Application WO2020028592. High-Power-Density Piezoelectric Energy Harvesting System. The disclosed subject matter has resulted from the research work carried out on campus of the University of California, Merced, sponsored by a grant from the California Energy Commission (Agreement Number: EPC- 16-049).

Update:

The project has completed design and fabrication of a batch of multi-layer piezoelectric generators, and has conducted laboratory evaluation of the prototype. The prototype design was revised and improved, resulting in a promising relationship between the loading and displacement of the piezoelectric unit. An order to purchase 200 piezoelectric generator towers was issued and the project team has fabricated mechanical parts for 100 piezoelectric generators. A patent has been filed for the mechanical amplification design. The project has started collecting field data.

Project Name: EPC-16-050 - Scaling Reliable, Next-Generation Perovskite Solar Cell Modules

Recipient/Contractor: The Regents of the University of California, on behalf of the San Diego campus

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/15/2017 to 1/31/2022

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

There is a need to deploy renewable energy at great scale to replace fossil energy and meet growing energy demand. Perovskite technology holds promise in dramatically reducing the cost of solar cell technology compared to silicon and thin-film solar cells because these cells can be fabricated at low-temperature (around 100 degrees Celsius). However, there is a need to address perovskite cell efficiency degradation.

Project Description:

Recent advances have pushed the solar conversion efficiency, making perovskites one of the most efficient solar technologies in existence. This project will use a scalable large-area manufacturing approach for fabrication of the perovskite solar absorber, the solar cell's transport and contact layers, and the encapsulation of the solar cell modules. The project will also include bifacial module design, where light enters from both front and back.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Currently, encapsulated perovskite cells degrade in several hundred hours even in controlled low-oxygen and low-humidity conditions. This project integrates materials innovations developed to date at UC San Diego in the perovskite absorber layer, the solar cell's contact layers, and the encapsulation of the module to make breakthrough advances in perovskite solar cell reliability and scaling. Combining these materials together in a module assembly with glass on top and bottom slows degradation by a factor of 1,000. In addition, the bifacial design of the module boosts its efficiency.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed> Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 2a, 4a

Lower Costs: This project aims to increase annual production of solar cells by reducing absorber and cell manufacturing costs relative to commercialized Si and thin-film technologies.

Greater Reliability: Integrating bifacial glass-glass modules should result in more energy production over time from solar cells and orders of magnitude improvement in perovskite solar cell durability, achieving at least 10-year operational lifetimes.

Economic Development: The number of solar jobs will increase when next-generation perovskite modules are introduced at competitive costs to silicon modules.

Environmental Benefits: A 1 percent market penetration on IOU-territory rooftops will produce 1.36 TW-hr/yr of renewable energy. The value of the renewable energy produced annually is $235.8 million with 4.48 million metric tonnes CO2e avoided.

Public Health: In addition to avoiding greenhouse gas emissions, solar energy generation does not produce toxic air emissions including mercury, NOx, SOx and particulate matter that produce smog and are detrimental to health. A 1 GW deployment of the perovskite module technology would reduce emissions of NOx by at least 400 tons annually by displacing burning of natural gas.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$184,540

EPIC Funds Encumbered:

$1,450,000

EPIC Funds Spent:

$896,217

Match Partner and Funding Split:

The Regents of the University of California, San Diego: $146,050 (9.2 %)

Match Funding:

$146,050

Leverage Contributors:

National Science Foundation: $550,000

Leveraged Funds:

$550,000

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 20 out of 20 bidders; phase 2: 9 out of 9 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-050 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project team successfully transferred graphene atop perovskite layers, developed new electron transport layers, and improved cell process by characterization and new absorber layer chemistry. The project team has compared the unencapsulated perovskite against the graphene barrier layer encapsulated perovskite cells. The project is growing crystals by using an electro-deposition approach. The project has established an 80 percent yield on perovskite solar cells of 5 mm2 in size of at least 16 percent power conversion efficiency under one sun.

Project Name: EPC-16-051 - Increased Energy Efficiency via Programmable Irrigation and Fertigation

Recipient/Contractor: PowWow Energy, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 4/12/2017 to 12/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Current energy efficiency programs do not address the complexity of farming. The lack of automation also slows the adoption of new irrigation and fertilization practices. An integrated approach to test cutting-edge technologies and demonstrating new irrigation strategies is necessary to provide additional energy and water savings without affecting crop yields. Geo-spatial and automated systems developed for the 3 commodity crops in the Midwest do not address the specific needs of California agriculture that grows over 350 specialty crops and produces more than 50 percent of the fruits, nuts and vegetables in the country.

Project Description:

PowWow Energy, in collaboration with WiseConn Engineering, West Hills College Coalinga (WHCC) and UC Santa Barbara (UCSB), is developing an automated, programmable irrigation management system that integrates cutting-edge technologies to increase the energy efficiency of irrigation (defined as using less energy to achieve the same level of crop production). Pilot-scale tests of the integrated technology platform are being conducted at two sites on commercial farms located in disadvantaged communities: an almond orchard near Delano (AgWise Enterprises, SCE territory) and a field with a rotation of row crops (tomato, garlic, etc.) near Huron (Woolf Farming and Processing, PG&E territory).

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

PowWow's technology integrates three new strategies for water and energy efficiency on farms (continuous pump testing with automated remote pump control, programmable irrigation for specific soil types and plant varieties, and management of water and fertility) with their cloud-based software. PowWow's data analytics software platform monitors irrigation pumps, energy rates, and other parameters and sends alerts to growers on how and when to irrigate to save energy, water, and cost without affecting crop yield or quality.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Water-Energy Nexus: R.13-12-011 <Closed> Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1h, 4a, 4c

Lower Costs: PowWow's technology demonstrated that it could lower energy and water costs by an estimated 25 percent annually while achieving optimum efficiency at each farm. During the project demonstration, water and energy usage were reduced by an average of 9 percent and 13 percent, respectively.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$341,285

EPIC Funds Encumbered:

$2,992,660

EPIC Funds Spent:

$2,547,051

Match Partner and Funding Split:

Naico ITS, Inc: $10,000 (0.3 %)

West Hills College Coalinga: $56,028 (1.7 %)

Environmental Studies Program & Bren School of Environmental Science & Management - UC Santa Barbara: $19,870 (0.6 %)

WiseConn Engineering: $7,000 (0.2 %)

Aduro Accounting & Consulting, LLC: $42,000 (1.3 %)

Mamala Research, LLC: $3,000 (0.1 %)

PowWow Energy, Inc.: $212,649 (6.4 %)

Match Funding:

$350,547

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 27 out of 28 bidders

Rank of Selected Applicant/ Bidder:

Phase 1 Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-051 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project is complete. Growers using PowWow's service cut water and electricity use by an average of 9 percent and 13 percent, respectively, without impacting crop yields. The recipient's software now monitors over 100,000 acres in California and continues to expand. PowWow changed their name to AgMonitor and completed another round of funding, raising an additional $1.5M from private sources, which was made possible by this project which helped AgMonitor increase their TRL from 5 to 7.

Project Name: EPC-16-052 - Force Multiplier Actuated Piezoelectric Energy Harvester for Roadway Energy Recovery

Recipient/Contractor: Pyro-E, LLC

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/15/2017 to 12/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Roadways are locations of tremendous energy consumption and transformation, but also hold potential to generate energy. One approach for making existing roadways more energy sustainable is through regenerative energy devices such as piezoelectric devices that have the ability to harvest energy from deflection, vibrations, and applied mechanical stresses from overpassing vehicles.

Project Description:

The project develops, designs, and installs a multitude of pavement-embedded devices to demonstrate energy harvesting from overpassing motor vehicles on the road in smart pavement covering 36 feet x 6 feet. The system consists of materials that exhibit the piezoelectric effect, generating an electric charge.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project demonstrates and assesses the potential of regenerative pavement technology, a roadway-embedded energy harvester that uses the untapped energy of car movements. The hardware devices developed using smart materials harvest energy from pavement deflections and vibrations under normal driving conditions. Energy performance data is collected to determine the technology's potential for widescale adoption in roadways and other surfaces.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Distribution Resources Plans (AB 327): R.14-08-013

Applicable Metrics: CPUC Metrics- 1e, 2a

Economic Development: This project is expected to displace a fraction of grid electricity with reduced rates. Retrofitting 1 percent of useable roadways (about 10 percent of total California roads) could service about 70,000 homes during peak traffic hours and about 500 GWh/year of peak load reduction and demand response.

Environmental Benefits: By retrofitting 1 percent of useable roadways with piezoelectric devices, the environmental benefits will be significant, with the potential of reducing about 210 kilotons of CO2 emissions and displacing 250 million gallons of fresh water from cooling gas power plants every year.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$234,596

EPIC Funds Encumbered:

$1,000,000

EPIC Funds Spent:

$808,944

Match Partner and Funding Split:

Pyro-E, LLC: $100,007 (9.1 %)

Match Funding:

$100,007

Leverage Contributors:

U.S. Department of Energy: $1,860,000

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 20 out of 20 bidders; phase 2: 9 out of 9 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-052 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project team completed basic design for the vibrational energy harvester, with a goal to maximize life under repeated impact and compression cycles from a vehicle. A batch of flexors, for converting vertical compression into horizontal extension, was fabricated and calibrated with force transducers and strain instruments to ensure proper specifications. A uniform subscale piezo-ceramic stack prototype was fabricated and assembled to prevent stress concentrations under buckling loads. Preliminary field testing at subscale was performed to collect data for power and energy. Work has started for permitting with the City of San Jose.

Project Name: EPC-16-053 - Habitat Influences on Desert Tortoise Translocation Success

Recipient/Contractor: Zoological Society of San Diego dba San Diego Zoo Global

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/22/2017 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.

Issue:

With planned expansions in the California deserts, renewable energy projects potentially represent another risk factor for the threatened Mojave Desert tortoise. Head-start methods have been identified as a potential recovery tool and mitigation action for the desert tortoise, but current methods that rely on more than 4 years in captivity are expensive and therefore may be impractical.

Project Description:

The project team is determining if habitat characteristics of the release sites can improve survival rates of smaller juveniles to the point that they are equivalent to the rates of the animals that were released only after reaching the desired size target. Careful measurement of resources that may help tortoises avoid predation or meet nutritional requirements will allow investigators to differentiate excellent habitat from merely adequate habitat. They are also studying the effects of outdoor rearing on juvenile desert tortoise behavior and health, and size-age relationships to survival in the wild upon their release. The project will generate quantitative scientific information about the most cost-effective husbandry and release methods during and following a head-start program for this threatened species.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will increase the effectiveness of conservation actions designed to mitigate renewable energy impacts on Mojave Desert tortoises. This will be achieved by evaluating the relative effectiveness of head-start and release methods in an experimental framework. Improvements to the effectiveness of habitat management to encourage natural recruitment of juveniles will also be tested experimentally where possible.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 2a, 3a, 3b, 4f

Lower Costs: This project is expected to lower costs by making head-start mitigation more cost-effective, reducing obstacles to future renewable energy deployment. It is important to determine the best practice methods for head-starting juvenile tortoises, including reducing time spent in captivity and increasing survival in the wild after release. This will minimize mitigation costs and maximize the contributions of these actions to desert tortoise recovery.

Environmental Benefits: New scientific knowledge on minimum size required at release will guide release site selection and management in the future, while improving survivorship, resource needs, and translocation practices. A better understanding of the habitat features that allow tortoises to thrive can also be applied to guidance for wildlife agencies about which land parcels to protect and set more meaningful restoration targets. Implementation of more effective mitigation practices may increase the probability of de-listing the desert tortoise from the endangered species list in the future. Lessons from the 2018 nest failure will provide important guidance for future mitigation efforts.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$32,237

EPIC Funds Encumbered:

$499,605

EPIC Funds Spent:

$415,011

Match Partner and Funding Split:

Zoological Society of San Diego dba San Diego Zoo Global: $390,528 (43.9 %)

Match Funding:

$390,528

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

14 out of 14 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-053 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project hatched the first cohort of 63 hatchling tortoises at Edwards Air Force Base (EAFB). This number is sufficient for the 18-month old group to be released in 2020. Unfortunately, there was complete nest failure at the Cadiz site. Researchers tried to overcome this setback by attempting to collect a larger number of eggs in 2019 so that half could be reared indoors to reach the size the 18-month cohort would have achieved, but this was unsuccessful. Investigating the cause of the nest failure should lead to improved guidance for head-starting. The team is collaborating with a complementary project (EPC-16-038). The COVID-19 pandemic also prevented access to EAFB, blocking the research team from releasing tortoises there in spring 2020. A no-cost time extension is being processed to allow adequate time to track this set of tortoises.

Project Name: EPC-16-054 - Open Vehicle to Building/Microgrid Integration Enabling ZNE and Improved Distribution Grid Services

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/30/2017 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S9: Advance Electric Vehicle Infrastructure to Provide Electricity System Benefits.

Issue:

The CPUC defines plug-in electric vehicles (PEVs) as a distributed energy resource; however, discharging energy stored in the vehicle to the grid (V2G) or to grid-connected homes and buildings (V2B) remains challenging and commercially limited. Barriers include the complex communication interfaces between the vehicle, charger, and electric grid; high costs of equipment; and automobile manufacturer uncertainty about impacts to vehicle battery degradation. There are few if any commercial products that homeowners can purchase to use the electricity stored in their PEV battery as backup power during outages such as public power safety shutoffs.

Project Description:

This project develops a "3-in-1" smart inverter, charging station, and building energy management system. The project focuses on defining and developing control algorithms to implement V2G and V2B with minimal impact to the PEV battery life, which is verified through accelerated battery testing. This project develops and demonstrates the Smart Power Integrated Node (SPIN) prototype -- an off-vehicle V2G power conversion and control device targeted at residential and small commercial customers. The bidirectional direct-current (DC) PEV charger allows customers to island from the electric grid during outages and support critical loads in their homes with energy stored in their PEV batteries. The integrated system simplifies installation and reduces expensive redundant equipment for customers with rooftop solar and a PEV.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is developing technologies that allow PEVs to become a controllable distributed energy resource (DER) by enabling V2G capabilities that provide resilience to residential and commercial customers. The SPIN prototype can also optimize charging to coincide with high renewable generation and low system demand, helping to reduce greenhouse gas emissions and integrate more PEV charging load without upgrading electricity infrastructure. Results inform investor-owned utilities on how V2G and V2B can be a viable resource to meet the Assembly Bill 2514 Storage Mandate and the CAISO energy storage and DER initiative. The project is validating

and informing valuation of several V2G use cases as well as informing automotive manufacturers considering inclusion of bi-directional capabilities in vehicles.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Alternative Fueled Vehicles: R.13-11-007 <Closed> Distribution Level Interconnection (Rule 21): R.11-09-011 <closed> Smart Inverter: D.14-12-035 (in R.11-09-011) Demand Response (DR): R.13-09-011 Streamlining Interconnection of Distributed Energy Resources and Improvements (Rule 21): R.17-07-007 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 1c, 1e, 2a, 3f, 4a, 5b

Lower Costs: The project will mitigate distribution system stress and maintenance costs through a microgrid and zero net energy operational modes using V2G integrated building DER management and control. The increased integration of renewable energy with V2G-enabled PEVs can provide a value of over $350 million per year in avoided capacity and reduced grid congestion.

Greater Reliability: The technologies developed under this project can provide ancillary services by combining V2G enabled vehicles' charge and discharge profiles that are locally and distribution system constrained to alleviate localized hotspots. The V2G services will smooth the grid load profile by charging batteries during periods of renewable over-generation. Homes with the SPIN technology installed can island from the distribution system during outages and provide backup power to critical loads from their PEV.

Environmental Benefits: The V2G-capable PEVs can enable higher penetration of distributed PV by mitigating renewable energy over-generation and decreasing renewable curtailment.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$540,024

EPIC Funds Encumbered:

$1,500,000

EPIC Funds Spent:

$1,350,000

Match Partner and Funding Split:

Flex Power Control, Inc.: $760,000 (19.8 %)

Electric Power Research Institute, Inc.: $1,220,140 (31.8 %)

Oak Ridge National Laboratory: $250,000 (6.5 %)

National Renewable Energy Laboratory (NREL): $110,861 (2.9 %)

Match Funding:

$2,341,001

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

29 out of 31 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-054 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In early 2020, the project team completed development and virtual testing of the optimization algorithms and control pathways to manage electric vehicle bi-directional charging, building loads, energy storage, and solar generation. Testing of the complete Solar Power Integration Node (SPIN) prototype began in November 2020 with modified bi-directional capable vehicles provided by Fiat Chrysler America. The team will verify the core functionality and safety of the SPIN

prototype and collect performance data through the end of 2020. Accelerated aging tests on vehicle battery packs to evaluate the impacts to battery degradation of V2G applications re-commenced at NREL in August 2020. Delays associated with COVID-19 and restrictions on laboratory access resulted in a no-cost time extension. The project team will continue prototype testing and demonstration through early 2021, with further commercialization activities supported by an award from the U.S. Department of Energy.

Project Name: EPC-16-055 - Improving Commercial Viability of Fast Charging by Providing Renewable Integration and Grid Services with Integrated Multiple DC Fast Chargers

Recipient/Contractor: Zeco Systems dba Greenlots

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/30/2017 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S9: Advance Electric Vehicle Infrastructure to Provide Electricity System Benefits.

Issue:

Public direct current (DC) fast chargers for plug-in electric vehicles (PEVs) allow drivers to charge quickly when needed, such as when taking long trips. However, DC fast charging installations can be expensive to operate and can cause stress on distribution infrastructure due to their high-power demands. With growing installations and use of DC fast chargers, unmanaged charging can contribute to peak load growth and increased grid congestion. There is a critical need to develop flexible technologies for managing DC fast charging and optimizing distributed energy resources to improve the commercial viability of DC fast charging and reduce burdens on distribution infrastructure.

Project Description:

The project enables day-ahead and real-time pricing for DC fast charging by developing an integrated hardware and software platform to engage drivers and customers, manage DC fast chargers, and control an on-site second life PEV battery storage device to limit peak demand. The site controller and network-based platform advances smart and efficient charging by managing four multi-port fast charging stations to minimize grid impact and lower operating costs, evaluates the suitability of DC fast charging to participate in demand response programs, and develops and evaluates control strategies to integrate more renewable generation on the California grid. The project produces real and simulated data from the demonstration site in Monterey Park, Ca, that supports DC fast charging service provider planning regarding use of managed charging and distributed energy resources. The technologies developed are being commercialized at other sites in California and nationally.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project advances technologies for aggregation and control of DC fast chargers and on-site stationary storage to reduce grid congestion, integrate more renewable generation, and manage peak demands. This will lower the cost of EV charging--helping to accelerate transportation electrification--and support efficient use of existing distribution infrastructure with savings passed on to ratepayers.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Alternative Fueled Vehicles: R.13-11-007 <Closed>

Applicable Metrics: CPUC Metrics- 1e, 1h, 2a, 4a

Lower Costs: Integrated DC fast charging management with second-life PEV batteries offers lower operating costs and can increase operating revenues by more than $4,000 per year for each DC fast charger.

Greater Reliability: Intelligent software control will enable the availability of flexible capacity to the grid, allowing additional renewable integration and reduced stress on grid during peak hours with demand response capacity.

Environmental Benefits: Using second-life lithium batteries removed from PEVs as energy storage provides another marketable use for these batteries and an alternative to disposal or recycling. Incentivizing charging in the middle of the day with lower prices can help avoid renewable curtailment.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$826,250

EPIC Funds Spent:

$742,861

Match Partner and Funding Split:

Zeco Systems dba Greenlots: $302,008 (26.8 %)

Match Funding:

$302,008

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

29 out of 31 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-055 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Greenlots completed building and testing of its network and control algorithms for managed charging in early 2020. All installation and permitting activities for the project demonstration site were completed in March 2020. The demonstration site consists of four direct current fast chargers and a second life battery installed in Monterey Park, CA. Usage is low due in part to COVID-19 impacts on travel behavior. The team advertised the location, installed credit card readers, and reduced the set point at which the battery discharges in August 2020 to improve data collection. The project team also leveraged data collected at other sites to simulate use cases that include demand charge reduction, demand response participation, and renewable integration. CEC staff reviewed preliminary results in November 2020, and simulation will continue through early 2021. Greenlots leveraged project findings at other sites and participated in multiple CEC workshops in 2020 to share project learnings.

Project Name: EPC-16-056 - Performance Evolution, Specification and Verification of Building Control Sequences

Recipient/Contractor: DOE- Lawrence Berkeley National Laboratory

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/10/2017 to 12/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S11: Provide Federal Cost Share for Applied Research Awards.

Issue:

HVAC building designers lack control strategy tools that can compare energy saving opportunities to reduce consumption. In most cases, commercial buildings fail to perform up to their technical design and equipment specifications. The current process of designing, implementing, and commissioning building automation systems is suboptimal. This results in expensive control systems that often do not deliver the necessary energy efficiency or comfort level. Annually, more than one quad/year is wasted from common deficiencies in building control design and operation in the US, and about 5 percent in California.

Project Description:

Many existing building predate current energy codes and standards . Few commercial buildings have optimized control systems and new construction projects that are designed to implement control strategies frequently struggle with complicated processes that can result in inefficient and often uncomfortable buildings that waste energy. The current software tools available for design controls is tedious and error prone. This agreement's goal is to build software tools to addresses the gap between expected building control's design and its actual performance The tool developed processes for commercial building control sequences to improve the design process, cost-effective implementation, and validation. Utilization of the software has the potential to substantially reduce energy use in both new commercial and existing buildings with controls retrofits. The agreement is co-funded by the California Energy Commission and the United States Department of Energy (DOE). The project web site is https://obc.lbl.gov

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

A major barrier to achieving the state's statutory energy goals is the failure of most commercial buildings to perform close to the technical design potential of its equipment. This can account for significant wasted energy. The team has shown that Innovations in commercial building control sequences can transform existing buildings to achieve energy savings. The team worked with the ASHRAE Standards Committee to use a standardized programming language, pioneered and developed in this project. The ASHRAE Guideline 36, software language will have an impact on improving the California Energy Code, Title 24, which requires specific algorithms, documented in

ASHRAE Guideline 36. This can result in a large impact to industry to enable accountability for controls performance between design and operation.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 3a, 3b, 3f, 4a

Lower Costs: The software platform tools could reduce energy use in commercial buildings. The tool can be used to improved design and implementation of building controls which minimize costs associated with design, construction, operation and maintenance expense. If this technology was widely adopted for 50 percent of the existing medium and large commercial buildings, it could achieve a 12 percent reduction in energy, with a potential cost savings of approximately 0.05 quads/yr in California, saving IOU ratepayers an estimated $300 million/yr.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$473,633

EPIC Funds Encumbered:

$1,000,000

EPIC Funds Spent:

$1,000,000

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

United States Department of Energy: $2,750,000

Kilowatt Engineering, Inc. dba kW Engineering, Inc: $20,000

Stanford University: $75,000

Integral Group, Inc.: $75,000

Controlco: $75,000

CBRE: $70,000

U.S. Department of Energy: $2,000,000

Leveraged Funds:

$3,065,000

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

43 bidders

Rank of Selected Applicant/ Bidder:

N/A

If not the highest scoring applicant/bidder, explain why selected:

The federal cost share solicitation was on-going and funds were awarded to passing proposals on a first-come, first-served basis.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-056 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The Final meeting was in Jan 21,2021. The final report is under Publications review. The team documented the potential for the control sequences to reduce heating, ventilation, and air-conditioning system energy use by 30 percent through the use of advanced controls. The project web site is https://obc.lbl.gov/

Project Name: EPC-16-057 - Development of Smart Charging Infrastructure Planning Tool (SCRIPT)

Recipient/Contractor: Board of Trustees of the Leland Stanford Junior University (SLAC National Accelerator Laboratory)

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/30/2017 to 11/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S9: Advance Electric Vehicle Infrastructure to Provide Electricity System Benefits.

Issue:

Plug-In Electric Vehicle (PEV) growth has the potential of adding stress to the grid. There are also tradeoffs between maximizing the use of PEV charging infrastructure and building more infrastructure to facilitate flexibility and market growth. For example, a congested charging station has limited flexibility for demand management through smart charging, while a more expansive charging infrastructure network allows PEVs to stay plugged in longer than the minimum charging time without affecting other drivers' travel plans and also providing additional flexibility for smart charging.

Project Description:

This project developed a tool that enables predictive smart charging of PEVs and performs cost-benefit analysis for investment in charging infrastructure from the point of view of different stakeholders. The tool will allow stakeholders to generate multiple future PEV adoption scenarios, evaluate the potential of smart charging in changing the overall load profile to reduce grid congestion and maximize solar utilization, understand the effects that investments in different charging segments has in the PEV load, and perform an assessment of the cost and benefits to the region, PEV owners and ratepayers. The goals of the project included: developing a predictive smart charging framework for PEVs that considers future travel plans of drivers and various power system conditions; performing a cost-benefit analysis for investment in charging infrastructure; and integrating the above elements to allow stakeholders to make decisions pertaining to new investments in charging infrastructure.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

There are significant benefits from workplace smart charging that may be shared with the vehicle owners. By exercising the flexibility of the vehicle charging in the workplace, commercial customers can save from energy and demand charge costs. Smart charging can decrease energy charges by up to 1.5 percent of the overall utility bill and decrease demand charges by up to 24.7 percent. Further benefits can be achieved from adding PV as a distributed energy resource at a site, but even without that addition there are significant benefits to both the EV owner and

workplace where the EV is being charged. The project team is conducting a cost-benefit analysis that will inform the final report.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Alternative Fueled Vehicles: R.13-11-007 <Closed>

Applicable Metrics: CPUC Metrics- 1e, 1f, 3a, 3f, 4a, 5b

Lower Costs: The predictive smart charging system allows PEV owners to charge during the periods of the day when energy is lowest cost. SCRIPT also allows for intelligent management of the existing charging and grid infrastructure, which reduces maintenance costs and future equipment costs.

Greater Reliability: SCRIPT's predictive smart charging algorithms will allow PEVs to intelligently charge during periods of renewable energy overgeneration, which reduces the amount of energy flowing back into the distribution grid.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$328,945

EPIC Funds Encumbered:

$1,500,000

EPIC Funds Spent:

$1,500,000

Match Partner and Funding Split:

ChargePoint, Inc.: $32,808 (2.1 %)

UC Santa Barbara: $61,345 (3.8 %)

Match Funding:

$94,153

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

29 out of 31 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-057 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project team completed development of the SCRIPT and achieved the tool's goals of providing predictive smart-charging, flexible load forecasts and interoperability that allows stakeholders the ability to perform analysis on efficient and effective PEV charging infrastructure planning. The project team used multiple scenarios for analysis that targeted a forecasted PEV adoption volume for 2025 and 2030, percentage of charging infrastructure across multiple segments (i.e. residential, workplace, and public), and the distribution projected across the state. The project team completed cost-benefit analysis from a societal, ratepayer, and PEV owner perspective. The flexible PEV load forecast will help utilities anticipate and plan for infrastructure investments to ensure high reliability while minimizing electricity costs. The forecasts will also provide load information at the state and county level identifying locations to install renewable generation with the appropriate capacity.

Project Name: EPC-16-058 - Advanced Transit Bus VGI Project

Recipient/Contractor: Prospect Silicon Valley

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/15/2017 to 6/30/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S16: Expand Smart Charging and Vehicle-to-Grid Power Transfer for Electric Vehicles.

Issue:

California has established ambitious goals for zero emissions vehicles (ZEV) and renewable energy, including a 100 percent conversion of transit fleets to ZEVs by 2040 and 50 percent renewables by 2030. Currently, transit buses are significantly more expensive than conventional buses, while having limited resources for conversion planning and integration with critical commercial operations. In addition, renewable energy goals require more responsive charging controls to address grid variability.

Project Description:

Led by Prospect Silicon Valley, the project leverages VTA's plans to purchase up to 15 all-electric buses towards electrification of its near 500-bus fleet in order to build on the strategies, technologies and partnerships from numerous existing VGI efforts. The Project Team successfully integrated the Energy Management Platform (EMP) with a telematics system installed on the buses, and fleet management software, so that VTA's bus operations team can use it to optimize the charging schedule and minimize the cost of charging, creating savings in charging costs for the agency.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project's goals were to implement a world-class electric transit fleet to significantly advance California's energy goals. The project applied integrated systems to reduce charging costs through demand management using unidirectional charging control. These features were integrated with commercial fleet management tools for the first fully integrated energy management in a heavy-duty fleet.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Alternative Fueled Vehicles: R.13-11-007 <Closed>

Applicable Metrics: CPUC Metrics- 2a, 4a, 4b

Lower Costs: The project lowered costs for VTA, especially for reduced demand charges. According to NREL's analysis report of the pilot in February 2020, smart charging can reduce maximum site power consumption by 31-65 percent compared to immediate charging. Smart

charging can reduce the number of chargers needed without impacts to service. For example, one 60kW charger may be used for 2.5 buses or one 120kW charger may be used for 3.8 buses

Environmental Benefits: The project had several environmental benefits, including reduced CO2 emissions and demonstrating energy resiliency, aligning with the mandate that public transit fleets in California should be zero-emissions by 2040. Additionally, as reported by NREL, adding PV at VTA can increase renewable incentives from California programs (e.g. Low Carbon Fuel Standard) and the flexibility that smart charging provides mitigates much of the need to install batteries.

Public Health: Conversion from diesel buses to electric buses significantly reduces criteria pollutant emissions, particularly NOx, CO, VOCs and particulate matter, especially important for under-served communities. VTA serves an estimated 500,000 residents in under-served communities.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$412,909

EPIC Funds Encumbered:

$1,675,417

EPIC Funds Spent:

$1,388,442

Match Partner and Funding Split:

Santa Clara Valley Transit Authority: $1,034,569 (37.8 %)

Proterra Inc.: $30,000 (1.1 %)

Match Funding:

$1,064,569

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

29 out of 31 bidders

Rank of Selected Applicant/ Bidder:

Group 4: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-058 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project team, in a coordinated effort with many subcontractors, has developed an Energy Management Platform (EMP) and telemetry systems to manage the E-bus charging sessions and fleet operations at VTA. Bus state of charge range, efficiency, odometer readings, and MAC ID settings between the actual busses and the EMP were successfully tested for full integration at VTA. Demonstrations of the EMP in real-world scenarios, using up to 5 E-buses, have been conducted through July-October 2020. The team is now conducting measurement and verification of the value of managed charging and summarizing the findings in the final report.

Project Name: EPC-16-059 - Advanced VGI Control to Maximize Battery Life and Use of Second-Life Batteries to Increase Grid Service and Renewable Power Penetration

Recipient/Contractor: DOE- Lawrence Berkeley National Laboratory

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 10/11/2017 to 12/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S9: Advance Electric Vehicle Infrastructure to Provide Electricity System Benefits.

Issue:

Plug-in electric vehicles (PEVs) can provide energy storage needed to support renewable power generation through vehicle-to-grid (V2G) and vehicle-to-building (V2B) services. However, the risk of accelerated battery degradation is commonly cited as a concern inhibiting the implementation of V2G and V2B technology. Additionally, second-life battery applications can provide value after a battery pack has exhausted its useful life in a vehicle. Real-world demonstrations are needed to complement existing battery degradation models, projections, and recyclability economic models to promote second-life battery future use in V2G and V2B applications.

Project Description:

This project demonstrates an automated control system for a fleet of PEVs and repurposed second-life batteries that reduces the overall cost of ownership by maximizing battery lifetime, shifting load to minimize electricity and demand charges, and providing V2G and V2B services, including those supporting the use of onsite solar generation. The demonstration adds a stationary second-life battery installation to the existing PEV fleet site at the Los Angeles Air Force Base.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is developing and implementing an optimization and control algorithm for a fleet of PEVs and stationary battery packs that includes impacts on battery health expressed as an economic cost, using models and parameters derived from actual battery measurements. These activities will help demonstrate PEV ownership lifecycle cost reductions and will advance scientific knowledge of the impacts of V2G and V2B services on mobile and second-life PEV batteries.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Alternative Fueled Vehicles: R.13-11-007 <Closed> Energy storage: R.15-03-011 <Closed>

Applicable Metrics: CPUC Metrics- 1h, 3f, 4b

Lower Costs: The project reduces the lifecycle cost of PEV ownership for fleets by increasing the useful capacity and lifetime of PEV batteries, including accounting for recycling costs and waste generation from manufacturing new batteries. Utility costs can also be lowered through load shifting and demand management. For 10 percent of commercial and government fleet vehicles in California converting to PEV and the corresponding number of second-life batteries that could be installed at fleet sites, the per battery (both PEV batteries and second-life batteries) savings from peak demand shifting is estimated to be about $400 per year, or $62M per year in aggregate.

Environmental Benefits: PEV batteries removed from transportation service but retained as storage assets at their primary location will result in significant increases in useful service life before recycling. Furthermore, a CEC report forecasting the potential impacts of second-life batteries predicted that 15 percent of the expected annual reduction in greenhouse gases could be achieved using second-life batteries for peak shifting.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$407,071

EPIC Funds Encumbered:

$1,500,000

EPIC Funds Spent:

$1,135,000

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

29 out of 31 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-059 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The August 2019 bankruptcy of Princeton Power Systems (PPS) left the project without any support for the continually problematic PPS charging stations. Without functional charging stations, the project EVs are not useful to the US Air Force project site partner eliminating the source of second-life batteries for the project. The project team has worked with the CEC CAM to amend the project scope to create the control systems as intended, demonstrate the controller in simulation, and address a related EV charging challenge for military bases. This change has been reviewed and approved by the base staff.

Project Name: EPC-16-061 - Intelligent Electric Vehicle Integration (INVENT)

Recipient/Contractor: Nuvve Corporation

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 7/3/2017 to 6/30/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S16: Expand Smart Charging and Vehicle-to-Grid Power Transfer for Electric Vehicles.

Issue:

As the Plug-in Electric Vehicle (PEV) population grows in California, the demand for electricity as a transportation fuel may lead to congestion and overloading on the transmission and distribution grid. Simultaneously, increasing the introduction of renewable energy sources requires adoption of more closely coordinated grid capabilities to effectively regulate grid voltage and frequency on a real-time basis and address morning and afternoon ramping.

Project Description:

This project is deploying vehicle-grid integration (VGI) technology with unidirectional and bidirectional power flow capabilities using light fleet and consumer vehicles. These vehicles will provide local grid support by controlling the charge rate based on locally available energy and power capacity, controlling the voltage, and providing grid-wide support by participating in frequency regulation or adjusting the reactive power. The mix of services provided will be optimized within a campus laboratory setting with the goal of expanding this technology into a real-world setting.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is developing an advanced VGI technology to optimize the blend of unidirectional charging, bidirectional operation, and vehicle-to-building functions, for different real-world grid applications such as frequency regulation, power quality, voltage control, and grid support. The project will show the value of EVs as distributed energy resources, with the ability to defer or eliminate the need for grid upgrades, and enable greater renewable energy penetrations.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Alternative Fueled Vehicles: R.13-11-007 <Closed> Distribution Resources Plans (AB 327): R.14-08-013

Applicable Metrics: CPUC Metrics- 1h, 3f, 4b

Lower Costs: The combination of load adjustment and energy storage is the most cost-effective way to integrate PEV and renewable energy sources at the same time. By sharing the battery in a

PEV when the PEV is not used (parked and connected) the grid will have access to a low cost distributed storage resource, which in turn will make it possible to introduce more non-dispatchable renewable energy such as solar or wind.

Greater Reliability: Since the batteries in the EVs function as distributed storage resources, they can improve grid reliability by stabilizing the grid-wide frequency as well as mitigating local grid overload in transformers or feeders.

Environmental Benefits: Helping to make EVs more affordable by identifying revenue creating strategies will increase the penetration of EVs. This will help to lower local pollution by reducing fossil fuel consumption within local transportation, especially in large cities.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$212,026

EPIC Funds Encumbered:

$3,967,165

EPIC Funds Spent:

$3,256,181

Match Partner and Funding Split:

The Regents of the University of California, San Diego: $335,604 (4.4 %)

Strategen: $13,100 (0.2 %)

FleetCarma: $13,892 (0.2 %)

Nuvve Corporation: $3,335,148 (43.5 %)

Match Funding:

$3,697,744

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

29 out of 31 bidders

Rank of Selected Applicant/ Bidder:

Group 4: Ranked # 5

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-061 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2019, Nuvve successfully demonstrated and operated nine uni-directional and nine bi-directional charging stations on the UCSD campus. These charging stations have demonstrated frequency regulation, demand response, and demand charge management as part of Nuvve's use cases. In June 2020, Nuvve began participation in California's wholesale energy markets through an agreement with SDG&E. Nuvve is now working to expand its market participation capabilities by incorporating more vehicles in its EV charging infrastructure.

Project Name: EPC-16-062 - Advancing Demand Response in the Water Sector

Recipient/Contractor: Regents of the University of California, Davis

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/5/2017 to 3/30/2021

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Water utilities are high electricity users responsible for about 10 percent of the state's electricity demand, but lack the ability to easily participate in demand response events or shift loads to reduce their energy costs. A water utility's energy uses are complex and their understanding of effective ways to meet inflexible demand needs and electric load management for demand response is lacking. Finding feasible, energy cost saving solutions requires assessment of the conditions at the plant, the system configuration, and assessing real time water and energy data.

Project Description:

This project is developing a demand management system to optimize energy use and operations using the Moulton Niguel Water District as a pilot site. Through better system optimization, the water utility will be able to reduce its energy bill by participating in demand response and load shifting incentive programs. The demand management system will optimize load for the potable and recycled water systems at Moulton Niguel and be easily adopted by other water districts and utilities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The demand management system uses real-time energy analytics to: (1) reduce and/or shift peak energy loads, (2) account for different energy tariff structures, and (3) balance the grid's intermittent renewable load generation. This demand management tool enables water utility participation in demand response and load shifting utility programs. The project efforts will market and communicate the technology, informing other water utilities, which could result in increased use and acceptance. Given the impact of energy consumption by the water industry in California, widespread use of the demand management system could help achieve energy demand reduction needed to support the state's energy goals.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Demand Response (DR): R.13-09-011 Water-Energy Nexus: R.13-12-011 <Closed>

Applicable Metrics: CPUC Metrics- 1e, 1g, 1h, 2a, 3h, 4a

Lower Costs: This project could lower costs for the water utility through participation in energy utility demand response programs. It could also result in a reduction in system costs through avoided demand charges and reduced constraints on the electric grid during congested periods. Moulton Niguel is expected to reduce peak demand by 25 percent using the technology solution.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$282,171

EPIC Funds Encumbered:

$2,984,983

EPIC Funds Spent:

$1,490,340

Match Partner and Funding Split:

Moulton Niguel Water District: $90,865 (2.9 %)

Helio Energy Solutions: $14,900 (0.5 %)

Match Funding:

$105,765

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 2: 6 out of 7 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-062 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The team has developed an energy grid model and continues to add features to the demand management system (DMS) to optimize energy demands of water systems. The team continues to refine data and inputs to the energy demand management system software, including gathering tariff and grid operation characteristics information from the utilities and the California Independent System Operator.. A working prototype of the DMS has been developed and is currently being tested at the water utility for final refinements before a full-scale demonstration.

Project Name: EPC-16-063 - Advanced Statistical-Dynamical Downscaling Methods and Products for California Electricity System Climate Planning

Recipient/Contractor: University of California, San Diego

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/30/2017 to 8/30/2021

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.

Issue:

There are two basic ways to produce climate scenarios for California. One of them involves the use of dynamic regional climate models. These "weather forecast models" are very expensive to run. The second option is to use statistical methods that use historical relationships with outputs from global climate models to create high resolution climate scenarios for California. This approach is far less expensive than running an entire weather forecast model, but it is unclear if the historical statistical relationships will be valid under future conditions. The researchers are developing and testing a hybrid downscaling technique that merge the benefits of statistical and dynamic models.

Project Description:

This project develops new and better ways of merging two modeling approaches, using both weather forecast models (more generally called dynamical models) and inferences from past history (statistical models). The combined method is called a hybrid dynamical-statistical approach for inferring fine-resolution climate information from the coarse-resolution global climate models. Ideally, the hybrid approach will be able to capture many of the physical processes simulated by the costly weather forecast models, but with the reduced expense of statistical models. The hybrid approach will be applied to three key areas of California's climate that have important implications for the state's ratepayers: wind, clouds, and hydrology.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project includes an extensive quantification (model validation) effort based on data from observed meteorological stations, satellite records of cloudiness compiled by project members, and USGS streamflow and groundwater observations (for the hydrologic modeling). The method under development could be used for the California's Fifth Climate Change Assessment and future energy planning.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Strategies and Guidance for Climate Change Adaptation: R.18-04-019

Applicable Metrics: CPUC Metrics- 5c

Lower Costs: Knowing how the climate is likely to change provides a sound scientific basis for minimizing economic impacts on the electricity system. For example, better projections of wind fields at heights of interest to wind generation and at appropriate time scales (i.e., sub-daily) will help guide long-term planning for wind generation. Improved, cost-effective planning for integration of renewables to meet California's Renewables Portfolio Standard potentially has significant benefits for California ratepayers.

Greater Reliability: This research will develop a method to produce high-resolution projections of climate parameters that are of great importance for managing the electricity system, in particular for managing peak demand and for shifting to a grid that is dominated by low-carbon, intermittent resources. For example, improved understanding of how low-lying coastal cloud cover is projected to evolve can improve planning for peak demand. Similarly, improved understanding of the availability of intermittent renewable generation fosters better management. This potentially has significant benefits in the form of increased reliability for California ratepayers.

Increase Safety: This research supports predictive modeling, providing information on how the climate is likely to change, which can be used to limit impacts to residents, infrastructure, and the economy. This has significant potential benefits for California ratepayers.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$192,928

EPIC Funds Encumbered:

$1,399,888

EPIC Funds Spent:

$823,384

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

14 out of 14 bidders

Rank of Selected Applicant/ Bidder:

Group 6: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-063 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The research team is running dynamic regional climate models and exploring the use of statistical models for hourly simulations. In the past, climate scenarios for CA only included projections with daily resolution. The research team has made significant progress on key areas such as: development of dataset variables that focus on low clouds, fire weather, and wind generation, with input from other CEC project(s); comprehensive verification of downscaled clouds, wind, and near-surface temperature; integrated hydrologic modeling using machine learning for building statistical models of hydrologic quantities through watersheds; and, merging multiple precipitation products to improve simulated hydrologic fluxes. The project has been extended to August 30, 2021 to complete model simulations to replicate historical conditions such as coastal clouds, wind, and humidity.

Project Name: EPC-16-064 - Investigating Avian Attraction to Solar Energy Facilities Through a Lake Effect

Recipient/Contractor: US Geological Survey

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 3/11/2018 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.

Issue:

PV utility-scale solar facilities in California (and elsewhere) are sources of bird mortality. Currently, it is unknown what behavioral processes and mechanisms lead to bird mortality observed at solar facilities. The leading hypothesis suggests that large fields of photovoltaic panels reflect light in a manner similar to large bodies of water. Moreover, the presence of these water-like surfaces in arid landscapes may add to their attractiveness to passing birds. Left unaddressed, this problem will lead to increased costs to ratepayers as solar energy projects face greater environmental permitting and mitigation challenges associated with developing and operating these facilities.

Project Description:

Researchers are exploring the behavior of attraction by birds to solar facilities, particularly in relation to the "lake effect" hypothesis. Specifically, they are studying 1) the ability of birds to detect potentially attractive visual cues associated with solar facilities (e.g., polarized light, irradiance); 2) the corresponding change in flight behavior characteristic of movement toward solar facilities; and 3) the mortality and natural history of birds that actually occupy solar facilities. First, the recipient is examining the sensory basis of attraction through field and lab experiments. Second, radar and thermal imaging are used to measure the degree to which birds alter their flight paths to settle at solar facilities. Data on behavior and mortality from multiple solar facilities are gathered to inform a statistical model to determine what characteristics of solar facilities and species' natural history together explain variations in mortality exhibited across sites.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is the first systematic study to determine whether birds are attracted to solar energy facilities and if so, to develop an understanding of the sensory basis and proximal response of birds to solar facilities in relation to the "lake effect" attraction phenomenon. Following from that new understanding, the project will identify potentially viable methods for deterring birds from approaching solar facilities and informing future siting decisions in ways that reduce the likelihood of birds fatally interacting with solar facilities.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 2a, 3a, 4f, 4g

Lower Costs: This project will lower costs by streamlining the permitting process of renewable energy projects in California. Renewable energy projects are often delayed because information on the impacts on wildlife required by state and federal law is insufficient or unavailable. Better information on the effects of these projects will reduce permitting delays. The findings of the research may also help to focus pre-construction surveying and post-construction monitoring and mitigation actions to the species at greatest risk from this form of attraction, which would also reduce the soft costs of deployment of solar energy technologies.

Environmental Benefits: By combining mortality and natural history data with new data gathered during the project, solar energy companies, state and federal agencies, and the public will have access to the best information for risk assessment and future siting decisions. The eventual adoption of such techniques reduces the likelihood that solar facilities impact species of concern, particularly state and federal threatened and endangered species. Suggestions for deterrent and mitigation strategies may lead to the application of technologies that reduce bird mortality.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$200,240

EPIC Funds Encumbered:

$499,785

EPIC Funds Spent:

$375,042

Match Partner and Funding Split:

United States Geological Survey: $348,152 (28.1 %)

Bard College: $75,390 (6.1 %)

Humboldt State University Sponsored Programs Foundation: $12,244 (1.0 %)

8minuteenergy Renewables, LLC: $50,000 (4.0 %)

First Solar: $50,000 (4.0 %)

NextEra Energy: $50,000 (4.0 %)

NRG Energy, Inc.: $50,000 (4.0 %)

Recurrent Energy: $100,000 (8.1 %)

Western EcoSystems Technology, Inc.: $4,465 (0.4 %)

Match Funding:

$740,251

Leverage Contributors:

United States Geological Survey: $22,000

Undisclosed Source: $28,000

Leveraged Funds:

$50,000

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

14 out of 14 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-064 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The first and second field seasons (fall 2018 and 2019) of data collection were successfully completed for both radars, as well as a bird carcass search and bird use surveys at several additional solar photovoltaic facilities across southern and central California. These data are in the process of being analyzed. The experimental tasks to study bird attraction to polarized surfaces are underway. The study is revealing important information about differences in polarization between polycrystalline vs. thin-film solar panels, times of day, and direction of flight relative to the sun that can be related to the radar and mortality survey field results. The COVID-19 pandemic prevented on-schedule completion of experimental work on bird attraction. The team has requested a no-cost time extension to be able to complete this task.

Project Name: EPC-16-065 - California E-Bus to Grid Integration Project

Recipient/Contractor: Zero Net Energy (ZNE) Alliance, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/30/2017 to 12/31/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S16: Expand Smart Charging and Vehicle-to-Grid Power Transfer for Electric Vehicles.

Issue:

Electrification of transit represents a tremendous opportunity to achieve cornerstone climate goals such as Assembly Bill (AB) 32, State Bill (SB) 350, and Executive Orders B-30-15 and B-16-2012. Cost and reliability are the largest barriers to scaled adoption of electric buses (E-bus). For transit fleets there is the added challenge of integrating E-buses into their bus schedules and ensuring that drivers are properly trained on how to operate them.

Project Description:

This project focused on improving the economics of incorporating e-buses in a transit agency fleet. The project team worked with the Antelope Valley Transit Authority (AVTA) to evaluate multiple scenarios, including smart charging, improving vehicular energy efficiency through best driving practices, and using the vehicle batteries for grid services when the E-buses are not being used for their routes. More effective smart charging reduces the frequency and duration of in-route charging, and the fuel economy improvements that come from smart driving result in operational cost savings. By reducing the likelihood that several/all E-buses will be charging at once, smart charging can achieve greater flexibility and decrease demand charges.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Exposure to on-road diesel emissions is a factor in the symptoms of lung disease and asthma. E-Buses have the technical and economic potential to rapidly displace diesel transit buses. AVTA's E-buses have been deployed with onboard telematics to understand the vehicle's operating health and parameters. High-power wireless inductive charging has been shown to be a viable solution for in-route charging. Together, these technologies help overcome range limitations and uncertainty. However, while these technologies alone provide great value and overcome key adoption barriers, integrating them with analytics and distributed energy resource (DER) management platforms can unlock even greater value.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Alternative Fueled Vehicles: R.13-11-007 <Closed> Greenhouse Gas Emission Allowance Cost and Revenue Issues: R.11-03-012

Applicable Metrics: CPUC Metrics- 2a, 3f, 4a

Lower Costs: By training operators on best practices and giving them customized feedback on how to continuously improve their driving habits, energy consumption per mile has improved substantially. Maintenance cost savings of an E-Bus compared to diesel can be $0.20-$0.30 per mile. Given the operators will receive best practices training, AVTA will recognize compounding benefits in the form of exceptional maintenance cost savings.

Greater Reliability: Data-driven models have shown that managed charging will be able to minimize operating costs for a fleet operator while also accommodating the need for grid reliability. For example, if vehicles are connected to chargers that are served by a transformer that is overloaded, location-specific signals from a utility can be used to temporarily reduce the load on transformers to avoid failure

Public Health: The electrification of transit fleets would have enormous impacts on public health, as diesel use is one of the biggest sources of particulate matter contributing to respiratory symptoms.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$658,112

EPIC Funds Encumbered:

$2,633,670

EPIC Funds Spent:

$2,150,996

Match Partner and Funding Split:

Antelope Valley Transit Authority: $2,900,097 (52.4 %)

Match Funding:

$2,900,097

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

29 out of 31 bidders

Rank of Selected Applicant/ Bidder:

Group 4: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-065 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The team developed an E-Fleet Energy Model that accounts for the effects of weather, geography, drivers' skill and other factors on the kWh/mi. efficiency of the E-Buses. Fleet operators are seeing the benefits of driver training in reducing the fleet's overall energy usage. The team also determined the greatest energy cost savings can be achieved through managed charging to reduce peak loads and charge during lower time-of-use rates. The project team worked with transit industry leaders in knowledge transfer activities to disseminate transit fleet electrification best practices.

Project Name: EPC-16-067, Project 1 - Robust Super Insulation at a Competitive Price

Recipient/Contractor: Lawrence Berkeley National Laboratory

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 7/14/2017 to 12/2/2020

Program Area and Strategic Objective:

Applied Research and Development

S11: Provide Federal Cost Share for Applied Research Awards.

Issue:

Currently, conventional building insulation is economical but has low R-values. There are emerging technologies with high R-values but are expensive. There is a need to develop a robust insulation with a high R-value to significantly reduce cooling and heating loads that can be sold at a competitive price.

Project Description:

Heating and cooling represents the greatest energy consumption in buildings. This project is developing thermal building insulation material with high R-value at low cost. The product is expected to provide a significant increase in energy savings for existing buildings.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Currently, there is no thermal building insulation material that can cost-effectively be assembled with high R-values. This Department of Energy cost share agreement is developing a manufacturing process to achieve a high R-value and decrease the installed thickness of the insulation, at a competitive price. This will make retrofits easier because much less space will be needed to accommodate existing building wall assemblies.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1h

Lower Costs: The insulation material lays the groundwork for scaling a material that could achieve 2 to 4 times increase in R-value at a price competitive with current insulation materials. This higher R-value will reduce heating and cooling costs to building owners and tenants.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$42,679

EPIC Funds Encumbered:

$100,000

EPIC Funds Spent:

$100,000

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

U.S. Department of Energy: $1,500,000

Lawrence Berkeley National Laboratory: $100,000

Leveraged Funds:

$1,600,000

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

43 bidders

Rank of Selected Applicant/ Bidder:

N/A

If not the highest scoring applicant/bidder, explain why selected:

The federal cost share solicitation was on-going and funds were awarded to passing proposals on a first-come, first-served basis.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-067 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

Technology Patent

Description of New Intellectual Property Developed Under this Project:

LBNL filed two provisional patent applications. One in 2019 and one in 2020. The 2020 application is the only active case.

Update:

This federal cost share grant has completed and the Final report was submitted to LBNL for edits in Feb 2021.This research set the ground work to develop a high R value material for building envelope insulation. The team achieved an R/inch of 9 for the one-inch insulation sample. In order to scale up, further R&D is needed to create a larger sample size. LBNL filed a provisional patent application #62/001,818 was filed in 2020. At the end of March, LBNL expects to decide whether they will convert the provisional applications to have a publicly available patent application.

Project Name: EPC-16-068 - Integrated Community-Level Solutions for Resource Management for a Grid and Customer Benefits

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 8/18/2017 to 3/31/2022

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

California seeks to make energy innovations serve all of society so that everyone can derive the economic and quality of life benefits from a clean energy future. Many technical research gaps need to be addressed to help realize this goal, including the following: (1) assessing new, high-efficiency solar technologies that can address space constraints in commercial and multifamily buildings, (2) testing how integration of solar, energy storage, and connected end-use load control can help manage customer needs with electrical grid benefits and (3) evaluating approaches to enable community solar and storage as a tool to enable grid reliability.

Project Description:

This project demonstrates the feasibility of using an integrated community-scale solar plus storage system, sited at a low-income multi-family disadvantaged community in Willowbrook, CA. The technology solution balances a combination of grid-connected distributed energy resources (DERs), including advanced solar PV, energy storage, smart inverter, and load management. The project team is working with Southern California Edison to study the distribution grid impacts that the DERs can mitigate, realizing cost savings and enabling increased PV penetration. It is also investigating innovative business strategies to maximize the value of DERs to both end-users and the utility. Another objective of the project is to demonstrate a cost-effective solution to achieving Zero Net Energy (ZNE) within an affordable housing community to realize California's 2020 goal for new sustainable and scalable ZNE communities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project includes high efficiency bifacial 355 W solar modules manufactured by Canadian Solar that can substantially assist commercial and multifamily buildings with roof area constraints, as well as the integration of solar and storage with smart inverters that include segmentation of storage for meeting multiple needs. The project also demonstrates a platform that can manage both loads and storage while integrating DC mini grids to eliminate conversion losses for solar PV.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Self-Generation Incentive Program: R.12-11-005 <Closed> Demand Response (DR): R.13-09-011 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1a, 1b, 1c, 1e, 1f, 1h, 1i, 2a, 3f, 4a, 4b

Lower Costs: The project will demonstrate energy savings of 231,240 kWh to the grid on an annual basis from the solar generation. With the inclusion of an additional 10 percent savings through reduction in conversion losses and another 10 percent through energy efficiency measures, the project will save 289,050 kWh annually. If this project were replicated to cover 15 percent of California residential energy use (20 percent of ratepayers are low income, and 75 percent of low income is multifamily), Californian's total energy bills would be reduced by $185 million per year.

Environmental Benefits: The project shows a potential, if replicated to cover 15 percent of California residential energy use, for energy use reduction of 1089 GWh per year, which translates to statewide CO2 reduction of 397,631 tons per year.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$864,761

EPIC Funds Encumbered:

$2,976,991

EPIC Funds Spent:

$1,205,790

Match Partner and Funding Split:

OhmConnect, Inc.: $108,000 (2.7 %)

Electric Power Research Institute, Inc.: $406,241 (10.2 %)

LINC Housing Corporation: $405,455 (10.2 %)

Gridscape Solutions, Inc.: $71,796 (1.8 %)

Staten Solar Corporation: $11,408 (0.3 %)

Match Funding:

$1,002,900

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

31 out of 35 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-068 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The Energy Commission issued a Stop Work Order (SWO) on December 11, 2019, since EPRI's subcontractor and site host LINC Housing failed to execute a subcontract agreement with lender Los Angeles County Development Authority (LACDA), which needed to authorize LINC Housing to proceed with the start of construction. This impacted several aspects of the project, including the schedule for the start of construction; commissioning the system; and gathering, analyzing, and evaluating the data. EPRI addressed all requirements and was released from the SWO in August 2020. The construction-related activities, interconnection by SCE, and permit to operate were completed in Q4 2020, with data collection anticipated to start in Q1 2021.

Project Name: EPC-16-070 - Integrating Front-of-the-Meter Energy Storage with Smart PV Inverters and Solar Forecasting

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 8/3/2017 to 3/31/2023

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S15: Demonstrate Advanced Energy Storage Interconnection Systems to Lower Costs, Facilitate Market and Improve Grid Reliability.

Issue:

Although it is recognized that in front-of-the-meter and community-scale storage projects can benefit the grid and may be able to provide higher value to customers, it is not yet clear what those values are, how they can be maximized, or how to minimize the impacts of high penetration of renewables (e.g., in a community).

Project Description:

The purpose of this agreement is to design and install in front-of-meter energy storage with smart PV inverters and solar forecasting. The research will demonstrate a cost-effective and scalable solution that integrates distributed energy resources to address grid needs and identify cost reductions and revenue-generating opportunities for developers and commercial customers. The project will also identify barriers to integration of front-of-the meter resources and strategies to overcome these barriers.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will demonstrate an interoperable solution that integrates in front-of-the-meter energy storage with smart PV inverters and satellite-based solar forecasting to address grid limitations. The results will provide strategies for aggregating larger amounts of distributed energy resources on the grid with front-of-the-meter energy storage to support the state's goal for achieving zero carbon electricity by 2045.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed> SB 1122 Bioenergy feed-in tariff: R.18-07-003, R.11-05-005 <Closed> Integration of Distributed Energy Resources (IDER): R. 14-10-003 Greenhouse Gas Emission Allowance Cost and Revenue Issues: R.11-03-012

Applicable Metrics: CPUC Metrics- 1a, 1e, 3a, 4a

Lower Costs: This project will demonstrate the wholesale market participation for in front-of-the-meter storage. The demonstration will evaluate revenue streams that can defer the cost of the system and provide additional energy savings in a facility by reducing daily load.

Greater Reliability: This project will explore several value stream opportunities for front-of-the-meter storage, including critical power services during grid outages. The intent of this type of solutions deployed at scale is to provide benefits to the customer and distribution system. In particular, for the local system, benefits can include mitigating adverse PV impacts such as voltage violations; at the bulk level, potential benefits can include leveling out the "duck curve" and limiting dependency on operating reserves.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$644,129

EPIC Funds Encumbered:

$1,832,770

EPIC Funds Spent:

$537,245

Match Partner and Funding Split:

Electric Power Research Institute, Inc.: $229,753 (9.5 %)

Sonoma Valley Unified School District: $361,685 (14.9 %)

Match Funding:

$591,438

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

31 out of 35 bidders

Rank of Selected Applicant/ Bidder:

Group 6: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-070 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, the project focused on the interconnection process, which took more time than initially envisioned. Also, PG&E required that an existing transformer be transferred to the customer, and PG&E filed an ownership transfer approval request with the CPUC under Section 851 and General Order 173 in October, which was approved by CPUC on December 10. Separately, the storage system initially proposed for this project was no longer available due to the vendor closing its energy storage division in June and no California based vendors sell the same size battery within budget. The team identified a system at a different power rating that met the project scope. PG&E required the recipient to submit a revised interconnection application for the new energy storage system. The new application was submitted in September and the Small Generator Interconnection Agreement (SGIA) between PG&E and Sonoma Valley Unified School District was fully executed on December 14.

Project Name: EPC-16-073 - Valencia Gardens Energy Storage

Recipient/Contractor: Natural Capitalism Solutions, dba Clean Coalition

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 9/1/2017 to 6/30/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S15: Demonstrate Advanced Energy Storage Interconnection Systems to Lower Costs, Facilitate Market and Improve Grid Reliability.

Issue:

Traditionally, renewable energy located on the distribution grid has been deployed one rooftop at a time, and when a circuit becomes congested there may not be an opportunity to add more. Energy storage in front of the meter provides potential to reduce the congestion and increase solar deployment, but demonstrations are needed to determine the value of front-of-the-meter (FTM) energy storage systems.

Project Description:

The project will deploy 750kWh of energy storage at a public housing complex in San Francisco's Mission District with existing PV of 580kW on a circuit with a peak load of 570kW. Valencia Gardens has 218 family flats and 42 senior apartments among 16 buildings on a five-acre site. This Energy Storage System (ESS) will provide multiple integrated services: increasing the PV hosting capacity of the circuit, optimizing and balancing circuit load and generation, providing ancillary services to the California Independent System Operator (CAISO), and providing local grid resilience.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will lead to technological advancement and breakthroughs to overcome barriers to the achievement of California's statutory energy goals by utilizing energy storage as a local balancing and optimization solution on a circuit on the distribution grid. The project will demonstrate a combination of advancements and breakthroughs including, but not limited to, an advanced local energy system that utilizes energy storage on a circuit to optimize local circuit balancing, increases PV hosting capacity and provides the California Independent System Operator with ancillary services.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed> Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1e, 1h, 4a, 5b

Lower Costs: The project team estimates that this system will result in $240,000 in peak capacity savings per year and $425,000 in transmission and distribution line loss savings per year.

Greater Reliability: This project will enable higher penetrations of distributed renewable energy, improve circuit reliability, and optimize local balancing of electricity supply and demand. It will utilize indefinite, renewables-based backup power to critical loads in a disadvantaged community during grid outages to achieve greater community resilience.

Environmental Benefits: By enabling greater local penetration of PV, this project will contribute to a decrease in the reliance on fossil fuels for electricity generation, and thereby reduce greenhouse gas emissions and other hazardous emissions from power plants. The project team estimates that the10 MW of PV in the project area will yield 15,785 MWh of emissions-free generation per year, which is equivalent to offsetting the emissions of 2,052 average homes in PG&E territory.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$251,310

EPIC Funds Encumbered:

$1,994,687

EPIC Funds Spent:

$953,117

Match Partner and Funding Split:

PATHION, INC: $620,470 (23.7 %)

Match Funding:

$620,470

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

31 out of 35 bidders

Rank of Selected Applicant/ Bidder:

Group 6: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-073 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The recipient worked through interconnection planning with PG&E and also received permit approval from the San Francisco Planning Commission on October 15, 2020 for the battery energy storage system. The project will now move forward to the construction phase, which is being coordinated with PG&E for interconnection to the grid. The system is expected to be operational in the second quarter of 2021.

Project Name: EPC-16-077 - Solar+ Storage Integrated Energy Management Demonstration in a Supportive Housing Facility

Recipient/Contractor: The Regents of the University of California, on behalf of the Riverside Campus

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 1/31/2018 to 3/31/2022

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Battery Energy Storage System (BESS) integrated energy management activities have the risk of potentially increasing peak demand and peak utility loads. Behind-the-meter photovoltaic (PV) generation is also uncontrolled by the utility. Unmanaged energy production and storage creates additional challenges for utility energy management and distribution. Pairing PV and BESS with controls and managed loads has great potential, but community-scale PV and BESS solutions at multi-family residences have struggled to be adopted in California, as there have been limited demonstrations that such systems can provide benefits to the building owner, tenants, and the grid simultaneously.

Project Description:

The project deploys a 100 kW high-performing solar PV system, a 150 kW/150 kWh li-ion battery energy storage system, a smart inverter, and an advanced energy management platform to demonstrate different use cases and showcase the advanced functions of smart inverters. These components will be integrated to optimize flexibility in demand side energy management through load shifting, solar PV self-consumption, emergency back-up, demand response, and ancillary grid services. The proposed system will be able to autonomously meet demand response and energy management requests while critical loads at the building are maintained, minimizing operational impacts. It will also realize energy and demand charge cost savings to the building owner and tenants.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project integrates BESS and PV technology with advanced control algorithms and smart inverter autonomous functions. The solar+ system uses high efficiency solar panels that are DC coupled with Li-ion BESS and demonstrates various smart inverter functions to provide autonomous grid services and energy management practices under a variety of operational conditions. The team is assessing the impact smart inverter-provided grid services and solar + storage operation have on each other. The project provides BESS and PV technology integrated

with an energy management system to support diurnal energy loads. This project implements utility-initiated demand response functions and creates an architecture that allows expansion to future power regulation and potential wholesale market participation.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Distribution Resources Plans (AB 327): R.14-08-013 Smart Inverter: D.14-12-035 (in R.11-09-011) Demand Response (DR): R.13-09-011 Net energy metering: R.14-07-002 Streamlining Interconnection of Distributed Energy Resources and Improvements (Rule 21): R.17-07-007

Applicable Metrics: CPUC Metrics- 1c, 1d, 1e, 1g, 1h, 2a, 3d, 3f, 3h, 5a

Lower Costs: This project uses PV generation integrated with BESS to manage energy use through load shifting and solar PV self-consumption. The integration of proposed energy management system components will reduce peak energy demand by shifting building and community loads. The reduction of peak energy use will reduce the costs to procure additional energy during periods of peak demand and lower consumer's energy bills. For example, the project site, a low-income/affordable housing facility, is estimated to receive an energy cost savings of $262,800 and a peak demand charge reduction of $190,507 over a ten-year period. These savings will transfer to tenants as an electricity bill reduction.

Greater Reliability: This project uses PV generation integrated with BESS to manage energy use through load shifting, emergency back-up, demand response, and ancillary grid services. The integration of proposed energy management system components will reduce peak energy demand by using a BESS to shift building and community loads. The project is scalable in both size and quantity. Therefore, this effort will demonstrate the commercial feasibility to deploy many MWh of dispatchable energy integrated in a PV/BESS configuration with smart inverters.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$332,995

EPIC Funds Encumbered:

$2,110,657

EPIC Funds Spent:

$681,966

Match Partner and Funding Split:

LINC Housing Corporation: $80,000 (3.2 %)

Regents of the University of California, Riverside Campus: $265,259 (10.5 %)

EnSync Energy Systems: $46,750 (1.9 %)

EnerBlü: $19,500 (0.8 %)

Match Funding:

$411,509

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

31 out of 35 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-077 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Construction on the mixed-use supportive housing building was completed in 2020, and it is scheduled for occupancy by early 2021. UC Riverside spent most of 2020 permitting and applying for interconnection of the solar + storage system. The battery and solar equipment were installed onsite as of December 2020. To date, the research team has submitted their Energy Management System Test Plan, System Operation Test Plan, Control Algorithms Report, Smart Inverter Performance Assessment Test Plan, and System Impact Assessment Plan.

Project Name: EPC-16-079 - Impact Assessment & Secure Implementation of California Rule 21 Phase 3 Smart Inverter Functions to Support High PV Penetration

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/30/2017 to 9/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S6: Advance the Use of Smart Inverters as a Tool to Manage Areas with High Penetrations of PV.

Issue:

California Rule 21 was revised to include autonomous device control, data communication, and dynamic electrical control functions for smart inverters. A number of additional functions with the potential to substantially increase the grid's solar hosting capacity are deferred to the third phase, the timeline for which is uncertain. Phase III includes advanced functions that affect the real power produced by solar PV systems. There are both technical and economic questions that must be answered before these capabilities are to come into use.

Project Description:

This project will comprehensively evaluate the smart inverter Phase III functions. The process includes computer modeling of California distribution circuits for economic analysis, implementation of Phase III functions in multiple inverter brands, laboratory testing, and field pilot testing. An economic analysis will build on the technical findings from the computer modeling, identifying the impact to the asset owner, performing an economic valuation of these impacts, and providing guidance regarding potential compensation. A comprehensive cyber security assessment of the communication system will be performed and key public infrastructure will be established to support the cyber security needs in California.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will help overcome three major barriers to achieving the state's energy goals by: 1) proving that CA Rule 21 Phase III functions can be deployed feasibly, safely and predictably via standardization; 2) demonstrating that grid penetration levels can be increased by 25 percent or more via use of the Phase III advanced control functions; and 3) enabling secure, scalable and affordable cyber security infrastructure that can make the grid safer and more reliable.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed> Distribution Level Interconnection (Rule 21): R.11-09-011 <closed> Smart Inverter: D.14-12-035 (in R.11-09-011)

Applicable Metrics: CPUC Metrics- 1a, 1b, 5a, 5b, 5f, 5g

Greater Reliability: This project delivers standardized DER control functions that minimize and mitigate reverse power flows, voltage sags/dips, and other conditions that degrade grid stability and DER performance, thus increasing grid reliability and increasing the availability of access to solar energy.

Increase Safety: The standardized methodology for demonstrating compliance to Rule 21 Phase III requirements eliminates the variability implied by proprietary solutions and enables dynamic electrical control functions to be deployed safely at scale. The availability of cyber security best practices and a public key infrastructure ensures that common security pitfalls are avoided as compliant systems are deployed in the field.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$601,394

EPIC Funds Encumbered:

$2,935,822

EPIC Funds Spent:

$2,642,240

Match Partner and Funding Split:

SunSpec Alliance: $177,502 (3.9 %)

Sunrun: $1,102,122 (24.0 %)

Electric Power Research Institute, Inc.: $379,453 (8.3 %)

Match Funding:

$1,659,077

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

31 out of 35 bidders

Rank of Selected Applicant/ Bidder:

Group 4: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-16-079 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, the project team continued the evaluation of two commercial smart inverters for Phase III compliance. The lab test at the University of California, San Diego (UCSD) was also leveraged to conduct cyber security testing (penetration testing). The test results were aimed at providing guidelines to California's DER stakeholders about safe and secure deployment of smart inverter communications. A proof of concept for cyber secure communications was established, 50 residential customers were recruited for the field demonstration of Rule 21 Phase III functions, and communication and control systems to update Phase III functions was successfully established. In March 2020 all testing was completed. The project concluded successfully in September 2020 and the final report was published in December 2020.

Project Name: EPC-17-001 - Best-in-Class: Demonstrating Scalable Operational Efficiency through Optimized Controls Sequences and Plug-and-Play Solutions

Recipient/Contractor: Taylor Engineering, LLC

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 7/31/2017 to 12/31/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

Typically, energy upgrade efforts focus on equipment replacement, which often have high costs. Updating the controls for existing systems to operate more efficiently presents a prime opportunity to achieve cost-effective savings. However, the current upgrade model presents a barrier for building owners and operators to effectively scale installation of advanced controls due to high transaction costs and the need for custom analysis and programming. This project aims to demonstrate large-scale HVAC and lighting control upgrades across a portfolio of building types that achieve energy savings while reducing transaction costs.

Project Description:

This demonstration optimizes and simplifies control upgrades (HVAC and lighting) that achieve energy savings while also improving occupant comfort by using automated fault detection and diagnostics, continuous commissioning, and advanced measurement and verification procedures. The team will use the results to develop recommendations for strategies, tools, and initiatives to address market barriers and promote large scale market adoption.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project facilitates increased market adoption of control system retrofits that result in significant energy savings in commercial buildings. The successful demonstration of scalable, plug-and-play integrated packages of HVAC and lighting controls will allow commercial building owners and operators to maximize energy savings across large portfolios of buildings while reducing transaction costs.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h

Lower Costs: Deploying a simplified approach to achieving sustained operational savings of HVAC and lighting can reduce costs for building owners and operators and has the potential to increase market adoption. In addition, integrating measures into single installations can yield building electricity savings of up to 25 percent while reduce overall project costs and payback periods.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$934,507

EPIC Funds Encumbered:

$2,966,716

EPIC Funds Spent:

$2,289,644

Match Partner and Funding Split:

Kaiser Permanente Medical Center: $2,300,000 (40.1 %)

Enlighted Inc.: $246,750 (4.3 %)

KGS Buildings: $25,000 (0.4 %)

Delos: $57,000 (1.0 %)

Alerton: $15,000 (0.3 %)

Trane U.S., Inc.: $15,000 (0.3 %)

Automated Logic Corporation: $30,000 (0.5 %)

Siemens Corporation, Corporate Technology: $10,000 (0.2 %)

United States Department of Energy: $75,000 (1.3 %)

Match Funding:

$2,773,750

Leverage Contributors:

CalRecycle: $4,000,000

California Alternative Energy and Advanced Transportation Financing Authority: $600,000

Leveraged Funds:

$4,600,000

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 2: 13 out of 15 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-001 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Progress this year includes finalizing installations of optimized controls at all demonstration sites, commissioning installed systems, and collecting data. Preliminary results indicate whole building electricity savings of 10-25 percent.

Project Name: EPC-17-002 - Scaling Solar+ for Small and Medium Commercial Buildings

Recipient/Contractor: Humboldt State University Sponsored Programs Foundation

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 9/17/2017 to 9/30/2021

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Although a range of distributed energy resources (DERs) are being designed to power and support the fast-changing electric grid, these DERs are often procured and operated separately. Without coordination between them, there are missed opportunities to reduce the soft costs of deployment and better support bulk power and distribution system operations. Integration technology elements appropriate for small-to-medium sized commercial buildings (SMB) are not commercially available, making it too costly to effectively deploy smart, integrated DERs.

Project Description:

This project is developing standardized components for a Solar+ system designed specifically for the SMB sector. The research team is designing, implementing, operating, and evaluating a Solar+ system in a pilot scale application at a convenience store. The project is designed to innovate across three key priority areas necessary for technology scale-up: hardware design guidelines, integration software, and site targeting. Filling these knowledge gaps will help move the deployment of Solar+ technologies forward, thereby bringing substantial benefit to individual building owners, as well as opening opportunities to provide service to the broader distribution and bulk power systems. This project focuses on the convenience store/fueling station SMB sector, but lessons learned and products developed can be transferred to other SMB sectors.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is integrating DERs, including energy storage, and controllable loads to increase the value of Solar+ systems in the SMB sector. Optimized relative sizing of batteries to PV and flexible operations from model-predictive control (MPC)-enabled building automation are demonstrating how investment in an integrated system can save costs and create efficiency compared to standalone PV and storage. The project is developing and demonstrating an open-source MPC algorithm. Improved hardware-software interfaces integrate the solar PV system with localized energy storage and MPC-improved load control systems. This allows SMB owners to optimize the benefits of distributed solar and approach net-zero energy buildings while also supporting the larger grid power system.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Self-Generation Incentive Program: R.12-11-005 <Closed> Energy storage: R.15-03-011 <Closed> Distribution Resources Plans (AB 327): R.14-08-013 Smart Inverter: D.14-12-035 (in R.11-09-011) Demand Response (DR): R.13-09-011 Streamlining Interconnection of Distributed Energy Resources and Improvements (Rule 21): R.17-07-007

Applicable Metrics: CPUC Metrics- 1c, 1e, 1f, 1h, 1i, 2a, 3d, 3h, 5a, 5f

Lower Costs: This project will reduce onsite energy demands and peak loads, resulting in customer bill savings. For example, the estimated site benefits include energy and demand charge savings of $0.20 per watt of PV per year, along with payments for demand response for the distribution system and build power system of $0.20 per watt of PV per year. Without a coordinated effort to install solar + storage as a package, the commercial cost of such systems would be about $9 per watt of PV. This project will develop hardware design guidelines, integration software, and a site targeting toolkit to reduce the costs of installing solar PV, battery energy storage, and smart inverter equipment by about 33 percent.

Greater Reliability: This project will expand the ability to provide power for critical services (e.g., fuel dispensing and refrigeration loads) in times of emergency when the utility grid is disabled (e.g., due to weather-related disaster). These project benefits will accrue both to the site host and to the local distribution grid. However, the greatest benefits from the project will likely come from amplification effects through the improved ability to promote smart deployment of Solar+ systems at scale throughout California.

Environmental Benefits: Preliminary calculations indicate significant DER capacity could be deployed through the framework and systems this project is developing. On first order, if each of the 12,000 convenience stores in California were to install or procure the equivalent of 50 kW in PV capacity, this would result in 600 MW of additional statewide capacity that generates 880 GWh annually. If there were no commensurate reduction in the RPS compliance requirements (because the generation would be behind the meter) this would represent accelerated progress on greenhouse gas emissions reductions, saving 300,000 tonnes CO2e per year.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$413,443

EPIC Funds Encumbered:

$1,500,000

EPIC Funds Spent:

$1,229,894

Match Partner and Funding Split:

Humboldt State University Sponsored Programs Foundation: $41,577 (2.2 %)

Serraga Energy, LLC at Blue Lake Rancheria: $288,382 (15.5 %)

Tesla Motors, Inc.: $25,000 (1.3 %)

Match Funding:

$354,959

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

31 out of 35 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-002 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The convenience store microgrid at Blue Lake Rancheria successfully demonstrated its load-shedding and islanding capabilities while responding to California's grid needs in the September 2020 fire season. Schatz Energy Research Center at Humboldt State University conducted capability and performance testing of the solar plus storage system from August to September 2020, and as of December 2020, the research team's final report is under review for publication. The final meeting for this agreement is scheduled for January 2021.

Project Name: EPC-17-003 - Developing a Comprehensive, System-Wide Forecasting to Support High-Penetration Solar

Recipient/Contractor: Clean Power Research, L.L.C.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 9/1/2017 to 6/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S4: Improve Power Plant Performance, Reduce Cost, and Accelerate Market Acceptance of Existing and Emerging Utility-Scale Renewable Energy Generation Systems.

Issue:

California experiences a wide range of meteorological phenomena, including coastal and valley fog, monsoon events, and temperature inversion and smog events. These phenomena impact the reliability of both satellite-based and Numerical Weather Prediction (NWP) forecast models due to the challenge of predicting cloud formation and dissipation during these conditions. This weather-based uncertainty translates into PV simulation uncertainty in which electric grid operators increasingly rely upon forecast of PV production in their dispatch of operating resources. Forecast inaccuracies cost California millions of dollars annually and result in the unnecessary curtailment of renewable generation.

Project Description:

This project developed, tested, and validated a high-accuracy forecast for photovoltaic (PV) generation across California and coordinated with the California Independent System Operator (CAISO) on incorporating the results into its PV forecasting operation. The comprehensive forecast included both behind-the-meter (BTM) and in-front-of-the meter scale PV systems. The project quantified the costs and benefits of these improvements. The researchers used mid-term distributed energy resource (DER) adoption forecasts adapted from the investor-owned utility distribution resource plans to project the distribution of DERs through 2050. The team also provided CAISO with the steps required to incorporate the statistically-adjusted BTM solar PV generation estimates into CAISO's Reconstituted Load forecasting approach.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project advanced the state of PV forecasting in California by improving the accuracy of solar irradiance and PV forecasts, particularly rooftop solar, which was not previously well-understood. Participants in the Energy Commission's January 2017 forecasting workshop identified the lack of visibility into DER impacts on net load as a major barrier to generating accurate forecasts. Forecast inaccuracies cost California millions of dollars annually and result in the unnecessary curtailment of renewable generation.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 1c, 2a, 3a, 5c

Lower Costs: This project implemented and improved PV production forecasts that will enable CAISO to reduce net load forecast uncertainty, resulting in cost savings to California. The forecast improvements will reduce the cost of procuring both spinning and non-spinning reserve resources. Clean power Research (CPR) developed methods that estimated the savings from improved CAISO forecasts. The "Resource Adequacy" method estimated the capital cost of gas generation reserve capacity necessary to mitigate 90 percent of the forecast uncertainty. Using this method, CPR estimated that the forecasting methods developed in this project will save California $176 million over the next 30 years.

Greater Reliability: This project provided CAISO with an improved PV production forecast to increase electric power system reliability across California. The uncertainty of PV generation imparts costs to the California ratepayer, because the CAISO must carry spinning and non-spinning reserve resources to accommodate this uncertainty. It was demonstrated that increasing the forecast accuracy narrows the error distribution and therefore decreases the reserve requirement and costs. The project provided knowledge to grid operator and California decision-makers to help the state plan for increased adoption of DERs while maintaining reliability standards by examining the impacts of DER adoption on forecast accuracy.

Environmental Benefits: Improved solar forecasts improve California's environmental footprint, because greater DER generation will decrease the use of fossil-fueled reserves, which would otherwise be required to accommodate PV forecast inaccuracy.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$261,080

EPIC Funds Encumbered:

$750,000

EPIC Funds Spent:

$744,661

Match Partner and Funding Split:

State University of New York at Albany: $20,000 (1.9 %)

Clean Power Research, L.L.C.: $300,000 (28.0 %)

Match Funding:

$320,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

31 out of 35 bidders

Rank of Selected Applicant/ Bidder:

Group 5: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project developed several forecast improvements by advancing methods for identifying low-level clouds motion and PV forecast uncertainty. The researchers refined the Reconstituted Load Model, developed under a prior EPIC agreement, to account for systematic day-ahead forecast errors due to the misspecification of the solar PV generation impact. The study demonstrated that the accuracy of the existing Reconstituted Load models can be improved by replacing the unadjusted solar PV generation with statistically-adjusted data. The day-ahead forecast of the

morning, midday/afternoon, evening, and dawn hours are expected to have accuracy gains of 20 percent, 3 percent, 10 percent, and 8 percent, respectively. CAISO has incorporated this project's BTM forecast into its short-term load forecast models to improve the forecasts as penetrations of BTM solar increase. The final report was published in September 2020.

Project Name: EPC-17-004 - Enhanced Modeling Tools to Maximize Solar + Storage Benefits

Recipient/Contractor: Energy and Environmental Economics, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 9/18/2017 to 3/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Customer adoption of solar photovoltaics (PV), storage, and other distributed energy resources (DERs) is set to substantially increase in California as technology costs decrease, new products are brought to market, and the relationship between customer and utility evolves. DERs could have very different costs to ratepayers depending on how customers are incentivized to use them. If the incentivized use of DERs by customers through their tariffs or programs is not aligned with the needs of the grid, increased DER adoption could be very costly to ratepayers.

Project Description:

This project developed a free, publicly available tool that performs a comprehensive cost-effectiveness analysis for energy storage and other distributed energy resources (DER). The Solar + Storage Tool identifies the most effective and economical approach of integrated solar photovoltaic and storage systems and estimates the value delivered to the customers based on their expected operations, location on the grid, electricity market prices, and other factors. The Solar + Storage Tool is equipped with the California Public Utilities Commission's (CPUC) avoided costs for DERs, as well as market-price forecasts and utility rates, to develop cost-benefit analyses from a variety of perspectives.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project developed a modeling tool, with feedback from Technical Advisory Committee members, that enhanced the existing Local Net Benefits Analysis (LNBA) tool developed by the project team under the CPUC's Distribution Resource Planning (DRP) proceeding. As a successor to the LNBA tool, this tool can perform the same analysis, but with a higher degree of accuracy and additional functionalities. In addition to the DER benefits evaluation provided by the LNBA tool, the Solar + Storage Tool can evaluate a suite of DER technologies and perform pro forma analyses to calculate total project costs. It's capable of simulating the operations of DERs under different tariff and program designs and determining the new designs that align the best uses of DERs for customers and for the grid and can maximize the benefits of DERs for ratepayers.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Streamlining Interconnection of Distributed Energy Resources and Improvements (Rule 21): R.17-07-007

Applicable Metrics: CPUC Metrics- 1a, 1b, 1c, 2a, 3b

Lower Costs: The functionalities of the Solar+ Storage Modeling Tool result in lower electricity costs to ratepayers. Investor-owned utilities can use this tool to identify cost-saving new technologies in their DRP processes. The tool can also help utilities design rates or programs that benefit both participants and other ratepayers. In addition, the tool can be used to estimate the impact of electric vehicle adoption and the potential benefits provided by vehicle-to-grid programs.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$457,030

EPIC Funds Encumbered:

$987,379

EPIC Funds Spent:

$987,368

Match Partner and Funding Split:

Southern California Edison: $3,852 (0.3 %)

Energy and Environmental Economics, Inc. (E3): $79,411 (7.2 %)

Starboard Energy Advisors, LLC: $32,200 (2.9 %)

Match Funding:

$115,463

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

31 out of 35 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The public release of the Solar + Storage Modeling Tool was completed in June 2019, with the link to download the tool available at the Energy Commission's website. E3 held two public workshops to introduce the tool. The first workshop in June 2019 introduced the tool, reviewed the user guide and functionalities, and discussed how the tool can simulate and determine which design will maximize the benefits of DERs to ratepayers. The workshop in August 2019 provided an in-depth training for stakeholders interested in using the tool. E3 guided stakeholders through the process of creating inputs, analyzing the cases, and viewing the final results. This vetted public tool is also available for evaluating DER with local distribution benefits in the CPUC's Integrated Distributed Energy Resources and DRP proceedings. The final report was published in September 2020.

Project Name: EPC-17-005 - Integrating Building-Scale Solar + Storage Advanced Technologies Maximizing Value to Customer and the Distribution Grid

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 12/13/2017 to 12/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Regulatory and economic factors in California have accelerated penetration of rooftop solar photovoltaics (PV) in the small commercial segment, benefitting facility managers in energy savings while helping to achieve California's renewable goals. However, uncontrolled and uncoordinated renewable generation creates issues with stability and reliability of the distribution grid. Given that implementation of PV, storage, and energy efficiency and energy management systems (EMS) technologies are typically siloed, synergistic benefits are difficult to realize. An integrated Distributed Energy Resource (DER) management approach is needed to balance commercial customer and grid requirements.

Project Description:

This project assesses the performance and benefits of integrated solar PV and storage along with advanced energy efficiency, demand response, and distributed energy resource management technologies in a commercial building setting. The goal is to leverage the synergies of integrated and controllable components to improve distribution grid stability and reliability while also enabling the commercial customer to reduce both capital costs and operational and management costs for optimal value.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

For California to achieve its long-term greenhouse gas reduction goals, there is a greater need for flexibility at all levels of grid operations. This project is demonstrating a suite of DER technologies, including solar + storage, at a commercial building, with the capability for active and reliable control of customer-owned loads and resources to 1) reduce the building owner's energy bill and 2) reduce the need to build new transmission and distribution infrastructure that is often required to compensate for high loads and customer-side generation.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Distribution Resources Plans (AB 327): R.14-08-013 Net energy metering: R.14-07-002 Streamlining Interconnection of Distributed Energy Resources and Improvements (Rule 21): R.17-07-007

Applicable Metrics: CPUC Metrics- 1h

Lower Costs: Synergistic integration with storage further reduces grid stress and expensive peak generation at ramp-up time, improves distribution capacity utilization, and reduces stress to prolong asset life and reduce costs of distribution system upgrades. Total lifecycle cost (capital cost, installation, and operations and maintenance) for a behind the meter solar + storage system is expected to be reduced by up to 10 percent through energy system integration.

Greater Reliability: This project demonstrates reducing peak load in response to grid operator needs. If scaled, projects like this could help address over-generation periods and steep ramps in the evening by smart (dis)charging.

Environmental Benefits: Solar generation helps reduce greenhouse gas and air pollutant emissions associated with grid power, particularly when off-setting peak power. This project will enable the cost-effective integration of increased penetrations of solar generation.

Consumer Appeal: Benefits also include better integration of customer preferences with grid operations. Cost-effective implementation reduces both acquisition costs and operations and management.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$360,079

EPIC Funds Encumbered:

$1,491,764

EPIC Funds Spent:

$1,080,210

Match Partner and Funding Split:

Electric Power Research Institute, Inc.: $271,090 (15.4 %)

Match Funding:

$271,090

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

31 out of 35 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project team completed the majority of the installation at the demonstration site in early 2020 but had problems getting approved for interconnection through PG&E due to test failures, design issues, and missing documents. Those issues are now resolved, and the project is almost ready for interconnection. As of November 2020, EPRI is in the process getting bollards installed to prevent vehicles from backing into the meter. Once that is done, PG&E will issue permission to operate. The project has been delayed in part because of COVID-19. EPRI has completed the following deliverables: DER-integrated design document, test plan, requirements definition document, site readiness document, measurement and verification plan, software algorithm report, final report outline, energy data warehouse final report, tariff effectiveness document.

Project Name: EPC-17-006 - Development, Implementation, and Integration of a Holistic Solar Forecasting System for California

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 10/5/2017 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S4: Improve Power Plant Performance, Reduce Cost, and Accelerate Market Acceptance of Existing and Emerging Utility-Scale Renewable Energy Generation Systems.

Issue:

Successful integration of renewable resources into power system operations will require the ability to forecast the output of these resources in timeframes from less than an hour to days ahead. Fog and stratus affect solar irradiance in California throughout the year, and shortcomings in predicting fog and stratus dissipation currently constrain the accuracy and confidence of short-term solar irradiance forecasts. The value of using improved forecasts is still not well understood by grid operators and utilities due to the difficulty of assessing return on investment for an improved forecasting system particularly for deploying instruments to improve the data used in forecasting models.

Project Description:

The project develops an improved forecasting system for solar irradiance in California, with a particular focus on fog and stratus conditions, through targeted deployment of instrumentation. The improved forecasts will be integrated into operational tools for use by the California Independent System Operator (CAISO) and utilities. This project utilizes a targeted instrumentation network, consisting of existing and new sensors, to improve the models used for forecasting fog and stratus conditions. The Recipient will design and deploy this network with the aim of improving the forecasts that are most important to CAISO and utility operations.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The use of an advanced network of existing and new instrumentation to inform numerical weather and statistical model improvements will significantly improve the current state of solar forecast modeling in California. The holistic forecasts produced will showcase a combination of various aspects of the weather forecast value chain, not previously demonstrated, linking observation systems and advanced physical and statistical modeling for solar forecasting. The project's focus on fog and marine layer forecasts, which are traditionally challenging to predict, will improve solar energy forecasting and contribute to increased PV penetration.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed> Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1b, 2a

Lower Costs: Improved forecasts help reduce operating costs by improved commitment and dispatch of generating resources, reductions in solar power curtailment, and more optimal procurement of resources for Investor Owned Utilities (IOUs).

Greater Reliability: Improved forecasts support the advancement of reliability of renewable energy by reducing uncertainties in generation across the CAISO system, improving voltage control on distribution systems, and ensuring that utilities can perform transmission and distribution switching.

Increase Safety: Improved forecasts can help maintain safety at the distribution and transmission level, improve switching operations required for DER management, and inform new smart grid devices that can manage voltage.

Economic Development: Improved forecasts of marine layer and fog conditions have the potential to improve the efficiency of generation dispatch, reduce the need for operating reserves to manage forecast error and maintain or increase reliability while integrating increased levels of renewables.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$365,395

EPIC Funds Encumbered:

$749,740

EPIC Funds Spent:

$674,642

Match Partner and Funding Split:

AWS Truepower, LLC: $177,229 (16.5 %)

Sonoma Technology, Inc.: $83,000 (7.7 %)

Electric Power Research Institute, Inc.: $64,601 (6.0 %)

Match Funding:

$324,830

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

31 out of 35 bidders

Rank of Selected Applicant/ Bidder:

Group 5: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-006 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project completed a measurement program involving targeted deployment of ground-based atmospheric boundary layer sensors. This successful measurement program can serve as a model for coordinating similar efforts in the future. Given the overlapping benefits of boundary layer sensor data across weather, air quality, and energy forecasting applications. The team performed many months of forecasts to investigate the impact of various physical parameterization choices on the WRF model. The results show an overall improvement in forecast skill and suggested that point measurements at a handful of locations are not likely to substantially improve forecasts above their already fairly high skill. The team also implemented and tested machine learning models for predicting cloudiness and solar irradiance at very short-term forecast horizons using project sensor data. Overall results could be integrated into operational tools of CAISO and utilities.

Project Name: EPC-17-007 - Integrated Community Solar and Storage at a Low-Income Mobile Home Park

Recipient/Contractor: Center for Sustainable Energy

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 7/13/2017 to 12/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Distributed solar photovoltaic (PV) systems will continue to be deployed to meet California's GHG reduction and renewable energy goals, but they can lead to daytime grid oversupply and difficulty meeting evening demand. Energy storage can shift PV generation from mid-day to evening peak, but rates do not adequately incentivize mid-day storage charging periods. Adding storage to existing solar PV installations requires duplication of permitting, installation, and commissioning efforts and costs. In addition, an integrated community-scale solar + storage solution has not been adequately demonstrated in mobile home parks, which host over 360,000 mobile homes in California.

Project Description:

The Center for Sustainable Energy (CSE) planned to apply high efficiency solar and storage technologies to create an integrated community solar and storage energy system at a low-income mobile home park. If this project had proceeded as planned, it would have illuminated operational strategies for solar and storage to provide clear value propositions to end-use customers with existing tariff structures and demonstrated alternate structures and additional value streams that could have increased the value of solar and storage to the end customer while better achieving distribution system operational goals.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project planned to design, install, and evaluate integrated high-efficiency solar panels with energy storage batteries, along with low-cost control hardware to demonstrate the impact of an integrated community solar and energy storage system in a low-income mobile home community. The project was designed to demonstrate the impact of an integrated community solar and energy storage system in a low-income community mobile home community to reduce net energy consumption and energy bills. A demonstration of a scalable solar and storage solution that provides clear value to residents is necessary to spur adoption of these clean energy technologies in the underserved mobile home residential sector.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Net energy metering: R.14-07-002 Streamlining Interconnection of Distributed Energy Resources and Improvements (Rule 21): R.17-07-007

Applicable Metrics: CPUC Metrics- 3h

Lower Costs: The primary application of the solar PV and energy storage system would have been to lower energy costs, by approximately 37 percent, for the individual tenants within the mobile home park. Additionally, by providing potential locational benefits such as reducing congestion on the distribution feeder or increasing the integration capacity of the circuit, the grid would function more efficiently, potentially deferring or offsetting grid transformer or line upgrades. Shifting excess solar PV generation from the middle of the day to evening residential peak hours would reduce the need to deploy more expensive peaker plants.

Greater Reliability: The project was strategically sited in a distribution area identified by PG&E for needing capacity upgrades due to potential thermal overloads and voltage concerns. Storage integrated with solar PV on the distribution system can increase system reliability through services such as local overload relief, renewable integration on circuits with high penetration of intermittent generation, and local customer back-up.

Environmental Benefits: If this project had proceeded as planned, it could have led to reductions in greenhouse gas and air pollutant emissions through reduced energy consumption and generation. Deployed at 5 percent of mobile home and multifamily dwellings across the state by 2025, community-scale solar PV and energy storage operated as proposed could have reduced annual energy generation needs, including peak-demand, by 800 MWh. This reduced energy consumption would have resulted in an estimated reduction of roughly 505,000 metric tons of CO2 annually, with concurrent reductions in both NOx (criteria pollutant) and methane (GHG) emissions.

Consumer Appeal: The integrated suite of solar PV, energy storage, and smart controls was anticipated to reduce annual energy usage by 32 percent, bringing total utility bills down by approximately 37 percent, which would have been substantial considering the energy discounts the park already receives through the California Alternate Rates for Energy (CARE) program. The same configuration and use cases piloted in this project could have been replicated at other multifamily dwellings as well.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$499,016

EPIC Funds Encumbered:

$2,005,923

EPIC Funds Spent:

$28,528

Match Partner and Funding Split:

Resident Owned Parks, Inc.: $340,905 (14.5 %)

Match Funding:

$340,905

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

31 out of 35 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Due to many complications in subcontracting and siting, agreement EPC-17-007 is being processed for mutual termination with CSE.

Project Name: EPC-17-008 - Empowering Energy Efficiency in Existing Big-Box Retail/ Grocery Stores

Recipient/Contractor: Center for Sustainable Energy

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 8/1/2017 to 1/31/2022

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

California Senate Bill 350 aims to double statewide electricity end use savings from energy efficiency and conservation measures by 2030. Meeting this aggressive target will require the commercial building industry to install holistic energy efficiency technology packages that are emerging, pre-commercial products. According to the 2013 Navigant California Potential and Goals Study, aging, existing commercial buildings, particularly in inland communities, present the greatest energy savings potential. Emerging technologies such as retrofit RTU motors, DC lighting, direct-evaporative cooling, and a cloud-based control platform will demonstrate 20 percent onsite energy reduction.

Project Description:

This project demonstrates the impact of an integrated suite of pre-commercial energy efficiency technologies in a large, existing, retail building located near a disadvantaged community. One of the technologies that comprise the installation package includes a novel supervisory controller to provide system-wide optimization, to reduce electricity consumption across numerous building subsystems, including lighting, refrigeration, and heating, ventilation, and air-conditioning. This could enable site electricity savings of greater than 20 percent.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project demonstrates how pre-commercial energy efficient technologies can deliver cost-effective, deep electric savings in a big-box retail environment, while also showcasing the demand reduction potential of these strategies. The project team will install a holistic suite of pre-commercial technologies such as a variable speed rooftop unit (RTU), high rotor pole switched reluctance (HRPSR) retrofit motor, direct current (DC) LED technology, direct-evaporative cooling to treat RTU condenser inlet air, and a cloud-based control system that will monitor all systems and detect energy waste, equipment malfunctions, and other operational problems. These technologies have the ability to demonstrate 20 percent energy savings.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1h, 2a, 3a, 4c

Lower Costs: The project could result in lowering on-site electricity use by 20 percent.

Greater Reliability: The project adds valuable capacity to California's electrical transmission and distribution system by reducing power consumption of packaged HVAC systems which are disproportionately responsible for critical capacity shortfalls on the grid. The demand response controls will maximize the use of variable renewable resources, such as the site's PV system.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$544,329

EPIC Funds Encumbered:

$2,824,685

EPIC Funds Spent:

$1,770,617

Match Partner and Funding Split:

Walmart: $250,000 (7.0 %)

Southern California Edison: $100,000 (2.8 %)

Software Motor Corporation: $79,704 (2.2 %)

TRC Engineers, Inc.: $81,880 (2.3 %)

i2 Systems California: $200,748 (5.6 %)

LumaStream LLC: $13,669 (0.4 %)

Center for Sustainable Energy: $7,553 (0.2 %)

Rector Law Office: $26,430 (0.7 %)

Match Funding:

$759,984

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 2: 13 out of 15 bidders

Rank of Selected Applicant/ Bidder:

Phase 2: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-008 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

in 2020, the team identified a new lighting technology with I2 Systems, Inc. The lighting system uses DC drivers to power the LED lights in the store. NREL completed the optimization report which outlined the modeling of the suite of measures to be installed at the store. The modeling predicts that the measures will achieve the overall goal of reducing the site's electricity consumption by 20 percent. In 2020, construction began with installation of new efficient motors for the RTU and refrigeration systems. In 2021, the project is expected to complete installation and begin their 12 months of post-retrofit data collection.

Project Name: EPC-17-009 - Bundle-Based Energy Efficiency Technology Solutions for California (BEETS for California)

Recipient/Contractor: Willdan Energy Solutions

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 8/1/2017 to 3/28/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

Much of California's existing buildings stock is old and inefficient. An estimated 50 percent of the state's existing buildings were built before California's Building Energy Efficiency Standards went into effect in 1978. Commercial facilities consume 37 percent of the state's electricity, more than any other sector. Yet there remains significant energy reduction potential for this sector. Adoption of comprehensive energy efficiency packages has been limited. Market barriers such as lack of stakeholder knowledge, fear of early adoption, and the high cost of emerging technologies means significant energy savings opportunities remain.

Project Description:

This project demonstrates three innovative bundles of pre-commercial technologies. The technology bundles were strategically developed through a systems-level approach to address the most energy-intensive areas in commercial buildings. These include: (1) Chilled Water Plants: Optimized all-variable-speed chilled-water (CHW) plants utilizing alternative refrigerant chillers. (2) Office and Exterior Space LED fixtures with integrated advanced controls, advanced building management system (BMS), and plug load controls controllable for demand response (DR), and off-grid, exterior, LED lighting in the parking lot, and lastly (3) Advanced laboratory ventilation, fume hood exhaust, and direct current (DC) lighting systems.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The demonstration project offers an innovative approach applicable to a range of commercial buildings. This strategy will accelerate adoption of energy savings technologies, contributing to reaching the state's energy efficiency and GHG reduction goals. By demonstrating this comprehensive approach in a real-world application this research has the potential to lead to further scale up and adoption of similar technology packages in other government and commercial buildings.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Demand Response (DR): R.13-09-011 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1h, 3b

Lower Costs: Energy savings achieved through implementation of these technologies could generate cost savings for building owners and operators. It is projected that these technologies will save an estimated 20 percent of building energy consumption. Future adopters will benefit from lower costs associated with economies of scale as production increases.

Environmental Benefits: In addition to GHG emission (CO2) reductions associated with the energy savings of the project, the project includes chillers that utilize low global warming potential (GWP) alternative refrigerant that contain no stratospheric ozone depletion compounds. These refrigerants are in alignment with the Montreal Protocol Kigali Agreement to phase out high GWP refrigerants. It also supports the California Air Resources Board target to reduce short lived climate pollutants.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$875,037

EPIC Funds Encumbered:

$3,994,256

EPIC Funds Spent:

$2,586,411

Match Partner and Funding Split:

ASWB Engineering: $5,330 (0.1 %)

Aris Wind: $33,250 (0.5 %)

Trane U.S., Inc.: $50,000 (0.8 %)

Willdan Energy Solutions: $2,293,645 (36.0 %)

Match Funding:

$2,382,225

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 2: 13 out of 15 bidders

Rank of Selected Applicant/ Bidder:

Phase 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project continues to progress as expected. The Recipient worked with site owners to meet their procurement requirements and the chiller, cooling tower, and lab space retrofits have been completed. Work is ongoing to complete the DC backup infrastructure and plug load controls. Measurement and verification is ongoing and preliminary data shows the project will exceed the expected 20 percent site savings. Data analysis and lessons learned are ongoing and a draft final report is expected in late 2020.

Project Name: EPC-17-010 - Integrated Heat and Moisture Calculation Tool for Building Envelopes

Recipient/Contractor: DOE- Lawrence Berkeley National Laboratory

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 8/14/2017 to 12/1/2020

Program Area and Strategic Objective:

Applied Research and Development

S11: Provide Federal Cost Share for Applied Research Awards.

Issue:

To mitigate negative effects of accelerated global climate change, ZNE buildings are being built with highly insulated and very tight envelopes. This could cause moisture to build up inside buildings. By failing to account for the moisture characteristics in the thermal envelope, designers and builders can introduce moisture-related problems that endanger the health and safety of building occupants as well as the durability of the building itself. It is important to solve the problems of designing and constructing building envelopes that are correctly detailed for ensuring excellent thermal performance without introducing moisture problems.

Project Description:

This project's purpose is to enhance the existing software tool widely used by building designers for thermal envelope modeling. The existing modeling software is used in Title 24 and Energy Plus development. It is an official tool by National Fenestration Rating Council,Passive House Institute and Window Attachment Energy Rating Council. The new software tool, integrates both thermal and moisture modeling to improve envelope design and analysis for new construction and retrofit applications.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The development of the user-friendly modeling software tool enables improved design to building envelopes. The integration of both thermal and moisture modeling is expected to improve envelope energy efficiency and prolong the life of buildings. Building envelopes are responsible for approximately 0.37 quads (equivalent to approximately $4 billion annually) in California's residential and commercial buildings and nationally, envelopes are responsible for approximately 7.6 quads (approximately $80 billion annually). It is estimated that a 5% improvement in building envelope energy performance can be attributed to more confident building envelope design, resulting in 0.02 quads (approximately $200 million annually) in energy savings in California and 0.38 quads (approximately $4 billion annually) nationally.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1h

Public Health: The presence of moisture can degrade both the durability and thermal performance of the building envelope as well as introduce mold problems that endanger the health and safety of building occupants. Damage due to moisture problems is one of the leading causes of lawsuits in construction and having tools for modeling moisture and thermal characteristics will help ensure that United States can meet its energy, comfort, health and durability goals in buildings.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$59,209

EPIC Funds Encumbered:

$125,000

EPIC Funds Spent:

$125,000

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

Lawrence Berkeley National Laboratory: $1,250,000

WESTLab: $45,000

The Regents of the University of California; Center for Forestry/Forest Products Laboratory: $8,000

Owens Corning: $24,000

SmithGroup: $18,000

British Columbia Institute of Technology: $14,175

WinBuild: $16,000

Leveraged Funds:

$1,375,175

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

43 bidders

Rank of Selected Applicant/ Bidder:

N/A

If not the highest scoring applicant/bidder, explain why selected:

The federal cost share solicitation was on-going and funds were awarded to passing proposals on a first-come, first-served basis.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The existing THERM software already had a large, established user community of professionals, academics, and researchers using the tool for rating windows and buildings. The team continues to use web-based forums to disseminate information and request testing from users. The research team is currently testing and doing verification of THERM-M and continues to work on making the software tool more user friendly and fixing bugs in the software based on user feedback. The draft final report is under review. The team continues to inform potential users at conferences and industry gatherings regarding the project results. The web page with the latest version of THERM-M, as well as documentation, including technical documentation is located on the LBNL Therm 8 / Window 8 web page (https://windows.lbl.gov/therm-8-window-8).

Project Name: EPC-17-011 - Demonstration of an Innovative, Community-Scale, Organic Waste-to-Energy Facility

Recipient/Contractor: HZIU Kompogas SLO Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 8/9/2017 to 9/30/2020

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Biomass-to-Energy Conversion Systems, Enabling Tools, and Deployment Strategies.

Issue:

Newly adopted state goals have called for increased production of renewable energy, increased waste diversion from landfills, and a reduction of short-lived climate pollutant emissions. Increased deployment of anaerobic digester systems can help meet all of these goals by producing renewable energy, diverting organic waste from landfills, and reducing associated short-lived climate pollutant emissions. However, anaerobic digester systems tend to be logistically complicated, technologically complex, and prohibitively expensive. There is therefore a need to demonstrate and deploy cost-effective anaerobic digester systems in local communities.

Project Description:

The goal of the project was to construct and demonstrate operation of an innovative, state-of-the-art anaerobic digestion facility for converting organic waste into renewable electricity in San Luis Obispo County. The facility is the first of its kind in dry digester technology to be installed in the United States and is expected to process about 36,500 tons of food waste and urban waste into 6.2 million kWh per year of renewable electricity, 13,000 tons of compost, and 1.6 million gallons of liquid fertilizer leading to a host of benefits for the environment (e.g., reduction of 5,300 MT CO2e per year), economy, grid reliability, and safety.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will benefit California ratepayers by demonstrating an innovative, state-of-the-art anaerobic digester facility. Once economical operation is proven, similar facilities can be replicated across California to provide similar benefits to other local communities.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed> SB 1122 Bioenergy feed-in tariff: R.18-07-003, R.11-05-005 <Closed>

Applicable Metrics: CPUC Metrics- 1a, 1b, 1c, 2a, 3a, 3b, 3g, 3h, 4a

Lower Costs: This project will demonstrated a cost-effective approach converting food wastes and other urban organic wastes into renewable electricity, allowing utilities to meet their bioenergy mandates while also lowering the cost of bioenergy for electric ratepayers.

Greater Reliability: This project demonstrated capacity to generate approximately 6.2 million kWh of distributed renewable electricity annually, improving local system reliability and reducing the stress on the grid.

Environmental Benefits: Diversion of organic waste from landfills will result in avoided methane and nitrous emissions, both powerful short-lived climate pollutants. The project demonstrated the diversion and conversion of organic wastes, which will result in estimated net annual emission reductions of approximately 5,300 metric tons of carbon dioxide.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$4,000,000

EPIC Funds Spent:

$4,000,000

Match Partner and Funding Split:

HZIU Kompogas SLO Inc.: $5,278,373 (56.9 percent)

Match Funding:

$5,278,373

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-011 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project successfully completed the construction and demonstration of the state-of-the-art anaerobic digester facility in San Luis Obispo. The facility currently converts 700 tons of green waste and food waste per week into 465 kWh of renewable electricity on average. The BioMAT PPA agreement was executed in July 2019 and facility has since been selling power to PG&E at a price 12.7 cents per kWh. In addition, the facility produces compost and has been selling it to wineries.

Project Name: EPC-17-012 - Biomass-to-Electricity: Pilot-Scale Testing of Baseload Compared to Flexible Power

Recipient/Contractor: Taylor Energy

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 8/1/2017 to 12/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

In 2016, the U.S. Forest Service reported the estimated occurrence of over 102 million dead and dying trees in California's forests. This buildup of dry fuel increases the likelihood of large wildfires, which have significant negative impacts to the environment, human health, and safety. Disposal of these dead and dying trees is necessary to mitigate wildfire risk, however, it is extremely expensive and has been difficult to recover the costs. Adoption of community-scale bioenergy systems can create a sink for forest wood waste that generates renewable electricity and local revenue. There is a need to identify technologies that can cost-effectively convert forest waste biomass to energy.

Project Description:

The project tests and evaluates three different energy pathways for conversion of woody biomass to electricity. The three pathways tested with the pilot-scale gasifier system are: 1) clean fuel gas production for baseload power generation, 2) syngas to Fischer-Tropsch liquid production for storage and flexible power generation, and 3) direct bio-crude production for storage and flexible power generation. Results from the three pathways will be compared and an optimal pathway will be identified for extended testing. After performing extended testing of the optimal pathway, the technical, environmental, and economic performance of a full-scale facility will be evaluated.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will test and evaluate new biomass-to-energy pathways, which is critical to meeting several of California's energy goals and provides numerous economic, environmental, and safety benefits to California ratepayers.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed>

Applicable Metrics: CPUC Metrics- 2a, 3a, 3b, 3e, 4a

Lower Costs: The technology aims to significantly reduce the capital costs of biomass gasification systems, subsequently reducing the cost of renewable electricity generated. The technology is expected to provide at least a 20 percent improvement in cost-effectiveness compared to existing systems and would be capable of delivering power at $0.118/kWh for a full-scale system.

Increase Safety: Increased use of forest waste biomass can reduce the risk of catastrophic wildfires, which can have major impacts on human health and safety.

Environmental Benefits: The technology aims to produce significantly reduced criteria pollutant emissions compared to conventional biomass boiler generator systems, which will be quantified during the project. Compared to conventional natural gas power plants, this technology aims to reduce greenhouse gas emissions by 50 percent. In addition, increased utilization of forest-derived biomass may reduce wildfire damage, which produces the majority of black carbon emissions in California.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$254,980

EPIC Funds Encumbered:

$1,499,000

EPIC Funds Spent:

$1,279,285

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-012 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project team has completed initial system modifications and has performed testing of the first pathway - clean fuel gas production for baseload power generation. The project team is performing system modifications required for testing of the other two pathways. The contractor has completed gas clean-up and carbon-char removal systems, while testing biomass gasification.

Project Name: EPC-17-013 - Small Scale Forest Waste Power System

Recipient/Contractor: Altex Technologies Corporation

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 9/1/2017 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

The risk of forest fires is very high in the semi-arid climate of California. Innovative management of woody biomass can reduce the serious risk of high severity forest fires. Forest waste material could be utilized as a renewable fuel resource to help California achieve its Renewables Portfolio Standard. However, use of forest biomass for power production has been challenging due to high costs associated with collection, pre-processing, and transportation. One of the possible solutions is an operationally reliable and affordable modular biomass power plant that can utilize this abundant resource to produce cost competitive renewable electricity.

Project Description:

This project develops a pilot-scale modular biomass power system called Altex Forest Power Technology (FORPOWER) that uses biomass from forest management as fuel to generate renewable electricity. FORPOWER is based on an indirectly-fired gas turbine technology that separates the fuel combustion products from the clean gas turbine working fluid by using a novel heat exchanger. The system uses forest slash as a renewable fuel while meeting criteria pollutant requirements, reducing greenhouse gas emissions, supporting renewable energy goals, and improving forest sustainability. FORPOWER is expected to cost-effectively convert forest slash to electric power and interconnect with the grid at distributed locations within investor-owned utility regions that are close to forest resources.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Integrating a low cost feedstock densification approach and innovative heat exchanger with gasifier and externally-fired gas turbine to efficiently generate electricity from forest slash will provide multiple benefits to California investor-owned utility ratepayers, including reduced power cost relative to alternative approaches, improved electric power generation reliability, reduced risk of forest fires and pollutant emissions, and improved economic development opportunities in forested regions.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed> SB 1122 Bioenergy feed-in tariff: R.18-07-003, R.11-05-005 <Closed> Integration of Distributed Energy Resources (IDER): R. 14-10-003 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Greenhouse Gas Emission Allowance Cost and Revenue Issues: R.11-03-012

Applicable Metrics: CPUC Metrics- 1a, 2a

Lower Costs: The Altex FORPOWER uses a low-cost forest slash densification approach (developed under the Public Interest Energy Research Program); and combines this approach with an externally-fired turbine and innovative heat exchanger that further lowers the cost of power by over 39% compared to a typical forest biomass gasifier coupled to an internal combustion engine.

Greater Reliability: A successful distributed generation technology like FORPOWER will help improve system reliability once dispersed in different locations by distributing feed in of power to the grid at multiple locations thereby reducing loads on transmission lines and substations.

Economic Development: Ten units of the scaled-up system (at 30 MW of total capacity) could provide revenue of over $20 million per year from generated electricity. Revenue from the production of power from biomass power plant operation and sales of power plant units along with collection and transport of biomass will bring economic development near forests and create jobs. Researchers estimate that 10 units would create 90 direct jobs.

Environmental Benefits: FORPOWER technology will help reduce fossil fuel use and the associated emissions of criteria pollutants and greenhouse gases. Assuming a 31% reduction in forest management costs and 50 units of the technology are deployed over 10 years, the reduction in greenhouse gas emissions could surpass one million tons per year.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$768,611

EPIC Funds Encumbered:

$1,499,994

EPIC Funds Spent:

$1,335,698

Match Partner and Funding Split:

The Avogadro Group, LLC: $7,250 (0.4 percent)

Altex Technologies Corporation: $154,478 (9.3 percent)

Match Funding:

$161,728

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

FORPOWER densification and bioenergy modules have been built and tested. The work was delayed due to a generator power output problem and a biomass feeding problem. Both problems were corrected, and testing of those components was completed. Technical and economic evaluation are proceeding and data results being collected for the report. The results will determine the potential of the concept to convert forest slash into power.

Project Name: EPC-17-014 - Advanced Plug Load Controls and Management in the Educational Environment

Recipient/Contractor: Newcomb Anderson McCormick, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 11/8/2017 to 3/31/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

Advanced Plug Load Management Device (APMD) demonstration projects have only been conducted on a small scale (100 units). These studies have not evaluated large deployment, nor led to broad market acceptance/penetration. Many college buildings lack the ability to control plug loads. This project deploys and evaluates approximately 3,500 APMD units at multiple community college districts in investor-owned utility (IOU) service territories throughout California. This project offers opportunities for cost-effective market transformation of the plug load controls for the community college market.

Project Description:

This project deploys APMD technology at approximately 3,500 computer workstations at several community colleges, and focuses on integrating the technology with facility operations to ensure that they meet the needs of the sites and staff. One of the devices is the Embertec Tier 2 Advanced Power Strip which controls an occupant's computer workstation by powering off when it detects no user presence by mouse movement or keyboard hits. The other device is the Ibis Intellisocket which controls large plug load end uses such as water coolers, TV displays, and large printers. Key features of the project include outreach and individual education programs to California Community College Districts, evaluation of sites for participation in the project, purchase and installation of APMDs at approved sites, measurement and verification (M&V) activities both pre- and post-APMD implementation at the selected demonstration sites. The goal is that the plug load controllers are reduce energy use by 20%.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Reductions in electricity consumption and cost could occur with implementation of the APMD technology. Preliminary results show that the plug load controllers are reducing the controlled plug loads by 20%. Following project completion, the APMD systems will continue to provide savings throughout their 8 to 10 year expected useful life. Successful deployment at participating Districts could be leveraged to expand technology adoption to other community colleges.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1h, 2a

Lower Costs: A conservative estimate of savings to the participating California Community College Districts is $850,000 per year in immediate and ongoing annual savings.

Consumer Appeal: The project gathers a wide range of data about the technology and its performance that will be incorporated into an outreach campaign to build awareness and accelerate adoption of APMD technology with IOUs, technology vendors, and property owners in institutional and commercial buildings statewide. In addition, APMDs will provide a new data visualization capability and plug load energy information system to the participating sites.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$181,505

EPIC Funds Encumbered:

$1,264,296

EPIC Funds Spent:

$1,149,708

Match Partner and Funding Split:

Ibis Networks: $357,047 (18.9 percent)

Embertec: $33,115 (1.8 percent)

Newcomb Anderson McCormick, Inc.: $235,324 (12.5 percent)

Match Funding:

$625,486

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 2: 13 out of 15 bidders

Rank of Selected Applicant/ Bidder:

Phase 2: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-014 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project team completed installations of nearly more than 3,500 plug load controllers across multiple community colleges. In 2020, the team collected more than one year of post-installation data. Currently, the devices are controlling approximately 700,000 kWh of annual baseline plug loads across all the demonstration sites. Preliminary results show that the plug load controllers are reducing the controlled plug loads by 20% or 142,000 kWh/yr. The team is currently finalizing their draft final report and technology transfer tasks for the project. The technology transfer activities include meeting with community college facility meetings to see if they will further adopt these technologies to other locations based on the savings presented.

Project Name: EPC-17-016 - An Online Siting Tool Application for Woody Biomass-to-Electricity Facilities in California

Recipient/Contractor: University of California, Davis

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 11/8/2017 to 12/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

It has been estimated that $650,000 of up-front capital is necessary in the current investment landscape to develop a biomass-to-electricity project to the point at which private capital will invest. Much of those costs are related to evaluating feedstock supply, harvest methods, transportation costs, and grid capability. Many businesses and communities that aspire to produce energy from woody biomass are small businesses, start-ups, or communities that cannot easily afford the preliminary studies necessary to assess project feasibility and how to begin development.

Project Description:

This project develops a decision support system that will reduce the soft costs of estimating and planning new bioenergy power plants that consume woody biomass from sustainable forest management activities. The open-source facility-siting tool will be hosted online and will allow users to quickly evaluate economic feasibility and environmental performance potential of locations for developing a wood-based biomass power plant. The project includes case study analysis to understand feasibility and barriers to developing biopower facilities in high-risk hazard zones.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will increase the cost competitiveness of biopower plant projects, resulting in expanded opportunities for using biomass waste streams. The online and open application architecture will ensure that everyone has open, public access to this resource.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

SB 1122 Bioenergy feed-in tariff: R.18-07-003, R.11-05-005 <Closed>

Applicable Metrics: CPUC Metrics- 1a, 1b, 1c, 3b, 3h, 4a, 5d, 5e

Lower Costs: This bioenergy facility siting tool will achieve lower costs for renewable biomass electricity generation by reducing the cost of siting a bioenergy facility, thus increasing the cost

competitiveness of bioenergy facility projects. Approximately $650,000 in up-front capital is necessary to develop a project to the point at which private capital will invest. Much of those costs are related to evaluating feedstock supply, grid capability, etc., which can be supported by the proposed application. Assuming 40% of the project initial development cost can be reduced by the siting tool, the application could save about $260,000 per project.

Increase Safety: The bioenergy facility siting tool will reduce risk of wildfire impacts to grid infrastructure by facilitating markets for residual woody biomass, thus reducing a potential wildfire fuel source.

Environmental Benefits: This tool will expand opportunities to use biomass waste streams that would otherwise contribute to criteria air pollutants and higher levels of climate pollutants from prescribed burns or wildfire. For a 3 MW facility, local and regional emissions reductions for NOx, PM10, VOC, CO, and CO2eq are estimated to be 80.4, 193.7, 149.6, 1,879, and 9,582 tons per year, respectively (Springsteen et al., 2011).

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$203,977

EPIC Funds Encumbered:

$1,222,284

EPIC Funds Spent:

$638,294

Match Partner and Funding Split:

Regents of University of California, Davis: $28,523 (2.3 percent)

Match Funding:

$28,523

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-016 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

UC Davis received 2016 tree mortality data for the Sierra Nevada region from the U.S. Forest Service's (USFS) F3 modeling team, but the production of the 30-year forward projected data for the Sierra Nevada region, as well as the rest of California, is delayed due to the USFS F3 team's urgent work related to California's wildfires. The UC Davis research team is carrying on with the development of the tool for the Sierra Nevada regional tree mortality data. The siting tool based on the Sierra Nevada area is expected to be completed early 2021 and will be updated as the rest of the F3 data becomes available.

Project Name: EPC-17-017 - The Nexus of Clean Energy, Healthy Forests, and a Stable Climate: Innovative Biomass Gasification for Sustainable Forest Management

Recipient/Contractor: All Power Labs, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 10/27/2017 to 12/31/2022

Program Area and Strategic Objective:

Applied Research and Development

S3: Develop Innovative Solutions to Increase the Market Penetration of Distributed Renewable and Advanced Generation.

Issue:

Climate change contributes to California's forest health crisis, with a tree mortality emergency of over one hundred million dead trees, at risk of being ignited in catastrophic wildfires. There is a need for an economical and climate-sensitive way to reduce the risk of catastrophic wildfire, while also addressing the state's need for renewable energy. All Power Lab's pre-commercial Powertainer technology -- a containerized 150kW gasification system that converts forestry waste into renewable energy and sequestered carbon -- is designed to run profitably under the SB1122 BioMAT feed-in-tariff. Yet high technological and economic barriers to widespread commercial deployment remain.

Project Description:

This project supports the development of the Powertainer+ (PT+) -- a multi-modal power and products platform designed to generate low-cost renewable energy, process thousands of tons of forestry waste, and sequester carbon. The Powertainer+ will include a combined heat and power module, increase the power capacity (from 150kW to between 210-250kW), and increase the forestry waste processing capacity to up to 2200 bone dry tons per year.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Broadly, the goals of this project are to decrease the modular technology platform's levelized cost of electricity, increase its forestry residue processing capacity, add new value streams in the forms of hot water and biochar production, and enhance the system's carbon sequestration capacity.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed> SB 1122 Bioenergy feed-in tariff: R.18-07-003, R.11-05-005 <Closed> Combined heat and power: D.10-12-035., R.08-06-024. <Closed>

Applicable Metrics: CPUC Metrics- 1a, 1f, 3g, 4a, 4e

Greater Reliability: The PT+ will increase PG&E's grid reliability by reducing peak loading by up to 250 kW. The technology supports increased grid reliability in hard to serve places and reduced peak demand charges for rural businesses under net energy metering arrangements. The technology will provide on-demand, non-weather dependent, renewable energy.

Increase Safety: By creating a market demand for forestry biomass residue, this project will increase safety by creating an economic driver to support sustainable forestry management activities, thus reducing the risk of catastrophic wildfire and the associated damage to the Investor Owned Utility infrastructure, such as transmission lines and remote substations. The project is receiving over 80% of biomass materials from CalFire-designated High Fire Hazard Zones.

Economic Development: The PT+ biochar off-take provides the critical linkage between the forest and agricultural industry value chains. The PT+ creates economic benefit by producing marketable biochar for distribution companies and farmers. The biochar sold into this market creates economic and environmental value for the agricultural industry, as it increases soil fertility and water retention and decreases nutrient input requirements and runoff.

Environmental Benefits: By processing forestry residue from CalFire designated High Hazard Zones, the PT+ creates demand for biomass that was previously considered waste, creating value and increasing incentives to remove residues that would otherwise not be economical and providing an alternative to controlled open slash burning. This reduces greenhouse gas emissions and lowers wildfire risk.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$1,500,000

EPIC Funds Spent:

$966,113

Match Partner and Funding Split:

Humboldt State University Foundation, Schatz Energy Research Center: $17,235 (0.8 %)

Anderson Biomass Complex: $50,000 (2.2 %)

All Power Labs, Inc.: $682,765 (30.3 %)

Match Funding:

$750,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-017 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project team conducted activities associated with the manufacturing and integration of the gas making components of the PT+ system, building all subsystems (except for the enclosure and fuel feed subsystems) at APL's facility in Berkeley. These subsystems include the emissions control, pre-combustion biochar off-take, and heat module subsystems, as well as automation assembly, gasifier, flare, and filter subsystems. Before the COVID-19 shutdown, the project made a lot of progress in integrating the bioenergy system, and conducting engineering and validation tests of the gas making module and the production of biochar. Delays and challenges experienced during the temporary shutdown due to COVID-19 made the team to focus on behind-the-meter demonstration activities at the demonstration site in Anderson, Shasta County.

Project Name: EPC-17-018 - Demonstrating the Potential for On-Site Electricity Generation from Food Waste Using Containerized Anaerobic Digestion Units

Recipient/Contractor: University of California, Davis

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 11/6/2017 to 10/17/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Biomass-to-Energy Conversion Systems, Enabling Tools, and Deployment Strategies.

Issue:

The common model for managing food waste generally involves disposal in a landfill where the organic material releases methane gas (a greenhouse gas with 25 times the global warming potential of carbon dioxide) to the atmosphere as it degrades. The conversion of food waste to electricity and heat via anaerobic digestion (AD) provides a promising alternative solution to the current model, but large-scale centralized facilities require expensive and carbon-emitting transportation of food waste over long distances from its source, and small scale decentralized AD systems have not been well-demonstrated in California.

Project Description:

This project assesses the potential for a highly standardized and rapidly deployable decentralized AD solution as a compelling alternative to large-scale centralized AD facilities. By implementing on-site AD at locations where food waste is generated and electricity demand exists, it is possible to reduce or avoid 1) the consumption of non-renewable electricity, 2) the transmission and distribution (T&D) losses associated with the delivery of electricity across long distances on the regional grid, and 3) the transport costs (inclusive of the monetary, environmental, and public health costs) of hauling food waste long distances to feed larger AD generators.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project addresses the knowledge gap regarding the optimal scale for the deployment and use of AD technology to convert food waste into renewable electricity, heat, and fertilizer. To meet this need, researchers will perform techno-economic and environmental assessments of increased deployment of micro-scale AD systems across the state. Researchers will also develop new information about the performance variability of micro-scale AD systems relative to fluctuating and heterogeneous food waste feedstock inputs.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

SB 1122 Bioenergy feed-in tariff: R.18-07-003, R.11-05-005 <Closed>

Applicable Metrics: CPUC Metrics- 1a, 1b, 2a, 3b, 3g, 4a, 4e

Lower Costs: The small-scale, on-site AD system will directly avoid the long-term costs of electricity supply expansion. The pilot unit is expected to reduce the cold storage facility's net peak demand on the SCE grid by 53 kW, approximately saving $64,752 a year, or $152/MWh. By disposing the food waste onsite and locally (within 7 miles) instead of transporting it to landfills, food waste producers can avoid a total tipping fee of $72,236. At an estimate of 1 percent market penetration, the decentralized AD technology would save ratepayers $4.78M/year.

Greater Reliability: Onsite sustainable and flexible energy generation will be able to reduce the facility's peak load and potentially minimize the impact of unexpected power outages.

Environmental Benefits: This technology demonstration project will reduce the amount of food waste going to landfills by about 1,220 tons of municipal food waste per year locally. The technology will avoid an estimated 427.2 metric tons of CO2 emissions per year. By implementing on-site AD at locations where food waste is generated and electricity demand exists, it is possible to reduce/avoid 1) the consumption of non-renewable electricity, 2) the transmission and distribution (T&D) losses associated with the delivery of electricity across long distances on the regional grid, 3) the environmental and public health costs of hauling food waste long distances to feed larger AD generators.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$171,649

EPIC Funds Encumbered:

$2,411,007

EPIC Funds Spent:

$611,618

Match Partner and Funding Split:

SeaHold, LLC: $20,800 (0.7 %)

Biodico, Inc.: $610,886 (19.3 %)

UC Davis: $124,447 (3.9 %)

Match Funding:

$756,133

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-018 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The equipment was delivered to the Oxnard site in September 2020, and the system was installed and integrated in December 2020. Commissioning is scheduled to commence in January 2021. UC Davis has completed an Operation and Maintenance manual for the system. UCD has identified food waste producers that will provide feedstock for the containerized anaerobic digestion system.

Project Name: EPC-17-019 - Burney-Hat Creek Bioenergy

Recipient/Contractor: Fall River Resource Conservation District

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 10/18/2017 to 3/31/2022

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Biomass-to-Energy Conversion Systems, Enabling Tools, and Deployment Strategies.

Issue:

Forest biomass is a potentially valuable resource for power generation but has been difficult to deploy at scale given lack of cost competitiveness and other barriers. There remains a need to advance cost-effective, efficient, and low-emission biopower facilities that are suited to local communities and to develop modular biopower technologies that could be economically scaled up and transported or replicated at different forest locations.

Project Description:

This project seeks to bring West Biofuels gasification technology, a technology funded by EPIC under an applied research and development program grant (EPC-14-024), to full commercialization. The West Biofuels gasification solution is designed to utilize forest derived biomass and is ready for scale-up demonstration and deployment. To advance its commercial readiness, this project is developing and demonstrating a community-scale forest biomass facility in the Burney-Hat Creek region that is designed to address the need for increased markets for forest biomass resources. The bioenergy facility will be consistent with the requirements of the BioMAT Category 3 and obtain a power purchase agreement at a financially viable price. The plant will consume about 22,000 bone dry tons (BDT) of forest sourced feedstock per year, generate 2.88 MW of renewable energy at full rated capacity, and have a capacity factor that is greater than or equal to 75 percent.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The Burney-Hat Creek Bioenergy facility will be the first commercial deployment of an innovative gasification system that integrates a horizontally positioned rotary gasifier based off a torrefaction reactor, a thermal oxidizer and an Organic Rankine Cycle (ORC) technology in place of an internal combustion engine. The technology is expected to overcome important challenges with the use of forest-sourced wood, including environmental compliance and operating challenges that are hindering large scale bioenergy projects.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

SB 1122 Bioenergy feed-in tariff: R.18-07-003, R.11-05-005 <Closed>

Applicable Metrics: CPUC Metrics- 1a, 1b, 2a, 3g, 3h, 4a, 4b, 4e

Lower Costs: California IOU's have been mandated to procure 250 MW of biomass electricity through SB 1122. Burney-Hat Creek Bioenergy is part of a cost-effective set of options for the utilities to acquire this capacity through the SB 1122 BioMAT program. A set of factors -- including relatively low capital cost using essentially free feedstock while leveraging a local partnership of a technology manufacturer and the construction company -- will help deliver a LCOE for the project that is well below the average price identified by Black & Veatch for Category 3 projects for BioMAT categorized as Sustainable Forest Management Byproducts.

Greater Reliability: Distributed forest biomass projects provide important grid reliability in northeastern California, a remote region of the PG&E grid. Burney-Hat Creek Bioenergy will help provide greater reliability through: reduced power losses and the reduction in system harmonics through local distributed generation minimizing the heat generation from long-distance transmission; improved grid resilience to climate change by supporting sustainable forest management and reducing black carbon emissions from wildfire; and faster outage restoration time by providing the opportunity for micro-grid operations limiting the impact of a fault event.

Increase Safety: By developing the region's biomass infrastructure, the project will promote fire-safe forest management, helping protect ratepayer property and grid infrastructure.

Public Health: Diverting biomass from pile and burn reduces criteria pollutants -- the source of significant acute and chronic respiratory illness -- by more than 75 percent.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$5,000,000

EPIC Funds Spent:

$233,159

Match Partner and Funding Split:

Hat Creek Bioenergy, LLC: $5,000,000 (50.0 %)

Match Funding:

$5,000,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-019 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project team successfully negotiated a PG&E BioMAT contract in 2019. PG&E is reviewing some changes required with the interconnection application and the project team is awaiting new approvals to move forward with the execution of the interconnection agreement. Equity financing has been obtained and operating agreements and land leases are in development. Debt financing and loan guarantees are under review, with the goal of achieving financial close by the end of 2020. Project has made significant progress in pre-construction engineering and other activities while the actual construction will begin in 2021.

Project Name: EPC-17-020 - Demonstration of Vehicle-Grid Integration under Non-residential Scenarios

Recipient/Contractor: Board of Trustees of the Leland Stanford Junior University (SLAC National Accelerator Laboratory)

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 10/10/2017 to 12/31/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S16: Expand Smart Charging and Vehicle-to-Grid Power Transfer for Electric Vehicles.

Issue:

There are knowledge gaps that inhibit the expansion of electric vehicles (EV) fleet charging including: 1) how to quantify the flexibility of EVs as a resource (in a consistent well-developed and tested methodology); 2) how to develop accurate physical models of charging stations and integrate them with distribution system models; 3) how to quantify and minimize the impact of EV charging on the distribution system assets; and 4) how to calculate the value streams for electric vehicle fleets.

Project Description:

This agreement will demonstrate vehicle-grid integration in non-residential facilities to show the flexibility of smart charging. The team will build and validate models that incorporate usage patterns, quantify the impacts of EV charging, develop controls to manage the smart charging to minimize grid impacts and utility costs, and calculate the value streams and costs associated with realizing those value streams.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will develop and demonstrate advanced model-predictive control strategies that are more sophisticated than the current state of the art technology by incorporating usage patterns, quantifying the impacts of EV charging while managing the smart charging, and calculating the value streams/costs. This project will demonstrate how to minimize electric vehicle charging effects on the distribution system while analyzing EV fleet capabilities under non-residential scenarios.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Alternative Fueled Vehicles: R.13-11-007 <Closed> Distribution Resources Plans (AB 327): R.14-08-013

Applicable Metrics: CPUC Metrics- 1h, 3f, 4b

Lower Costs: The project will lower grid asset costs by extending the life of distribution grid assets and reducing peak load impacts from uncontrolled charging. In particular, the system could minimize transformer aging in hot climate regions due to reduced loading. Managed charging will lower the energy costs and demand charges associated with EV charging.

Greater Reliability: This project will provide higher reliability due to mitigation of voltage, current, and harmonics issues with EV clusters. This project is estimated to improve power losses and voltage drop by at least 10 percent via smart charging.

Environmental Benefits: This demonstration project will accelerate EV adoption, thus reducing greenhouse gases with the adoption of more EVs.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$728,697

EPIC Funds Encumbered:

$2,340,000

EPIC Funds Spent:

$1,905,217

Match Partner and Funding Split:

Google, Inc: $200,000 (6.8 %)

ChargePoint, Inc.: $61,248 (2.1 %)

Kisensum: $75,000 (2.6 %)

UC Santa Barbara: $61,345 (2.1 %)

Board of Trustees of the Leland Stanford Junior University (SLAC National Accelerator Laboratory): $200,000 (6.8 %)

Match Funding:

$597,593

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

29 out of 31 bidders

Rank of Selected Applicant/ Bidder:

Group 4: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-020 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The SLAC team is developing and implementing managed charging functionalities at its SLAC and Google campus demonstration sites. With the real-time data obtained from each site, the team was able to develop software interfaces to control and optimize EV charging events. At the Stanford site, SLAC has developed software to optimize the charging strategy of its E-Bus fleet by improving bus schedules and routes. The optimized charging will reduce the peak charging loads and lower demand charges.

Project Name: EPC-17-021 - Mariposa Biomass Project

Recipient/Contractor: Mariposa County Resource Conservation District (MCRCD)

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 3/21/2018 to 12/31/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Biomass-to-Energy Conversion Systems, Enabling Tools, and Deployment Strategies.

Issue:

About 65 percent of the homes in Mariposa County are at the 2000 ft. - 6000 ft. elevation range in the conifer or mixed conifer zone and are at risk of wildfires and falling trees. There is a need for managing excess vegetation and a need to demonstrate advanced technologies that can economically convert woody biomass while meeting emission standards. However, no commercially proven technology has the flexibility in both the feedstock and fuel outputs. Larger scale biomass plants have difficulty scaling to below a 3 MW size, while small-scale pyrolysis-based systems that use a reciprocating engine have high maintenance costs and low reliability and availability.

Project Description:

This project is designing and constructing a thermochemical biomass-to-energy conversion facility for forest wood waste that will have a capacity between 2.0 and 2.4 megawatt (MW) annually and produce between 15,000 to 18,500 MWh annually of renewable, community-scale, grid-connected electricity. The project demonstrates and optimizes this forest waste bioenergy technology and assesses the performance characteristics and best practices when using wood waste from forest management as feedstock. The project is in Mariposa, CA -- often referred to as ground zero for the tree mortality disaster -- and will use forest biomass obtained from a high fire hazard zone.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The Mariposa Biomass Project has partnered with Cortus Energy to demonstrate an innovate gasification system trademarked as WoodRoll technology. The technology uses a 3-stage drying, pyrolysis and gasification process to produce a clean high BTU syngas, thus reducing costly engine maintenance costs and outages; and the gasification facility will integrate automation and remote monitoring to further reduce operating costs. The WoodRoll facility will have 16 standardized factory-tested modules that can be installed quickly and moved if necessary. The combination of high efficiency and availability combined with low operating and maintenance costs will allow the Mariposa Biomass Project to be a financially successful small-scale forest

biomass demonstration facility that can be replicated in other rural areas with access to sustainable forest biomass supplies.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed> SB 1122 Bioenergy feed-in tariff: R.18-07-003, R.11-05-005 <Closed>

Applicable Metrics: CPUC Metrics- 1a, 1b, 3g

Environmental Benefits: The proposed facility will provide community and state benefits, including forest ecosystem protection (due to removal of dead trees and excess forest growth that can lead to catastrophic wildfires), watershed protection, and air quality benefits and greenhouse gas benefits (by diverting biomass from burn piles and controlled burns and utilizing the biomass as an energy resource in a controlled environment).

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$8,842

EPIC Funds Encumbered:

$5,000,000

EPIC Funds Spent:

$66,286

Match Partner and Funding Split:

Cortus Energy: $11,135,367 (69.0 %)

Match Funding:

$11,135,367

Leverage Contributors:

U.S. Forest Service: $248,858

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-021 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project team successfully entered PG&E's BioMAT queue in October 2019. PG&E is reviewing this application and the project team is awaiting the execution of the power purchase agreement. Development of a sister plant by the project's major subcontractor, Cortus Energy, has been completed and fully commissioned. Once the power purchase agreement with PG&E is executed, the components will be shipped to the designated plant site in Mariposa County.

Project Name: EPC-17-022 - Skid Mounted Mobile Pilot/Education Unit for Source Separated Organics Processing with Cogeneration Capabilities

Recipient/Contractor: Lystek International Limited

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 11/28/2017 to 11/29/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S13: Demonstrate and Evaluate Biomass-to-Energy Conversion Systems, Enabling Tools, and Deployment Strategies.

Issue:

California is striving to achieve a greater diversion of wastes and increase renewable energy generation. A primary objective of this diversion is to reduce greenhouse gas emissions from controllable sources. As an alternative to traditional solid waste disposal, wastewater treatment plants are a potential receiver of organic wastes that can be used to generate renewable energy, helping meet waste diversion and renewable energy goals.

Project Description:

The purpose of this project is to construct and demonstrate an innovative technology to pretreat organic wastes prior to anaerobic digestion at a wastewater treatment facility to enhance operational efficiencies and increase biogas production. The pretreatment technology will be constructed as skid-mounted mobile units for processing source-separated organic wastes and biosolids and will have cogeneration capabilities, thereby further increasing the energy generation from the wastewater treatment system.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will yield greater biogas generation and utilization resulting in higher diversion opportunities of organic wastes while producing more renewable electricity than conventional digester systems. If successful, the combined technologies will provide wastewater treatment operators with greater confidence in working with generators and processors of organic waste for accepting feedstock material suitable for co-digestion.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed> Integration of Distributed Energy Resources (IDER): R. 14-10-003 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Greenhouse Gas Emission Allowance Cost and Revenue Issues: R.11-03-012

Applicable Metrics: CPUC Metrics- 1a, 2a, 4a, 4e, 5b

Lower Costs: The project will result in lower costs by demonstrating a technology that both diverts organic waste and increases the biogas yield and renewable electricity generation. The increase in gas production can be about 385 kW per ton of organics processed. This is an increase of at least 20 percent in biogas production for moderate performing anaerobic digesters. The lower quantity of biosolids resulting from the process will lower expenses for disposal management at wastewater treatment facilities.

Environmental Benefits: The proposed approach to biosolids processing, land application and enhanced energy recovery through the improved anaerobic digestion process may result in net greenhouse gas reductions of 47–65 tonnes of CO2 per 100 dry tonnes of biosolids processed. Assuming 723,000 dry tonnes of biosolids could be converted by Lystek in California for beneficial use every year for biogas enhancement and electricity generation, there is potential for reducing more than 339,800 Mg CO2e of GHGs.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$19,396

EPIC Funds Encumbered:

$1,589,163

EPIC Funds Spent:

$1,430,247

Match Partner and Funding Split:

GHD, Inc.: $123,000 (5.9 %)

Design2Operate: $58,000 (2.8 %)

Lystek International Limited: $312,075 (15.0 %)

Match Funding:

$493,075

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-022 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The first delivery of food waste came from UC- Santa Barbara (USB) dining hall on August 27, 2019. They have been slowly feeding the test digesters since start-up and reached optimum capacity in December 2019. The project recorded measurable levels of biogas generation from the test digesters early in the project timeline. Due to feedstock supply interruptions in December 2019 and January 2020, the project converted to a hybrid mix (adding treated sludge waste to the feedstock). As a result of the non-uniform waste characteristics as well as COVID-19 closure of USB dining hall, the project experienced a reduction in biogas generation. Starting from May 2020, the project resumed testing with preferred sludge waste streams.

Project Name: EPC-17-023 - High Performance, Ultra-Tall, Low Cost Concrete Wind Turbine Towers Additively Manufactured On-Site

Recipient/Contractor: Jason Cotrell, dba RCAM Technologies

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 12/26/2017 to 6/30/2022

Program Area and Strategic Objective:

Applied Research and Development

S4: Improve Power Plant Performance, Reduce Cost, and Accelerate Market Acceptance of Existing and Emerging Utility-Scale Renewable Energy Generation Systems.

Issue:

Large wind turbines can tap into higher altitude, higher speed winds that can increase power production. However, their deployment is constrained in part by the challenging transportation and installation logistics and costs associated with large components. As a result, the average conventional wind turbine tower height installed in the United States is slightly over 80 meters tall even though an ultra-tall 140-meter tower increases the amount of energy produced by more than 20 percent at a site with moderate wind shear.

Project Description:

This project aims to develop and test a reinforced concrete additive manufacturing (RCAM) technology for building low cost ultra-tall wind turbine towers on-site at a wind plant. Taller wind turbine towers capture more wind energy from faster winds aloft, but are constrained by transportation size and weight. The key goal is to develop a RCAM technology that can be used to fabricate a wind turbine tower on-site in one day at half of the cost of conventional steel towers, and reduce the levelized cost of wind generated electricity in a low wind speed site by 11 percent.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Substantial recent investments and advancements in concrete additive manufacturing technologies for buildings make this an opportune time to use the RCAM technology for constructing tall wind turbine towers in California. Concrete additive manufacturing technologies are being developed by countries around the world; however, most development has been performed on concrete printing manufacturing methods for buildings that have little or no structural reinforcement necessary. The project team will build upon the state-of-the art technology to develop the innovative RCAM method that incorporates reinforcement in concrete printing for ultra-tall turbine towers.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed>

Applicable Metrics: CPUC Metrics- 2a

Lower Costs: RCAM technology provides new transformative design possibilities that reduce cost and energy consumed by using less concrete and labor than conventional wind tower construction, and by eliminating concrete forms. The RCAM offers the potential of reducing the construction time by 66 percent and additional cost reduction potential through automation. This technology has the potential to reduce the levelized cost of wind generated electricity in a low wind speed site by 11 percent.

Greater Reliability: An ultra-tall wind turbine with a hub height between 140-170 meters increases the amount of energy produced as compared, for example, to a typical 80-meter tower. The 140-meter towers have the potential to increase the California land area with gross capacity factors above 35 percent by tenfold, adding flexibility and reliability of the electrical system by increasing geographic diversity. Ultra-tall towers can also be used with larger rotors to obtain further improvements in capacity factors.

Economic Development: If the RCAM technology is successfully commercialized, a large number of jobs in wind turbine construction, operations, and maintenance will be created in the deployment of ultra-tall towers. These deployments will also provide lease and tax revenues for California communities. Empirical results for counties hosting wind power projects that were installed between 2000 and 2008 show an increase in county-level personal income of $11,000/MW of installed capacity and an increase in average county-level employment by approximately 0.5 jobs/MW.

Environmental Benefits: Wind deployments avoid substantial emissions of greenhouse gases compared to fossil fuel generated electricity. Wind generated electricity emits up to 120 times less carbon dioxide (CO2e) than natural gas generated electricity and nearly 200 times less than coal on a lifecycle basis (5 g/kwh, 607 g/kWh, and 975 g/kWh respectively). An RCAM 140-m tower is projected to result in 85 times less CO2 compared to natural gas and 138 times less than coal fired generation on a lifecycle basis.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$164,368

EPIC Funds Encumbered:

$1,249,982

EPIC Funds Spent:

$393,275

Match Partner and Funding Split:

RCAM Technologies: $62,558 (4.8 %)

Match Funding:

$62,558

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

19 out of 19 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-023 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The researchers decided to manufacture its 140-meter tall tower using commercially available large-scale 3D concrete printers with locally available cementitious materials supplied by standard ready-mix concrete trucks and/or by on-site mixing, and selected an innovative two-step assembly and manufacturing process to reduce assembly time and crane costs by manufacturing and assembling the towers in sections. The team is still analyzing alternative forms of reinforcement, such as random fibers and meshes, that have the potential to reduce the cost and

material usage for turbine towers, as well as to increase the production rate by further reducing the manual labor needed for reinforcement. Current activities are focused on testing ultra-high-strength 3D printing concrete specimens and performing large-scale printing of tower segments.

Project Name: EPC-17-024 - Electric Access System Enhancement (EASE)

Recipient/Contractor: Southern California Edison

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/1/2019 to 12/31/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S17: Provide Federal Cost Share for Technology Demonstration and Deployment Awards.

Issue:

The current trend of rapid solar PV adoption requires a host of grid modernization efforts to manage the substantial progress SCE envisions in decarbonizing the electricity provided on the grid. The existing paradigm for integration of renewables is based around legacy enterprise control solutions and a relatively static distribution planning approach. Dynamic visualization of capacity, automation of the interconnection process, and self-discovery of new devices into distributed control subsystems as part of a hierarchical control paradigm are required to achieve scalable integration of distributed energy resources (DER) in excess of 50 percent of peak load.

Project Description:

Distributed control capabilities will enable distributed intelligence and control capability to support fast, automated decisions and improve overall resiliency of the system. This project implements a plug and play concept to facilitate service discovery from PV and batteries both under direct control and being controlled via aggregator to streamline all interconnection types and rationalize multiple systems and processes. In addition, the project explores and demonstrates distributing the existing enterprise functions, i.e. state estimation and optimization, out on the distribution system and to the edge, where necessary and desirable to securely operate the system closer to limits. This project is a federal cost share project to SCE's EASE project under U.S. DOE's ENERGISE program.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will form an architecture and cooperative framework enabling a "system of systems" approach that streamlines the integration of DERs from planning to operations and enables cross optimization between different participants (IOU, third-party DER owners, CAISO) to allow exchange of services and improved use of assets.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed> Smart grid: R.08-12-009 <closed> Distribution Resources Plans (AB 327): R.14-08-013 Distribution Level Interconnection (Rule 21): R.11-09-011 <closed> Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1d, 1g, 1h, 1i, 3f, 3h, 5b

Lower Costs: The primary mechanism through which this project will benefit investor-owned utility ratepayers is through lower costs associated with streamlining the DER interconnection process and DER integration with utility control systems.

Greater Reliability: This project will streamline the DER interconnection process and the DER integration with utility control systems, and may also facilitate the integration of microgrids.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$75,160

EPIC Funds Encumbered:

$2,000,000

EPIC Funds Spent:

$0

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

United States Department of Energy: $4,188,000

Southern California Edison: $4,000,000

Leveraged Funds:

$8,188,000

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

43 bidders

Rank of Selected Applicant/ Bidder:

N/A

If not the highest scoring applicant/bidder, explain why selected:

The federal cost share solicitation was on-going and funds were awarded to passing proposals on a first-come, first-served basis.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-024 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

As of December 2020, SCE and subcontractor KITU Systems have begun efforts to acquire customers for the EASE pilot program. The SCE research team has completed the final use cases for the system, hardware-in-loop testing of the DER provision service, and a cybersecurity report that assesses how to securely integrate third party aggregators with SCE's utility interface.

Project Name: EPC-17-025 - TradePro Connect Product and Service Procurement Project

Recipient/Contractor: Cohen Ventures, Inc. dba Energy Solutions

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 3/22/2018 to 1/31/2022

Program Area and Strategic Objective:

Market Facilitation

S19: Facilitate Inclusion of Emerging Clean Energy Technologies into Large-Scale Procurement Processes.

Issue:

When considering a DER or energy efficiency project, many institutional and residential customers do not have the tools to find the best prices, products, and service providers. Additionally, service providers often face significant complexities for customer purchasing, bidding, and training required to participate in utility programs which would lower project costs.

Project Description:

This project is creating TradePro Connect - an online platform that provides a marketplace that facilitates tailored connections between customers and service providers. It empowers customers to find qualified contractors serving their area; request, evaluate and select bids; and schedule services. Contractors enrolled in the platform will gain access to new work opportunities, an ability to represent their certifications and training, and membership in an exclusive clean energy Group Purchasing Organization. The project aims to enroll a minimum of 100 contractor organizations on the platform, directing at least 30 jobs to small, disabled veteran, minority, LGBT and/or women business enterprises; as well as implement at least 50 projects during the project period. TradePro Connect is being demonstrated by facilitating projects for the SOMAH and SCE Auto DR programs as well as service-territory-agnostic On-Bill Financing (OBF) functionality.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

By streamlining the customer's buying experience, working with the supply-chain to stock and promote best-in-class products, and ensuring proper design, installation, commissioning, operation and maintenance, the project reduces the cost and risk of DER technology procurement which increases adoption. This leads to lower energy use and GHG emissions and also facilitates compliance with SB 350's Responsible Contractor Policy.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1c, 3b

Lower Costs: TradePro Connect will result in lower DER product costs from suppliers because, apart from a few large firms, contractors and engineers do not receive volume pricing from suppliers. Through TradePro Connect, when service providers participate in the group purchasing organization (GPO), service providers have access to products at costs comparable to volume pricing from suppliers. These savings are then passed down to the customer when a project is performed. Separately, when customers purchase or implement demand side management measures facilitated by this platform, such as smart thermostats and Auto DR services, customers save money by participating in demand response programs.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$159,260

EPIC Funds Encumbered:

$991,110

EPIC Funds Spent:

$768,093

Match Partner and Funding Split:

ASWB Engineering: $10,000 (0.5 %)

Qmerit: $140,000 (7.1 %)

ProQure: $120,000 (6.0 %)

Ecometes: $180,000 (9.1 %)

Cohen Ventures, Inc. dba Energy Solutions: $544,084 (27.4 %)

Match Funding:

$994,084

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

15 out of 15 bidders

Rank of Selected Applicant/ Bidder:

Group 4: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-025 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

As of October 2020, 73 service providers have been onboarded onto the TradePro Connect platform, primarily servicing the CPUC's Solar on Multifamily Affordable Housing (SOMAH) program. The platform has facilitated 27 projects by working with SCE to offer customers free smart thermostats with optional Auto DR integration for additional savings. To get the offer, customers and service providers would have to use TradePro Connect to execute the project, after connecting to each other in TradePro Connect's online bid process. The Recipient will continue to demonstrate the platform by facilitating additional SOMAH projects and will also look for new opportunities to connect contractors and new utility and State agency clean energy programs to potential customers.

Project Name: EPC-17-026 - Accelerating the Adoption of EVs as DERs through Fleet Procurement

Recipient/Contractor: Lawrence Berkeley National Laboratory

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 4/16/2018 to 12/31/2021

Program Area and Strategic Objective:

Market Facilitation

S19: Facilitate Inclusion of Emerging Clean Energy Technologies into Large-Scale Procurement Processes.

Issue:

Corporate and government fleets across California operate hundreds of thousands of vehicles. Fleet managers face a wide range of uncertainties while considering a switch to an electric vehicle fleet. This stems from an overall lack of awareness and data on issues such as payback time from energy savings, fleet operating costs and whether EV technology, including advancements in range and smart charging, are adequate to meet fleet needs. These uncertainties create formidable barriers for fleet managers making purchasing decisions and inhibit market pull of EVs. This results in most fleet managers choosing to keep conventional vehicles, since they are the familiar choice.

Project Description:

The MyFleetBuy fleet procurement system developed in this project will mitigate uncertainties for fleet managers by providing clarity on cost savings offered by EVs and smart charging, and verifying the range viability of EVs. MyFleetBuy will leverage the sophisticated vehicle physics models underlying the LBNL-developed MyGreenCar technology, analyzing individual fleet vehicle duty cycles and translating the analysis into easy-to-understand graphics. MyFleetBuy will provide fleet managers with a low cost, highly scalable data collection and analytics system with which to compare their options when investing in new vehicles. The platform will accelerate fleet procurement of EVs by raising awareness of options while mitigating the uncertainties that limit their adoption in fleets.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

MyFleetBuy will raise fleet managers' awareness of EVs while mitigating the risks and uncertainties that inhibit their adoption of EVs. MyFleetBuy will (1) collect high-resolution data on individual fleet vehicles, including driving distances, traffic, terrain, driving style, and more, using low-cost data loggers; (2) analyze these data with sophisticated vehicle physics models; and (3) provide fleet managers with a decision-support tool to compare fuel costs of conventional, hybrid, or EVs; compare overall operating costs for all vehicles; and, calculate the difference in costs of uncontrolled vs. smart charging for EVs.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Alternative Fueled Vehicles: R.13-11-007 <Closed>

Applicable Metrics: CPUC Metrics- 3a, 4a, 5b

Lower Costs: By encouraging fleet procurement of EVs with smart charging, fleet entities will minimize expensive demand charges and maximize charging during periods where time-of-use rates are lower. The operating costs for fleet entities will also be substantially lower given that typical EV fueling costs are 1/4 to 1/2 of comparable conventional cars. With increasing EV adoption, costs can be lowered for ratepayers overall, as EVs can substantially broaden the base of electric ratepayers that support recovery of the fixed costs of maintaining reliability of utility distribution systems.

Greater Reliability: MyFleetBuy will show fleet managers how smart chargers can save them money, leading to greater penetration of smart chargers instead of uncontrolled chargers. The shift toward EVs with smart charging will help to mitigate excessive demands at fleet charging hubs, thereby avoiding local grid faults, transformer overloading, and excessive voltage deviations.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$115,875

EPIC Funds Encumbered:

$1,000,000

EPIC Funds Spent:

$1,000,000

Match Partner and Funding Split:

County of Alameda: $164,398 (5.9 %)

Caltrans: $1,342,440 (48.3 %)

City of Oakland Bureau of Infrastructure and Operations: $272,880 (9.8 %)

Match Funding:

$1,779,718

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

15 out of 15 bidders

Rank of Selected Applicant/ Bidder:

Group 4: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-026 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, the recipient made significant progress on market discovery, customer development, and securing market traction for MyFleetBuy (MFB).The MFB software has been tested with fleet telematics data from pilot fleets from Alameda County and Caltrans. Feedback from the pilot fleets and entities engaged during the sales-outreach process was used to develop an understanding of how MFB caters to customer demands, and how the product must evolve to meet customer demand. The MFB team also concluded a case study where they were contracted to assess municipal fleet electrification for the City of Fremont. Using the MFB software, the team identified a pathway to electrify 159 of the city's current vehicles. These EVs would result in $3,000,000 of reduced operating expenditures and 54 percent reductions over the life of these vehicles. In 2021 the recipient plans to continue business development to secure contracts and partnerships to scale MFB to government and commercial fleets.

Project Name: EPC-17-027 - The Distributional Electricity Impacts of Climate Change on California's Residential Communities

Recipient/Contractor: The Regents of the University of California, Berkeley Campus

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/3/2018 to 6/30/2020

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.

Issue:

California is a leader in addressing climate change and is aggressive in its policies to reduce greenhouse gases as well as local pollutants. While many have studied the national or statewide impacts of climate change, no rigorous analytics have been done to identify how different communities are affected by climate change using empirically calibrated dose response functions at the community (ZIP code or census tract) level. Communities will not be affected uniformly; damages will vary by community as a result of climatic conditions, income levels, and population density.

Project Description:

This project studied the impacts of rising temperatures on electricity demand and the related emissions of pollutants from current generation stations. On the demand side, the researchers created an empirically calibrated statistical model using household level data to estimate household response of electricity demand to temperature. On the supply side, the study estimated the implications of the increased intensity and frequency of extreme heat events from climate change on peak demand and concentrations of criteria air pollutants in the absence of policy intervention or technology change. These changes in peak demand and air quality were then compared between disadvantaged and non-disadvantaged communities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project generated new and precise estimates of the forecasted damages to California's residential communities due to climate change. This created a scenario in the absence of additional standards and policies (such as additional emissions abatement requirements) and hence created a baseline for calculating their value. These two approaches provide the most comprehensive analysis of the potential impact of climate change on California's residential communities and particularly on disadvantaged communities.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Strategies and Guidance for Climate Change Adaptation: R.18-04-019

Applicable Metrics: CPUC Metrics- 2a

Lower Costs: This project could lower costs by forecasting the changes to electricity demand because of climate change so that IOUs, CAISO, and CPUC can plan a more efficient, effective, resilient, and low-cost electricity system with less environmental impact.

Public Health: This project modeled the future ambient concentrations of air pollutants associated with peak electricity demand under climate change. These pollutants have public health consequences, which were beyond the scope of this project. However, this study generated the stressor data on pollutants that could be the foundation for a study of the public health impacts and social costs.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$36,240

EPIC Funds Encumbered:

$200,000

EPIC Funds Spent:

$188,940

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 29 bidders

Rank of Selected Applicant/ Bidder:

Group 4b: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-027 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project was completed in 2020 and the final report is in the final revision stage. Disadvantaged communities, as defined by SB 535, are projected to see larger percentage increases in electricity consumption and smaller decreases in natural gas consumption than their non-SB 535 counterparts. Disadvantaged communities experience twice the increase in ambient concentrations of NOx, SO2, and particulate matter compared to non-disadvantaged communities. However, increases in ambient concentrations from a 20 percent increase in demand are extremely small.

Project Name: EPC-17-028 - High Resolution Source Importance Mapping to Minimize Impacts of Waste Biomass Distributed Generation on Ozone Air Quality in Disadvantaged Communities in the San Joaquin Valley

Recipient/Contractor: DOE- Lawrence Berkeley National Laboratory

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/1/2018 to 3/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.

Issue:

To reach California's energy goals, distributed bioenergy generation could play an important role. A recent study showed that bioenergy production at its full potential under currently permitted technologies could exacerbate ozone air pollution in the San Joaquin Valley, where many disadvantaged communities are located. A variety of factors may influence air pollution impacts on disadvantaged communities. Therefore, it is necessary to develop new tools to quantify these impacts and to develop mitigation strategies.

Project Description:

This research includes high-resolution mapping of local and regional sources that influence ozone pollution in disadvantaged communities and non-attainment areas in the San Joaquin Valley across diverse weather conditions. The researchers will use a 3-D chemical transport modeling system in a number of simulations to determine location-dependent emission limits for bioenergy distributed generation deployment needed to protect the public health of disadvantaged communities and meet federal ozone standards. A decision support model will be developed to aid planners in siting distributed bioenergy generation and mitigating associated impacts.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This study maps both local and upwind emission sources that contribute to ozone air pollution in disadvantaged communities (DAC) and uses the source importance mapping to develop site-specific ozone mitigation strategies.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 2a, 4b

Environmental Benefits: The results from this project provide valuable new information for stakeholders regarding the greatest opportunities for efficient and cost-effective minimization of the air quality impacts from biomass distributed generation.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$89,052

EPIC Funds Encumbered:

$200,000

EPIC Funds Spent:

$200,000

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 29 bidders

Rank of Selected Applicant/ Bidder:

Group 4a: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-028 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The researchers have developed the modeling protocol and are conducting modeling simulations and assessing ozone impact metrics. That task has been completed and a report on the modeling simulations was submitted. The researchers are currently identifying impact risks by running simulations based upon populations in disadvantage communities in the San Joaquin Valley, and areas with ozone levels that exceed air quality standards. The research team continues to work on modeling and analysis to understand heterogeneity in the sources based upon meteorology, precursor emissions, and impact metrics. Due to the pandemic, this project is behind schedule and is requesting a one-year no cost time extension until March 2022.

Project Name: EPC-17-029 - Lowering Costs of Underwater Biological Surveys to Inform Offshore Renewable Energy

Recipient/Contractor: Cal Poly Corporation

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/21/2018 to 7/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.

Issue:

As California explores opportunities to develop offshore renewable energy capacity, there will be a growing need for pre-construction biological surveys and post-construction monitoring in the challenging marine environment. Underwater video is a powerful tool to facilitate such surveys, but the interpretation of the imagery is costly and time-consuming. Emerging technologies have greatly improved automated analysis of underwater video, but these technologies are not yet accurate or accessible enough for widespread adoption in the scientific community or industries that might benefit from these tools.

Project Description:

This agreement funded a core team of scientists, students, and staff from computer science and marine biology to develop DeepSeaAnnotations.com, a free and open-source, web-based software. The team performed three main development tasks that will lead to open-source artificial intelligence classification capabilities: 1) "intelligent" video/image annotation tools to streamline annotation/classification workflows; 2) custom convolutional neural network training using an iterative training process to improve the accuracy of the prediction model; and 3) the annotation software, workflow, and tools on the cloud to provide widespread adoption and customization capabilities for the broader scientific and consulting community. Using this tool, undergraduate marine biology students interpreted 50 hours of high-resolution, benthic survey video provided by the Monterey Bay Aquarium Research Institute, resulting in more than 40,000 annotations of more than 100 classifications of deep-sea, benthic species. These data were then used to annotate new videos for five environmentally important species and assess the accuracy.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project provides advanced tools to scientists to facilitate the efficient collection of higher quality data that will provide regulators, decision makers, and the public with greater scientific certainty regarding the impact of marine renewable energy on California's marine ecological resources. Reducing the regulatory uncertainty of marine renewable energy production will provide decision makers with better information about impacts of offshore renewables as

California seeks to achieve its Renewables Portfolio Standard (60 percent renewable electricity by 2030) and the 100 percent renewable and zero-carbon electricity goal established in Senate Bill 100.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 2a, 4f

Lower Costs: This project will lower costs by automating costly and time-consuming tasks in marine biological surveys associated with the planning and permitting of offshore renewable energy facilities.

Environmental Benefits: This project will provide regulatory agencies, decision makers, and stakeholders with higher-quality, lower-cost data on marine ecosystems and the potential impact of offshore renewable energy technologies (including wind and wave energy technologies) on those ecosystems.

Consumer Appeal: Reducing the scientific uncertainty in the assessment of marine ecosystems and potential impacts will be important to gaining stakeholder acceptance of offshore renewable energy deployment.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$29,057

EPIC Funds Encumbered:

$199,978

EPIC Funds Spent:

$199,478

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 29 bidders

Rank of Selected Applicant/ Bidder:

Group 4b: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-029 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project was completed in 2020 and the final report is available online. The team completed the development of the video annotation software and the machine learning portion of the project to automate the identification of target species in the video. Students annotated underwater video from the Monterey Bay Aquarium Research Institute. The technology developed for this project is a proof of concept and achieved acceptable accuracy for several species. Additional work is needed before this tool can be used for large-scale implementation of automated classification of deep-sea organisms. Computer science students gained real-world experience coding the software, while marine biology students learned to identify species in the underwater video. The approach could be extended in the future for other applications, such as marine or terrestrial birds and bats.

Project Name: EPC-17-030 - California Opportunities for Procurement to Accelerate Clean Energy (Cal-OP ACE)

Recipient/Contractor: Prospect Silicon Valley

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 4/2/2018 to 3/31/2023

Program Area and Strategic Objective:

Market Facilitation

S19: Facilitate Inclusion of Emerging Clean Energy Technologies into Large-Scale Procurement Processes.

Issue:

More distributed energy resource (DER) solutions must be deployed and adopted to meet California's energy policy goals of reducing GHG and doubling energy efficiency. Scaling DER solutions can simultaneously help buyers and sellers, but there are barriers in connecting the two parties. Large institutional customers typically purchase equipment through formal procurement processes not suited to the culture and resources of clean energy ventures. For DER technology companies to sell into institutional and commercial markets, they must navigate complicated institutional procurement processes, and procurement customers must overcome structural inertia to adopt new DER technologies.

Project Description:

This project will establish a new incubator program specifically geared towards bridging the gap between California clean energy companies and institutional/commercial customers that rely on formal procurement processes to purchase DER solutions and packages. The project will provide and coordinate key services, assistance, and resources needed to bridge the gap between emerging energy technology solutions and large-scale procurement processes. Cal-OP ACE will provide support to clean energy ventures navigating and competing in institutional energy procurement processes, while providing guidance to customers updating and streamlining their procurement processes for advanced DER technologies. Cal-OP ACE will be responsible for facilitating information sharing so clean energy ventures are aware of market opportunities provided by institutional customers; and institutional customers are aware of new DER technology features that can address their critical needs.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The need for connecting DERs to Integrated Demand Side Management (IDSM) strategies has been well-established in the following state policy contexts: 1) California energy code (Title 24) requirements for building controls and demand response (DR) capabilities; 2) AB 802 requirements for utilities to shift to Normalized Metered Energy Consumption (NMEC) to inform more rigorous utility pay for performance efficiency programs; 3) SB 350 doubling energy

efficiency targets and rolling out a responsible contractor policy to ensure proper installation and commissioning of DERs; and 4) AB 793 energy management technology requirements.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integration of Distributed Energy Resources (IDER): R. 14-10-003 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 1c, 1f, 2a, 3e

Lower Costs: Cal-OP ACE will reduce costs in many ways, including but not limited to: leveraging purchasing power of institutional buyers, enabling peak demand reductions and energy and water savings from more efficient products, providing demand charge mitigation and DR opportunities from connected buildings and battery storage, and reducing maintenance costs from better equipment warranties and proper commissioning.

Consumer Appeal: By focusing on enhanced product effectiveness, clear performance standards and certifications, strong warranties, interoperability, and robust verifiable savings, the Cal-Op initiative will help increase DER awareness and adoption in the broader consumer marketplace as well as among large institutional buyers.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$128,875

EPIC Funds Encumbered:

$3,998,715

EPIC Funds Spent:

$2,012,881

Match Partner and Funding Split:

Prospect Silicon Valley: $51,550 (1.0 %)

Energy Solutions International: $700,000 (13.4 %)

Lawrence Berkeley National Laboratory: $150,000 (2.9 %)

TerraVerde: $100,000 (1.9 %)

Ecomedes: $141,000 (2.7 %)

California State University - Office of the Chancellor: $101,900 (1.9 %)

Match Funding:

$1,244,450

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

15 out of 15 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-030 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, this project has aligned Empower Procurement team members to design and launch 6 Procurement Initiatives (PI) that guide efforts to streamline the adoption of DER technologies: E-Fleet, Benchmarking, Contracts, Practices, Products, and Services. With the use of common tools like custom-designed assessments, a common digital dashboard for project management, and a work plan for each PI, all six initiatives are currently underway with California institutions. In 2021, the project team will focus on enrolling more institutions to participate in the PIs, with the objective of gathering a robust and diverse data set of insights to address the scalability of these PIs.

Project Name: EPC-17-031 - Port of Long Beach Microgrid - Resilience for Critical Facilities

Recipient/Contractor: City of Long Beach, Harbor Department (Port of Long Beach)

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 4/23/2018 to 3/31/2023

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S14: Take Microgrids to the Next Level: Maximize the Value to Customers.

Issue:

The Port of Long Beach is implementing a zero-emissions future and the Port-wide electrical load is expected to quadruple. Without energy management, the difference between base load and peak load will widen and strain the utility grid. Increased reliance on electricity adds risk to marine terminal operations with electricity cost price uncertainty. In addition, a single point of failure, such as a grid outage, could result in millions of dollars per day of damage to the economy and leave the Port's Joint Command and Control Center (JCCC) emergency response facility reliant on diesel generated emergency electrical power.

Project Description:

This project will create a microgrid at the Port's critical response facility, the JCCC. Key features include photovoltaic energy production, stationary battery energy storage, mobile battery energy storage, and a microgrid controller. Both batteries will provide grid services, such as demand response and peak shaving, during regular operation of the utility grid. During wide-spread outages or emergencies, the microgrid will support the JCCC, which coordinates response to emergencies. The mobile battery will act to extend the microgrid as a zero-emission generator that can be deployed where needed, such as stormwater pump stations and refrigerated container yards.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project has several innovations, including the ability to allow for direct DC transfer of energy from the PV system to the battery, significantly improving the efficiency of the stored energy, and testing charge and discharge strategies for the mobile battery to support load reduction during normal operations and providing support power to various distributed critical loads in an emergency.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Distribution Resources Plans (AB 327): R.14-08-013

Applicable Metrics: CPUC Metrics- 1b, 1c, 1h, 4a, 5b

Lower Costs: The Port microgrid will reduce load during normal operations, which will lower the Port energy costs. Smart load management reduces demand on the utility grid, specifically of peak power, which provides important but high-cost electricity. This microgrid installation will also integrate new solar PV capacity, reducing the net demand on the Southern California Edison (SCE) system. These two factors will lower costs to the Port by reducing expensive peak power needs and to SCE ratepayers by increasing the longevity of existing grid infrastructure through the production of onsite power.

Greater Reliability: The Port microgrid will add stationary energy storage and demand response capabilities, allowing the Port JCCC to respond to utility signals and reduce demand during peak periods. Strategic load shaving in response to utility signals improves the reliability of utility grid services, particularly during times of peak demand.

Energy Security: The Port microgrid will provide important ride-through capabilities during a power outage, allowing the Port JCCC to maintain uninterrupted operations as the microgrid switches to islanded mode. Additionally, the solar PV system mitigates against fuel supply risk in an emergency, allowing for long-term all-renewable operations.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$95,909

EPIC Funds Encumbered:

$5,000,000

EPIC Funds Spent:

$116,951

Match Partner and Funding Split:

National Renewable Energy Laboratory: $240,000 (3.4 %)

Electric Power Research Institute, Inc.: $80,000 (1.1 %)

Advanced Power and Energy Program (APEP) - University of California, Irvine: $80,000 (1.1 %)

City of Long Beach, Harbor Department (Port of Long Beach): $1,120,000 (15.7 %)

Schneider Electric Buildings Americas, Inc.: $550,000 (7.7 %)

South Orange County Community College District: $50,000 (0.7 %)

Match Funding:

$2,120,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

54 out of 60 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-031 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The microgrid design is near complete. Final design iterations are addressing grid interconnection requirements and site constraints for installing the solar array. Two of the energy storage battery banks have been assembled. A workforce development study has begun that will identify the workforce needs for supporting a microgrid. The outputs of the study will be used by a community college to develop microgrid training packages. Initial cyber-security development work has explored various system configurations to address operational user needs, real-time system communication requirements, and protective features.

Project Name: EPC-17-032 - Miramar Microgrid - Flight Line Resilience through Landfill Gas and Energy Storage

Recipient/Contractor: The Regents of the University of California, on behalf of the San Diego campus

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 4/23/2018 to 1/31/2023

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S14: Take Microgrids to the Next Level: Maximize the Value to Customers.

Issue:

Miramar Marine Base is a critical military facility that requires energy reliability and resiliency for mission critical operations. The Base's availability of intermittent bio gas generators can meet the electrical demand. However, the generators can be interrupted with the inconsistent flow of landfill bio gas. When this happens, the electrical power is switched to natural gas generators that can take considerable starting time to fully power up the Base and impact the Base's ability to reduce fossil fuel use. The microgrid and storage batteries envisioned by Base operations will help mitigate this issue while also increasing energy reliability and resiliency.

Project Description:

This project will demonstrate a microgrid at Marine Corps Air Station Miramar. It will incorporate distributed energy resources including: bio gas generators, solar PV, battery energy storage, and electric vehicles. When operational, the microgrid will help maintain critical flight line facilities during grid outages and facilitate higher renewable generation from landfill gas (LFG) generators.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is incorporating a large scale battery storage system, as well as advanced demand response controls, into a very complex microgrid with a heavy penetration of renewables and over 100 buildings worth of load. Energy storage will allow the microgrid to incorporate higher penetrations of renewable landfill power in island mode, while mitigating demand charges in economic mode, saving money for the Base. This project will address critical challenges associated with instantaneous power loss from the bio gas generators by using microgrid controlled distributed energy resources. Furthermore, project findings will be relevant to landfill gas generation facilities, wastewater treatment plants with biogas generation, as well as hospitals, ports, and military bases.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Alternative Fueled Vehicles: R.13-11-007 <Closed> Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 2a, 3h, 4b, 5a

Lower Costs: The battery energy storage system will reduce utility peak load and demand charges, which will help the Base reduce overall energy costs. This will also result in less reliance on the utility grid during peak periods and during LFG outages. This will allow the utility to defer infrastructure upgrades including distribution systems and peak generation plants.

Greater Reliability: The microgrid will be able to shift net load to participate in time-based demand response programs and improve regional transmission constraints.

Public Health: The microgrid will reduce the use of the 1.8 MW diesel generator on the Base, which will reduce emissions for the Base population. The reduction in grid congestion will help the local utility reduce reliance on peaker plants, which also reduces local air pollution.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$425,962

EPIC Funds Encumbered:

$5,000,000

EPIC Funds Spent:

$106,807

Match Partner and Funding Split:

Marine Corps Air Station Miramar: $6,002,320 (54.6 %)

Match Funding:

$6,002,320

Leverage Contributors:

U.S. Department of Defense: $20,000,000

Leveraged Funds:

$20,000,000

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

54 out of 60 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-032 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, the project team brought the battery energy storage system (BESS) design to 90 percent completion. Seven modes of operation of the BESS were defined and the implementation into the microgrid controller was laid out. The project team also compiled a measurement and verification plan for demand limiting of building energy use and implemented demand limiting functionality into the Miramar's building energy management system. Additionally, during the heat storm events that occurred in August and September 2020 where the overall California Grid was stressed, the Miramar Microgrid was able to island from the local grid and provide a load reductions of approximately three megawatts.

Project Name: EPC-17-033 - Building on the Cal-Adapt Platform to Deliver Actionable Information in Support of Electricity Sector Resilience

Recipient/Contractor: The Regents of the University of California, Berkeley Campus

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 4/20/2018 to 3/31/2022

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.

Issue:

Electricity sector operations, risk management, and planning require best-available and peer-reviewed data on projected climate and weather-related parameters to maintain safe, efficient, and reliable energy. California's energy infrastructure, including power generation facilities and transmission lines, is vulnerable to climate-related risks and extreme weather events that may differ significantly from historical records due to a changing climate. Understanding projected climate-related risks that may cause disruption and energy vulnerability is critical to energy sector resilience and planning.

Project Description:

This project builds on the Cal-Adapt platform to provide enhanced tools, data services, and visualizations that leverage existing web infrastructure and features to improve usability to energy sector stakeholders. The research team will collaborate closely with the Energy Commission and energy stakeholders, including IOUs and the California Independent System Operator, to build on Cal-Adapt, developing enhanced targeted visualizations and tools that allow for improved decision support that leverages projections of parameters associated with climate-related risk. Priority tools will address sea level rise and wildfire. These new tools are being designed in close coordination with stakeholders, as the requirements of each organization necessitate tools that are specific to their application needs. Targeted visualization tools depict climate-related risks from a variety of stressors on electricity infrastructure, enabling improved planning for future reliability.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is providing needed actionable information to energy sector stakeholders regarding climate change consequences on electricity generation and distribution. California's energy system is facing, and will continue to contend with, a changing climate. Substantial changes in the climate are projected to occur within a timeframe that overlaps with the time horizons of a variety of electricity system planning decisions, such as siting of power generation facilities and

transmission lines. Regionally downscaled climate projections with high spatial resolution are valuable resources to better plan electricity and energy infrastructure developments, adaptations, and future siting.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Strategies and Guidance for Climate Change Adaptation: R.18-04-019

Applicable Metrics: CPUC Metrics- 3a, 5c

Greater Reliability: This project will improve electricity reliability by supporting electricity sector planning, management, and adaptation. These benefits are derived from enhanced Cal-Adapt visualization tools that allow integration of up-to-date, peer-reviewed scientific research pertaining to climate-related risk.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$172,916

EPIC Funds Encumbered:

$900,000

EPIC Funds Spent:

$491,038

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 29 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-033 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project has incorporated new hourly observed station data. This supports demand forecast calculations by enabling users to access a record of 39 stations across the state, each with an observation period of greater than 30 years (1973 to present). The Wildfire Tool has been enhanced to include adding monthly time steps and additional projected wildfire probability. This work was developed with input from Technical Advisory Committee members, from meetings with electricity IOUs, from users via webinars, and support from volunteer beta-testers. The research also took steps to develop an Enhanced Sea Level Rise Tool and updated the Stakeholder Engagement Plan, which allow the team to better track progress related to engagement activities.

Project Name: EPC-17-034 - California Energy Product Evaluation Hub

Recipient/Contractor: The Regents of the University of California, Davis-Western Cooling Efficiency Center

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 4/23/2018 to 3/31/2023

Program Area and Strategic Objective:

Market Facilitation

S19: Facilitate Inclusion of Emerging Clean Energy Technologies into Large-Scale Procurement Processes.

Issue:

Large customers responsible for procurement contracting are often times overwhelmed by the many choices and uncertainties surrounding advanced distributed energy resource (DER) technologies. New technologies entering the marketplace often lack rigorous, real-world evaluations that prioritize customer needs, leaving customers without pertinent details required to make better, more informed purchase decisions. This can add significant time and costs to the procurement process and deter customers from pursuing advanced DER solutions.

Project Description:

This project will develop the California Energy Product Evaluation (Cal-EPE) Hub to conduct and disseminate evaluations of advanced DER products relevant to large commercial and institutional customers through a web-based buyer's guide. To accomplish this, the recipient will: (1) determine Cal-EPE Hub user (i.e. large commercial and institutional customers) needs; (2) develop a list of product categories to evaluate based on user needs; (3) develop evaluation guidelines and methodologies; (4) acquire (through purchase or donation) and evaluate products from product categories; and (5) develop a web-based Buyer's Guide, which will contain the results of product evaluations and related information and documentation.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The California Energy Product Evaluation (Cal-EPE) Hub will increase the adoption of advanced DER technology products in the marketplace by disseminating reliable and independent product evaluations to large commercial and institutional customers, through a web-based buyer's guide, which will help these customers more confidently select the DER technology they require with their procurement process.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integration of Distributed Energy Resources (IDER): R. 14-10-003 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Long-

Term Procurement Proceeding (LTPP): R.13-12-010 <Closed> Water-Energy Nexus: R.13-12-011 <Closed>

Applicable Metrics: CPUC Metrics- 1c, 1f, 1h, 2a, 3b, 3e, 3h, 4a

Lower Costs: The California Energy Product Evaluation (Cal-EPE) Hub will reduce vendor noise that can add significant time and cost to procurement of DER solutions.

Consumer Appeal: The California Energy Product Evaluation (Cal-EPE) Hub will increase consumer confidence that the DER technology solutions they are procuring are "best-in-class".

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$3,915,128

EPIC Funds Encumbered:

$10,993,646

EPIC Funds Spent:

$1,883,431

Match Partner and Funding Split:

Lawrence Berkeley National Laboratory: $675,000 (5.1 %)

Cohen Ventures, Inc. dba Energy Solutions: $420,000 (3.1 %)

Regents of the University of California, Berkeley (Center for the Built Environment): $120,000 (0.9 %)

Local Government Commission: $25,000 (0.2 %)

Collaborative for High Performance Schools: $25,000 (0.2 %)

Sheet Metal Workers 104 & Bay Area Industry Training Fund: $99,000 (0.7 %)

Western Cooling Efficiency Center - UC Davis: $983,629 (7.4 %)

Match Funding:

$2,347,629

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

15 out of 15 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-034 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

To date the recipient has determined the needs of advanced DER users, developed a list of product categories to evaluate, and developed evaluation processes to test selected products. The recipient prioritized the evaluation of products into three testing phases. Phase 1 evaluations include the follow product categories: electric space conditioning, plug load products, and building fenestration and windows. Phase 2 evaluations are expected to include the follow product categories: energy management and information systems, distributed photovoltaics and energy storage, lighting, electric space conditioning, and agricultural irrigation systems.

In 2020, Phase 1 testing began where possible, with some delays due to COVID-19. The Buyer's Guide website development continued and included preliminary Phase 1 data to mock-up product category sections.

In early 2021, the recipient will focus on completing Phase 2 test protocols and procedures, continue Phase 1, and start Phase 2 evaluations.

Project Name: EPC-17-035 - Building Healthier and More Energy-Efficient Communities in Fresno and the Central Valley

Recipient/Contractor: DOE- Lawrence Berkeley National Laboratory

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/1/2018 to 1/31/2022

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Fresno includes many disadvantaged communities with high unemployment and poor air quality, and its high pollution load contributes to adverse health outcomes. The disadvantaged communities in Fresno also suffer from lack of air conditioning or cannot afford to run air conditioning during hot summer months, which significantly impacts occupant health. At the same time, access to clean technology options (e.g. solar PV, major energy efficiency upgrades, battery-electric vehicles) is constrained in disadvantaged communities by many structural barriers.

Project Description:

This project develops a holistic community action plan to achieve climate benefits and air quality improvements through energy efficiency measures, electrification, and distributed energy resources in the residential building and light-duty and medium-duty transportation sectors in the City of Fresno. Field surveys and validation testing provide inputs on appropriate implementation strategies and selection of systems and technologies to overcome barriers associated with site characteristics and user responses. Researchers monitor energy use in typical households within disadvantaged communities to inform analysis of energy programs.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project provides state-of-the-art information and analyses on the impacts of prioritized and integrated energy efficiency, electrification, distributed energy resources, and battery electric vehicles in the Fresno area in relation to climate benefits and air quality improvements.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 2a, 4b

Public Health: The energy action plan developed by this agreement will provide the City of Fresno and other similar cities in California pathways to reduce energy costs to their residents and to improve air quality and public health.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$401,103

EPIC Funds Encumbered:

$1,100,000

EPIC Funds Spent:

$659,691

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 29 bidders

Rank of Selected Applicant/ Bidder:

Group 2b: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-035 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Due to the COVID-19 pandemic, in-home walk-throughs for collecting baseline equipment data and energy use information from residents in south Fresno has been replaced with remote data collection using phone interviews. In early 2020, the team completed a long-form survey which was approved by the Human Subjects Committee at LBNL. Five pilot interviews were conducted by Rising Sun - a community-based organization - and the long form survey was adjusted based on the responses from the pilot survey. The research team has also compiled building data from publicly available sources, and the neighborhood-scale City-BES modeling tool (CityBES.lbl.gov) has been updated to include building data for south Fresno neighborhoods of interest. Data includes building vintages and floor sizes for all residential buildings.

Project Name: EPC-17-038 - Camp Parks Army Microgrid - A Blueprint for Nested, Modular Design

Recipient/Contractor: DOE- Lawrence Berkeley National Laboratory

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 12/7/2018 to 3/30/2023

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S14: Take Microgrids to the Next Level: Maximize the Value to Customers.

Issue:

Military bases must ensure uninterrupted energy access, optimal use of energy resources, and building energy security and resilience to reduce vulnerability and risks. To maximize the use of bases, the military is moving toward multiple zoning with mixed military and commercial tenancy, collaborating with local communities to implement innovative, sustainable technology and business solutions. Enabling smaller microgrids nested within a larger microgrid would give the military the greatest flexibility and resilience.

Project Description:

The Parks Reserve Forces Training Area (PRFTA) microgrid project will produce a permanent, modular, nested design that maximizes renewables and is inherently secure, expandable, economically viable and efficient. The project will deliver a blueprint for incorporating multiple distributed energy resources (DER); a vendor-neutral microgrid control system; and a resilient nodal building block approach that supports grid-within-grid nesting. The project will also develop engineering guidelines and an easy-to-adapt "how-to" case tool for accelerated adoption and commercialization.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will demonstrate how a nested set of smaller microgrids within an overall base microgrid can be designed and operated to provide resilience on the base, while substantially reducing energy use and the need for multiple backup diesel generators. This approach can be transferrable to other military bases or similar commercial or academic campuses or local communities to improve resilience.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1h, 2a, 3h, 5a

Lower Costs: The base will be able to reduce electricity procurement by ~3,100 megawatt-hours (MWh) per year. The expected savings at PRFTA is ~$600,000 per year. Additionally,

ratepayer benefits from the installation of a 2 MW PV with 2 MW/4 MWh energy storage would enable the utility to defer up to 1 MW of distribution level upgrades at the local substation.

Environmental Benefits: The project will reduce GHG emissions by ~1,300 tons and the use of diesel generators as backup power.

Energy Security: It would ensure energy quality and reliability, and continuity of critical operations in islanded mode with renewable assets for the requisite 14 days.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$817,221

EPIC Funds Encumbered:

$5,000,000

EPIC Funds Spent:

$1,649,032

Match Partner and Funding Split:

Customized Energy Solutions: $30,000 (0.2 %)

Ultrasolar Technology: $287,900 (1.8 %)

U.S. Army: $11,093,000 (67.6 %)

Match Funding:

$11,410,900

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

54 out of 60 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-038 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, the project team completed detailed designs and specifications for ten integrated resilient nodes (IRNs) including IRN #1 that includes a 100 kW PV array and 400 kWh 4-hr battery energy storage system. Vendors have been selected for the CEC-funded IRN #1 and an RFP package has been prepared to acquire a vendor for the other Army-funded IRNs.

Project Name: EPC-17-039 - Validated, Transparent, and Accessible Microgrid Valuation and Optimization Tool (DER-VET)

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/11/2018 to 3/31/2023

Program Area and Strategic Objective:

Applied Research and Development

S7: Develop Advanced Distribution Modeling Tools for the Future Smart Grid.

Issue:

Microgrids have the potential to enhance grid reliability and resiliency, improve efficiency, increase utilization of grid assets, and allow greater penetration of renewable energy sources. Determining the economic case for microgrids is challenging, but with proper placement, design, and operation, there are opportunities to stack benefits to offset installation costs. Technical gaps exist in the present suite of tools used by grid planners and technology developers to design and analyze DER in utility grids and microgrids and were not designed to address the unique strengths and limitations of the wide range of DER and the increasing needs of grid resiliency and flexibility.

Project Description:

The Distributed Energy Resource Value Estimation Tool (DER-VET) is publicly available at www.der-vet.com as a modeling tool that provides a platform for the calculation and understanding of the value of energy storage, other distributed energy resources (DER), and microgrids based on their technical merits and constraints. DER-VET incorporates the full range of DER technologies into the analysis tool including energy storage, solar, wind, controllable load, electric vehicle (EV) charging, internal combustion engines, and combined heat and power in different configurations, including microgrids. DER-VET uses load and other data to determine the optimal size, duration, and technical characteristics for energy storage and/or solar systems to optimize reliability, resilience and economic objectives. DER-VET enables consistent technical and economic analysis to support DER and microgrid opportunity identification and design. This tool has the capability to assess a wide array of different microgrid use cases, technologies, and locations. To support this, it covers different microgrid ownership models, regulatory and market environments, topologies, and DER technologies.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The objectives of this project are focused on the development of (1) a powerful and user-friendly microgrid assessment tool, (2) a comprehensive microgrid analysis framework, and (3) a novel approach to microgrid location screening and selection to help streamline the deployment of microgrids across California. The tool will be useful to maximize potential benefits of microgrids to

end-customers (including disadvantaged communities), the distribution grid, and the bulk system. At the same time, it will reduce soft-costs of microgrid project development and enhance engineering capabilities by simplifying the techno-economic analysis of prospective microgrid projects.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Distribution Resources Plans (AB 327): R.14-08-013

Applicable Metrics: CPUC Metrics- 1b, 1c, 1f, 1h, 5b, 5f

Lower Costs: Currently, microgrid projects are being deployed based on ad hoc analysis across disparate approaches and tools. The implemented analysis framework and DER-VET itself give decision makers the tool set necessary to make informed and streamlined deployment decisions based on standardized guidelines. Rather than one-off analyses, the tool enables the informed deployment of microgrids throughout California and creates the potential for realizing a variety of benefits, both to the grid as well as to the customers, including the potential for additional revenue from customer and grid services such as demand response or ancillary service participation.

Greater Reliability: California ratepayers will also benefit from greater reliability. The tool evaluates how the microgrid systems could be used as potentially flexible resources, which utilities, through the appropriate programs and incentives, can use to support their objectives. The direct benefits of well-planned and operated microgrids include greater reliability through better integration of renewable sources and reduced or avoided outage times.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$479,496

EPIC Funds Encumbered:

$2,000,000

EPIC Funds Spent:

$1,460,069

Match Partner and Funding Split:

XENDEE: $186,778 (7.3 %)

Electric Power Research Institute, Inc.: $381,332 (14.8 %)

Match Funding:

$568,110

Leverage Contributors:

U.S. Department of Energy: $5,900,000

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 29 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-039 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In April 2020, the EPRI team released the beta version of DER-VET to the public for user testing and feedback. EPRI has captured and utilized the feedback received from a wide array of beta users to finalize the tool for the planned full release to the public in March 2021. Additionally throughout 2020, EPRI has actively validated the tool with live project case studies and actual data while presenting the validation results in a transparent and accessible forum through EPRI's Energy Storage Integration Council (ESIC) at (https://www.epri.com/pages/sa/epri-energy-storage-integration-council-esic).

Project Name: EPC-17-040 - Mass Deployment of Energy Efficiency Retrofits in Disadvantaged Communities

Recipient/Contractor: Rocky Mountain Institute

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/29/2018 to 3/31/2023

Program Area and Strategic Objective:

Applied Research and Development, Technology Demonstration and Deployment

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors., S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

The Net Zero Energy Coalition, an organization focused on accelerating market adoption of net-zero energy buildings and communities in North America, states in its 2017 Residential Zero Energy Inventory that only 5,279 new single and multifamily units in California are currently operating at ZNE performance or zero energy ready. This represents a very small portion of the existing building stock of nearly 13 million units per the 2017 US Census. To achieve the state's zero carbon goals especially for multifamily buildings by 2030, research is needed to identify opportunities to drive down retrofit costs, energy costs and carbon emissions.

Project Description:

This project develops and demonstrates standardized energy efficiency retrofit packages, specifically geared towards the low-income multifamily housing market, and that can be scaled to drive down costs. As part of the agreement, the recipient will develop a business model for these packages to overcome financing challenges.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Significant improvements in speed and cost reductions of retrofit packages are critical to realizing mass-scale deployment of retrofits. Even when pairing grants from the State's Low-Income Weatherization Program (LIWP) for multifamily buildings, it is rare that those retrofit projects alone can achieve ZNE. The key to bringing costs down and construction speeds up is to simultaneously address the technical and business model barriers that exist in the market. Some of the innovative approaches to be considered include: modularized, pre-fabricated, pre-insulated building enclosures; packaged multi-function heat pumps for heating and cooling; energy recovery ventilation; advanced heat pump water heaters; and behavior modification technologies and strategies. These approaches hope to speed up implementation, bring down retrofit costs, and integrate them into programs, such as LIWP.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Demand Response (DR): R.13-09-011 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 2a, 3a, 3b, 3f

Lower Costs: One out of every three low-income families report facing challenges in paying their energy bills, which could include forgoing purchasing food or keeping their apartments at unsafe temperatures. This project could result in the potential for a fixed energy expenditure and allow for potential cost savings to building owners as the cost of retrofit solutions come down due to mass scaling. There is also potential for tenants to financially benefit from taking part in additional revenue streams such as demand response programs.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$1,555,647

EPIC Funds Encumbered:

$7,204,308

EPIC Funds Spent:

$1,116,475

Match Partner and Funding Split:

Association for Energy Affordability: $6,499,062 (46.7 %)

City of San Francisco Department of Environment: $900 (0.0 %)

Stone Energy Associates: $700 (0.0 %)

Rocky Mountain Institute: $204,646 (1.5 %)

Match Funding:

$6,705,308

Leverage Contributors:

California Multifamily LIWP: $6,200,000

Leveraged Funds:

$6,200,000

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

18 out of 18 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-040 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, the research team identified 3 of the 4 sites that will be the location of the newly installed energy efficient retrofit measures. The team completed a summary of baseline and recommended measures for each site identified. All sites are multifamily housing that are located in a disadvantaged community. The team also completed a Building Characterization report of the different multifamily building types in California in order to target which building typography is best suited for the scalable retrofit approach. The team is finalizing a list of emerging technology selection matrix and retrofit scope of work plan with each site and project partners. In 2021, the goal is to start installing the measures at the sites and developing a market assessment of the technologies.

Project Name: EPC-17-041 - Lead Locally

Recipient/Contractor: Sonoma Clean Power Authority

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/1/2018 to 6/30/2022

Program Area and Strategic Objective:

Applied Research and Development, Technology Demonstration and Deployment

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors., S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

Substantial potential for efficiency improvements remains untapped in the existing building stock, but effective strategies that generate widespread consumer interest and adoption have yet to be implemented. The specific challenges of doubling efficiency by 2030 will depend on:

* Expanding adoption of energy efficiency upgrades that go beyond existing codes and standards.

* Advancements in technologies to increase performance and reduce equipment and labor costs.

* Innovative deployment and funding strategies, business models and private/public partnerships, and informed decision-making to spur mass adoption and scale-up.

Project Description:

This project is evaluating and demonstrating strategies to increase retrofits of existing buildings and includes the following elements: 1) identification and pilot testing of promising emerging efficiency technology packages for cost-effectiveness, feasibility, and customer acceptance; 2) development of an "Energy Marketplace" where consumers can directly procure technologies appropriate for their buildings. This will be combined with financing and rebates. The program targets those with little to no upfront capital and are the most difficult to reach. Training will be offered to contractors, realtors, and building officials with the goal of greatly increasing customer knowledge, decreasing code violations, and increasing penetration of energy efficiency measures outside the framework of utility programs.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project could increase market penetration for existing building retrofits and result in deeper savings per site using the existing program funding that Sonoma Clean Power and the investor-owned utilities will allocate in future years. The project anticipates providing a full range of options for customers--from whole building integrated retrofits to partial retrofits and traditional equipment upgrades, depending on the customer's interest, budget, and need. The high level estimated net present value of the project benefits is over $60M in 2030. Additional benefits

could be realized if fuel-switching strategies that are being evaluated as part of the applied research phase of the project meet cost-effectiveness, feasibility, and customer acceptance criteria and can be included in the Energy Marketplace.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h

Lower Costs: Lower costs could be achieved through a dual approach of directly reducing customer utility bills through installation of energy efficiency measures and decreasing implementation costs by providing training and direct customer access. This project goal is to deliver site electric savings of 10 percent for residential and 20 percent for commercial properties. The recipient is currently conducting installations of specific technologies.

Greater Reliability: Greater electricity reliability will be established through electricity savings, tailoring program measures to those that will best reduce peak kW usage and grid challenges in the Sonoma Clean Power service territory. Additionally, many of the strategies investigated in the applied research phase have the ability to integrate into the existing Sonoma Clean Power DR platform for additional grid reliability gains.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$4,687,705

EPIC Funds Encumbered:

$9,814,596

EPIC Funds Spent:

$5,304,856

Match Partner and Funding Split:

Sonoma Clean Power Authority: $3,335,500 (25.4 %)

Match Funding:

$3,335,500

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

18 out of 18 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-041 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The recipient has completed the installation of following technologies: (1) air-to-water heat pump space heating and cooling systems (10 sites), (2) phase change materials (five sites installed and four more sites underway), (3) advanced daylighting system (one site), (4) residential induction cooking (three sites), (5) aerosol envelope sealing (four sites), and Nightbreeze economizer ventilation (three sites). Additionally, the recipient has chosen 10 sites for demonstrating grid integrated hear pump water heaters. The renovations for the Advanced Energy Center have been delayed and the facility is expected to be ready for consumers by late December 2020. This project was featured at the 2019 ACEEE Hot Water Forum, and the CPUC-CEC Joint Agency Workshop on Building Decarbonization on 4/8/19. The official website of the program can be found at sonomacleanpower.org/lead-locally.

Project Name: EPC-17-042 - Camptonville Biomass-to-Energy Project

Recipient/Contractor: Camptonville Community Partnership, Inc

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 1/27/2020 to 3/31/2022

Program Area and Strategic Objective:

Technology Demonstration and Deployment

4.4 Improve the Value Proposition of Bioenergy

Issue:

California is experiencing unprecedented levels of tree die-off. Factors that are contributing to the die-off include several consecutive years of drought, warmer temperatures, and an infestation of bark beetles. The number of dead trees in California greatly exceeds the level expected for healthy forests, and this overabundance of forest fuel increases the risk of catastrophic wildfires that threaten property and lives. Bioenergy is captured as one solution to help manage forest biomass volumes; however, there is a need to demonstrate technologies that can economically convert biomass to electricity.

Project Description:

This agreement will fund the demonstration and deployment of a 5 MW net biomass power plant. The biomass facility will include advanced low-emissions technology to reduce NOx, CO and VOC emissions, and the facility will include a state-of-the art low water consumption condenser.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will address the goal of reducing wildfire threats by using dead and diseased trees and other forest byproducts removed from forest lands to fuel a 5 MW renewable energy power plant. The project will export 3 MW to the grid under the Bioenergy Market Adjustment Tariff (BioMAT) program with an additional 2 MW exported through other market channels. The power plant will integrate an advanced emissions controls and a state-of-the-art low water use condenser. The technologies that comprise the integrated system have all been successfully used at large scales but have not been demonstrated as an integrated system at a the relatively small scale planned for this project.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

SB 1122 Bioenergy feed-in tariff: R.18-07-003, R.11-05-005 <Closed> Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 1a, 1b, 1c, 2a

Greater Reliability: Power will be exported to PG&E, which will help increase grid reliability in rural regions near Camptonville and the surrounding foothill communities.

Increase Safety: By utilizing dead and diseased trees and forest byproducts, this project will reduce the risk of catastrophic wildfires, thereby mitigating threats to people and property.

Economic Development: The Camptonville project will create living-wage jobs in economically distressed Sierra Nevada communities by demonstrating a successful business model for biomass utilization. The Camptonville plant is estimated to create up to 27 full time new jobs. This employment increase is expected to cut the unemployment rate in the community by more than 50 percent (decrease from nearly 9 percent to about to 4 percent).

Environmental Benefits: The Camptonville project will generate power using advanced emissions controls that will keep NOx, CO, and VOC emissions well within air district limits. In addition, the project will use an advanced condenser for heat rejection that will significantly reduce water consumption.

Consumer Appeal: This project is a community-based initiative that has many supporters, including local community organizations and agencies, environmental organizations, regional timber operators, county and state government representatives and agencies, federal land management agencies, and several air quality management districts.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$110,031

EPIC Funds Encumbered:

$4,999,830

EPIC Funds Spent:

$123,894

Match Partner and Funding Split:

Phoenix Energy: $13,030,225 (72.3 %)

Match Funding:

$13,030,225

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-042 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The grant recipient Camptonville Community Partnership (CCP) held its second technical advisory committee meeting in September 2020. During the second TAC meeting, CCP and Designer Group USA (DGU) presented the preliminary design and engineering study for the biomass plant, and this study was used to prepare a request for proposals (RFP) to select a contractor. CCP received approval from TAC members to proceed with their technical plans. As of November 202, the project was on schedule, however, having financial challenges, e.g. needed to start investing in equipment to meet the Investment Tax Credit requirements, which could delay the project if not met.

Project Name: EPC-17-043 - GLOW: A User-friendly Interface for GridLAB-D

Recipient/Contractor: Hitachi America LTD

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/11/2018 to 3/31/2023

Program Area and Strategic Objective:

Applied Research and Development

S7: Develop Advanced Distribution Modeling Tools for the Future Smart Grid.

Issue:

GridLAB-D is an open-source electric system simulation tool developed by the U.S. Department of Energy. It is used by the electric power industry to support policy development and to address planning and operational needs, including simulating distributed energy resource impacts on the electric system. However, it has an antiquated user interface, which requires users to memorize command lines and build scripts in languages such as Python to enter data into the simulation tool. An intuitive interface would significantly improve the use of this powerful tool for power system simulation in California.

Project Description:

This project is developing GridLAB-D Open Workspace (GLOW), an intuitive interface for GridLAB-D that will provide a user-friendly environment for researchers, planners, developers, and regulators involved in advanced electric grid technology simulation and scenario analysis. The interface will simplify data input and simulations, enable visualization of complex information, and be scalable for big data simulations. GLOW will be a freely available and widely supported open-source tool based on existing GridLAB-D technology.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The technical advancement of the project is the development of an intuitive and widely available user interface for GridLAB-D, a software simulation tool for advanced distribution system simulation and analysis developed by the U.S. Department of Energy.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Distribution Resources Plans (AB 327): R.14-08-013

Applicable Metrics: CPUC Metrics- 3b, 3c, 5b

Lower Costs: Lower simulation and analysis costs will be achieved by developing a new, intuitive and convenient user interface, which will reduce the high costs of training due to the current, cumbersome and challenging interface of GridLAB-D. The improved interface will lower the barrier to widespread use.

Greater Reliability: Greater electricity reliability is achieved by improving distribution planning through grid simulation and analysis to determine impacts of distributed energy resources and controllable loads on distribution networks and substations. The development of a user interface will increase access to simulation and analysis results for advanced power system solutions by technology developers, researchers and public agencies.

Consumer Appeal: Consumer appeal is achieved by developing a user interface that is intuitive and more convenient to non-expert users. This will result in GridLAB-D becoming more widely adopted due to the increased ease of use and lower level of training required to perform simulations using a simple user interface.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$193,906

EPIC Funds Encumbered:

$2,999,699

EPIC Funds Spent:

$1,560,863

Match Partner and Funding Split:

Hitachi America LTD: $1,175,060 (27.6 %)

National Grid: $80,000 (1.9 %)

Match Funding:

$1,255,060

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 29 bidders

Rank of Selected Applicant/ Bidder:

Group 4: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-043 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, the GLOW team held two technical advisory committee (TAC) meetings. They showcased preliminary software and offered alpha testing to TAC members, including regulators, IOUs, and private vendors to help test use cases and request for additional functions as necessary. Alpha testing started in November and will plan to run updates with stakeholders until the end of 2021 when beta testing is released. GLOW is also offering periodic public seminars due to annual in-person workshop being canceled from the global pandemic.

Project Name: EPC-17-044 - Researching, Developing, Demonstrating the Commoditization of Building Energy Efficiency Retrofits in Southern California

Recipient/Contractor: InTech Energy, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/13/2018 to 3/31/2022

Program Area and Strategic Objective:

Applied Research and Development, Technology Demonstration and Deployment

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors., S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

Wide-scale energy efficiency retrofits lag behind technical and market potential. Utility programs are often difficult to participate in, and commercial customers lack the knowledge to understand how to plan for and finance a complex retrofit on their own. This leads to unrealized retrofit projects and energy waste and untapped economic benefits. Increased energy efficiency adoption depends on customer engagement and education, as well as cost effectiveness of the programs to get projects to customers.

Project Description:

The project had hoped to develop a web-based marketplace platform for connecting customers with energy service providers, technologies, and lenders; installing retrofits at a variety of commercial customer sites in southern California, evaluating the pay-for-performance concept. This includes financing components to offset customer costs, insurance markets to reduce perceived risk for lenders, and a sales-as-a-service marketplace where efficiency products and services are connected with sales professionals.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project had hoped to accelerate the adoption of market-driven, pay-for-performance retrofits at commercial customer sites by maximizing market potential using Sales-as-a-Service marketplace where customers, products and supporting services can connect with industry professionals. Through this marketplace, the recipient had hoped that the value of energy efficiency will be standardized and transparent, lowering cost and time to implement these technologies. The combination of these methods, along with new energy efficiency technologies in the demonstration sites, would showcase how cost-effective, energy-efficient solutions can be provided in a timely fashion.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h

Lower Costs: This project had hoped to lower energy costs for commercial customers.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$2,139,730

EPIC Funds Encumbered:

$7,199,315

EPIC Funds Spent:

$829,261

Match Partner and Funding Split:

InTech Energy, Inc.: $2,600,274 (26.5 %)

Match Funding:

$2,600,274

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

18 out of 18 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-044 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

This project is being mutually terminated because the project objectives are unlikely to be met.

Project Name: EPC-17-045 - Oak View Microgrid: Using Microgrid Technologies to Simultaneously Improve Quality of Life and Electric Grid Operations

Recipient/Contractor: The Regents of the University of California, Irvine Campus

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/16/2018 to 3/31/2022

Program Area and Strategic Objective:

Applied Research and Development

S7: Develop Advanced Distribution Modeling Tools for the Future Smart Grid.

Issue:

Disadvantaged communities suffer disproportionally from the environmental impacts of energy conversion. Microgrid technologies can reduce these impacts, helping combat poor air quality while also improving grid performance and resiliency. Currently, there are no standard methodologies for microgrid design that simultaneously consider air quality, grid reliability, and grid resiliency. In addition, there is a dearth of experience in designing microgrids while also improving building energy efficiency and retrofitting at a reasonable cost.

Project Description:

This project develops multiple urban energy scenarios in which multiple types of energy efficiency, electrification, and microgrid technologies are considered. The design approach uses integrated methods that simultaneously consider various technology and retrofit options, while also verifying that the proposed technology mixes accomplish the goals of improving air quality and grid operations. The work will result in the proposal of a microgrid design ready for implementation in the Oak View community and an extensible and robust design methodology that can be used throughout the state for economic and environmentally sensitive microgrid development.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is helping overcome challenges in integrating emerging and proven sustainable energy technologies with various end uses in the Oak View community, helping to facilitate the implementation of SB 535 and AB 1550 that require maximizing benefits from low-carbon technologies to disadvantaged communities. This study is assessing ways to reduce particulate matter, nitrogen oxides, and other indoor and outdoor air pollutants associated with appliances used in homes and with electricity generated and served to the subject community. The research team is using big data to develop decarbonization pathways for the community energy system that will include increased energy efficiency improvements within existing residential buildings, renewable energy generation and energy storage technologies, vehicle electrification, and electrification of natural gas appliances.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Streamlining Interconnection of Distributed Energy Resources and Improvements (Rule 21): R.17-07-007 Strategies and Guidance for Climate Change Adaptation: R.18-04-019

Applicable Metrics: CPUC Metrics- 1f, 1h, 2a, 4a, 4b

Lower Costs: The microgrid design is intended to decrease transmission and distribution losses and reduce the need for new transmission infrastructure, thereby lowering costs to ratepayers.

Greater Reliability: The microgrid design developed under this project is expected to serve the critical loads inside a community without interruption, provide ancillary services to the grid during normal operations, and provide black-start capability.

Public Health: The designed microgrid is expected to reduce greenhouse gas emissions and criteria pollutant emissions, leading to improved air quality and providing health benefits to communities.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$157,594

EPIC Funds Encumbered:

$1,099,760

EPIC Funds Spent:

$668,209

Match Partner and Funding Split:

National Renewable Energy Laboratory (NREL): $118,000 (8.0 %)

Altura Associates, Inc.: $20,000 (1.4 %)

County of Orange/City of Huntington Beach: $20,000 (1.4 %)

Advanced Power and Energy Program (APEP) - University of California, Irvine: $209,804 (14.3 %)

Match Funding:

$367,804

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 29 bidders

Rank of Selected Applicant/ Bidder:

Group 2a: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-045 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The team has completed the following: finalized the URBANopt community energy model and tested 100+ HVAC system configurations; improved modeling capabilities of URBANopt; developed baseline OpenDSS circuit model; developed post-processors reporting transformer and line overloads; improved energy efficiency and financial analysis tool and incorporated updated baselines; projected cost and environmental impacts of future technology; researched energy efficiency options related to building insulation and HVACs; developed emissions predictions based on CEC carbon emission projections; established a market model for person-to-person (P2P) auction trading; created a residential P2P trading framework and model to allow energy trade between residents with PV+; developed battery strategy to help P2P energy trade; corrected Oak View OpenDSS model to account for discovered underground infrastructure and incorporated dynamic PV and ESS systems; developed topology of new methods for islanding.

Project Name: EPC-17-046 - HiPAS GridLAB-D: A High-Performance Agent-based Simulation using GridLAB-D

Recipient/Contractor: SLAC National Accelerator Laboratory

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/11/2018 to 3/31/2023

Program Area and Strategic Objective:

Applied Research and Development

S7: Develop Advanced Distribution Modeling Tools for the Future Smart Grid.

Issue:

GridLAB-D is an open-source electric system simulation tool developed by the U.S. Department of Energy. It is used by the electric power industry to support policy development and to address planning and operational needs, including simulating distributed energy resource impacts on the electric system. However, GridLAB-D software does not take advantage of modern computing hardware (i.e., parallel processors). This results in extremely slow processing time for electric system simulations, increasing the time and cost of evaluating multiple scenarios, which is necessary for policy development and operational planning.

Project Description:

The High Performance Agent-Based Simulation (HiPAS) GridLAB-D project will increase the performance of the open-source version of GridLAB-D and improve the broad accessibility of high-performance power grid simulation capabilities to the community of smart grid and distribution simulation users in California. HiPAS includes methods that parallelize many of the iterative methods used in simulations. HiPAS is intended for both desktop multi-core processors and cloud platforms. It will enable GridLAB-D users to more efficiently analyze multiple scenarios with improved resolution by reducing the computational costs associated with analysis.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will achieve technology advancement and usability breakthroughs in the following performance areas: 1) Granular object-level parallelization of computations; 2) Large-scale parametric job control; 3) Sensitivity analysis; and 4) Monte Carlo analysis. These advancements will improve the accessibility and applicability of GridLAB-D to California utilities, government agencies, and researchers who are responsible for system policy, planning, operation and oversight in the presence of growing customer-based demand response and renewable energy resources.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Distribution Resources Plans (AB 327): R.14-08-013 Distribution Level Interconnection (Rule 21): R.11-09-011 <closed> Resource Adequacy (RA) 2016 and 2017 Compliance Years: R.14-10-010 <Closed> Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1a, 1b, 3a, 5b

Lower Costs: HiPAS GridLAB-D will address the primary barriers to analyzing more grid locations for distributed energy resource deployment, by reducing the computational costs associated with these kinds of analyses. This will reduce the cost for interconnection studies.

Greater Reliability: The HiPAS enhancements to GridLAB-D achieved through this project will increase utility analyst productivity in performing distributed energy resource integration studies by improving the accuracy and timeliness of results supporting interconnection and grid planning.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$1,149,270

EPIC Funds Encumbered:

$3,068,781

EPIC Funds Spent:

$2,384,292

Match Partner and Funding Split:

National Grid: $300,000 (8.9 %)

Match Funding:

$300,000

Leverage Contributors:

U.S. Department of Energy: $6,000,000

U.S. Department of Energy: $150,000

U.S. Department of Energy: $580,000

Leveraged Funds:

$6,730,000

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 29 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-046 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, the project team released alpha versions of HiPAS to coordinate with OpenFIDO and GLOW. The updates are under "beauharnois", which had 13 releases this year. HiPAS has integrated machine learning powerflow and the performance is currently being evaluated. There will be four use-cases developed for HiPAS: integrated capacity analysis, distribution system resilience analysis, tariff design, and end-use load electrification. Online documentation for HiPAS was deployed, including dynamic versioning from GitHub and direct support for tutorials.

Project Name: EPC-17-047 - OpenFIDO: An Open-source Framework for Integrated Data Operations

Recipient/Contractor: SLAC National Accelerator Laboratory

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 5/11/2018 to 3/31/2023

Program Area and Strategic Objective:

Applied Research and Development

S7: Develop Advanced Distribution Modeling Tools for the Future Smart Grid.

Issue:

Various tools are used in distribution planning. They come from a diverse number of suppliers and do not work within a single user framework to interact and share information. Utility planners and grid researchers need a tool and integration framework to quickly move data from one application to another as part of their engineering, planning, and review activities. Enabling the sharing of information across distribution planning tools will save time and money.

Project Description:

This project will develop OpenFIDO, an open source tool to transfer data between various programs that are part of the suite of tools used in by utilities, distributed energy resource (DER) engineers and regulators in California. The tool is an integration framework to quickly move data from one application to another as part of their engineering, planning, and review activities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Current grid simulation tools do not support the exchange of data to other programs. This is not sufficient when many different tools are used to analyze the many multi-disciplinary problems energy system researchers, analysts and regulators must address. OpenFIDO proposes to use an open multi-standard approach to data exchange called polyglot representation. This approach allows data to be exchanged so that data sets of commercial buildings, retail tariffs, and distribution networks can be reliably exchanged between the various distribution system analysis and simulation tools that are currently used. This enables better analysis of the impacts of DERs in distribution planning.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Distribution Resources Plans (AB 327): R.14-08-013 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1b, 1c, 5a, 5b

Lower Costs: The capabilities of OpenFIDO will help grid simulators more reliably and efficiently exchange system data sets with analysts, regulators, vendors and others who perform grid simulation and analysis. The reduction in labor intensity and staff training by using this framework will improve productivity, to lower overall costs.

Greater Reliability: Determination of the grid impacts of DERs requires multiple iterations of power flow analysis, which utilities perform as part of their interconnection studies. This requires analysis using multiple tools that must exchange data. Greater data exchange will enable deeper analysis of the impacts of DERs and the measures to limit those impacts to maintain and increase reliability.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$367,282

EPIC Funds Encumbered:

$1,000,000

EPIC Funds Spent:

$950,000

Match Partner and Funding Split:

National Grid: $30,000 (2.9 %)

Match Funding:

$30,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 29 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-047 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, the project team developed data import capabilities that can convert end-use load monitoring data and import Advance Metering Infrastructure and Supervisory Control and Data Acquisition and weather data into GridLAB-D simulations. OpenFIDO (Open Framework for Integrated Data Operations) integration with HiPAS (High Performance Agent-Based Simulation) GridLAB-D is currently in progress and the production evaluation versions of OpenFIDO will begin in March 2021. SLAC has entered into an agreement with Presence Product Group to build the first commercial release of OpenFIDO with a view to full commercialization by the end of the project.

Project Name: EPC-17-048 - Engaging Communities in the Design of Sustainable Energy and Localized Futures (SELF) Models in California's San Joaquin Valley

Recipient/Contractor: The Regents of the University of California, Berkeley Campus

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 4/16/2018 to 6/30/2022

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.

Issue:

Interdisciplinary analysis is critical for understanding the potential for energy transformation around the interface of dense urban environments with agricultural lands, communities, and natural resources. This research specifically addresses the people and communities most affected by development in these "urban-agriculture interface zones." This project aims to advance the engagement of communities in the design of Sustainable Energy and Localized Futures (SELF) models in California's San Joaquin Valley.

Project Description:

Through the analysis of "big data" comprising remotely-sensed images (e.g. agriculture lands, road networks, and built environment) and Geographic Information System (GIS) layers (e.g., energy consumption, distribution networks, new build construction, reserve areas, and planning documents), the project team is developing an analysis that examines specific dense urban areas with both high potential for retrofits that can help meet the needs of disadvantaged communities. Through the identification of critical "Urban-Agriculture Interface Zones" using a GIS-based hot spot analysis across the southern San Joaquin Valley, the project identifies and engages with communities (with community-based organizations) to conduct Sustainable Energy and Localized Futures (SELF) modeling. This project identifies opportunities in the SELF communities for efficiency and energy system improvements based on analysis of energy optimization tools such as the Solar, Wind, Investment in Technology, Hydropower (SWITCH) model. An optimization model is being developed for these densely populated zones to design "SELF- SWITCH" systems (SELF-SWITCH model).

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This research is advancing the state of the art by developing a new model that can explore the cost and feasibility of generation, transmission, and storage options for the future electricity system in a sub-regional environment. The model identifies cost-effective investment decisions for meeting electricity demand, taking into account the existing grid as well as projections of

future technological developments, renewable energy potential, fuel costs, and public policy. Integrating this model with updated GIS and geographically relevant data and algorithms for a sub-regional development will assist California's energy system planners.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Identify Disadvantaged Communities in the San Joaquin Valley and Provide Economically Feasible Options for Affordable Energy: R.15-03-010

Applicable Metrics: CPUC Metrics- 3a

Lower Costs: The project will lower long-term costs through identification of transformational system upgrades that will deliver less costly energy services in dense urban zones.

Greater Reliability: The project will result in the ratepayer benefits of greater reliability by identifying environmental and system risks of meeting transformational system upgrades in the southern San Joaquin Valley region.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$228,397

EPIC Funds Encumbered:

$1,100,000

EPIC Funds Spent:

$98,632

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 29 bidders

Rank of Selected Applicant/ Bidder:

Group 2b: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-048 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The research team developed a GIS-based dataset for the southern San Joaquin Valley (SSJV) that incorporates a number of layers including population density, built environment, environmental impact, CalEnviroScreen, electrical load, distributed generation, land use, and other data to aid in the development of SELF communities in the SSJV. The research team used this dataset and collaborated with a local community benefits organization, Self Help Enterprises (SHE), to identify six communities with the highest potential for a deeper-dive case study application of the SELF approach. The team is currently working with SHE to perform a household survey of approximately 1,000 households across the six communities to collect more detailed information about demographics, energy use, and willingness to adopt energy upgrade measures.

Project Name: EPC-17-049 - Port of San Diego Microgrid - Resiliency in Terminal Operations

Recipient/Contractor: San Diego Unified Port District (Port of San Diego)

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/13/2018 to 3/31/2023

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S14: Take Microgrids to the Next Level: Maximize the Value to Customers.

Issue:

California ports are electrifying their operations to move toward zero emission operations. The move to all-electric terminals will result in many terminals at least tripling their peak power consumption, while becoming more susceptible to electricity price uncertainties and vulnerable to operational disruptions due to losses of grid power. The Port of San Diego Tenth Avenue Marine Terminal (TAMT) provides critical functions such as pumping jet fuel to the nearby airport as well as processing bulk perishable food imports for distribution throughout California and beyond.

Project Description:

The project will develop a new, permanent, renewable microgrid at the Tenth Avenue Marine Terminal that can be replicated at other seaport terminals and distribution facilities throughout California, the U.S., and internationally. The project will incorporate solar photovoltaic renewable generation, battery energy storage, energy efficiency improvements, and a centralized microgrid controller to allow key elements of the terminal to remain operational when islanded from the electrical grid for a minimum of 12 hours.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will create a replicable approach for developing a solar-powered, resilient microgrid in a port or other industrial setting that will provide power to critical loads and allow key elements of a terminal to remain operational for 12 hours or longer when islanded from the grid.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Distribution Resources Plans (AB 327): R.14-08-013

Applicable Metrics: CPUC Metrics- 1b, 1c, 1h, 4a, 5b

Lower Costs: The project will lower customer costs by reducing peak demand charges. Additionally, ratepayer costs will be lowered by reducing the need for electric utility infrastructure improvement through consistent management of peak loads from industrial sites, which are large energy users. The project will investigate different options to reduce capital investments and document cost effective options for ratepayers implementing similar projects.

Increase Safety: The microgrid will increase energy resiliency resulting in a safer staging area that can be used for emergency relief, supplies, and fuel in the event of a disaster that causes a disruption to the electrical grid.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$422,043

EPIC Funds Encumbered:

$4,985,272

EPIC Funds Spent:

$33,898

Match Partner and Funding Split:

The Regents of the University of California, San Diego: $201,963 (2.1 %)

San Diego Unified Port District (Port of San Diego): $4,427,973 (46.1 %)

Match Funding:

$4,629,936

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

54 out of 60 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 5

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-049 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The Port developed the preliminary microgrid design at a level sufficient to complete a competitive procurement for final microgrid design and build services. In parallel, the Port has begun warehouse roof replacement work to support the solar PV array installation, as well as energy efficient lighting installation work.

Project Name: EPC-17-050 - Using Big Data to Holistically Assess Benefits from Building Energy System Transition Pathways in Disadvantaged Communities

Recipient/Contractor: The Regents of the University of California, on behalf of the Los Angeles Campus

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 7/11/2018 to 12/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S5: Reduce the Environmental and Public Health Impacts of Electricity Generation and Make the Electricity System Less Vulnerable to Climate Impacts.

Issue:

There is a need to better understand effective approaches for conducting holistic energy planning for urban areas in California, especially in California's Disadvantaged Communities (DACs). This study is designed to develop a cost-effective approach that could be replicated in other urban areas. The results of this study will help to create an energy transition pathway for California to achieve its goal of reaching 100 percent renewable and carbon-free energy by 2045. Additionally, the results of this study will help to quantify the health benefits of transitioning homes in disadvantaged communities away from natural gas combustion appliances.

Project Description:

This research project supports holistic urban energy planning for the Avocado Heights community that simultaneously considers urban renewables, indoor and outdoor air quality, deep energy efficiency options, retrofitting of homes and buildings, electrification, and issues of environmental justice. The project aims to evaluate the feasibility and effectiveness of advances in four energy transition pathways, including electric vehicles, energy efficiency, residential appliance electrification, and distributed solar generation. The project will analyze Southern California Gas utility usage data, in conjunction with indoor and ambient air quality monitoring data and surveys from volunteer households, to identify economically attractive options for greenhouse gas (GHG) reductions in the unincorporated areas of Bassett and Avocado Heights, CA.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Energy planning is often conducted in a piecemeal fashion, focusing on opportunities relevant to individual market sectors or fuels. This project is taking a different approach, using a holistic approach for urban energy planning with the final goal of identifying economically attractive options for deep GHG reductions and improved environmental conditions in Bassett and Avocado Heights. The project will additionally analyze four energy transition pathways and determine

which are the most economically and environmentally feasible options for California's Disadvantaged Communities.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Long-Term Procurement Proceeding (LTPP): R.13-12-010 <Closed> Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 4a, 4b

Lower Costs: This project will result in the ratepayer benefit of lower costs through the development of urban energy scenarios, which will examine pathways to economically reduce greenhouse gas emissions and improve overall environmental conditions. The analysis of hourly natural gas use has revealed important insights into the potential cost impacts of appliance electrification. The project's findings will inform recommendations for integrated strategic planning approaches that the state can take to reduce cost impacts, particularly for low income households.

Environmental Benefits: The project will estimate effective ways of improving outdoor air quality and reducing GHG emissions in the studied urban area. Analysis of indoor air quality monitoring results will allow for the development of recommendations to community members for improving indoor air quality. The project will also evaluate the trade-offs between indoor and ambient air quality changes as a result of various energy transitions; insights and recommendations will support state policy to improve environmental outcomes.

Public Health: The research team is measuring indoor air quality conditions to determine the indoor air quality benefits of electrification. This will inform the development of recommendations to community members for improving indoor air quality. Upcoming analysis on this project will look at trade-offs between indoor and ambient air quality changes as a result of various energy transitions; insights and recommendations will support state policy to improve public health outcomes. This will ultimately assist in mitigating the public health impacts associated with poor indoor air quality.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$233,968

EPIC Funds Encumbered:

$1,098,662

EPIC Funds Spent:

$292,306

Match Partner and Funding Split:

Regents of the University of California, Los Angeles: $54,740 (4.7 %)

Match Funding:

$54,740

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 29 bidders

Rank of Selected Applicant/ Bidder:

Group 2a: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-050 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The research team monitored 64 homes in the El Monte, Avocado Heights, and Basset neighborhoods in southern California for two weeks in the Summer of 2019 (July) and two weeks in the Winter of 2019 (February). The team used Purple Air Monitors to determine indoor particulate matter levels and Ogawa NO2 monitors to determine indoor Nitrogen Dioxide levels. The research team attended 36 community meetings and sent surveys to homes asking about appliance types, appliance usage, and general occupant behavior. The team received 449 home surveys back. The research team additionally received access to hourly-usage data from SoCal Gas, which was used to finalize the community energy modeling and related analysis of hourly load profiles, included in a Building Models report. These findings and analyses have allowed the research team to run building energy models and develop load profiles for various scenarios related to the different energy transition pathways.

Project Name: EPC-17-051 - LEED: A Lightwave Energy-Efficient Datacenter

Recipient/Contractor: The Regents of the University of California, on behalf of the San Diego campus

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/18/2018 to 1/31/2020

Program Area and Strategic Objective:

Applied Research and Development

S11: Provide Federal Cost Share for Applied Research Awards.

Issue:

Increasing the Power Utilization Efficiency (PUE) of a data center will not increase the overall datacenter energy efficiency. Further improvements in the energy efficiency of a datacenter require directly addressing the energy utilization of each server. Based on current trends, this is a challenging problem because datacenter traffic is increasing at a much faster rate than packet switch chip bandwidth is increasing. This means that future datacenters will require more switch chips and constantly more power, to support the ever-increasing data rate.

Project Description:

The goal of this federal cost share grant, the Lightwave Energy-Efficiency Datacenter (LEED) program, is to at least double the current energy efficiency of a datacenter. This dramatic improvement is realized by increasing the energy utilization of each server by means of a novel lightwave network. The LEED network can substantially increase the network bandwidth which leads to a corresponding improvement in the server energy utilization. This improvement can be realized at a cost comparable to a state-of-the-art datacenter network based on conventional electrical switching technologies.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project could lead to technological advancement in lightwave technology for datacenters. It could double the efficiency of datacenters by increasing the speed of response and reducing energy input.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1c, 1f, 2a

Consumer Appeal: This technology uses optical switches in the server hub, to increase data transferring speeds and energy efficiency. Using light signals with a rotor switch reduces the amount of heat produced in the data center, which in turn reduces the amount of cooling energy required for datacenters.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$78,440

EPIC Funds Encumbered:

$475,000

EPIC Funds Spent:

$474,997

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

U.S. Department of Energy: $3,800,000

The Regents of the University of California, San Diego: $491,524

Axalume: $127,000

National Science Foundation: $225,000

Leveraged Funds:

$4,643,524

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

43 bidders

Rank of Selected Applicant/ Bidder:

N/A

If not the highest scoring applicant/bidder, explain why selected:

The federal cost share solicitation was on-going and funds were awarded to passing proposals on a first-come, first-served basis.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-051 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The first phase of the project was completed and successfully developed its optical switch and the necessary transmitter and receiver to revolutionize data centers. Currently, fiber optical lines are used for internet, but data centers are still using electrical lines to each data center rack. Using light signals in the optical switches is expected to increase energy efficiency by 50 percent and would process data faster. The data processing speed is one of the main driving factors in consumer appeal for data centers and should be easily marketed in the data center industry. Funding for the second phase of the program has been approved by Department on Energy and the project will continue the development and demonstration of the technology.

Project Name: EPC-17-052 - Urban Microgrids for Grid Resiliency and Disaster Readiness

Recipient/Contractor: Gridscape Solutions

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 7/18/2018 to 3/31/2023

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S14: Take Microgrids to the Next Level: Maximize the Value to Customers.

Issue:

Critical facilities such as fire stations, 911 call centers and community service centers cannot afford to be without power, even for a moment. The aging nature of the grid and limited funding for critical facilities' operation have made disadvantaged communities particularly vulnerable and more susceptible to outages caused by natural disasters such as wildfire, severe weather, or earthquakes. Disadvantaged communities need better, resilient infrastructure such as clean, renewable energy powered microgrids to help support critical operations.

Project Description:

This project is developing a software-driven, modular microgrid network for disaster-readiness, resiliency, and grid services and will deploy them at least five demonstration sites in DAC areas and two different IOU service territories. It will connect multiple customer-owned behind-the-meter DER assets into virtual networks of microgrid via cloud-based controls and an optimization platform. Each microgrid will be able to operate independently in a cybersecure way to reduce facility electric costs and to island in the event of an unplanned power outage or public safety power shutoff (PSPS) to keep critical operations and emergency shelters running.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is leading to technological advancement and breakthroughs by developing and demonstrating the ability to remotely operate multiple microgrids, which can be useful for keeping all critical functions operational in the event of a grid outage, reducing utility costs, and minimizing the reliance on diesel backup generators. The key breakthroughs in this project to overcome barriers are use of clean renewable power in both on-grid and off-grid modes and streamlining interconnection process with the utility grid.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Distribution Resources Plans (AB 327): R.14-08-013 Distribution Level Interconnection (Rule 21): R.11-09-011 <closed> Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1a, 3h, 4a, 5a, 5b

Lower Costs: This project is demonstrating a business case for applying microgrids to critical facilities, by showcasing the energy cost reductions that make these systems economical for local governments.

Greater Reliability: This project provides orderly coordinated integration of renewable generation at distributed sites, which can be coordinated remotely and enable an owner or aggregator to take a larger load off the grid, particularly during peak periods to provide greater grid reliability.

Increase Safety: Each microgrid will be able to island during a utility outage or natural disaster such as a wildfire or earthquake and provide emergency power to critical loads for more than 3 hours for facilities that provide critical safety functions in their communities including 911, police and fire support.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$562,214

EPIC Funds Encumbered:

$4,995,498

EPIC Funds Spent:

$863,160

Match Partner and Funding Split:

Electric Power Research Institute, Inc.: $429,752 (5.2 %)

TRC Energy Services: $10,074 (0.1 %)

InTech Energy, Inc.: $15,000 (0.2 %)

Gridscape Solutions, Inc.: $260,666 (3.1 %)

City of Fontana: $650,000 (7.9 %)

Chabot-Las Positas Community College District: $1,916,500 (23.2 %)

Match Funding:

$3,281,992

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

54 out of 60 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-052 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, the Gridscape EnergyScope Microgrid System (microgrid-in-a-box) design was finalized and systems are being manufactured. Each system integrates battery energy storage with an interconnection relay, inverter, controller, and other related electrical equipment. The City of Fontana has approved permit drawings for deployment at the City Hall and Community Senior Center by the second quarter of 2021. In April 2020, Gridscape signed an agreement with the Chabot Community College in Hayward for a campus microgrid, which will provide electricity to three essential service buildings. This microgrid is currently in the design stage and the installation is expected by the third quarter of 2021. In addition, Gridscape is in the process of getting approval for a city in Southern California with four additional DAC sites.

Project Name: EPC-17-053 - Santa Rosa Junior College Urban Microgrid Project

Recipient/Contractor: Sonoma County Junior College District/ Santa Rosa Junior College

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 9/27/2018 to 3/31/2023

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S14: Take Microgrids to the Next Level: Maximize the Value to Customers.

Issue:

Academic campuses are particularly interested in maintaining critical functions in the event of a grid outage, notably during and after a disaster event. The functions primarily support the students, faculty and staff but could provide support to the broader community. Microgrids have the potential to provide important resiliency benefits, especially in an area prone to disasters such as wildfires; however, it is difficult to justify their cost on resiliency alone and to build a business case for the development and deployment of a microgrid.

Project Description:

Santa Rosa Junior College (SRJC) will demonstrate a microgrid on campus. This project will integrate three types of distributed energy resource (DER) elements: solar photovoltaic (PV) generation, energy storage, and load reduction devices and load control systems, all managed by a single microgrid controller. The goals of this project are to meet 40 percent of the campus electricity requirement with emissions-free PV solar power, to reduce the campus peak load, to optimize energy use, to provide support services to the surrounding grid, and to create a highly resilient power system benefitting the campus and the community. This project will demonstrate the environmental, economic, and resiliency benefits of a highly flexible campus microgrid. Operational objectives encompass demonstration of power flow, load control, and energy storage in a large multi-building campus, operating at appropriate scale and in actual operating conditions.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will result in advancements in the deployment of a microgrid, including the use of storage technologies, adaptive load management, and the monetization of microgrid assets while providing community support facilities in times of need. This project will also demonstrate coordination of multiple large energy storage devices with different dynamic capabilities. By demonstrating a local approach to stabilizing utility grid frequency, the microgrid will be transformed from a source of load transients to a point of stabilization reaching far beyond the point of interconnection.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Smart grid: R.08-12-009 <closed>

Applicable Metrics: CPUC Metrics- 1c, 1g, 1h, 2a, 3f, 3h, 4a, 4b, 5a, 5b, 5d

Lower Costs: The microgrid will reduce costs for the school by lowering peak demand charges and energy costs through on-site generation and storage. It will also reduce costs of lost operation by allowing the campus to remain open for classes during grid outages. The project will benefit the utility and ratepayers by providing local voltage support and frequency regulation, thus allowing the distribution grid to rely less on centralized local power electronics to provide these services.

Greater Reliability: Power quality will be improved on both the college campus and local distribution system through demonstration of dynamic frequency regulation and voltage control technologies. With the ability to provide both real and reactive power and to respond autonomously to changing grid needs, the project will be capable of providing grid stabilization to the local distribution feeder. The project will provide back-up power to the school in the event of an outage.

Increase Safety: The project will provide back-up power to the school campus in the event of grid outages, thereby improving the safety of staff, students, and potentially local residents.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$348,244

EPIC Funds Encumbered:

$4,999,005

EPIC Funds Spent:

$0

Match Partner and Funding Split:

Sonoma County Junior College District/ Santa Rosa Junior College: $239,000 (1.7 %)

SunPower Corporation, Systems: $8,450,759 (61.7 %)

Match Funding:

$8,689,759

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

54 out of 60 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-053 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The team is currently working on collecting data from the submeters to ensure pre-microgrid operation baselines are developed for all campus buildings. The team is also in the planning phase for the installation and testing of the 12 kV switchgear and the installation and interconnection of the energy storage system. The energy storage system is currently in procurement and assembly and is anticipated to be ready to be shipped to the site in Q1 of 2021. Additionally, the team is assessing DR program participation and will work on the installation of load shed devices.

Project Name: EPC-17-054 - Rialto Resilient Clean Power Microgrid

Recipient/Contractor: Rialto Bioenergy Facility LLC

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 8/31/2018 to 3/31/2023

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S14: Take Microgrids to the Next Level: Maximize the Value to Customers.

Issue:

Presently, microgrid system deployment at facilities that manage wastewater, wastewater biosolids, or food waste, is very uncommon. Microgrids have the potential to optimize onsite power management, enhance power export, and provide other grid and ratepayer benefits which can reduce the overall operational costs of these facilities and enable them to operate in the event of a grid outage. Additionally, California has a goal of diverting 75 percent of waste from landfill disposal by 2020, as called for by AB341; anaerobic digestion to convert waste into energy is part of the solution.

Project Description:

The purpose of this project is to fund a new permanent microgrid installation at the Rialto Bioenergy Facility (RBF), which will generate biogas from food waste. The microgrid will manage energy from biogas production and an energy storage system to support the power demand of the RBF. This will minimize grid draw and enhance renewable electricity export. The project will install battery storage, demand response capabilities, new power production capacity, an enhanced Supervisory Control and Data Acquisition (SCADA) interface, and switchgear to allow islanding in the case of a utility outage.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will demonstrate the business case for a microgrid that can improve operations of a food and biowaste treatment facility, as well as a wastewater treatment facility, located in a disadvantaged community. The microgrid will use a microgrid controller to optimize a biogas cogeneration system, fueled by available feedstock, and utilize energy storage to enable the facility to continue operations during a grid outage. This project will demonstrate the microgrid's ability to provide benefits to the residents of the disadvantaged community by providing opportunities to participate in demand response activities, providing cleaner air quality, and increasing grid reliability and resiliency. The business case could be applicable to the 156 critical wastewater treatment plants across California.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed>

Applicable Metrics: CPUC Metrics- 1b, 1e, 1f, 1h, 4a, 4b, 4d, 4e, 5b, 5f

Lower Costs: The microgrid will allow the facility to cut operating energy costs, which will make the economics of anaerobic digestion of food waste and biosolids more feasible in the state.

Greater Reliability: The project is located near the end of the San Bernardino Corridor, a congested transmission system, and will provide distributed power resources to this area. Greater electricity reliability will result by implementing demand response, minimizing peak power demand and by providing a local source of 2 MW of power. This will alleviate grid bottlenecking and enhance power supply resiliency and reliability to nearby disadvantaged communities.

Environmental Benefits: The RBF will support diversion of food waste from landfills and enable the state to better utilize biosolids, rather than ship them to neighboring states for management; thus, reducing greenhouse gas emissions.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$5,000,000

EPIC Funds Spent:

$3,186,190

Match Partner and Funding Split:

The Grant Farm, Inc: $80,000 (0.7 %)

Trinity Consultants: $77,360 (0.7 %)

Rialto Bioenergy Facility LLC: $3,256,049 (28.3 %)

Southern Electric: $3,101,591 (26.9 %)

Match Funding:

$6,515,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

54 out of 60 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-054 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, the project team completed construction of the RBF digester and installation of four combined heat and power units and the supporting electrical and mechanical connections. RBF began operation and taking in organic material and municipal solid material in Fall 2020. The team also installed the necessary transformers, switches, and panels to support the site's microgrid and is in the process of down-selecting vendors for the energy storage system for the microgrid.

Project Name: EPC-17-055 - Redwood Coast Airport Microgrid

Recipient/Contractor: Humboldt State University Sponsored Programs Foundation

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 8/8/2018 to 3/31/2023

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S14: Take Microgrids to the Next Level: Maximize the Value to Customers.

Issue:

As load serving entities, community choice aggregators (CCA) are procuring local community-scale renewable generation and energy storage to serve their customers. IOUs are updating interconnection processes, developing tariff structures, and grappling with the effects of more intermittent renewable energy on the grid. Meanwhile, climate change has increased the frequency and severity of natural disasters, highlighting the importance of resilient electricity supplies to keep critical facilities operating in times of need. This project will demonstrate a replicable model for multi-customer critical facility microgrids, including potential tariff structures between a CCA and a utility.

Project Description:

This project is a community-scale renewable energy microgrid located at the California Redwood Coast-Humboldt County Airport. It will deploy and demonstrate the first multi-customer, front-of-the-meter (FTM) microgrid on PG&E's distribution system. The generation resources will be owned and operated by a CCA (Redwood Coast Energy Authority or RCEA) and will be 100 percent renewable. The microgrid circuit will be owned and operated by PG&E. This microgrid will allow the CCA to participate in the wholesale electricity market and provide renewable energy for the airport during normal operations, It will also provide low carbon resilience through islanding capabilities that serve critical facilities: a commercial airport and a U.S. Coast Guard Air Station. Controllable EV chargers also will be installed at the airport terminal parking lot.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

In order to manage increased DERs, California needs sophisticated DER management systems and strategies, and microgrids can play an important role. This project will lead to significant technological advancements and breakthroughs by deploying a highly automated, multi-customer microgrid to provide end-use customer resiliency support and wholesale market participation with renewable energy. Islanding will be demonstrated for the customers behind the meter. RCEA will collaborate with PG&E to create experimental tariffs and agreements for operating multi-customer microgrids. These tariffs and agreements will become important examples to other utilities and CCAs and inform the CPUC's microgrid tariff proceeding.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Smart grid: R.08-12-009 <closed> Smart Inverter: D.14-12-035 (in R.11-09-011) Streamlining Interconnection of Distributed Energy Resources and Improvements (Rule 21): R.17-07-007

Applicable Metrics: CPUC Metrics- 1a, 1b, 1i, 2a, 3h, 5a

Lower Costs: The solar PV array will lower annual energy purchases by using onsite renewable energy resources to meet a portion of the onsite load; thus, lowering costs. Directly coupling the battery and photovoltaic array will reduce the cost of required distribution system upgrades.

Greater Reliability: Reliability and resilience will be increased for the commercial airport and US. Coast Guard Air Station (two critical regional facilities). Due to the remote and isolated location of Humboldt County, these critical facilities will provide the means to transport critical supplies into and around the region in a large-scale emergency. Because of the large PV array and storage battery relative to onsite islanded peak loads, the microgrid will be able to supply nearly continuous renewable power in the event of a prolonged outage.

Economic Development: The microgrid, with an estimated 3100 MWh/yr of renewable electricity generation coupled with energy storage, is estimated to generate an annual economic benefit of approximately $356,000. During the construction phase, an estimated 37 full time jobs will be created, with $1.5M in earnings and $3.4M in economic output expected.

Environmental Benefits: Over 3100 MWh/yr of renewable electricity will be generated. This is estimated to result in CO2 emission reductions of over 880 MT/yr.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$500,449

EPIC Funds Encumbered:

$5,000,000

EPIC Funds Spent:

$1,501,998

Match Partner and Funding Split:

Redwood Coast Energy Authority: $5,996,358 (53.0 %)

Humboldt State University Sponsored Programs Foundation: $326,370 (2.9 %)

Match Funding:

$6,322,728

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

54 out of 60 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-17-055 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Site preparation activities were completed in 2020 and the microgrid is on track to be constructed in the summer of 2021. The final designs were completed for the site electrical and civil works and for the PG&E distribution system upgrades. The interconnection switchgear is fully designed and in the manufacturing queue. The FAA airspace obstruction analysis team approved the project and their environmental team finalized and circulated the Environmental Assessment. The County Supervisors and the RCEA Board of Directors have approved a land lease for the project. A microgrid operating agreement between PG&E and RCEA has been drafted and is in legal review. The team provided valuable input to the CPUC's microgrid proceeding and the CAISO's hybrid resource initiative in multiple meetings and public workshops.

Project Name: EPC-18-001 - Port Hueneme Navy Data Center Microgrid

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 11/1/2018 to 3/31/2023

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S14: Take Microgrids to the Next Level: Maximize the Value to Customers.

Issue:

Microgrids often experience system failures during transition between grid connected and islanding modes due to electric instabilities (e.g., unstable voltage, current, or power waveforms). Many of the controlling systems cannot recognize and respond to these rapid events. This is especially problematic for facilities that are sensitive to instabilities, such as data centers.

Project Description:

This project will demonstrate a standardized, high-penetration distributed energy resource (DER) microgrid to support a data center at the Naval Surface Warfare Center - Port Hueneme Division near Oxnard, CA. The data obtained on capital cost, operating cost, performance and lessons learned will support commercial deployment for both military and non-military applications.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project is developing new approaches to microgrids that can ensure stable power to sensitive components, such as in data centers. The team will demonstrate a standardized microgrid, analyze and define the savings and market barriers, and provide new, valuable performance data that will be used to develop a viable market for future deployments.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Smart Inverter: D.14-12-035 (in R.11-09-011) Demand Response (DR): R.13-09-011 Streamlining Interconnection of Distributed Energy Resources and Improvements (Rule 21): R.17-07-007

Applicable Metrics: CPUC Metrics- 1a, 1b, 1e, 1h, 1i, 2a, 5a

Lower Costs: The collective use of installed on-site PV and battery energy storage system (BESS) will significantly reduce the need for the Southern California Edison (SCE) grid supplied energy and, in turn, will decrease the resulting cost of energy to the site. Furthermore, replacing the current leased lead-acid BESS with a permanent Li-ion BESS will save the site on leasing fees.

Greater Reliability: The microgrid will allow the site to operate independently from SCE grid, supply power with lower cost PV renewable energy from a localized source, and nullify the potential detrimental outcomes due to unplanned power outages. The findings from this project

will be leveraged to recommend a standardized design to improve reliability and lower capital costs of future microgrids in commercial applications.

Environmental Benefits: The microgrid's combined use of renewable PV generation, battery energy storage, and EV charging stations will reduce carbon emissions, which are produced by fossil fueled power generation and automobiles, and will dramatically reduce the need for fossil fueled backup diesel generators for up to 4-hours during night time and islanding events at the data center.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$848,609

EPIC Funds Encumbered:

$4,998,345

EPIC Funds Spent:

$347,646

Match Partner and Funding Split:

Electric Power Research Institute, Inc.: $1,738,707 (20.5 %)

Schweitzer Engineering Laboratories, Inc.: $1,537,028 (18.1 %)

Distributed Utility Associates: $227,019 (2.7 %)

Match Funding:

$3,502,754

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

54 out of 60 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 6

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-001 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project team completed construction, factory testing, transport, installation, commissioning, acceptance testing, and initial performance testing for the microgrid battery storage system (500 kW, 4 hours) located at Naval Base Ventura County, Port Hueneme. The measured beginning of life AC round trip efficiency of the overall battery system had a measured value equal to 93.2 percent, which was 2.9 percent points better than the required contract value of 90.3 percent. Also, the project team completed the design and initial construction of the microgrid's protection relays, switchgear, synchronous condenser, and control system.

Project Name: EPC-18-002 - California Test Bed Initiative

Recipient/Contractor: California Clean Energy Fund dba CalCEF Ventures

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 12/10/2018 to 3/31/2023

Program Area and Strategic Objective:

Market Facilitation

S18: Foster the Development of the Most Promising Energy Technologies into Successful Businesses.

Issue:

In California, clean energy entrepreneurs and innovators experience significant difficulty making the leap from prototype to pilot scale demonstration of their technologies because they lack access to testing facilities and services to validate their products' design, safety and performance; and lack technical feedback to shift product specifications to meet the requirements of potential customers.

Project Description:

This project will develop and implement a voucher program to provide clean energy companies access to testing facilities to test and/or certify prototypes of pre-commercial distributed energy resource technologies, and help them refine their prototype to meet customer specifications. This project will start with an initial network of testing facilities that includes 29 University of California facilities from nine campuses and two National Laboratory facilities. The project intends to grow this network throughout the duration of the project. This network of testing facilities will connect testing facilities throughout California, which would otherwise be disconnected, in order to serve clean energy companies more efficiently and effectively throughout all of California.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

CalTestBed will accelerate new, clean, energy-efficient technologies to market and, as a result, reduce ratepayer costs. By early engagement of target customer groups in the refinement of product specifications and the evaluation of commercial viability, CalTestBed will accelerate the rate of development and commercialization of technologies that improve California's air, water and energy profile and drive economic investment, business creation and jobs.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 2a, 3a, 3b, 3e

Increase Safety: CalTestBed develops and streamlines the feedback process among testbeds to meet customer safety specifications, as well as supporting the standardization of "customer-

facing" services by testbeds to the innovation community. Through the CalTestBed Network, coordinates California testbeds to standardize safety testing and certifications and develop best practices for managing the testbed/entrepreneur relationship. Includes Customer Engagement elements to involve customer groups in evaluation of the safety of proposed technologies.

Economic Development: CalTestBed will provide objective feedback to help entrepreneurs improve their products to meet customer needs, and grow into self-sustaining businesses. These services that CalTestBed will provide will increase the likelihood that clean energy companies can develop and scale their technologies and bring them to the market.

Consumer Appeal: CalTestBed will provide the opportunity for target customer groups to give feedback to entrepreneurs letting them know what changes can be made to improve their products to meet customer needs.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$566,364

EPIC Funds Encumbered:

$10,999,701

EPIC Funds Spent:

$501,599

Match Partner and Funding Split:

California Clean Energy Fund dba CalCEF Ventures: $267,053 (2.2 %)

University of California, Office of the President: $620,000 (5.2 %)

Match Funding:

$887,053

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

15 out of 15 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-002 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, the CalTestBed voucher program launched its first solicitation and received over 100 applications. Technical reviewers scored the applications and provided recommendations on which applicants should proceed to the next round of consideration. In this second round, applicants completed consultations with testbed facility staff to determine compatibility of the entrepreneur's testing needs and the facility's capabilities, as well as to create a scope of work. A total of 26 entrepreneurs were selected as voucher recipients and matched with testbed facilities for the 2020 solicitation. In December, the first annual CalTestBed Symposium was held, during which confirmed voucher recipients were announced and featured. Laboratory testing of selected technologies will be performed in 2021. A second solicitation will be issued in 2021 for new applications.

Project Name: EPC-18-003 - Ultra-thin Flexible LED Lighting Panels

Recipient/Contractor: Lucent Optics, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 1/23/2019 to 3/31/2022

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Adoption of lighting emitting diode (LED) lighting for general illumination is poised to be the largest advancement in building lighting efficiency during the 21st century. LED manufacturers have focused on research into improving the efficacy and cost at the expense of quality, resulting in an influx of poor quality LED products with minimal options. This has led to use of the same outdated legacy forms and bulky designs of the incumbent fluorescent fixtures and thus fail to create a unique aesthetic appeal for the end-users. All this dramatically slows down the adoption of LED technology and prevents realizing its full energy saving and technological potential.

Project Description:

The project will produce a custom thin, flexible lighting platform technology for making material-efficient and aesthetically pleasant wide-area LED lighting luminaires at a fraction of the cost of traditional fluorescent and LED fixtures. The objective is to create a universal, area-distributed LED source and associated luminaire technology platform that would (1) set a new standard for wide-area luminaire efficiency, (2) provide much lower cost of ownership compared to other lighting technologies, and (3) dramatically improve aesthetics of lighting fixtures and provide virtually unlimited design opportunities through introducing thin and flexible forms.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project could improve understanding of metrics and test procedures associated with LED quality and performance; increase the ability of commercial building operators/owners to comply with future energy codes and standards; produce higher quality LED products; and, increase consumer acceptance of LED lighting luminaires.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h, 2a, 3a, 3b, 4a

Lower Costs: The energy efficient lighting products resulting from this project will lower the electricity bills of California ratepayers by lowering their energy use for indoor lighting, thus providing the benefit of lower energy cost for the electricity ratepayers. By replacing just 60 percent of the linear fluorescent lights in commercial buildings, the proposed technology could save 5,610 GWh to California IOU electricity ratepayers and reduce their energy costs by $900 million on the annual basis. The annual cost reductions due to energy saving ($900 million) are calculated using the statewide average electricity price of $0.16/kWh in the commercial sector (5,610 GWh x $0.16/kWh).

Greater Reliability: The lighting solution provided in this product gives a longer lifespan than standard LED luminaries of about 75k-100k hours. The reduced consumption of electricity for this lighting solution will reduce peak demand and electric grid loads, thus contributing to the improvement of grid reliability.

Increase Safety: The proposed wide-area LED lighting panels will replace fluorescent lights that have been associated with environmental hazards (due to the mercury content), suboptimal energy efficiency, poor quality of light (choppy spectrum missing warm colors, flickering and glare), subpar aesthetics, and the need of periodic lamp replacements, thus increasing safety in buildings.

Environmental Benefits: The lighting products developed in this project will give an annual reduction in greenhouse gas emissions by using the Emission Factor 0.331 kg/kWh, which yields 1.857 million metric tons (5,610 GWh saving x 0.331 kg/kWh).

Consumer Appeal: The innovative lighting solutions developed in this project are anticipated to improve occupant comfort by providing higher-quality, ambient lighting environment and eliminating glare and environmental hazards of fluorescent lights.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$516,434

EPIC Funds Encumbered:

$1,692,069

EPIC Funds Spent:

$719,902

Match Partner and Funding Split:

IVESTA LLC: $169,207 (9.1 %)

Match Funding:

$169,207

Leverage Contributors:

U.S. Department of Energy: $999,978

U.S. Department of Energy: $199,994

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

21 out of 33 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 5

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, this project successfully completed the development of an innovative additive manufacturing process for optical patterning of plastic sheets and producing large-area optical waveguides which are essential components for making thin and flexible LED lighting panels. The project scaled up the patterning process to the panel sizes of up to 2ft x 4ft and established pilot manufacturing of custom-format optical waveguides in Sacramento. In 2021, the project team will send the first batches of commercially produced large-area waveguides to manufacturers - which make lighting and signage end-products.

Project Name: EPC-18-004 - Accelerating Commercialization of Advanced Energy Efficient Windows

Recipient/Contractor: Ubiquitous Energy, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 2/8/2019 to 12/12/2022

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Although premium low-E windows maximize the rejection of excessive heat from entering a building, it usually does so at an unwanted aesthetic tradeoff as seen in the windows having an undesired pink-purple color tint. Additionally, the solar heat being reflected back into the environment is not being captured as useful energy. To date, there is not a market ready window product that effectively prevents heat from entering the building through the windows, generates renewable energy, and is easily manufactured at an attractive price point.

Project Description:

This project will scale Ubiquitous Energy's ClearView PowerTM technology to meet the size requirements and specifications needed for window production. ClearView PowerTM is a transparent solar coating that, when applied to glass, selectively absorbs and converts non-visible light to electricity while also blocking the infrared light that causes heat gains in buildings. As part of this project, Ubiquitous Energy will demonstrate that the solar coating application can be integrated into a standard glass manufacturing process.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The mass-market commercialization of clear windows that generate renewable energy and premium insulation will provide demonstrable improvements over existing low-E windows currently used in commercial buildings. This will allow California to better design and create zero net energy (ZNE) buildings to meet the state's energy efficiency goals. Furthermore, CVP's solar generating capabilities would broaden the application and generation of solar energy throughout California.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 1e, 1f, 2a

Lower Costs: The increased insulation and electric generation will lower the operation costs of commercial buildings in California.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$407,192

EPIC Funds Encumbered:

$2,998,055

EPIC Funds Spent:

$1,439,686

Match Partner and Funding Split:

Ubiquitous Energy, Inc.: $4,085,059 (55.9 %)

Lawrence Berkeley National Laboratory: $225,600 (3.1 %)

Match Funding:

$4,310,659

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

21 out of 33 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, the project team continued testing and refining the larger 14" x 20" R&D prototype samples to prepare for external evaluation by certified laboratories. They partnered with two independent certified UL facilities in California to provide performance and durability testing for both solar generation and energy efficiency. Testing was delayed by four months due to COVID-19, concluding in September. The results were promising, showing that the film coating was able to maintain its transparency and functionality. In November, LBNL began test modeling on a window facade installed at their facility for energy efficiency and recorded internal temperature measurements. The team also recorded performance results on the window facade previously installed at their offices, for the year. In 2021, the team will refine the second prototype as necessary and continue market validation, talking with different actors in the window industry and looking for opportunities to pilot the windows.

Project Name: EPC-18-005 - Building Energy Impact Analysis of Low Cost NanoEC Electrochromic Window Control Algorithm Optimization

Recipient/Contractor: Heliotrope Technologies, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 1/16/2019 to 11/30/2021

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

Lighting and thermal management each represent about 30 percent of the energy used within a commercial building. Windows are a critical component of building energy efficiency in part because they determine the amount of natural light and solar gain that enters a building. Recent progress has been made toward improving window energy efficiency through the use of inexpensive static coatings that either retain heat in cold climates (low emissivity films) or reject solar heat gain in warm climates. However, these windows coatings are not responsive to changing occupant needs, have limited performance in seasonal climates, and have a high cost of greater than $50/sq. ft.

Project Description:

Heliotrope's NanoEC is the first neutral grey electrochromic window product that achieves a price point less than $25/sq. ft. This project is aiming to evaluate and optimize the building energy impact of this electrochromic smart window. By reaching the color/cost barriers needed to create mass adoption, Heliotrope will use this project to design, test, and validate energy conservation in building applications through field installations at both a test bed facility and at a real world commercial facility. Data from this study will help optimize window tinting control algorithms to achieve the lowest building energy consumption.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by developing a dynamic glass technology that will reduce HVAC energy consumption. By optimizing the control algorithm design in this project, Heliotrope's NanoEC electrochromic smart windows will improve thermal management within buildings. This technology is also showing an increase in light energy savings while providing product improvement of color and overall cost.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 1e

Lower Costs: Heliotrope's NanoEC electrochromic windows are estimated to have an average daily lighting energy savings of 10-15 percent compared to south facing static windows with lowered Venetian blinds. Their product is the first electronic product to reach a price point lower than <$25/sq.ft., which is estimated to allow large market adoption.

Consumer Appeal: Heliotrope's NanoEC electrochromic windows is a ground breaking smart glass that has already achieve an aesthetic all pleasing neutral grey color.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$1,182,911

EPIC Funds Encumbered:

$3,667,104

EPIC Funds Spent:

$2,806,672

Match Partner and Funding Split:

Heliotrope Technologies, Inc.: $952,276 (20.6 %)

Match Funding:

$952,276

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

21 out of 33 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, this project installed a 4 x 2 wooden residential window demo wall to utilize as a testbed for continued development of its proprietary algorithm aimed at improving building energy consumption while maintaining occupant comfort. The 350mm x 500mm window size utilized for the demo wall represented a good approximation for the first field installation at Lawrence Berkeley National Lab (LBNL). The algorithm was tested and validated to meet target specifications. A full system design was completed and sent for production which included new control hardware, wiring, and user interface (wired & wireless). In 2021, the project team will integrate the Alpha system design into the upcoming field installation at LBNL.

Project Name: EPC-18-006 - Radiative Sky Cooling-Enabled Efficiency Improvements on Commercial Cooling Systems__

Recipient/Contractor: SkyCool Systems Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 2/21/2019 to 12/31/2021

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Commercial space cooling and refrigeration systems contribute to a significant percentage of commercial electricity use in California. A challenge with standard cooling systems is that they become less efficient as the ambient air temperature outside rises. This rise in ambient temperature causes the condenser to increase in temperature and pressure, resulting in more energy consumption. The increase in consumption on hot days causes strain to the grid, sometimes resulting in an inability to meet the demand of electricity. There is a need for technologies that reduce electricity use of commercial air conditioning and refrigeration systems that can be added to existing equipment.

Project Description:

This project is demonstrating a technology that will enable new and existing air conditioning and refrigeration systems to run more efficiently and in certain applications replace AC units with a cooling system requiring only the energy to run a pump. The technology being demonstrated is a rooftop-mounted, radiative sky-cooling panel that has a specialized film to enable daytime radiative cooling. The panels cool without evaporating water and only require electricity to run a small circulating pump. The cooling effect from the panels occurs all day, which is well aligned with the 24/7 operation of refrigeration systems in supermarkets and air conditioning systems in data centers and hotels. In this project, SkyCool Panels will demonstrate its use cases at two sites. The first site's panels will pair with thermal storage and an indoor radiant cooling system to demonstrate a reduction of electricity use for air conditioning by as much as 50 percent relative to conventional cooling systems. The second site's panels will act as a passive subcooler in a commercial supermarket to increase the system efficiency as much as 10 percent.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals. It will enable the measurement and verification of two promising integrations for a platform cooling technology in operational commercial settings, the results of which might not otherwise have been deployed if

pursued purely through a competitive consumer market. SkyCool technology will help California reach policy goals set out in SB 350, AB 32, and AB 758 by reducing barriers for installing the panels in commercial systems and enable the broader adoption across California's cold chain and HVAC sectors.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h, 2a, 3a, 4a, 4c

Lower Costs: This project will demonstrate lower operating costs in commercial buildings with the reduction of electricity usage of a commercial air conditioning system by 50 percent and a commercial refrigeration system by 10 percent.

Greater Reliability: Deployment of SkyCool panels can improve grid reliability by reducing facility peak demand. The highest demand for electricity is typically during summer afternoons/early evening when the demand for cooling is greatest. This is in part because conventional refrigeration and air conditioning systems are least efficient during these hottest times. SkyCool panels have equal cooling efficiency across ambient temperature ranges.

Environmental Benefits: Deployment of SkyCool panels can reduce greenhouse gas emissions by reducing the electricity consumed from the grid and do not use heat-trapping refrigerants. SkyCool panels also reduce water consumption associated with cooling because the panels cool without evaporating water.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$406,651

EPIC Funds Encumbered:

$1,770,563

EPIC Funds Spent:

$312,245

Match Partner and Funding Split:

SkyCool Systems Inc.: $238,386 (11.6 %)

Electric Power Research Institute, Inc.: $50,000 (2.4 %)

Match Funding:

$288,386

Leverage Contributors:

U.S. Department of Energy: $352,810

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

21 out of 33 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 6

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-006 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The SkyCool team has focused its efforts on the design, permitting and implementation of its technology at two sites in California. The first site will demonstrate their panels as an add-on to reduce energy use in a supermarket refrigeration system; the second site will use SkyCool's panels plus thermal storage to replace an air conditioning system at Cal Maritime. Agreements between each site are being finalized and installation designs will be completed in the first half of 2021.

Project Name: EPC-18-007 - High Efficiency Dynamic Lighting Systems

Recipient/Contractor: Glint Photonics, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 2/18/2019 to 12/1/2021

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

An estimated 41 TWh of electricity is used annually on lighting by California IOU ratepayers, yet the majority of the generated light is wasted. Spaces are typically over-lit in order to achieve required light levels in all areas, all the time. Department of Energy studies indicate that 2x-3x efficiency improvements are possible through improved light utilization, which represents an enormous energy savings potential. Utilization efficiency improvements will have to come from innovation at the luminaire level, not at the LED source level.

Project Description:

The purpose of this project is to develop, smart, high-efficiency lighting products that dynamically target light to wherever is needed. For this project, Glint will develop the intuitive control systems and a luminaire motorization system to meet long term durability targets. Furthermore, Glint will demonstrate a sensor-linked luminaire that tracks room occupants and directs a task light that follows their location. This novel capability in solid-state lighting, will improve not only the efficiency with which light is generated, but also the efficiency with which it is utilized. In addition to reduced operating energy, these lighting products will provide new functionality, enable customer cost savings by reducing the number of installed luminaires needed, and provide improved lighting quality and safety in the lit environment.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This technology can provide substantial energy savings in California's lighting sector, contributing to the state's Senate Bill 350 energy efficiency savings, and Zero Net Energy Buildings goals outlined in the CPUC's Energy Efficiency Strategic Plan. An estimated savings of up to 18.5 TWh, annually, can be realized in California's investor-owned utility service territories, alone.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h, 3h

Lower Costs: The dynamic lighting technology will offer customers significant savings. Not only do the products reduce the amount of energy needed to properly illuminate an area (e.g., higher efficiency and fewer lighting fixtures needed), they will be offered at a much lower price than the motorized luminaires that are currently available on the market.

Consumer Appeal: Customers will enjoy a variety of benefits, including: better lighting distribution, less time spent on re-aiming lighting (e.g., product displays, event centers, and galleries), and ability to remotely adjust scene-lighting (e.g., typically experienced in theaters).

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$43,764

EPIC Funds Encumbered:

$1,999,990

EPIC Funds Spent:

$1,712,324

Match Partner and Funding Split:

Glint Photonics, Inc.: $195,064 (8.9 %)

Chaz Teplin: $5,000 (0.2 %)

Match Funding:

$200,064

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

21 out of 33 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The recipient has completed the prototype of their automated luminaire. The control software has been demonstrated with upgrades to enable dynamic sensor-linked control in progress. The next task is a pilot installation including integration of their dynamic lighting products with a sensor to detect occupant location and activity, and implementation of control algorithms to optimize the lighting distribution for the room usage. Shelter-in-place orders limited the ability to develop and test control systems intended for application in public areas such as offices, galleries, and retail stores. The agreement term was extended nine months due to COVID-19 affecting both internal operations at Glint, and operations at UC Davis, where the demonstration for this project was initially planned.

Project Name: EPC-18-008 - Improving Energy Efficiency and Performance of Wastewater Recycling

Recipient/Contractor: MicroBio Engineering, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 3/6/2019 to 3/30/2022

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

California recognizes that there is a need to maximize synergies in the Water-Energy-Food Nexus. Wastewater treatment facilities have been slow to adopt more efficient technologies due to cost effectiveness and reliability of new systems. Algae-based wastewater treatment has the potential reduce energy consumption and chemical usage while also recycling nutrients and producing fuels from wastewater. However, algae-based wastewater treatment technologies have seasonal limitations that prevent their use in winter months.

Project Description:

This project will advance the RNEW (Recycle Nutrients Energy and Water) process, which will overcome the seasonal limitation of current wastewater treatment pond processes by the selective use of mechanical aeration to optimize wastewater treatment in winter months and incorporating a two-stage process of biomass settling and filtration for algae - biomass harvesting. The products resulting from this process are unrestricted reuse water, and biomass that can be used to generate biofuels and fertilizers. RNEW is suitable for both small and large communities. The RNEW process can be applied to new, or retrofitted to existing, wastewater treatment plants. The technological and scientific knowledge being advanced by this project are the controlled operation of intensive high-rate algal ponds for year-round wastewater treatment. This includes low-cost harvesting of the algal biomass by a combined algal settling and membrane separation for recovery of energy, fertilizers and reclaimed water.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will advance the science and engineering of algae wastewater treatment systems, to enable current and future California wastewater plants to reduce net electricity consumption while improving plant performance and lower overall costs. The RNEW technology has projected 80 percent lower electricity consumption and 50 percent lower annualized capital and operating costs than conventional activated sludge, and meets California's Title 22 recycled water standards, with much lower nutrient effluent concentrations than currently required.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Water-Energy Nexus: R.13-12-011 <Closed>

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h, 2a, 3a, 3b, 4a

Lower Costs: The RNEW technology has projected 80 percent lower electricity consumption and 50 percent lower annualized capital and operating costs than conventional activated sludge.

Environmental Benefits: The estimated annual greenhouse gas emissions reduction for all cities within the San Joaquin Valley (with a population greater than 100,000) is 46,000 to 48,000 mt CO2e/yr (metric tons of carbon dioxide equivalent, per year) by incorporating algae raceways and turbine generators to the water treatment plants.

Consumer Appeal: The projects economic goals are to improve the cost effectiveness of the RNEW system, which will increase consumer appeal. Improvements in greenfield purification are projected to reduce cost by $2,600 per 1M Gal. Improvements for the nutrient removal upgrade are projected to reduce cost by $350 per 1M Gal.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$548,356

EPIC Funds Encumbered:

$1,550,227

EPIC Funds Spent:

$254,411

Match Partner and Funding Split:

MicroBio Engineering, Inc.: $160,000 (9.4 %)

Match Funding:

$160,000

Leverage Contributors:

United States Department of Energy: $200,000

Leveraged Funds:

$200,000

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

21 out of 33 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-008 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, MicroBio further advanced their RNEW technology for recovering nutrients, energy, and water from the wastewater treatment process in three main ways. They completed the setup of the full-scale experimental system for Test Set 1 (nitrogen conversion improvement testing) and the pilot-scale recycled water filtration experiments for Test Set 2 (nitrogen treatment optimization testing). Their optimization experiments for Test Set 1 & 2 are generating weekly data sets to be used to develop operation models and guidelines. MicroBio's Technical Advisory Committee and Critical Project Review meetings also generated valuable feedback for the project leaders on advancing the RNEW technology.

In the closing of 2020, and early 2021, the recipient will focus on continuing optimization experiments for Test Set 1 & 2 (especially going into winter when nitrogen removal is more challenging) and establishing the framework to develop operational models from the results.

Project Name: EPC-18-009 - Energy Savings Through Osmotic Concentration for the Food and Beverage Processing Industry

Recipient/Contractor: Porifera, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 4/1/2019 to 1/30/2023

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings.

Issue:

There is a need for energy-efficient methods to concentrate food and beverage products with high tolerance to processing conditions, that will not degrade product quality. While thermal evaporators are widely used, they are energy intensive and degrade products. Membrane systems have also been used to concentrate dilute food and beverage products, but most of these systems have significant operation limitations caused by fouling of the membrane and pressure limits. These issues have rendered most membrane systems unusable for the majority of food and beverage processing, including concentration of fruits and vegetable juices, and dairy products.

Project Description:

Porifera will demonstrate a commercial-scale system that offers an energy efficient way to create high quality concentrates without using heat or pressure. They will build and install their PFO Concentrator system, using an innovative forward osmosis technology to reduce energy, chemicals, and maintenance required for food and beverage processors. The system will be installed for operations at a watermelon processing plant in California, for the duration of three consecutive processing seasons. The team will generate and analyze various juice samples throughout the season and post-season, and make refinements to the system until a third and final configuration is able to demonstrate production of a sellable concentrate that is superior to current quality levels. Porifera is also partnering with the U.S. Department of Agriculture (USDA) to study and produce freeze-dry products from the concentrates to demonstrate other applications of the system. Measurement and Verification will be performed by the USDA and results will be shared with Energy Commission staff, industry stakeholders, and the demonstration host site.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will help the state achieve its statutory energy goals by demonstrating an innovative technology that can produce juice concentrate and freeze-dried powder products that meet food

safety standards, is cheaper, and more energy efficient than current mainstream thermal evaporator systems.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h, 3a, 3g, 4a, 4c, 4d, 4e

Lower Costs: The PFO Concentrator has the potential to provide between 50-90 percent cost savings over conventional thermal evaporators by offsetting energy and water use.

Environmental Benefits: The PFO Concentrator will reduce CO2 emissions and will improve groundwater and surface water resources due to increased reuse of water.

Consumer Appeal: Food and beverage products will have improved aromas, flavors, and colors, increasing the variety of natural products available on the market.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$908,606

EPIC Funds Encumbered:

$2,800,687

EPIC Funds Spent:

$2,087,540

Match Partner and Funding Split:

Porifera, Inc.: $605,073 (17.8 %)

Match Funding:

$605,073

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

21 out of 33 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Porifera has successfully doubled the capacity of their forward osmosis concentrator at their demonstration site hosted by Van Groningen & Sons, a third-generation California watermelon grower and processor. With the close of their second watermelon season the team has processed 17,035 L of fresh juice into 1,583 L of 65 brix juice concentrate. There has been positive feedback from interested parties on the quality of product produced. The team is now beginning the preparation of their final season and demonstration, where they will evaluate the energy intensity of their system under ideal processing conditions for producing high quality product.

Project Name: EPC-18-010 - Energy and Water Savings in Food and Beverage Wastewater Reuse

Recipient/Contractor: Porifera, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 4/1/2019 to 1/30/2023

Program Area and Strategic Objective:

Applied Research and Development

S1: Improve Energy Efficiency Technologies and Strategies in California's Building, Industrial, Agriculture, and Water Sectors.

Issue:

Affordable water reuse is a pain-point for food and beverage manufacturers, especially in water-stressed areas in the state, like southern and central California. Waste disposal costs and water sourcing expenses are increasing. Manufacturers are looking for solutions that will offset these rising costs of water use and treatment through energy efficient and reuse practices.

Project Description:

The goal of this agreement is to develop new capabilities with the Porifera Forward Osmosis (PFO) Recycler so that it can treat high-starch wastewater from food and beverage manufacturing facilities and turn it into clean water for onsite reuse. If successful, this project will open up new market opportunities for the PFO Recycler and provide California's food and beverage manufacturers with a new energy efficient solution to rising water prices and wastewater disposal costs.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

California recognizes the relationship between water use and energy use. California food and beverage processors are large energy and consumers. This project has the potential to produce an energy efficient method for treating water at the source of its production.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Identify Disadvantaged Communities in the San Joaquin Valley and Provide Economically Feasible Options for Affordable Energy: R.15-03-010 Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h, 3a, 4c, 4d, 4e

Lower Costs: This technology would provide benefits to the site operator by decreasing costs for water consumption and electricity for pumping, by as much as 40 percent compared to the current leading technology. Additionally, by using on-site wastewater treatment, costs are avoided through reduced wastewater treatment.

Environmental Benefits: This project will reduce water consumption and imbedded energy use from pumping and wastewater treatment, resulting in more availability of water and reduced carbon emissions.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$480,430

EPIC Funds Encumbered:

$1,777,132

EPIC Funds Spent:

$889,211

Match Partner and Funding Split:

Porifera, Inc.: $195,000 (9.9 %)

Match Funding:

$195,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

21 out of 33 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Porifera is currently in the planning of installation phase for their initial PFO recycler pilot demonstration. The team finalized their agreement and installation plans with Frito-Lay to arrange the terms of their initial testing of treating wastewater consisting of high starch content. The team, meanwhile, has been performing in house testing of sample wastewater from the facility. The system is currently being fabricated and is scheduled to begin installation and field testing in quarter two of 2021.

Project Name: EPC-18-011 - Lancaster Advanced Energy Community (AEC) Project

Recipient/Contractor: Zero Net Energy Alliance, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan, 2018-2020 Triennial Investment Plan

Project Term: 6/20/2019 to 3/31/2023

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings., 2.4 Incentivize DER Adoption through Innovative Strategies at the Local Level

Issue:

Local governments and cities will play a large part in reaching California's ambitious renewable energy goals. However, as cities move their energy mix to more renewable energy, they face new challenges. 100 percent renewables requires intelligent resource management to help balance the grid. There is a need for new public-private partnerships and business models that enable cost-effective implementation of zero net energy buildings, community-scale solar and storage, and other distributed energy resources. Finally, intensifying climate impacts have underscored the need to increase local resilience to grid outages by accelerating deployment of renewable microgrids.

Project Description:

This project will deploy energy storage and microgrids at sites throughout Lancaster and integrate these DERs into a first-of-its-kind Virtual Power Plant (VPP). The project will demonstrate the power of local renewables, storage, and flexible load to balance the local grid, mitigate the duck curve, and provide valuable new grid services. These shovel-ready projects include two master-metered, ZNE affordable housing developments that island as microgrids. Renewable microgrids will be deployed at three Lancaster city schools, allowing these schools to provide critical services and act as shelters in an emergency. In addition, 3 MWh of energy storage will be deployed at commercial sites throughout Lancaster via the Lancaster Green District program, which will demonstrate an innovative public-private partnership model. All of these resources will be integrated into the Lancaster VPP, which will enable optimized performance of 5 MW of solar PV and 10 MWh of energy storage. The Lancaster VPP will demonstrate how local load-serving entities can help mitigate the problem of solar over-generation and intermittency with economic DER solutions.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will support the development and commercialization of technological advancements and breakthroughs that overcome barriers to the achievement of the State of California's statutory energy goals by demonstrating a virtual power plant that can optimize the value and improve the economic attractiveness of distributed energy resources. In addition, the project will act as a demonstration for promising technical solutions that will lower costs and provide superior operational value, including a side-by-side demonstration of flywheel and lithium-ion storage systems, as well as several deployments of modular microgrids.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Smart grid: R.08-12-009 <closed> Net energy metering: R.14-07-002 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Streamlining Interconnection of Distributed Energy Resources and Improvements (Rule 21): R.17-07-007 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 1a, 1b, 1c, 1e, 1f, 1h, 1i, 2a, 3a, 3b, 3f, 4a, 5a

Lower Costs: These developments will utilize an innovative stationary storage business model that minimizes up-front capital costs through a shared savings model. This project will demonstrate how master-metering new residential subdivisions can reduce interconnection costs and enable easier participation in grid services markets. Also, the residential microgrids will demonstrate flywheel energy storage, which offers enticing cost savings, extended operating life, and superior perforce compared to conventional battery storage.

Greater Reliability: As Lancaster increases its reliance on distributed solar PV as a base load resource, the battery storage deployments and integration with the VPP will increase grid reliability and substantially mitigate reliability issues with PV generation.

Increase Safety: Lancaster is located directly over the San Andreas fault at the end of a long feeder line, which creates exceptional risk of long-term outages in the event of an earthquake, fire, or other emergency. The residential community and resilient school microgrids will have islanding/anti-islanding capabilities to maintain critical community services and act as shelters during emergencies, while preventing back feeding energy onto the grid.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$809,583

EPIC Funds Encumbered:

$4,999,060

EPIC Funds Spent:

$1,047,057

Match Partner and Funding Split:

City of Lancaster: $5,025,000 (47.1 %)

Gridscape Solutions, Inc.: $239,720 (2.2 %)

Lancaster School District: $330,000 (3.1 %)

Amber Kinetics, Inc.: $75,000 (0.7 %)

Blue Strike Environmental, Inc.: $5,000 (0.0 %)

Match Funding:

$5,674,720

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

9 out of 9 bidders

Rank of Selected Applicant/ Bidder:

Group 6: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-011 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, the project team finalized technical assessments as well as the cost and load-modeling for the microgrid sites. Additional battery storage was installed at school sites and the team helped formalize the school district's participation in the Green District Program with LCE. The team began the technical design for the VPP and drafted a program design for the Green District Program. Delays occurred in June when SCE raised concerns regarding regulatory and interconnection-related challenges to the residential microgrid's master-meter design. The team identified options for moving forward on the residential microgrid and hired a legal expert to provide analysis on these options. In 2021, the city will consider the final analysis and determine the best option. Once the city decides, the team will meet with CEC staff to determine any impacts on the project. The team remains optimistic that the project goals will be met.

Project Name: EPC-18-012 - Production Scale-Up of Low-Cost, Long-Life Flow Battery

Recipient/Contractor: Primus Power Corporation

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/28/2019 to 3/31/2023

Program Area and Strategic Objective:

Market Facilitation

S18: Foster the Development of the Most Promising Energy Technologies into Successful Businesses.

Issue:

Grid energy storage, including Li-ion and flow batteries, needs to become more cost effective, safe and reliable. Unlike flow batteries, Li-ion batteries pose fire risks and decrease delivered power over time. The main barrier to wide-spread adoption of flow batteries is its high comparative cost to Li-ion. Once mass produced at scale, flow batteries should have a significant cost advantage. However, making the transitioning from a production process designed to build prototypes to high-volume manufacturing presents a number of technical challenges and financial risks for early-stage energy technology companies.

Project Description:

This project will support the production scale-up of the EnergyPod 2 (EnergyPod) from MRL 7 (Manufacturing Readiness Level) to MRL 8. The EnergyPod is a zinc bromide flow battery that offers energy storage with an estimated five hours of continuous output at 25 kW, a useful life of 20 years, no electrode stack replacement and no fire risk.

The Recipient (Primus) will transition to a mature, high volume manufacturing process using a contract manufacturing strategy that leverages existing high-volume manufacturing equipment and processes. Primus will receive the major subassemblies for the flow battery from contract manufacturing partners and complete the final assembly in its existing facility. Using this new process of contract manufacturing; Primus will be able to increase production while lowering costs, which will lead to Primus' ability to offer more cost-effective energy storage.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by scaling up production of the Recipient's flow battery with rated power of 25kW and discharge energy of 125 kWh. Primus' technology offers a battery with no membrane, single flow loop and high voltage with low cost chemistry. The Recipient's flow battery differs from traditional flow batteries in that it does not require an ion exchange membrane and it uses a single electrolyte flow loop. These differences provide significant competitive advantages because they require fewer parts and have longer

system cycle life, higher power density, higher reliability and reduced safety risks. The Recipient's flow battery units may be interconnected with each other to form larger energy storage systems.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed> Smart grid: R.08-12-009 <closed>

Applicable Metrics: CPUC Metrics- 1i, 2a, 3a, 3b, 3h, 4a, 5d, 5e

Lower Costs: The EnergyPod 2 will be able to reduce the market price dramatically of grid energy storage, leading to state-wide cost savings on new storage capacity installations and allowing for increased deployment of renewable generation. The most relevant cost saving metric is the reduction in the market price of long duration energy storage as a direct result of scaling-up Primus' manufacturing capacity and of this specific project. Because Primus' technology benefits from a low raw material cost advantage over all other flow and Li Ion competitors in the market, the EnergyPod 2 is expected to become the market leader in low-cost, long-duration storage once it reaches high volume production.

Greater Reliability: The EnergyPod 2 has a lab-tested 20-year lifespan (30,000 cycles) without performance degradation. Compared to other flow batteries, the EnergyPod 2 is more reliable and energy dense.

Increase Safety: In addition to its sustainability, the EnergyPod 2 is comprised of metals that pose much lower safety and environmental risks compared to Li Ion. The EnergyPod 2's electrodes are made with coated titanium, which have a low-toxicity, have geographically diverse mining resources, and do not pose significant health risks. In addition, the EnergyPod 2 has an inherently non-flammable ZnBr system.

Environmental Benefits: If Primus EnergyPods were used to capture annual renewable over-generation, which equates to 130,000 MWh in 2020 (CAISO forecasting), and then discharged to offset the rapid ramping requirements from natural gas capacity to meet evening peak loads, California would avoid emitting 6,610 metric tons of CO2 per year. As wind and solar supply more of the total annual energy demand in CAISO, the expected curtailment and potential emissions savings from storing over-generation grow as well.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$400,000

EPIC Funds Encumbered:

$4,000,000

EPIC Funds Spent:

$0

Match Partner and Funding Split:

Primus Power Corporation: $6,319,321 (61.2 %)

Match Funding:

$6,319,321

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 31 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-012 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The start of this project has been delayed due to COVID-19 related issues. The recipient is expected to start this project in early 2021 and will focus on preparing their facility for manufacturing their product (EnergyPod 2) at scale. The recipient will test their product and refine its design for manufacturability. This will include buying and installing equipment for manufacturing at scale, followed by performing initial production tests with design refinements, certifying their product's design, and performing pilot production tests to prepare their product for Low Rate Initial Production.

Project Name: EPC-18-013 - The Oakland EcoBlock, Phase II: A Zero Net Energy, Low Water-Use Retrofit Neighborhood

Recipient/Contractor: The Regents of the University of California, Berkeley

Investment Plan: 2015-2017 Triennial Investment Plan, 2018-2020 Triennial Investment Plan

Project Term: 6/28/2019 to 5/30/2023

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S12: Overcome Barriers to Emerging Energy Efficiency and Demand-Side Management Solutions through Demonstrations in New and Existing Buildings., 2.4 Incentivize DER Adoption through Innovative Strategies at the Local Level

Issue:

Adoption of energy efficiency and distributed energy resources in the existing residential building stock is happening too slowly to meet California's energy and climate goals. Adoption of these technologies have been hindered by transaction costs associated with customer acquisition, permitting, financing and construction inherent to the one-house-at-a-time model, and limited access to capital to finance the high upfront costs. Since about 60 percent of California's housing stock was constructed before energy codes, tackling this scale of retrofits in a short time-frame calls for a strategic plan that leverages the economies of scale of retrofitting multiple neighboring houses at the same time.

Project Description:

Leveraging economies of scale, the EcoBlock advances a new model for scaling DER in existing neighborhoods through holistic block-scale retrofitting that combines deep energy efficiency retrofit strategies, integrated distributed energy generation systems, and water conservation and capture systems in a low-to-middle income neighborhood in the City of Oakland. This project is the second Phase of the EPIC Challenge: Accelerating the Deployment of Advanced Energy Communities. This project will implement the master plan developed in Phase I.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

SB 350 sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Deploying customer-side of the meter technologies at scale will help meet this goal, but will require new innovations to how local jurisdictions design, plan, finance, and manage energy upgrades at the community level. This project is deploying sustainable financing structures, clear owner-operator responsibilities, and streamlined planning and permitting processes, which are critical to successfully deploying community-scale energy retrofits throughout the state.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1f, 4a

Lower Costs: By aggregating and collectively controlling the electrical load of an entire block allows the cost-effective construction of a microgrid with shared DERs that lowers capital costs and improves operational efficiency. Overall, thanks to the economies of scale that its collective approach allows, the EcoBlock will lower utility bills by reducing residential energy use by an estimated 60 percent-70 percent.

Greater Reliability: Reduced electricity consumption and peak demand reduction, achieved by the deep energy retrofits, local storage, and the microgrid controller scheme proposed in this project, will avoid reliance on least-reliable generation sources at the margin. In addition, the microgrid's ability to operate independently ("island") of the PG&E grid in case of emergency or natural catastrophe will protect consumers from grid outages, thanks to the robustness its own DC grid reliability.

Increase Safety: Consumers are safer when more appliances can be switched to locally generated power during grid outages. More important, the microgrid's islanding capabilities enable consumers to gain access to critical electrical end uses (like heating, hot water, lighting, and refrigeration) during outages and potential catastrophic events. Finally, the conversion of end-uses to electricity avoids the dangers of natural gas in the home, including fires, explosions, and combustion products in indoor air.

Consumer Appeal: By aggregating the required design, permitting, financing, and construction work across a block of homes, the EcoBlock concept reduces transaction costs, overcomes information barriers, and allows access to lower-cost financing mechanisms that are not available to individual building owners.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$700,249

EPIC Funds Encumbered:

$5,000,000

EPIC Funds Spent:

$417,216

Match Partner and Funding Split:

Spie Batignolles: $1,000,000 (11.8 %)

City of Oakland: $1,200,000 (14.1 %)

EMerge Alliance: $100,000 (1.2 %)

ARDA Power Inc.: $220,000 (2.6 %)

Rexel USA, Inc. DBA Platt Electric Supply: $70,000 (0.8 %)

Building and Construction Trades Council of Alameda, AFL-CIO: $50,000 (0.6 %)

Spectrum Energy Development, Inc.: $33,600 (0.4 %)

Stanford University - Civil and Environmental Engineering: $16,000 (0.2 %)

Morgan, Lewis & Bockius LLP: $800,000 (9.4 %)

Siegel & Strain Architects: $2,000 (0.0 %)

Match Funding:

$3,491,600

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

9 out of 9 bidders

Rank of Selected Applicant/ Bidder:

Group 5: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

After conducting outreach and corresponding with residents of the original residential block planned for this demonstration, the project team decided to select a new block in Oakland. UC Berkeley put together technical criteria for selecting a new demonstration site, conducted a campaign for blocks to self-elect themselves, and chose a block in the Fruitvale neighborhood of Oakland. Due to COVID-19, the recipient has developed a Disease Action Plan that will cover all interactions with the residents, including future meetings, signed forms and in home assessments and retrofits. The project team has also begun conducting deep energy audits on residences to use the data to create engineering and design documents. In 2021, the recipient plans to finalize design and engineering plans and the governing structure of the EcoBlock which will take over after the agreement and finance the ongoing operation and maintenance costs of the communal and energy and water installations.

Project Name: EPC-18-014 - Production Scale-Up of Thermionic Energy Harvesters

Recipient/Contractor: Spark Thermionics, Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/28/2019 to 3/29/2024

Program Area and Strategic Objective:

Market Facilitation

5.2 Accelerate the Most Promising Energy Technologies from Prototype to Market Entry

Issue:

California is relying heavily on solar PV and wind for clean renewable generation. However, these generation technologies cannot meet peak demands and therefore need to be supplemented with energy storage. Such storage can be provided by the combination of concentrated solar power (CSP) and thermal energy storage (TES), which resolves issues such as lifetime and reliability that plague battery storage. However, currently CSP adoption is limited by its cost, which is more expensive than PV despite being comparable in price several years ago.

Project Description:

This agreement is to fund the production scale-up of Spark Thermionics' thermionic energy converter, to low rate production stage. When combined with next-generation CSP, the Recipient's technology can increase the power output by 75-90 percent relative to today's best CSP plants. This additional power can drive down the cost to 5.6 cents/kWh. Under this agreement, the project team will analyze cost reduction for process development and manufacturing for the core and encapsulation components within the energy harvesters. The project will also validate that the thermionic topping cycle within the energy harvester has adequate heat rejection from CSP that would be necessary for thermal energy storage (TES) to increase the efficiency and power output of a power generating system. With this technology, flexible generation can address the grid-level challenges of solar PV- generated electricity, namely variability, uncertainty, and nonsynchronous generation.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The high-temperature energy harvesting technology will improve the efficiency of concentrated solar power generation, reducing the capital and operating costs associated with power generating systems. The combination of having a technology that can absorb adaptable amounts of heat and then utilize the heat for time-varying electrical consumption will expedite further large-scale integration of renewable resources to enable California's highly ambitious energy goals. This technology will allow for more integration of renewables for California at a lower cost.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Renewables Portfolio Standard Program: R.18-07-003 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1b, 1e, 1f, 1h, 1i, 2a, 3b, 4a, 5d

Lower Costs: According to calculations for thermionic topping cycles led by NREL, the levelized cost of electricity (LCOE) for next-generation CSP with TES when combined with a thermionic topping cycle can be as low as $0.056 / kWh. This reduction will result in lower costs for electricity ratepayers compared to competing dispatchable generation.

Greater Reliability: California is targeting 60 percent of retail electricity to come from renewables by 2030. However, a high penetration of intermittent renewables to achieve this target could jeopardize grid reliability. Concentrating Solar Power (CSP) with thermal energy storage (TES) can not only provide renewable generation, but also flexible, stabilizing generation. Thermionic topping cycles will enable lower costs to drive the adoption of low-cost CSP with the added benefit of reliable, dispatch able generation.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$184,914

EPIC Funds Encumbered:

$1,349,933

EPIC Funds Spent:

$341,655

Match Partner and Funding Split:

Spark Thermionics, Inc.: $270,000 (16.7 %)

Match Funding:

$270,000

Leverage Contributors:

Defense Advanced Research Project Agency: $1,500,000

U.S. Department of Energy: $150,000

Leveraged Funds:

$1,650,000

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 31 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-014 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, this project has acquired and commissioned important equipment, such as a leak detector, glovebox, and multiple furnaces. For portions of fabrication, manufacturing, and assembly performed in-house, this equipment has accelerated the development of processes and testing for energy harvester components. Following the completion of cost modeling at the LRIP stage, evaluation of multiple manufacturing routes for components and identifying promising manufacturing vendors and partners. This cost modeling has also illuminated simplifications to the harvester design that will further reduce long-term costs.

Project Name: EPC-18-015 - Improved Batteries for California's Zero-Emissions Vehicle Future

Recipient/Contractor: Cuberg, Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/28/2019 to 12/31/2022

Program Area and Strategic Objective:

Market Facilitation

5.2 Accelerate the Most Promising Energy Technologies from Prototype to Market Entry

Issue:

The performance of lithium-ion batteries is beginning to plateau as the technology approaches the fundamental limits of the materials. New types of batteries with new chemistries are required to continue to create batteries with more energy capacity, durability, and power. Batteries with lithium metal anodes can hold more energy than traditional Li-ion technologies and some are nonflammable. However, these batteries can be expensive to make and saving manufacturing costs by using low-cost foreign contract manufacturers can compromise the intellectual property.

Project Description:

The purpose of this Agreement is to fund the setup and commissioning of a pilot-scale production facility for manufacturing lithium-metal battery pouch cells. These innovative lithium-metal battery cells have a high energy density and are non-flammable. The Recipient has pioneered a capital-efficient approach to scale up by using low-cost foreign contract manufacturers to produce the parts of the lithium metal battery that are standard and finishing the manufacturing in-house. During in-house manufacturing, dry cells are cut open, injected with a unique electrolyte and vacuum-sealed. The Recipient hopes to avoid more than 95 percent of the capital expense typically required to scale up a new battery technology to pilot production while still retaining tight control over all IP (contained in the liquid electrolyte formulation and formation cycling protocols, which are all done in-house).

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by enabling low rate initial production of high energy and safe lithium batteries, which increase the safety and range of electric vehicles to increase electric vehicle adoption in California. Currently, California aims to have 5 million zero emission vehicles by 2030. Enabling the scale up in pilot production scale will eventually accelerate the mass market adoption of electric vehicles as cheaper, higher range and safer electric vehicles are produced. This will assist California to achieve statutory goals as electric vehicles become more economically and functionally more appealing for the customers.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Alternative Fueled Vehicles: R.13-11-007 <Closed> Energy storage: R.15-03-011 <Closed>

Applicable Metrics: CPUC Metrics- 4a

Lower Costs: These next generation Lithium-metal batteries perform better than today's typical Lithium-ion battery but are expensive to make because each order is made in a one-off fashion. This project will enable the Recipient to move from building one-off prototypes to low-rate initial production manufacturing which will allow for a lower total cost of production as the technology scales up.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$229,783

EPIC Funds Encumbered:

$1,566,639

EPIC Funds Spent:

$1,158,993

Match Partner and Funding Split:

Cuberg: $316,200 (16.8 %)

Match Funding:

$316,200

Leverage Contributors:

United States Department of Energy: $1,049,989

Leveraged Funds:

$1,049,989

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 31 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 5

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-015 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Over the past year, even amidst supplier and labor challenges due to COVID-19, the project team has been able to design and build an LRIP pilot line for Cuberg's commercial cells with production volumes up to 3,000 cells/month with a yield greater than 80 percent. The team has also received substantial interest from potential customers, selling enough battery cells for evaluation to generate several hundred thousand dollars in income. Lastly, due to efforts and results from this CEC project, Cuberg has secured a high-profile, strategic partnership with a large-scale preeminent EV battery manufacturer (to be announced in Q1 2021).

Project Name: EPC-18-016 - Production Scale-Up of Advanced Wafer Technology for Drastic Solar Photovoltaics Cost Reduction

Recipient/Contractor: Halo Industries, Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/28/2019 to 3/31/2024

Program Area and Strategic Objective:

Market Facilitation

5.2 Accelerate the Most Promising Energy Technologies from Prototype to Market Entry

Issue:

The silicon solar wafer, which is the base material that the individual solar cells are fabricated from, currently account for 30 percent to 40 percent of the cost of a solar module. Solar wafers are currently created using a diamond-coated steel wire that cut through cylindrical silicon ingots using a process that results in up to 50 percent loss of ingot material as silicon saw dust while also wasting significant amounts of water. Additionally, the wafers can vary in thickness by 10-20 micrometers which further increases waste and lowers quality. New solar wafer production methods with less waste and more precision are needed.

Project Description:

The purpose of this Agreement is to fund the production scale-up and validation of a novel solar photovoltaics wafer manufacturing technology, proven at the full-scale prototype level, to low rate production stage. This technology uses silicon laser processing technology which results in no silicon material loss and nearly five times thinner wafers and five times less variation in thickness. This new process does not require water and reduces the GHG emissions embedded in the wafer manufacturing process by 50 percent while increasing quality and performance.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This Agreement will scale up and validate a novel solar wafer manufacturing technology to low rate initial production and generate significant long-term benefits in the solar photovoltaics field including: a decrease in costs associated with solar modules, an increase in the efficiency of solar modules, a reduction in the environmental impact of the manufacturing of solar modules and an enabling of next-generation solar cell/module architectures.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 1c, 1h

Lower Costs: This project is anticipated to significantly lower the cost of solar PV technology by eliminating the waste associated with solar wafer manufacturing and increasing the quality and precision of the cut.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$584,267

EPIC Funds Encumbered:

$4,000,000

EPIC Funds Spent:

$635,677

Match Partner and Funding Split:

Halo Industries: $1,250,000 (23.8 %)

Match Funding:

$1,250,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 31 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-016 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The first phase of the project, which involved the engineering and design work needed to determine and achieve target pilot production metrics using both in-house capabilities and outsourced expertise, has been largely concluded. The second phase of the project, which involves the development of a stable, scalable supply chain and the construction of the pilot production system to the design specifications determined in the first phase, is currently in progress. Steady headway is being made in engaging with suppliers, sourcing components and testing parts as they come in to verify performance and suitability. The project remains on budget and on track to achieve the targeted performance metrics.

Project Name: EPC-18-017 - Scaling Up Pilot Production of Nanoporous Membranes for Battery Storage Technologies

Recipient/Contractor: Sepion Technologies, Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/28/2019 to 3/29/2024

Program Area and Strategic Objective:

Market Facilitation

5.2 Accelerate the Most Promising Energy Technologies from Prototype to Market Entry

Issue:

Batteries, charged with clean renewable energy, are poised to be the 21st century's zero-carbon solution to fossil fuel combustion, powering everything from electric vehicles to the electric grid. In order remove barriers to large-scale adoption and meet the expected increased demand for EVs, battery life, range and cost must be optimized. Current lithium batteries suffer from degradation over extended use periods, vulnerabilities to thermal runaway, and a dependence on rare-earth metals, such as cobalt, sourced from conflict ridden areas of the planet.

Project Description:

The purpose of this project is to scale-up the production of an advanced battery membrane platform for market facilitation of safe, low-cost, and energy-dense batteries. The proposed approach is to establish optimal processes for each key component of the innovative membrane (polymer, polymer ink, and roll-to-roll coating) to generate quality assurance and quality control metrics that will lead to an in-house low rate initial production of the membrane for batteries. The intent is to establish a steady commercialized platform technology that will create multiple market opportunities in a variety of battery chemistries. The innovative membrane, in addition to improving the cycle life of batteries, enables more energy to be extracted from the same cathodes used under previously abusive conditions, operate at elevated temperatures, and allows use of more abundant materials such as manganese instead of cobalt.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The nanoporous membrane platform opens paths to safely increasing Li-metal battery energy density by 40 percent, dropping the cost below $100/kWh while developing manufacturing capabilities for advanced battery components in California. This technology can be integrated with existing Li-metal battery manufacturing infrastructure to reduce barriers to market entry. Beyond Li-metal batteries, this platform membrane technology is already being leveraged to enable breakthroughs in Li-metal batteries for advanced electric vehicles with greater than 350 mile range and ultra-low-cost flow batteries for long-duration grid storage, multiplying the potential for impact.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed> Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1b, 1c, 1e, 2a, 3a, 3f, 3g, 3h, 4a

Lower Costs: The innovative membrane resulting from this project will allow the elimination of cobalt (the largest cost factor) and the use of cheaper materials to reduce cost of Li-ion batteries that will also offer increased life, reliability and range.

Greater Reliability: The resulting membrane will reduce lifetime costs, increasing durability, and boosting energy density of Li-ion batteries for EVs and grid storage.

Economic Development: This start-up company has been able to increase their company growth and hire 3 more skilled-labor employees since the start of the grant. The company is anticipating hiring 35 addition skilled-labor workers by the end for the grant.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$382,307

EPIC Funds Encumbered:

$2,675,793

EPIC Funds Spent:

$1,057,546

Match Partner and Funding Split:

CAMX Power: $150,000 (2.9 %)

Argonne National Laboratory: $210,000 (4.1 %)

Washington Clean Energy Testbeds: $50,000 (1.0 %)

Ambrosi Donahue Congdon Certified Public Accountant: $10,000 (0.2 %)

Sepion Technologies, Inc.: $2,069,417 (40.1 %)

Match Funding:

$2,489,417

Leverage Contributors:

ARPA-E: $2,500,000

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 31 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-017 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, this project scoped, installed, and validated a roll-to-roll coating tool essential to demonstrating and de-risking low-rate initial production of the novel battery membrane product. Optimization of the roll-to-roll process has already unlocked a 60-fold increase in membrane production throughput alongside notable improvements in coating quality and batch-to-batch reproducibility. In-house validation of these membranes in lithium-metal cells designed for long-range and low-cost electric vehicles yielded promising results for safe lithium metal plating. Sample membranes produced with the roll-to-roll coating tool were successfully validated in energy-dense lithium metal cells with a commercial partner. In 2021, the project team will support the following priorities in the new year: additional customer testing, in-house optimization of membrane-enabled lithium-metal cells, and deepening understanding of unit economics at scale.

Project Name: EPC-18-018 - Prototype to Production: Modular Battery Platform Project for California Critical Infrastructure

Recipient/Contractor: Caban Systems, Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/28/2019 to 3/31/2024

Program Area and Strategic Objective:

Market Facilitation

5.2 Accelerate the Most Promising Energy Technologies from Prototype to Market Entry

Issue:

California IOU ratepayers are increasingly vulnerable to power outages due to electrical equipment and infrastructure failures, brownouts, wildfires, earthquakes, severe storms and landslides. This makes it imperative to accelerate the deployment of energy storage solutions for critical communication infrastructure to keep ratepayers safe. IOUs also need modular energy supply systems that can be deployed quickly to communities during extended power outages and after natural disasters. This illuminates the need to scale-up production and deployment of reliable, modular energy storage platforms for life-saving, fossil-fuel-free, backup power for critical infrastructure.

Project Description:

This project will scale-up manufacturing for a dedicated, modular battery platform for critical infrastructure (initially targeting telecommunication towers) and make it possible for the manufacturing to be in California. The high-energy-density battery pack has best-of-class battery management and control software to remotely meter, monitor, and control the units. The battery platform is designed for fire resiliency and will withstand extreme temperatures. In combination with onsite renewable energy, the equipment can bring a cell tower under environmental distress back online. In case of Public Safety Power Shutoffs (PSPS), the platform can power telecommunication systems and critical infrastructure for hours or days, restoring communication immediately after a fire, no matter the damage to the grid infrastructure or power lines. The modular battery platform also can be used as a pop-up energy source to be quickly deployed to disaster areas to restore electricity for lights, water, heating, and cooling.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by accelerating the production of an emerging, best-of-class energy storage technology that will improve public safety, lower costs, and reduce emissions. Ratepayers rely on critical infrastructure for communication to keep them connected during power outages often related to wildfires and severe weather events. Currently, critical infrastructure, including telecom base stations, radio signal towers, and cell

phone towers rely heavily on fossil fuel-powered generators for back-up power. To maintain communication during outages, there is an immediate need to scale-up production for a clean-energy storage platform that can provide services to critical infrastructure during outages.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Self-Generation Incentive Program: R.12-11-005 <Closed> Energy storage: R.15-03-011 <Closed> Smart grid: R.08-12-009 <closed> Distribution Resources Plans (AB 327): R.14-08-013 Streamlining Interconnection of Distributed Energy Resources and Improvements (Rule 21): R.17-07-007

Applicable Metrics: CPUC Metrics- 1c, 1e, 1h, 1i, 2a, 3b, 3c, 4a, 4b, 5a, 5d, 5e

Lower Costs: The project will lower costs for IOUs, and thus ratepayers, by reducing the need for grid extensions to critical infrastructure in remote locations.

Greater Reliability: The project will scale-up production of a modular battery platform that will increase the reliability of life-saving, critical infrastructure during power outages and peak grid hours.

Increase Safety: The project will help increase safety by providing a modular battery platform that can be used as a pop-up energy source for communities when the grid is offline.

Economic Development: The project expects to create 21 new, direct, living-wage jobs in California through the scale-up of their manufacturing facility.

Environmental Benefits: The project will provide environmental benefits by reducing or eliminating the need for diesel- and gas-powered back-up generators for critical infrastructure.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$1,878,760

EPIC Funds Spent:

$1,690,765

Match Partner and Funding Split:

Caban Systems, Inc.: $1,396,943 (42.6 %)

Match Funding:

$1,396,943

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 31 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-018 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, Caban Systems has completed validation and testing of their core product, the Enduro System. They improved their manufacturing capability from a pilot line to beginning low rate initial production, identified and purchased all required capital equipment (CTL, laser welder, etc.), and will be at MRL 9 by the end of 2020. Caban Systems will have shipped approximately 70-80 Enduro energy systems to customers worldwide by the end of the year. They completed all required UN certifications, begun required UL certifications and have successfully stayed on or ahead of their project schedule.

In early 2021, Caban will focus on scaling production to reach full capacity at their manufacturing facility, growing their sales and customer pipeline, and completing UL testing and certification. They will continue to lower costs across materials and production and plan to raise a Series B round of financing to support their continued growth.

Project Name: EPC-18-019 - Treau: Low-GWP, High-Efficiency Heat Pump and Air Conditioner

Recipient/Contractor: Treau, Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/28/2019 to 3/31/2024

Program Area and Strategic Objective:

Market Facilitation

5.2 Accelerate the Most Promising Energy Technologies from Prototype to Market Entry

Issue:

There are limited energy-efficient and all-electric solutions for space heating and cooling for multi-family and low-income homes. In the US, heating and cooling in buildings constitutes 15 percent of all energy use and produces more emissions than the transportation sector. The growing energy demand and CO2 footprint must be reduced by using low-Global Warming Potential refrigerants and replacing methane heating with electric heat pumps. Multi-family and low-income residences are limited to poor-performing window and portable ACs with few efficient and low-carbon options compatible with their buildings, budgets, and needs.

Project Description:

The purpose is to scale-up a manufacturing line of quieter, less expensive, and easy-to-install, retrofit window electric heat pumps. The unique design allows unfettered access to the window where the unit is placed. Customers are able to install the unit without expensive tools or professional installation. The proposed approach is to build successive prototypes, which will be tested for performance and usability to finalize a product ready for manufacturing scale-up. The project will result in quality assurance and quality control metrics, relationships with suppliers, and a system design that leads to initial low-rate production of air conditioners for the residential market. The benefits of the project, as related to California IOU electricity ratepayers, are lower heating and cooling costs, more comfortable homes, and reduced air pollution. Successful execution will accelerate the reduction of cost and emissions of building heating and cooling goals for existing buildings at significant scale, especially among users of window A/C. Additionally, this technology can provide a high-efficiency all-electric product for achieving California's residential Zero Net Energy Action Plan.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project would help displace low-efficiency window air conditioners, displace the use of polluting HFC refrigerants, and increase adoption of efficient air conditioners and heat pumps in homes and multi-family units. Additionally, because the Treau system uses a hermetically, factory-sealed, leak-tested refrigerant circuit, the unit substantially reduces the release of methane emissions compared to expensive mini-split systems. With energy savings up to 70

percent in heating, the technology can help achieve improved building efficiency goals for existing buildings in California. Additionally, Treau can provide a high-efficiency all-electric product for achieving California's residential Zero Net Energy Action Plan.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h, 2a, 3a, 3b, 3c, 4a

Lower Costs: Treau's system provides lower costs due to the development of a high-efficiency and low-cost heat exchanger and removing the high cost of professional installation.

Environmental Benefits: The new technology has the potential for reducing emissions from buildings. Treau's proposed technology saves 33 percent of the energy used for cooling and 70 percent energy used for heating compared to existing technologies. By using a natural refrigerant (R290), Treau will significantly reduce the cost and emissions of building heating and cooling. Additionally, R290 is capable of offsetting nearly 2 GtCO of emissions per year.

Consumer Appeal: Drawn from user research studies, Treau systems have a strong customer appeal due to their low-cost, low-profile, low-noise, and ease of installation. This technology will increase home comfort with little to no maintenance.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$834,152

EPIC Funds Encumbered:

$2,805,907

EPIC Funds Spent:

$771,854

Match Partner and Funding Split:

Treau, Inc.: $1,901,907 (40.4 %)

Match Funding:

$1,901,907

Leverage Contributors:

Strategic Growth Council: $2,000,647

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 31 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-019 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Treau is developing models for final design verification to begin manufacturing. They are testing pre-launch systems for feedback on installation, user interface, and phone app. Treau has tested different compressors and refrigerants, refined prototype test plans, and assembled three generations of prototypes and installed them in homes. Treau characterized how the unit performs on a system and component level, and considered dimensions, weight, and noise. They have built out the supply chain and begun conversations with manufacturing partners. After passing verification tests, Treau will select a manufacturing partner and develop tooling for plastic and sheet metal parts. Treau will complete reliability testing and regulatory certifications necessary for sale to customers. Treau will begin manufacturing units at the manufacturing partner's facility and verify all specifications are met. Treau expects to reach low-rate initial production of at least 300 units/year in 2021.

Project Name: EPC-18-020 - Production Scale-Up of High Efficiency Adjustable Lighting Products

Recipient/Contractor: Glint Photonics, Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/30/2019 to 3/29/2024

Program Area and Strategic Objective:

Market Facilitation

5.2 Accelerate the Most Promising Energy Technologies from Prototype to Market Entry

Issue:

An estimated 41 TWh of electricity is used annually on lighting by California IOU ratepayers, yet the majority of the generated light is wasted. Spaces are typically over-lit in order to achieve required light levels in all areas, all the time. Department of Energy studies indicate that 2x-3x efficiency improvements are possible through improved light utilization. Utilization efficiency improvements will have to come from innovation at the luminaire level, not at the LED source level. However, luminaire level innovations in particular are often overlooked in favor of more fundamental materials-based technologies.

Project Description:

Glint Photonics has pioneered revolutionary high-efficiency solid-state lighting products that use proprietary optical designs to provide precise control over light distribution, greatly increasing the amount of light that is delivered to the intended target and reducing unpleasant glare. The production scale-up work will focus on Glint's Hero family of luminaires. The objectives are (1) to refine the product design for production, focusing on improvements to manufacturability, quality, and cost; (2) to develop and qualify manufacturing processes, and build Glint's organizational capability to manage pilot production quality and operations; and (3) establish, qualify, and certify a pilot production line in partnership with a California-based contract manufacturer. At the conclusion of the project, the recipient will be ready to begin low-rate pilot production of Hero products and will have a strong foundation in place for scaling to mass production over time.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This technology can provide up to 10.2 TWh annual energy savings in California IOU territories. This a very significant contributor to the state's Zero Net Energy building goals, as set out in the CPUC's Energy Efficiency Strategic Plan and the Energy Commission's IEPR. The luminaires can also help meet the California Air Resources Board's Climate Change Scoping Plan target of 32 TWh of reduced energy consumption via energy efficiency improvements.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 3a, 3b, 4a

Lower Costs: This system lowers costs by saving energy and by reducing the number of luminaires that need to be installed in a particular space. Based on prototype performance, Glint's Hero products can deliver improved lighting quality and real-world energy efficiency improvements of approximately 50 percent over current products.

Consumer Appeal: Customers will enjoy a variety of benefits, including: better lighting distribution, less time spent on re-aiming lighting (e.g., product displays, event centers, and galleries), and ability to remotely adjust scene-lighting (e.g., typically experienced in theaters).

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$619,177

EPIC Funds Encumbered:

$1,998,922

EPIC Funds Spent:

$1,592,673

Match Partner and Funding Split:

Glint Photonics, Inc.: $399,831 (16.7 %)

Match Funding:

$399,831

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 31 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-020 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, the recipient continued to refine the product design, assembly processes, and supplier relationships required for Glint's lighting technology products to improve manufacturability, ensure quality, achieve certification, and reduce production cost. Glint recently redesigned internal mechanical parts to address issues in optical alignment and has since built test units which have met cosmetic appearance and photometric performance targets. In early 2021, Glint will submit their Hero product to a nationally recognized test laboratory for test and certification against the relevant safety standards. Glint also plans to establish and qualify an in-house pilot line in order to be capable of low rate initial production of the Hero product by the end of this agreement.

Project Name: EPC-18-021 - Production Scale-Up for Next Generation Batteries Using Liquefied Gas Electrolytes

Recipient/Contractor: South 8 Technologies

Investment Plan: 2015-2017 Triennial Investment Plan, 2018-2020 Triennial Investment Plan

Project Term: 6/13/2019 to 3/31/2024

Program Area and Strategic Objective:

Market Facilitation

S18: Foster the Development of the Most Promising Energy Technologies into Successful Businesses., 5.2 Accelerate the Most Promising Energy Technologies from Prototype to Market Entry

Issue:

Today's Lithium-ion (Li-ion) batteries were initially designed for consumer electronics (i.e. laptops, cell phones). With the growing demand for grid scale storage and electric vehicles, to decrease emissions, a new generation of batteries with improved performance are required. Improvements to the energy density, cost, and safety of lithium metal batteries, which have a high potential to replace lithium-ion in some application, have been slow to develop due to limitations in electrolyte chemistries.

Project Description:

South 8 Technologies has developed a liquefied gas electrolyte chemistry with increased performance metrics to traditional Li-ion battery electrolytes. These electrolytes enable lithium metal batteries to be produced having an increased temperature range and nearly twice the specific energy compared to traditional Li-ion batteries. Additionally these lithium metal batteries eliminate the risk of thermal runaway hazards. The purpose of this Agreement is to fund the design and build-out for a Low Rate Initial Production (LRIP) pilot line for the manufacture of liquefied gas electrolyte batteries with lithium metal anodes which have high energy density and increased safety.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This technology is advancing alternatives to Li-ion batteries that increase the safety of energy storage while also increasing the energy density. This technology does this by allowing the use of lithium metal anodes through a liquefied gas electrolyte. The developed battery technology will serve as an ideal flexible solution for both grid storage batteries and electric vehicles.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Alternative Fueled Vehicles: R.13-11-007 <Closed> Smart grid: R.08-12-009 <closed> Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1i, 2a, 3a, 3b, 3h, 4a, 5d, 5e

Lower Costs: South 8's LiGas cells will sell at an estimated $100 / kWh in full-rate production which leads reaching the United States Council For Automotive Research's goal for advanced high-performance batteries for electric vehicle applications. This also leads to an estimated levelized cost between $75/MWh to $100/MWh with additional savings over the lifetime of the project possible due to reduction in thermal management and insurance underwriting due to increased temperature stability and safety.

Increase Safety: With larger battery systems, safety is of primary importance since systems may be installed near populated or environmentally sensitive areas. South 8's battery has eliminated the risk of thermal runaway hazard that is common with lithium-ion batteries.

Environmental Benefits: The recipient estimates that annual emissions reductions for a 1 MWh grid-battery at 146,000 lbs. of CO_2. This has a substantial benefit to reducing carbon emissions and pollutants to ratepayers, ability to curb climate change and improve well-being.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$230,205

EPIC Funds Encumbered:

$1,028,059

EPIC Funds Spent:

$473,447

Match Partner and Funding Split:

South 8 Technologies: $466,416 (31.2 %)

Match Funding:

$466,416

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 31 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-021 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

South 8 is currently finalizing designs and starting installation of various components of their scaled-up manufacturing system. A key area of development is design of the equipment to accurately fill cells with the proprietary electrolyte; the battery cell injection and crimp design is currently being finalized. The recipient's gas storage and distribution system installation is close to completion. Construction of the gas delivery manifold is expected to begin in the first quarter of 2021. With the manufacturing system in place, demonstration pilot builds are expected to begin in the third quarter of 2021.

Project Name: EPC-18-022 - Advanced Energy Storage for Electric Vehicle Charging Support

Recipient/Contractor: Natron Energy, Inc.

Investment Plan: 2015-2017 Triennial Investment Plan

Project Term: 6/28/2019 to 3/30/2022

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S15: Demonstrate Advanced Energy Storage Interconnection Systems to Lower Costs, Facilitate Market and Improve Grid Reliability.

Issue:

Meeting California's goal of 5 million electric vehicles (EVs) by 2030 and electrifying rideshare will require a dramatic acceleration in the deployment of EV charging infrastructure, particularly workplace and EV Fast Charging (EVFC) stations. A sustainable business model for expanding workplace charging and public EVFCs remains extremely challenging because of high utility demand charges assessed during peak demand periods of electricity use.

Project Description:

For this project, Natron will produce an energy storage system (ESS) based on its new Prussian Blue/Sodium Ion (PB/Na-ion) battery technology. UCSD will perform on-grid performance validation of the ESS, and an existing publicly accessible EVFC station will be upgraded with a new ESS, inverter, and energy management software (EMS). This project will result in a cost-competitive alternative to Li-ion batteries that offers superior performance for high power / short-duration dispatch and long cycle life applications such as for EVFCs, frequency regulation, and grid stability during short-term utility and ISO outages. Natron will advance the battery manufacturing and product design of the ESS to Technology Readiness Level 8, enabling prompt commercial sales of PB ESS systems into the EVFC market.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The proposed project will generate greater market competition by creating superior alternative to Li-ion batteries for the EVFC market, accelerating EVFC station buildouts, and thus supporting progress towards California's GHG (AB 32, Exec. Order B-30-15), energy storage (AB 2514, AB 2868) and vehicle and rideshare electrification (SB 1014) goals.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Alternative Fueled Vehicles: R.13-11-007 <Closed> Energy storage: R.15-03-011 <Closed>

Applicable Metrics: CPUC Metrics- 2a, 3f, 5b

Greater Reliability: Energy storage paired with EVFC effectively manages local reliability and power quality impacts on the distribution grid, particularly in congested urban areas where EVFC is essential to promote adoption for multi-unit residents, disadvantaged communities and rideshare drivers. Furthermore, it enables reliable VGI services such as load following and load shifting at lower ratepayer costs as compared to utility scale storage, and with grid benefits as high as $1 billion per year in 2030.

Increase Safety: Unlike the incumbent Li-ion, Natron's PB/Na-ion batteries are not subject to fire hazards caused by uncontrolled increase in battery temperatures. Instead, Natron batteries are inherently safe in all scenarios compared to Li-ion cells. Natron batteries can be deployed in dense urban and rural remote environments without fear of fire hazards.

Economic Development: The project will fund permanent expanded manufacturing capacity at Natron's Santa Clara headquarters to produce a commercially available product. Natron will add jobs, produce a product for the EVFC market, and spur further EVFC buildout.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$96,753

EPIC Funds Encumbered:

$2,998,064

EPIC Funds Spent:

$0

Match Partner and Funding Split:

Natron Energy, Inc.: $1,239,515 (29.3 %)

Match Funding:

$1,239,515

Leverage Contributors:

ARPA-E: $19,883,951

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

7 out of 8 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-022 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

COVID-19 resulted in shutting down Natron facilities for R&D, engineering, and manufacturing for a majority of 2020. The facilities have recently reopened and the team resumed battery cell design. The EV fast chargers have been installed at UCSD. The Natron team is reassessing the project's schedule.

Project Name: EPC-18-023 - Utility Demonstration of Non-Flammable, Aqueous-Zinc Battery Storage: Innovation Scale-Up to Alleviate T&D Congestion and Mitigate Wildfire Risks

Recipient/Contractor: Eos Energy Storage, LLC

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/28/2019 to 3/30/2022

Program Area and Strategic Objective:

Technology Demonstration and Deployment

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

To date, California investor-owned utilities have focused almost exclusively on commercially available lithium-ion technologies for energy storage, which carries fundamental risks and challenges including potential higher lifecycle cost, potential fire hazards, and supply chain concerns due to raw materials needed and competition with use in electric vehicles. There is a need to demonstrate and commercialize other energy storage solutions with non-lithium ion technologies.

Project Description:

This project will demonstrate and deploy an Eos Generation 3 zinc hybrid cathode battery storage system at San Diego Gas and Electric's distribution station in Pala, San Diego County. The project will demonstrate the system, which is being designed to improve power and energy density by more than 25 percent over the previous Generation 2 system. The demonstration will support commercialization of the storage solution by providing data on system performance and safety that are necessary to create confidence in the market.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will demonstrate the application and benefits of a cost-effective and efficient non-lithium-ion energy storage solution to help with load shifting, reduction in grid congestion, and deployment of renewable energy resources to help the state meet its energy goals.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed>

Applicable Metrics: CPUC Metrics- 2a, 5a, 5d

Greater Reliability: Deployment in partnership with a utility at a distribution station to evaluate different operating scenarios will help demonstrate the value of energy storage for providing greater electricity reliability.

Increase Safety: There is no inherent risk in this battery technology for starting fires or fueling the spread of wildfires, thus making it a safer alternative to lithium ion storage systems.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$356,447

EPIC Funds Encumbered:

$2,986,110

EPIC Funds Spent:

$1,178,015

Match Partner and Funding Split:

Eos Energy Storage, LLC: $2,850,011 (46.7 %)

First Priority GreenFleet: $172,842 (2.8 %)

TBD - Contractor: $99,999 (1.6 %)

Match Funding:

$3,122,852

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

7 out of 8 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-023 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Eos completed the design and manufacturing of the Gen 3 system. Components were transported to and assembled in California and the system was installed at San Diego Gas and Electric's facility in Pala, San Diego County. The system was recently commissioned and testing is now underway.

Project Name: EPC-18-024 - Large-Scale Sulfur Thermal Battery Demonstration for Enhanced Grid Flexibility and Increased Renewable Penetration

Recipient/Contractor: Element 16 Technologies, Inc

Investment Plan: 2015-2017 Triennial Investment Plan, 2018-2020 Triennial Investment Plan

Project Term: 6/28/2019 to 3/30/2023

Program Area and Strategic Objective:

Technology Demonstration and Deployment

S15: Demonstrate Advanced Energy Storage Interconnection Systems to Lower Costs, Facilitate Market and Improve Grid Reliability., 2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

Stationary electrical energy storage systems play many important roles in the electricity grid to enhance grid reliability and flexibility. These systems are expected to grow as the grid continues to evolve with increased penetration of renewables. Pumped hydro-electric storage is by far the largest source of stationary electricity storage capacity on the grid today. However, installation of this technology is limited by geographic location, difficulty to permit new sites and high cost. Electrochemical batteries, especially Li-ion, are recently being researched mostly for deployment on the grid, but their high cost limits their viability in large-scale and long duration applications.

Project Description:

Element 16's sulfur thermal battery provides a low-cost solution to store and deliver high quality thermal energy due to its low cost, simple chemical composition, high heat transfer rates, and little to no need for any electrical heat tracing due to its low freezing point (~239 Fahrenheit), which guarantees low parasitic load and low O&M cost. The proposed project demonstrates sulfur thermal energy storage technology for electricity storage and generation, thus establishing new paradigms for increasing stored energy capacity and providing new forms of stationary electricity storage systems with the potential to drastically reduce the levelized cost of electricity.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The development of this project will enhance grid resiliency, support the transmission and distribution infrastructure, and will provide low-cost, long-duration electric storage capacity to the CA grid. Electrically charging the low-cost sulfur thermal battery gives rise to system flexibility with respect to coupling to different types of energy sources and will drive the expansion of intermittent renewable sources such as wind and solar in California. The installation of low-cost sulfur thermal battery systems provides a financial benefit in the upcoming carbon market scenarios due to reduced levelized cost of electric storage, enables delivery of electricity at peak

price periods, provides long-lasting backup power in the event of power outages during storm, etc., and substantially increases overall customer plant revenue.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed>

Applicable Metrics: CPUC Metrics- 1e, 1f, 3a

Lower Costs: The low-cost sulfur thermal battery technology can reduce peak demand charges and on-peak electricity consumption, and provide energy arbitrage. The modular nature of the sulfur thermal battery allows charge power, discharge power and storage capacity to be scaled independently with the overall net outcome of lowering cost for ratepayers and ensuring they are not paying for excess capacity.

Greater Reliability: The integration of low-cost distributed energy storage can help prevent blackouts, and provide long-lasting backup power during outages. Low-cost distributed energy reduces grid transmission congestion and secures stable electricity supply. This demonstration will pave the way for California industrial facilities to reduce their electricity usage during peak demand times, thus reducing the load placed on the California electrical grid, help with the duck curve, and seasonal over-generation or under-generation of renewables.

Increase Safety: By increasing renewable energy generation, fewer natural gas reservoirs will be required and harmful fossil fuel generation can be reduced. With the ability to provide backup power during a grid outage such as storms, it can support critical functions for hospitals, emergency meeting sites, etc.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$430,000

EPIC Funds Encumbered:

$3,000,000

EPIC Funds Spent:

$904,353

Match Partner and Funding Split:

Brad Alan LLC.: $50,000 (1.4 %)

Element 16 Technologies, Inc: $590,000 (16.2 %)

Match Funding:

$640,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

7 out of 8 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-024 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, the project team created computational models to simulate the performance of the energy storage system for design/cost optimization. A full-scale, high fidelity, 3D simulation was conducted to verify the natural convection activities and the expected transient system performance of the proposed specification. Based on these simulations, the project team determined the system size and design parameters required to meet the technical specifications of the 1500 kWhth demonstration unit, which is the ultimate goal of the project. The project team is now selecting the remaining components of the demonstration unit in order to present a final system-level design at a CPR meeting scheduled for December 1, 2020. The second year of the project will be spent on constructing and implementing the thermal battery demonstration.

Project Name: EPC-18-025 - Scale-up of Magnetocaloric Materials for High Efficiency Magnetic Refrigeration

Recipient/Contractor: General Engineering & Research, L.L.C.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/28/2019 to 3/31/2024

Program Area and Strategic Objective:

Market Facilitation

5.2 Accelerate the Most Promising Energy Technologies from Prototype to Market Entry

Issue:

Magnetic refrigeration is a high efficiency refrigeration technology that uses no hydrofluorocarbons (HFCs) and has the potential to replace traditional vapor compression systems. Magnetic refrigeration has been shown to be up to 50 percent or more energy efficient compared to VCC technologies, without using environmentally hazardous materials. Magnetic refrigeration utilizes the magnetocaloric effect (MCE), which is the temperature variation of a magnetic material after exposure to a magnetic field. However, the lack of low-cost and widely available magnetocaloric materials is preventing the wider adoption of magnetic refrigeration technology.

Project Description:

General Engineering & Research's (GE&R) has developed MCE compositions that meet both the performance and cost requirements to be compatible with large scale implementation of magnetic refrigeration systems. For this project, GE&R will develop the processing systems to manufacture their MCE materials in forms needed for integration into magnetic refrigeration systems (spheres and thin plates). Equipment with 1kg or larger batch processing will be installed to accommodate 1kg/day low-rate initial production. Production at this scale will allow for end users to develop and test magnetic refrigeration prototypes, and ultimately move these systems into production.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will help facilitate further development and deployment of magnetic refrigeration systems, which offer significant efficiency improvements over traditional vapor compression cooling systems while using no hydrodrofluorocarbons. Increased use of magnetic refrigeration can lead to lower energy use and GHG emissions.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 2a, 3c, 3f, 3h, 4a

Lower Costs: Magnetic refrigeration offers a significant reduction in energy consumption compared to traditional cooling technologies that rely on vapor compression. Additionally, the recipient's MCE materials can be produced at a lower cost than is currently available. Both these factors can contribute to reducing costs.

Environmental Benefits: Magnetic refrigeration is a high efficiency refrigeration technology that uses no hydrodrofluorocarbons (HFCs) and has the potential to replace traditional vapor compression systems.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$409,462

EPIC Funds Encumbered:

$1,088,188

EPIC Funds Spent:

$532,460

Match Partner and Funding Split:

Pacific Northwest National Laboratory: $150,000 (10.8 %)

General Engineering & Research, L.L.C.: $156,791 (11.2 %)

Match Funding:

$306,791

Leverage Contributors:

U.S. Department of Energy: $150,000

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

28 out of 31 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-025 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

In 2020, this project acquired and installed a new arc melting furnace to enable the in-house casting of innovative magnetocaloric materials that achieve 1kg per day production capacity target. Casting process development has been done to optimize performance of the materials and started to form the materials into sub-mm sized spheres using an atomization technique on this new furnace. In 2021, the project team will continue to optimize the post-casting anneals for each of the unique magnetocaloric compositions, optimize the atomization process, and acquire a new hydraulic pressing system and develop techniques to form the materials into thin plates.

Project Name: EPC-18-026 - Comprehensive Open Source Development of Next Generation Wildfire Models for Grid Resiliency

Recipient/Contractor: Spatial Informatics Group, LLC

Investment Plan: 2015-2017 Triennial Investment Plan, 2018-2020 Triennial Investment Plan

Project Term: 6/28/2019 to 3/28/2024

Program Area and Strategic Objective:

Applied Research and Development

S7: Develop Advanced Distribution Modeling Tools for the Future Smart Grid., 7.2 Increase the Resiliency of the Electricity System to Climate Change and Extreme Weather Events

Issue:

Many aspects of wildfires in California have changed in the past several decades, including climate patterns and the development of human infrastructure near wildlands. The impacts of wildfire on the electric grid have resulted in increased costs and reduced safety and reliability. Understanding the risks associated with wildfire remains challenging. Operational wildfire behavior models are empirical and not well suited for predicting extreme fire behavior. Therefore, key stakeholders responsible for managing the grid -- including IOUs and state agencies -- lack tools and information that could improve near-term management and long-term planning decisions.

Project Description:

The project is advancing wildfire science by incorporating the interaction of tree mortality and extreme fire weather into next-generation fire models. The project is developing zero-to-seven-day risk forecasts for the grid with predictive capabilities, and computational efficiency and scalability. To support planning, the team is developing long-term fire projections using a coupled fire-climate-vegetation statistical and dynamical model to integrate the latest climate projections, tree mortality, development in the wildland-urban interface, and adaptation strategies. To integrate the models into electric utility management and planning, the team is facilitating workshops with IOUs. To support the California's Fifth Climate Change Assessment, the team is developing a web-based scenario analysis tool to visualize and explore the impacts of climate change and adaptation strategies on the grid.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will aid regulators and stakeholders in meeting statutory goals by addressing critical fire science gaps and applying the science to provide advanced forecasting capability. Specifically, the project will: 1) advance the science of measuring, modeling, and analyzing extreme weather events, tree mortality, and fire spread at scale; 2) advance risk modeling frameworks to include wind extrema, statewide maps of fuel loads, updated parameterizations, and indicators of where

risk forecasting may underestimate fire risk due to gaps in science; and 3) advance the integration of science relating to vegetation dynamics, the wildland-urban interface, land-use, climate, and adaptation strategies, by building on existing models and comparing approaches.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Strategies and Guidance for Climate Change Adaptation: R.18-04-019

Applicable Metrics: CPUC Metrics- 3a, 3b, 3c, 4a, 4b, 5a

Lower Costs: The project seeks to improve IOU planning and decision-making related to wildfire risk, improving grid reliability and safety and lowering costs.

Greater Reliability: With the use of more granular, dynamic fire-spread models, mitigation activities can be more targeted, and damages associated with fire and outages can be reduced. Examples of mitigation activities include fire-hardening (pole pretreatments, equipment replacements or upgrades) and measures to minimize de-energization impacts (such as investments in distributed energy resources).

Increase Safety: Safety will be improved as IOUs can better plan for maintenance cycles to avoid areas of elevated fire risk, reducing the risk of injury and loss of life.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$546,431

EPIC Funds Encumbered:

$5,000,000

EPIC Funds Spent:

$951,723

Match Partner and Funding Split:

Reax Engineering Inc.: $242,000 (3.6 %)

University Corporation for Atmospheric Research: $49,557 (0.7 %)

Eagle Rock Analytics: $10,324 (0.2 %)

US Geological Society (USGS): $488,514 (7.3 %)

The Brattle Group: $75,000 (1.1 %)

Missoula Fire Sciences Laboratory: $622,000 (9.3 %)

Pyrologix, LLC: $95,000 (1.4 %)

Spatial Informatics Group, LLC: $74,205 (1.1 %)

Match Funding:

$1,656,600

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

9 out of 9 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-18-026 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

A beta version of the near-term fire risk forecast tool became available in May 2020 (pyregence.org). The tool displays forecasts for active fires and fire risk at a five-day horizon. An API allows for flexible integration with an organization's unique and existing workflows to assist in tactical fire and ignition risk decision-making.

The research team also developed beta versions of experimental fire size distribution and fractional fire severity class models covering all of California. They utilized a sample of the beta version fractional fire severity models with observed historical fire sizes to begin testing and validating a bootstrapping procedure for expressing spatial autocorrelation in the clustering of high severity burn patches within fire perimeters. The second technical advisory meeting was held in May 2020.

Project Name: EPC-19-001 - Reflex Flow Battery at Farm ACW

Recipient/Contractor: UniEnergy Technologies

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 9/16/2019 to 6/30/2022

Program Area and Strategic Objective:

Technology Demonstration and Deployment

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

As California moves toward the 50 percent RPS goal, the shape of the net load curve throughout the year will change wildly. To achieve 50 percent renewables using non-dispatchable resources, the grid will be necessarily producing 100 percent or more renewables during most days of the year. Current technologies being deployed generally have a cycle life of around 1000 cycles, which, if cycled daily would not even last 3 years. There are no bankable technologies, demonstrated in the MW scale that can meet the daily cycling required of a 50 percent renewables grid for the typical asset lifetime of 20 years.

Project Description:

This project will entail the deployment of an advanced vanadium redox flow battery, and the other elements to create a 1MW and 4MWh AC Energy Storage System (ESS) at US Marine Corps Base Camp Pendleton. The project will prove the scalability, the integration requirements, the reliability and the bankability of UET's newest high-performing ReFlex battery product. The 1MW and 4MWh system will consist of roughly 109 ReFlex modules connected in 8 DC strings. The system will deliver critical operational flexibility for the Camp Pendleton microgrid to incorporate maximum use of onsite variable renewable generation and optimize the use of dispatchable generators when needed. For SDG&E, the system will provide voltage support at a remote feeder. It will also provide the benefit to SDG&E of a net solar energy time shift to the later peak hours.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The development of this project will enhance grid resiliency, support the transmission and distribution infrastructure, and will provide low-cost, long-duration electric storage capacity to the California grid. The integration of the advanced vanadium flow battery system and the Power Conversion System (PCS) and peak power controller will provide a working solution for the California market and grid. The design and permitting of the storage system will provide customers and developers working in California with credible operational data, credible budgetary data and a credible pro-forma design.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed>

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h, 4a, 5a, 5d

Lower Costs: The advanced vanadium flow battery system's unlimited cycle life and 20-year calendar life promises much lower total cost of ownership for future energy storage applications that require high cycling.

Increase Safety: The advanced vanadium flow battery system's provides increased safety because the system is non-flammable. This is in sharp contrast to other battery technologies that are highly flammable.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$2,969,998

EPIC Funds Spent:

$0

Match Partner and Funding Split:

UniEnergy Technologies, LLC: $55,455 (1.4 %)

Indian Energy LLC: $840,035 (21.4 %)

Webcor: $61,471 (1.6 %)

Match Funding:

$956,961

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

7 out of 8 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-001 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project team advanced the design of the ReFlex product to achieve UL certification. In this process, they further improved product resiliency and ease of deployment. The project was placed under a stop work order on February 7, 2020. During the stop work order, the original host site dropped out. UET found a replacement site at US Marine Corps Camp Pendleton. The stop work order was lifted on October 13, 2020. The project value to California is notably improved due to the more rigorous US Marine Corps requirements and clear follow-on opportunities with all project partners.

Project Name: EPC-19-002 - "Smart Greenhouse": Integrated Photovoltaics/Photosynthesis for Energy and Food

Recipient/Contractor: The Regents of the University of California on behalf of the Los Angeles Campus

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 10/1/2019 to 12/31/2023

Program Area and Strategic Objective:

Applied Research and Development

4.1 Advance Emerging Thin-film PV Technologies for High Value Applications

Issue:

California is the most populous state and has a high electricity demand across all economic sectors. Also, California has some of the most ambitious goals for decarbonization of its economy and adoption of renewable energy technologies. Solar photovoltaics (PV) play an important role as a distributed energy resource in the state's transition to a low-carbon, resilient economy. However, rooftop space limitations can impede the distributed deployment of PV on buildings. One promising solution to this challenge is the development of innovative, low-cost transparent PV technologies that can be integrated into additional building surfaces and windows.

Project Description:

This project will improve the understanding of materials science and manufacturing approaches for transparent organic photovoltaic (TOPV) materials with conversion efficiency of 15 percent and average visible light transmittance of 30 percent. Moreover, the manufactured TOPV will be installed in a "smart greenhouse" and tested to assess their efficiency, transmittance, stability, reliability, and also their effect on plant growth.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Development of innovative transparent photovoltaic technologies that can be integrated in buildings will help to achieve California's renewable energy generation goals and statewide requirement for all new buildings to have solar photovoltaic installed even with rooftop space constraints.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integration of Distributed Energy Resources (IDER): R. 14-10-003 Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 1f, 2a, 3a, 3g, 4a, 4c

Lower Costs: Transparent organic photovoltaic materials that will be manufactured and tested as a part of this project can be produced from a solution at low temperatures contrary to the

production of silicon-based photovoltaic modules that involves high temperature processes. This makes manufacturing costs of transparent photovoltaics potentially much less expensive.

Economic Development: Transparent buildings-integrated photovoltaic products do not require permitting for land use approval and could become a state-of the art technology used in buildings, where the roof top space is limited and in areas with land use restrictions. Overall this technology could contribute to the growth of the PV industry and its workforce in California.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$97,807

EPIC Funds Encumbered:

$600,000

EPIC Funds Spent:

$71,841

Match Partner and Funding Split:

The Regents of the University of California, Los Angeles: $60,000 (9.1 %)

Match Funding:

$60,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

5 out of 7 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-002 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project kicked off in May 2020. During the first quarter, the project focused mainly on the development, fabrication, and examination of the absorption and transmittance spectrum of polymers. Because of the COVID-19 pandemic, supplies of necessary chemicals were delayed and time spent in the lab was constrained.

Project Name: EPC-19-003 - Processing and Architecture Design to Develop and Demonstrate Stable and Efficient Perovskite + Silicon Tandem Modules

Recipient/Contractor: Tandem PV, Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 10/11/2019 to 3/31/2023

Program Area and Strategic Objective:

Applied Research and Development

4.1 Advance Emerging Thin-film PV Technologies for High Value Applications

Issue:

California seeks to achieve 100 percent renewable and carbon-free electricity by 2045. A new generation of high-efficiency, low-cost tandem PV technologies can help achieve this goal by lowering costs to build and operate solar generation, facilitating economic combinations of solar and storage, and supporting increased installation of solar in urban environments and on homes. Tandem PV modules combine metal-halide perovskite material and silicon to increase solar panel efficiency and can do so without increasing panel ($/W) cost.

Project Description:

This project will improve the durability of perovskite solar cells and advance large-area perovskite deposition processes which demonstrate high performance, yield, and throughput. Specifically, it will develop scalable processing of perovskite photovoltaic layers through spray deposition and rapid thermal annealing to fabricate and test 6x6 inch perovskite/silicon tandem devices with 25 percent cell efficiency. Combinations of these two developments will result in demonstrations of product readiness for perovskite durability. These demonstrations will provide confidence to manufacturers and potential customers of solar panels using perovskite technology.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Lower cost and higher power density solar PV through higher-efficiency and lower cost solar panels consisting of a combination of perovskite and silicon in tandem.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

California Solar Initiative: R.12-11-005 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 1c, 2a, 3b, 4a, 5a

Lower Costs: Tandem perovskite/silicon PV modules will reduce balance-of-systems costs at all installation scales due to their higher efficiency compared with conventional silicon solar panels.

Economic Development: Development of cost-effective manufacturing methods for tandem solar PV provides an opportunity for California to compete with silicon-based PVs produced outside of the United States and develop solar manufacturing jobs in thin-film PV. Furthermore, an improvement to the cost and expanded use of solar energy is expected to increase jobs downstream, for example in solar panel installation.

Environmental Benefits: Increased affordability of solar energy generation will result in higher solar energy penetration and help reduce emissions of carbon dioxide.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$161,295

EPIC Funds Encumbered:

$999,802

EPIC Funds Spent:

$196,911

Match Partner and Funding Split:

Tandem PV, Inc.: $999,986 (50.0 %)

Match Funding:

$999,986

Leverage Contributors:

U.S. Department of Energy: $450,000

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

5 out of 7 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project kicked off in November 2019. The project team is steadily improving their scaled rapid coating and drying processes for both the first transport layer and the perovskite layer and have made efficient solar cells using only scalable processes. On the barrier material and durability, there was a breakthrough in the solution-applied material on top of the perovskite. No damage is detected when droplets of water were placed on top of the un-encapsulated solar cell for more than 10 minutes and did not see full penetration of the water through the perovskite layer until ~2h of direct water exposure (without this barrier material, the film degrades in seconds). They succeeded in scaling this layer as well. A next step is to begin module fabrication and accelerated durability testing on tandem cells.

Project Name: EPC-19-004 - High-Efficiency Perovskite Tandem Modules with Resilient Interfaces

Recipient/Contractor: The Regents of the University of California, on behalf of the San Diego campus

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 10/1/2019 to 3/31/2023

Program Area and Strategic Objective:

Applied Research and Development

4.1 Advance Emerging Thin-film PV Technologies for High Value Applications

Issue:

The dominant commercialized silicon (Si) PV technology has plateaued at 18-24 percent conversion efficiency, and the theoretical limit for any single-absorber solar cell under standard operating conditions (1 sun, 25 degrees Celsius) is approximately 30.5 percent. While other absorbers, such as perovskites, have attracted significant attention in recent years for offering a high quality semiconductor, with lower purity and lower fabrication temperatures than silicon (Si), the price of Si modules has fallen by 45 percent in the last three years to $0.36 per watt ($/W), leaving minimal margin or market for emerging single-absorber PV technology that can only achieve similar efficiency.

Project Description:

The purpose of this project is to develop robust, high-power perovskite-on-silicon tandem photovoltaic (PV) modules that achieve a power conversion efficiency of greater than 32 percent, using low-cost manufacturing approaches. The perovskite top cell will be deposited on textured silicon cells, increasing energy production by 30 percent when the sun is near the horizon, reducing the ramp rate necessary for other grid participants, and improving reliability at future high PV penetration that is under statutory mandate.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Perovskite-on-silicon tandem PV modules seek to achieve a power conversion efficiency of greater than 32 percent during the project period using low-cost manufacturing approaches that can scale to square meter (m2) products with a projected levelized cost of electricity of $0.031 per kilowatt-hour ($/kWh). These modules will incorporate optimized light-trapping and anti-reflection approaches to collect sunlight at wide angles, increasing energy production in the early morning and late evening to facilitate flattening of the duck curve.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

California Solar Initiative: R.12-11-005 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 1f, 2a, 4a

Lower Costs: Quantitative cost estimates using the DOE Solar Energy Technology Office's LCOE analysis framework and their cost numbers for balance-of-system indicate that our innovative perovskite-on-Silicon tandem modules will provide a LCOE 30 percent lower than line-of-sight projection costs of silicon (Si) PV, resulting in lower costs to ratepayers. The jump from Si to perovskite-on-Si tandem cells presents a strong return on investment, yielding a 50 percent increase in energy generation for a <10 percent increase in upfront module costs.

Environmental Benefits: Perovskite-on-Silicon tandem modules could produce 50 percent higher energy yield per area relative to standard Si PV. If the perovskite-on-Silicon tandem modules technology reaches 50 percent penetration in the CA rooftop market as rooftop installation becomes automatic under the new Buildings Energy Efficiency Standards, it is expected to offset an additional 38 million metric tons of CO2e per year compared to Si PV installations over the same rooftop area. According to EPA metrics, this is equivalent to taking more than 8 million passenger vehicles off the road.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$103,945

EPIC Funds Encumbered:

$993,458

EPIC Funds Spent:

$65,003

Match Partner and Funding Split:

D2Solar LLC: $100,000 (6.1 %)

The Regents of the University of California, San Diego: $559,295 (33.8 %)

Match Funding:

$659,295

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

5 out of 7 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project conducted the kick-off meeting in early 2020. The team successfully performed polymer film transfer experiments to textured silicon and evaluated the role that film thickness and mechanical properties play in the polymer film transfer. The diodes atop the silicon was also tested and achieved successful rectification, indicating electronic contact was made. Additionally, the team submitted a test plan focused on the preparation and characterization of a novel mechanically-compliant conductive adhesive (MCCA) material.

Project Name: EPC-19-005 - Richmond Advanced Energy Community (AEC) Phase II Project

Recipient/Contractor: Zero Net Energy Alliance, Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 3/2/2020 to 3/31/2025

Program Area and Strategic Objective:

Technology Demonstration and Deployment

2.4 Incentivize DER Adoption through Innovative Strategies at the Local Level

Issue:

To achieve robust zero carbon emissions targets, cities and load-serving entities require advanced energy solutions that enable the cost-effective deployment and integration of distributed and renewable energy resources, and the cost-efficient rehabilitation of homes to a near Zero Net Carbon standard. Achieving these outcomes in a disadvantaged community requires a combination of innovative technology, scaled finance, and the inclusive engagement of cities, NGOs, and community residents.

Project Description:

The Richmond Advanced Energy Community (AEC) Phase II project demonstrates two breakthrough AEC models that will advance state and local goals for energy and carbon savings, while maximizing benefits to the local community, the grid, and low-income residents in greatest need. These include: (1) Implementation of a DER Community program that optimizes economic and resilience value at the community and grid level, while directing new revenues and societal benefits to low-income residents residing in California's Disadvantaged Communities (DACs); and (2) Implementation of the Zero Net Carbon Ready (ZNCR) Homes Program to finance the rehabilitation of blighted homes to ZNCR status and their re-sale as affordable infill and retrofit properties to low-to-middle income residents using capital provided by Social Impact Bonds. The scale-up of these strategies will be supported by preparation of an AEC Solutions Toolkit and an AEC Finance Toolkit disseminated through the Local Government Commission and the state's leading network of regional climate action collaboratives.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This Agreement will support the development and commercialization of technological advancements and breakthroughs that overcome barriers to the achievement of California's statutory energy goals by: 1) demonstrating how DER aggregation can balance local energy load and generation to reduce transmission and distribution costs and provide value to local communities; 2) demonstrating how a Social Impact Bond can be used to rehabilitate abandoned, blighted, and distressed properties to be ZNCR and sell them at market rates to low-to-middle

income first-time homebuyers; and 3) demonstrating an energy efficiency financing model and related tools and policies that overcome the tenant/landlord split incentive.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Self-Generation Incentive Program: R.12-11-005 <Closed> Renewables Portfolio Standard Program: R.18-07-003 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 1h, 1i, 4a

Lower Costs: The project will: 1) Reduce customer costs via installation of high efficiency and all-electric appliances; 2) Enable ratepayers to participate in the emerging CAISO market; and 3) Provide customers with the ability to mitigate use of energy during high price periods.

Greater Reliability: The project will enable participating homes and businesses to reduce peak load, shift energy use away from the evening ramp period, and participate in DER aggregation to balance local generation, storage, building loads, and grid-integrated EVs.

Increase Safety: Safety will be improved by: 1) Reducing the dangers of gas leak and explosions by endeavoring to replace natural gas appliances in residences; and 2) Decreasing the likelihood that contractors install devices in an unsafe manner (both to themselves and others).

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$1,092,030

EPIC Funds Encumbered:

$4,998,555

EPIC Funds Spent:

$66,104

Match Partner and Funding Split:

GRID Alternatives: $1,050,654 (13.4 %)

City of Richmond: $400,000 (5.1 %)

Blue Strike Environmental, Inc.: $5,000 (0.1 %)

Richmond Community Foundation: $920,600 (11.8 %)

Olivine, Inc.: $437,200 (5.6 %)

Match Funding:

$2,813,454

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

5 out of 5 bidders

Rank of Selected Applicant/ Bidder:

Group 7: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project kicked-off in August and the team immediately began conducting technology assessments (determining current/baseline capabilities and necessary updates) to prepare for installation planning of the DER Community and homes to be remodeled under the ZNCR program. Additionally, the team began working with the City of Richmond to develop different design options for the ZNCR homes. Given the constraints of Stay-At-Home orders and COVID-19, the team is revising the community outreach plan in collaboration with the CBO partners. In 2021, the team will complete the site technology assessments and ZNCR home design options, planning to begin installations at these sites. Once the outreach plan is finalized, the team will begin community engagement including conducting focus groups to help inform educational materials that will be developed for the ZNCR homes. Finally, the team will begin development on the AEC Solutions Toolkit.

Project Name: EPC-19-006 - Basset-Avocado Advanced Energy Community

Recipient/Contractor: The Energy Coalition

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 5/1/2020 to 3/31/2025

Program Area and Strategic Objective:

Technology Demonstration and Deployment

2.4 Incentivize DER Adoption through Innovative Strategies at the Local Level

Issue:

Disadvantaged communities (DACs) suffer from a combination of economic, health, and environmental burdens and relatively few resources are utilized on retrofits and clean energy developments, despite the fact that these communities are home to low performing buildings and little resources to complete the retrofits. Major technical and structural barriers that DACs face in their transition to a clean energy future include: high levels of renters, limited capital, lack of wide-scale meter-level data, limited space for distributed energy resources (DER) and inadequate business and financing strategies.

Project Description:

The project will use private sites within the community to generate local, renewable and competitively priced electricity from a smart community solar system. The Bassett Avocado Heights Advanced Energy Community (BAAEC) project will include a resiliency microgrid to provide refuge to the community during emergencies and/or blackouts. The BAAEC aims to demonstrate the benefits of advanced energy homes with a prosumer network that includes installation of residential solar photovoltaics, battery storage and heat pump water heaters in single family homes. The prosumer network will feature a blockchain-enabled transactive energy pilot, simulating a scenario where enrolled participants generate, actively manage and sell energy. This approach tests a potential business model for converting passive bill-payers into discerning "prosumers," thereby empowering communities to benefit from their own local generation. Residential batteries will be aggregated and operate as a virtual power plant in partnership with the local utility to demonstrate how important grid services can be provided by DERs.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

A lack of capital to invest in energy solutions is a significant barrier. The BAAEC team has developed a comprehensive design that leverages private capital to develop local integrated renewable energy systems and alternative transportation opportunities. The proposed Smart Community Solar will provide participants, at least 50 percent of which will be low-income, with risk-free access to 100 percent renewable and locally produced electricity at a 20 percent

discount over their current electricity rates through a Community Solar Green Tariff program offered by the Clean Power Alliance. The BAAEC will create new community assets that have significant long term value and, once the model is tested and proven, its approach and benefits can be replicated in DACs throughout the state.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Self-Generation Incentive Program: R.12-11-005 <Closed> Energy storage: R.15-03-011 <Closed> Smart grid: R.08-12-009 <closed> Demand Response (DR): R.13-09-011 California Solar Initiative: R.12-11-005 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Identify Disadvantaged Communities in the San Joaquin Valley and Provide Economically Feasible Options for Affordable Energy: R.15-03-010

Applicable Metrics: CPUC Metrics- 1d, 1e, 1f, 1h, 4a, 4b

Lower Costs: This project will produce energy cost savings through community scale solar and battery storage systems and lower electricity rates.

Greater Reliability: This project will increase resilience during utility system power outages, natural disasters, weather events, severe heat days and other emergencies. This project will also alleviate local energy grid constraints with locally produced clean energy and dispatchable battery storage.

Public Health: This project will reduce health risks and reduced local pollutants through adoption of clean energy generation and zero emission vehicles. It also increases community safety through more resilient and reliable energy system.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$9,093,833

EPIC Funds Spent:

$300,574

Match Partner and Funding Split:

Enel X North America, Inc.: $3,464,815 (23.8 %)

Green Commuter Inc.: $562,865 (3.9 %)

Community Electricity: $82,280 (0.6 %)

Green Convergence: $962,500 (6.6 %)

Space AI: $43,243 (0.3 %)

GRID Alternatives: $227,500 (1.6 %)

SensorComm Technologies, Inc.: $20,000 (0.1 %)

Zeco Systems dba Greenlots: $96,660 (0.7 %)

Match Funding:

$5,459,863

Leverage Contributors:

California Air Resources Board: $606,445

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

5 out of 5 bidders

Rank of Selected Applicant/ Bidder:

Group 8: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-006 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Work on this agreement started in July of 2020. Since the kickoff, the recipient has developed a community outreach plan with its CBO partners in order to define the goals, objectives, and strategies to engage community members to actively take part in the implementation of their advanced energy communities. Currently, the project team is working to leverage Southern California Edison's Charge Ready 2 program which would provide funding for make-ready infrastructure and offer a rebate towards the EV charging equipment for the project. The project team is also finalizing energy system designs and power purchase agreements under the Community Solar Green Tariff program in order to begin construction in 2021.

Project Name: EPC-19-007 - On-site 3D Concrete Printing for Next-Generation Low-Cost Wind Plants

Recipient/Contractor: Jason Cotrell, dba RCAM Technologies

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 5/1/2020 to 3/31/2024

Program Area and Strategic Objective:

Applied Research and Development

4.2 Develop Technologies that Enable Increased Wind Capacity in California

Issue:

The size of wind turbine towers is constrained by transportation size and weight, making conventional towers prohibitively expensive for larger next-generation turbines in California. Overhead traffic signals, road width, and weight regulations limit conventional steel tubular towers to sub-optimal diameters of 4.3 meters. The tallest wind turbine towers installed in California is currently limited to 100 meters. The reinforced additive manufacturing technology has the potential to reduce capital costs for land-based tall towers by reducing installation time and logistics challenges, and increasing safety compared with conventional concrete construction methods.

Project Description:

This agreement aims to manufacture, demonstrate, and test wind tower sections and offshore wind energy components using an onsite three-dimensional concrete printed (3DCP) manufacturing process and design. The advancement in scientific knowledge in 3DCP materials, manufacturing methods and large-scale structural performance will facilitate the deployment of large land-based and offshore wind technologies that use 3DCP components to increase the cost-competitiveness of the wind energy generation needed to meet California's statutory energy goals.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Reinforced concrete additive manufacturing (RCAM)'s 3D printed (3DCP) towers will reduce tower capital costs by up to approximately 50 percent compared to 140-m steel tower for a 7.5-MW next generation turbine. RCAM is faster and safer than conventional concrete construction methods, while providing new transformative design possibilities that reduce cost and energy consumed by using less concrete than conventional construction and by eliminating concrete forms. The highly mobile 3DCP equipment and California's existing concrete supply chain can cost-effectively produce towers and foundations on-site in manufacturing lots of any size needed for California wind plants. The scope includes design, fabrication, pilot testing and demonstration of tower sections at up to 1:2 scale in laboratory and outdoor environments.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 2a, 3b, 4a, 4e, 4f

Lower Costs: This additive concrete 3D manufacturing technology targets are to manufacture a hybrid 140-m wind turbine tower on-site, at half the cost of conventional steel 140-m towers for a 7.5 MW next generation turbine.

Greater Reliability: As California moves toward a zero-carbon electricity mix in 2045, land-based and offshore wind can provide value to the grid by balancing solar generation. A 140-m RCAM tower will increase California land areas with gross capacity factors above 35 percent by tenfold, adding flexibility and reliability of the electrical system by increasing geographic diversity.

Economic Development: Increasing the tower height from 80 m to 140 m increases the potential wind capacity in California, which may be suitable for development more than 10 times (from 6 GW to 67 GW), representing about $60 billion of potential wind plant capital investments that result in local economic impacts from temporary and permanent employment in construction, engineering, transportation, manufacturing, and operations; local economic activity resulting from wind construction; and increased revenues from land lease payments and tax revenue.

Environmental Benefits: Wind deployments avoid substantial emissions of greenhouse gases compared to fossil fuel generated electricity. Wind generated electricity emits up to 120 times less carbon dioxide (CO2e) than natural gas generated electricity and nearly 200 times less than coal on a lifecycle basis (5 g/kwh, 607 g/kWh, and 975 g/kWh respectively.

Consumer Appeal: The use of additive 3D manufacturing approaches facilitate the development of taller wind turbines that significantly reduce the number of wind turbines deployed on a site for a given wind plant capacity, resulting in more aesthetically pleasing wind plants.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$507,530

EPIC Funds Encumbered:

$2,999,979

EPIC Funds Spent:

$0

Match Partner and Funding Split:

RCAM Technologies: $302,000 (9.1 %)

Match Funding:

$302,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

9 out of 9 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The kick-off meeting was conducted in June 2020. The team conducted some preliminary activities, such as reviewing 3D concrete printing (3DCP) materials and techniques for tower design, developing conceptual design drawings for a 3DCP segmented tower with various strategies for reinforcement, and initiating work on a finite element analysis.

Project Name: EPC-19-008 - NextWind Real-time Monitoring System

Recipient/Contractor: Aker Solutions, Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 4/20/2020 to 3/31/2023

Program Area and Strategic Objective:

Applied Research and Development

4.2 Develop Technologies that Enable Increased Wind Capacity in California

Issue:

One of the challenges for the offshore wind industry is to develop a strategy for how to leverage environmental and technology monitoring data -- including real-time data -- to support deployment planning, operations, maintenance, and environmental mitigation measures.

Project Description:

This agreement aims to establish a digital representation - or digital twin - of a floating offshore wind installation, enabling continuous improvements in production optimization, lower levelized cost of energy, and improved understanding of potential environmental impacts and associated mitigation measures.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The configuration of a digital platform that processes real-time data from offshore wind operations can help reduce the leveled cost of energy via reduced operation and maintenance costs and also improve understanding of and mitigation of potential environmental impacts.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 2a, 3a, 4a, 4f, 4g, 5a, 5d

Lower Costs: A proactive maintenance system will lower cost of perform maintenance tasks by avoiding mobilizing unplanned and very expensive and inefficient offshore operations to rectify issues. The team estimates that these cost savings will be significant and greater than the target of 21 percent.

Greater Reliability: This platform will facilitate the reduction of unplanned shutdowns with advanced prediction models, which will offer increased overall annual energy production and greater consistency in power output by increasing operational availability of offshore turbines.

Increase Safety: Remote monitoring of offshore wind farms will reduce unplanned and risky corrective maintenance operations, and thereby reduce risk for maintenance workers.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$503,271

EPIC Funds Encumbered:

$2,000,000

EPIC Funds Spent:

$747,077

Match Partner and Funding Split:

Cognite: $152,294 (6.9 %)

H.T. Harvey and Associates: $1,384 (0.1 %)

Aker Solutions, Inc.: $48,097 (2.2 %)

Match Funding:

$201,775

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

9 out of 9 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-008 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The kick-off meeting was conducted in June 2020. The team is engaging in discussions with project partners and stakeholders to obtain technical data to configure the offshore wind data platform and to facilitate environmental monitoring. The first technical advisory committee meeting was in October 2020 and included discussion on project status and needs for environmental monitoring analysis.

Project Name: EPC-19-009 - A Risk Assessment Framework to Evaluate Effects of Offshore Wind Farms on the California Upwelling Ecosystem

Recipient/Contractor: Integral Consulting Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 5/1/2020 to 12/31/2023

Program Area and Strategic Objective:

Applied Research and Development

7.3 Evaluate Strategies to Mitigate the Impacts of the Electricity System on the Environment and Public Health and Safety

Issue:

Wind-driven ocean upwelling along the California coast is responsible for much of the primary productivity that sustains one of the richest marine ecosystems on the planet. The development of large-scale offshore wind energy projects has the potential to reduce the wind stress at the sea surface, which could have local and/or regional implications on wind-driven upwelling, nutrient delivery, and ecosystem dynamics. It is therefore necessary to investigate the effects of large-scale wind farms on coastal upwelling in the context of historical climatology as well as climate change predictions.

Project Description:

The project team is conducting a numerical modeling study to determine potential changes in coastal upwelling due to offshore wind project development over a variety of environmental conditions. A number of baseline cases (no wind farms) will be modeled for a variety of climatologies and compared with modeled cases that include simulated offshore wind farms with varying characteristics in identified areas of interest. The methodology will combine coupled numerical atmospheric-ocean models. Results from the coupled models will provide an enhanced scientific understanding of the effects of wind energy reduction on nearshore ocean circulation.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by understanding potential environmental impacts of offshore wind, identifying data gaps and prioritizing research, informing monitoring and mitigation actions, and streamlining planning through a quantification of ecological risk. This project will directly support the National Environmental Policy Act, California Environmental Quality Act, and other federal, state, and local statutory and regulatory reviews and approvals. These barriers need to be addressed early in California in a comprehensive approach that considers physical processes and their links to biological processes as the basis for assessing significance of anticipated environmental changes.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed> Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 2a, 4f

Environmental Benefits: The agreement will identify the level of risk from floating offshore wind development on atmospheric and oceanographic circulation and the resulting effect on upwelling off the California coast. Upwelling is an essential process driving the exceptional ecosystem productivity and fishing industry in this region.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$174,739

EPIC Funds Encumbered:

$500,000

EPIC Funds Spent:

$122,803

Match Partner and Funding Split:

Integral Consulting Inc.: $126,256 (19.3 %)

University of California, Santa Cruz: $26,565 (4.1 %)

Match Funding:

$152,821

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

9 out of 9 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The agreement was approved at the April 2020 business meeting and kicked-off in the summer. The first TAC meeting was held in September. The research team is coordinating closely with the team from EPC-19-011 to use a common set of parameters for offshore wind turbines and wind facility locations and configurations with industry guidance.

Project Name: EPC-19-010 - Integrated Distributed Fiber Optic Sensing for Real-Time Monitoring of OWT Gearbox and Tower Operation and Marine Animal Activities

Recipient/Contractor: DOE- Lawrence Berkeley National Laboratory

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 5/1/2020 to 3/31/2024

Program Area and Strategic Objective:

Applied Research and Development

4.2 Develop Technologies that Enable Increased Wind Capacity in California

Issue:

Monitoring systems for offshore wind turbines (OWTs) can play an important role in anticipating and rectifying operational and maintenance issues such as gearbox failures and in conducting environmental monitoring and implementing mitigation measures.

Project Description:

This project aims to develop a fiber optic sensing system for real-time monitoring of offshore wind turbines (OWTs). This approach will provides critical data to allow (1) real time monitoring of OWT operational conditions and diagnostic signal of potential malfunctions to allow effective operation management that can significantly reduce O&M costs, and (2) real time monitoring of dynamic marine mammal activities near OWTs to better understand potential impacts of OWT developments on marine life.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The potential contribution from offshore wind energy to the renewable energy portfolio of California is key to achieve the 100 percent clean energy goals established in Senate Bill 100. Among the key challenges to floating offshore wind energy development is the high operation and maintenance cost. This project will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by enabling real time OWT gearbox and tower operation and marine animal activities monitoring, which can lead to reduced O&M cost, reduced LCOE, greater OWT reliability and safety, and enhanced environmental sustainability.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed> Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 2a, 3a, 3b, 4a, 4g, 5e

Lower Costs: The development of this novel sensing technology can lead to a reduced LCOE by improving operational and environmental monitoring strategies in an offshore wind farm that reduce the O&M costs.

Greater Reliability: The use of a fiber optic sensing system in offshore wind applications will allow greater electricity reliability and increased safety by providing real time monitoring capability to track operation status, and diagnose pre-failure signs that can be used to (1) reduce O&M cost, and (2) trigger emergency management to minimize chances of catastrophic events.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$684,912

EPIC Funds Encumbered:

$2,000,000

EPIC Funds Spent:

$300,000

Match Partner and Funding Split:

Lawrence Berkeley National Laboratory: $520,000 (20.6 %)

Match Funding:

$520,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

9 out of 9 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The kick-off meeting was conducted in June 2020. The team started the design of the testing facility and conducted an initial test to investigate the feasibility of using a distributed fiber optic sensor to measure the dynamic strain of a mock wind turbine. The team drafted the Technology Evaluation report, which discusses the state-of-the-art of fiber optic sensing technologies.

Project Name: EPC-19-011 - Seabird 3D Distribution and Relative Risk from California Offshore Wind Turbines

Recipient/Contractor: Humboldt State University Sponsored Programs Foundation

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 5/1/2020 to 6/30/2023

Program Area and Strategic Objective:

Applied Research and Development

7.3 Evaluate Strategies to Mitigate the Impacts of the Electricity System on the Environment and Public Health and Safety

Issue:

Future offshore wind development in California may create a risk to seabirds for collision or displacement. Existing seabird models, which describe the density and species composition in the California Current, can be used to identify hot spots for seabird activity, but these models do not delineate the presence of seabirds at different heights above the sea surface. Without incorporating flight height and how flight behavior changes with wind speed, it is difficult to accurately estimate the potential impact to seabirds from offshore wind farms.

Project Description:

The project is creating a three-dimensional spatial distribution of seabird density, species composition, and flight height for the entire California coast. The seabird model will be developed using a dataset including over 120 ship and aerial surveys spanning the period of 1976 - 2016. Using seabird density data that incorporates flight height will allow this project to study how different turbine heights and locations will overlap with the presence of different seabirds. After completing the seabird distribution model, several different wind farm scenarios will be investigated to evaluate the relative risk that offshore wind farms have on seabirds. For each offshore wind scenario, the project team will create power generation profiles using modeled wind speed and turbine performance parameters. The power generation and three-dimensional seabird models will be combined and compared using a multi-objective optimization to assess the tradeoffs between wind farm performance and bird mortality risk.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by providing information to project developers, permitting agencies, and turbine manufacturers about the conflicts between seabirds and turbines at various heights above the sea surface and allow them to design turbines and projects that minimize the impacts. The efforts to support environmentally responsible offshore wind development would help enable California to achieve high renewable energy penetration in the electric grid. Furthermore, the 3D seabird model, will allow project developers

to understand the conflict between seabirds and turbines at different heights above the sea surface.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed> Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 2a, 4f, 4g

Lower Costs: By enabling environmentally responsible offshore wind farm design and siting, the outputs from this model can help reduce environmental permitting costs.

Environmental Benefits: This project will provide environmental benefits by suggesting strategies to develop offshore wind farms that result in fewer bird deaths. This provides two types of environmental benefit. First, it will help enable development of a substantial renewable energy resource, thereby helping California meet its clean energy and climate mitigation goals. Second, it will help reduce environmental impacts to birds associated with offshore wind farm development.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$123,126

EPIC Funds Encumbered:

$500,000

EPIC Funds Spent:

$0

Match Partner and Funding Split:

Humboldt State University Sponsored Programs Foundation: $20,046 (3.9 %)

Match Funding:

$20,046

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

9 out of 9 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-011 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The agreement was approved at the April 2020 business meeting and kicked off in the summer of 2020. The first technical advisory committee meeting was held in the fall. The research team is coordinating closely with the team from EPC-19-009 to use a common set of parameters for offshore wind turbines and wind facility locations and configurations with industry guidance.

Project Name: EPC-19-012 - Affordable Space Conditioning and Domestic Hot Water Systems with Low Emissions and High Performance

Recipient/Contractor: Franklin Energy Services, LLC

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 5/20/2020 to 3/31/2024

Program Area and Strategic Objective:

Applied Research and Development

1.3 Meeting the Demand for Efficient and Environmentally Friendly Heating, Ventilation and Air Conditioning and Refrigeration Systems

Issue:

Heating, hot water, and cooling represent the top three energy uses in California households. While air conditioning GHG emissions will go down as renewable generation increases, reducing site emissions from natural gas space and water heating will require fuel substitution. Electric heating, ventilation, and air conditioning solutions will help meet the state's climate goals, but the options currently available are expensive. They often require the use of separate heat pumps for heating and hot water, and typical operation patterns overlap with grid peak times, resulting in higher customer bills, higher grid operation costs, higher GHG and criteria pollutant emissions.

Project Description:

This project will develop, test, and demonstrate a combined electric space conditioning and hot water system that incorporates built-in load shifting and will deliver clean, affordable space conditioning and domestic hot water to existing and new homes. The integrated pod will be installed in residential buildings to evaluate cost-effectiveness, load flexibility, and GHG emissions reductions.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project intends to achieve technological advancements and breakthroughs in thermal storage and load shifting. By developing a shared heat-pump system for air conditioning and water heating, along with advanced controls, the new technology proposed under this project will provide (1) Between 70 and 90 percent GHG emissions reductions compared to natural gas and 85 to 95 percent compared to conventional heat pumps without load shifting; (2) Up to 30 percent operational cost reductions compared to existing heat pump technology and 30 to 40 percent compared to existing natural gas technology.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Demand Response (DR): R.13-09-011 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 1c, 1d, 1e, 1f, 1g, 1h, 4a, 5a

Lower Costs: The single heat pump and storage tank design being demonstrated in this project could reduce equipment and installation costs relative to having a separate gas furnace/electric AC systems. Its higher efficiency and load shifting capabilities reduce energy costs compared to standard systems. The combined unit also minimizes the need for additional piping in between its components.

Greater Reliability: The control unit will provide greater grid system reliability for optimized operation by automating response to price or demand response signals rather than relying on occupants to manually adjust controls or behavior.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$343,790

EPIC Funds Encumbered:

$1,499,925

EPIC Funds Spent:

$0

Match Partner and Funding Split:

Harvest Thermal, Inc: $43,500 (2.6 %)

Franklin Energy Services, LLC: $120,250 (7.2 %)

Match Funding:

$163,750

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

17 out of 17 bidders

Rank of Selected Applicant/ Bidder:

Group 2A: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-012 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The agreement was executed on 10/28/2020. The kick-off meeting has been scheduled for December.

Project Name: EPC-19-013 - HP-Flex: Next Generation Heat Pump Load Flexibility

Recipient/Contractor: DOE- Lawrence Berkeley National Laboratory

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/15/2020 to 3/31/2024

Program Area and Strategic Objective:

Applied Research and Development

3.1 Accelerate Broad Adoption of Automated Demand Response Capabilities that Provide the Grid Flexible Response Services

Issue:

Small and medium-sized commercial buildings (SMCs) have a great potential for optimal load flexibility (LF) because the vast majority of these buildings in California have a similar space conditioning configuration that use multiple packaged heating, ventilation, and air conditioning (HVAC) units with relatively simple controls. While a few approaches exist for optimal control of SMC HVAC for energy efficiency and simple demand response (DR), there is no control solution for this market segment that can reliably and at low cost deliver LF capability for optimal load shift, shed, shape, and shimmy, while maximizing occupant comfort.

Project Description:

This project develops and tests an open-source building energy management system, called HP-Flex, that controls heat pump (HP) settings in SMC buildings to provide load flexibility (LF); shape, shift, shed, and/or shimmy; while meeting occupant needs and minimizing operating cost. The system includes new optimization software and equipment interfaces that together optimize HP operation, while being extensible to manage additional equipment such as refrigeration, water heaters, electrochemical and thermal storage. HP-Flex's standardized, modular design aims to make it easier to configure than existing systems, thus enabling a more cost-effective and reliable control for SMC applications.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project hopes to remove barriers to the widespread adoption of this newly developed HP-Flex system by using experience from this project's field tests to develop educational curricula to train future engineers and technicians who will design, install, and maintain these systems. Industry partners who participate in the TAC will help disseminate findings and may adopt the resulting software (HP-Flex). The HP-Flex package supports the emerging business model of optimization as a service; which lowers the barriers to entry by providing energy management on a subscription basis. The findings from the long-term site demonstration will improve understanding of LF capabilities of HPs, along with impacts on grid and building end users, which will inform the development of a guidebook for future installations.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1c, 1e, 1f, 1g, 1h

Lower Costs: HP-Flex offers greater benefits to building owners and the grid by allowing the integration of several types of building equipment (e.g., HP space conditioning, HP water heaters, thermal storage), unlocking the flexibility in heat pump loads, optimizing equipment operation, and lowering deployment costs in real buildings. Estimated reduced peak cost of 20 percent annually and a simple payback period of less than 2 years.

Greater Reliability: Estimated peak demand reduction of approximately 25 percent and GHG reduction of approximately 40 percent for the SMC sector, assuming an operating schedule from 7am to 7pm and reduction in nighttime load.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$989,122

EPIC Funds Encumbered:

$3,000,000

EPIC Funds Spent:

$1,313,000

Match Partner and Funding Split:

Lawrence Berkeley National Laboratory: $386,500 (11.4 %)

Match Funding:

$386,500

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

17 out of 17 bidders

Rank of Selected Applicant/ Bidder:

Group 4: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project held a kick-off meeting in summer 2020. Subcontracts are being developed and the first stages of system design has begun.

Project Name: EPC-19-014 - A zero GWP heat pump and distribution system for all-electric heating and cooling in California

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/1/2020 to 3/31/2024

Program Area and Strategic Objective:

Applied Research and Development

1.3 Meeting the Demand for Efficient and Environmentally Friendly Heating, Ventilation and Air Conditioning and Refrigeration Systems

Issue:

Heat pumps in the California climate are ideal substitutes for natural gas space heating. Unfortunately, the heat pumps available today use high global warming potential (GWP) refrigerants whose leakage into the atmosphere over time has the potential to offset any gains made by decarbonizing space heating. Currently, there is no commercially available technology that combines a reversible heat pump with near-zero GWP refrigerant at costs competitive with conventional refrigerants.

Project Description:

The recipient is developing, testing and demonstrating an advanced heat pump system that will reduce energy demand for multi-family (MF) or small to medium commercial (SMC) applications, with 10 to 20 tons of refrigerating capacity, based on a reversible heat pump that uses ammonia (NH3) and carbon dioxide (CO2) in a unique way: NH3 is the primary refrigerant, while CO2 is used both as a refrigerant and as a distribution fluid, depending on operating mode.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project develops a heat pump to provide both heating and cooling that uses ammonia (NH3) as a primary refrigerant to exchange thermal energy between the outside air and the carbon dioxide (CO2) refrigerant in the distribution fluid loop. A heat pump using NH3 offers advantages over other low GWP refrigerants, such as hydrocarbons. NH3 is inexpensive, has superior efficiency properties, low flammability compared to hydrocarbons, and its odor makes it detectable for leaks. NH3 is not for direct use as a distribution fluid in commercial or residential systems and needs a secondary fluid, such as CO2 which has been demonstrated promising efficiency results and lower cost than traditional mixtures as a distribution fluid.. The heat pump system will use the ability of CO2 to transfer more heat per unit mass, thereby reducing piping sizes, installation, and operating costs.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h, 4a

Lower Costs: The advanced heat pump can provide energy savings over conventional heat pump systems. With full market penetration, the heat pump system could result in annual savings of $550M to building occupants. The system has the potential to reduce refrigerant cost, both initial and replacement costs, since NH3 and CO2 are readily available natural refrigerants. They are inexpensive compared to HFC refrigerants, especially as expanding GHG regulations drive up high-GWP refrigerant costs. It also lowers the capital and installation cost by taking advantage of smaller pipe sizing for the CO2 distribution loop.

Greater Reliability: The advanced heat pump system could reduce the electricity peak cooling load, greatly benefitting a capacity-constrained system, especially in view of recent shutdowns of major transmission corridors due to concerns about fire prevention.

Increase Safety: Ammonia leaks are easy to detect, providing a self-alarming mechanism due to its pungent odor at levels less than 10 ppm (while R410A is odorless). Due to the high-pressure CO2 distribution loop, ammonia would not leak into the occupied space.

Environmental Benefits: The average annual refrigerant leakage is 10 percent. Since CO2 and NH3 are natural refrigerants with zero or very low GWP, this system has the potential of reducing or eliminating the impact on climate change due to system leaks caused by systems using high GWP refrigerants, such as R 410A.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$648,140

EPIC Funds Encumbered:

$2,498,557

EPIC Funds Spent:

$0

Match Partner and Funding Split:

Electric Power Research Institute, Inc.: $240,392 (8.2 %)

San Diego Gas & Electric Company: $100,000 (3.4 %)

Optimized Thermal Systems, Inc.: $99,608 (3.4 %)

Match Funding:

$440,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

17 out of 17 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-014 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project kicked off in late June 2020. The Technical Advisory Committee has been established and their first meeting is set for January 2021. The project team performed preliminary engineering calculations to determine design parameters and constraints and is currently refining the heat pump's design to minimize the number of components while realizing the required performance and cost characteristics.

Project Name: EPC-19-015 - Optimizing Heat Pump Load Flexibility for Cost, Comfort, and Carbon Emissions

Recipient/Contractor: The Regents of the University of California, Davis-Western Cooling Efficiency Center

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/15/2020 to 3/31/2024

Program Area and Strategic Objective:

Applied Research and Development

3.1 Accelerate Broad Adoption of Automated Demand Response Capabilities that Provide the Grid Flexible Response Services

Issue:

Heat pumps for space conditioning and water heating are currently controlled using rule-based logic to maintain a programmed temperature setpoint. This design does not provide any flexibility to adjust the heat pump operations based on cost of electricity or grid carbon emissions rate. As California continues to decarbonize the electrical grid and more customers electrify, the need for load flexibility for heat pumps will be critical for maximizing the use of carbon-free electricity sources. This is needed to stabilize the electricity grid, and minimize the cost of operation to end users, particularly as time-of-use rates begin to reflect the true costs of electricity generation.

Project Description:

This project develops and tests an advanced control system that saves energy, improves grid reliability, and reduces carbon emissions by optimizing heat pump operation based on building owner/occupant preferences, comfort and use patterns, electricity pricing, electricity grid needs, real-time carbon emission rates, and weather data. Load flexibility controls offer a way to mitigate the impact of electrification on low-income customers by empowering households to shift consumption to times of day with lower rates without compromising their comfort. The recipient will test controls for heat pump water heaters in multiple low-income households (across two climate zones). The developed controls for water heating will also be adapted to heat pumps that provide space conditioning and field test them in two low-income households. The controls will be futureproofed to facilitate integration with other smart home devices.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Electrifying California's housing stock to reduce carbon emissions could yield some unintended negative consequences, including creating a winter peak and increasing residential utility bills, especially when larger time-of-use rate differentials are anticipated. The recipient will develop load flexibility controls for heat pumps that will play a vital role in mitigating the impacts of switching water and space heating away from natural gas. The load flexibility controls have the

potential to improve grid reliability, lower emissions, and reduce utility bills for households with heat pumps.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1c, 1e, 1f, 1h, 4a

Lower Costs: It is estimated that the ability to shift load to off-peak hours would reduce residential customers' energy costs (relative to using heat pumps without load flexibility controls) by $28-107 per year, returning the investment in the controls in 3 to 10 years.

Greater Reliability: It is estimated that advanced load flexibility controls for water heating and space conditioning could shift a total of 7930 MWh and 28,344 MWh of energy use, respectively, to off-peak times resulting in improved grid reliability.

Environmental Benefits: It is estimated that the heat pump load flexibility controls for water heating and space conditioning could reduce emission by 8,267 metric tons of CO2eq emissions as well as reduce criteria pollutant emissions through reduction in natural gas and electricity use for heating and cooling over the next 30 years.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$570,955

EPIC Funds Encumbered:

$2,537,436

EPIC Funds Spent:

$7,946

Match Partner and Funding Split:

Western Cooling Efficiency Center - UC Davis: $104,701 (3.7 %)

WattTime: $35,000 (1.3 %)

ecobee: $42,000 (1.5 %)

Southern California Edison: $75,000 (2.7 %)

Match Funding:

$256,701

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

17 out of 17 bidders

Rank of Selected Applicant/ Bidder:

Group 4: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-015 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

This project kicked off in July 2020. Initial progress includes finalizing subcontracts, organizing the technical advisory committee, and completing the project kickoff benefits questionnaire.

Project Name: EPC-19-016 - Affordable Near- and Medium-Term Solutions for Integration of Low GWP Heat Pumps in Residential Buildings

Recipient/Contractor: The Regents of the University of California, Davis-Western Cooling Efficiency Center

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 5/13/2020 to 3/31/2024

Program Area and Strategic Objective:

Applied Research and Development

1.3 Meeting the Demand for Efficient and Environmentally Friendly Heating, Ventilation and Air Conditioning and Refrigeration Systems

Issue:

Next generation heat pump technologies have the potential to significantly reduce greenhouse gas emissions from buildings in California but have had some challenges penetrating the California marketplace, largely due to high initial costs. In order to meet California's aggressive energy and carbon goals it will be necessary to find low-cost solutions for switching the primary fuel for heating buildings from natural gas to electricity while also improving the heating and cooling efficiency of heat pumps.

Project Description:

This project develops and demonstrates affordable near-term (TRL 4 to high 7) and medium-term (TRL 4 to low 7) solutions for integration of lower cost, low- and ultra-low global warming potential (GWP) heat pumps. The combination of addressing both near-term (GWP less than 750) and medium-term (ultra-low GWP less than 10) needs is necessary to meet California's carbon reduction goals. The near-term solution focuses on a closer-to-market emerging technology that uses a proprietary, a lower cost compressor drive. This technology will be demonstrated for cost and energy savings at 10 pilot sites. The goal is to provide a market-ready product that is more efficient and 10 percent lower cost. The medium-term solution incorporates an innovative heat exchanger in the secondary loop to improve its efficiency, enabling use of hermetically-sealed ultra-low GWP flammable refrigerants in heat pumps. This technology will be tested at a laboratory scale.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project advances high efficiency heat pump equipment at a lower installed cost compared to current competing heat pump technology, improve the appeal and affordability of heat pumps. Heat pumps are vitally important in the effort to meet California's carbon reduction goals through building electrification, but until now their cost has hindered widespread adoption.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015) Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1h, 2a, 3a, 3b, 4a

Lower Costs: The proposed research will lead to lower costs for heat pumps in the near- and medium-term. This is necessary for greater market uptake.

Environmental Benefits: A total of 9.2 Million therms of natural gas could be offset through increased use of electric heat pumps, and while this would increase the electric demand statewide by 63.7 GWh, the greenhouse gas emissions in California related to heating could be reduced by over 34,000 MTCO2e.

Consumer Appeal: Reducing the cost of heat pumps will make them more attractive to customers who have so far largely ignored them due to high upfront costs relative to alternatives.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$455,123

EPIC Funds Encumbered:

$1,916,306

EPIC Funds Spent:

$11,564

Match Partner and Funding Split:

Rheem: $110,000 (5.2 %)

Dr. Prath Vaishnav: $12,000 (0.6 %)

Southern California Edison: $63,000 (3.0 %)

The Regents of the University of California, Davis: $15,000 (0.7 %)

Match Funding:

$200,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

17 out of 17 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-016 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

This project kicked-off in the summer of 2020. The project team is now in the early stages of lab testing the near-term heat pump solution that uses a combination of lower cost compressor drive and a low-GWP refrigerant. The units will be tested using the updated DOE SEER2 and HSPF2 methods that will be adopted for all products coming to the market in 2023. The team is also in the early stage development of the innovative heat exchanger that will be used in the medium-term solution heat pump.

Project Name: EPC-19-017 - Pilot Scale Recovery of Lithium from Geothermal Brines

Recipient/Contractor: Materials Research LLC

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/1/2020 to 12/29/2023

Program Area and Strategic Objective:

Applied Research and Development

4.3 Increase the Strategic Value of Flexible CSP and Geothermal to the Electricity System

Issue:

Although geothermal energy is an important resource with many benefits, the high upfront cost for installation has been a major barrier. Expansion of geothermal energy production in California will greatly benefit from the creation of a value stream produced by the recovery of useful metals such as lithium from geothermal fluids. The efficient separation of lithium from geothermal brines promises to make the geothermal power generation economically favorable. A supply chain for lithium will generate jobs and spur economic development in the community around the geothermal production plant.

Project Description:

This project will demonstrate a pilot scale integrated process for the recovery of lithium from geothermal brines based on: (1) a high-capacity selective solid sorbent for the extraction of lithium; and (2) a carbon negative sorbent regeneration process for the direct formation of high-purity lithium carbonate (Li2CO3). Compared to traditional methods of Li recovery from brines, the proposed high-capacity selective sorbent and its regeneration process is expected to lower the cost of Li production by enabling separation with high recovery efficiency and minimizing processing time. Co-production of lithium at geothermal facilities will bring additional revenue to the power plants thus making geothermal power more economically viable.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by reducing the cost of energy production from geothermal resources. This agreement will also help spur a new industry of lithium production that will displace the current practices using mining or solar ponds. Both current methods have large footprints and result in degradation of land resources.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed> Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 1c, 2a, 3g, 3h

Lower Costs: The technology will lower the cost of geothermal energy production as a result of the recovery of lithium from geothermal fluids. The economic value of lithium carbonate that can be co-produced by the ten power plants currently operating in the Salton Sea Known Geothermal Resource Area is estimated at $1 billion. Co-production of lithium carbonate can offset $30/MWh from the cost of geothermal energy production.

Economic Development: According to a 2008 feasibility study sponsored by the Imperial Irrigation District, developing geothermal resources could result in creation of some 7,000 to 9,000 jobs, many of which would likely be higher paying than typical jobs in the county. A number of these jobs are likely to be in communities to the north, east, and south of the Salton Sea, areas that meet the CalEnviroScreen designation as disadvantaged communities.

Environmental Benefits: The process utilizes carbon dioxide to generate lithium carbonate. Geothermal power is relatively carbon free with CO2 emissions coming from non-condensable gas from the wells. This process has the potential to utilize captured CO2 emitted from the wells to recover lithium. Additional geothermal energy sources in the Salton Sea Known Geothermal Resource Area will reduce air pollution, which may improve the health of people in affected zones. Revenue from the land leases and mineral recovery is expected to support Salton Sea restoration projects, which some sources estimate may cost $3 to $9 billion.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$265,480

EPIC Funds Encumbered:

$1,878,634

EPIC Funds Spent:

$327,197

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

13 out of 13 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-017 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Project team has begun building the pilot scale system.

Project Name: EPC-19-018 - Hell's Kitchen Geothermal Lithium Extraction Pilot

Recipient/Contractor: Hell's Kitchen Geothermal LLC

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/15/2020 to 6/30/2023

Program Area and Strategic Objective:

Applied Research and Development

4.3 Increase the Strategic Value of Flexible CSP and Geothermal to the Electricity System

Issue:

The Salton Sea geothermal brines contain one of the largest sources of lithium in North America. To date, no party has successfully commercialized lithium extraction from this resource due to significant technical challenges. Geothermal brines can be a challenging source for lithium because of their complicated geochemistry and high corrosive potential. In particular, the Salton Sea geothermal field contains a large amount of lithium, yet, at the same time it also contains large amounts of other chemical elements that make selective extraction difficult.

Project Description:

The goal of this project is to design a pre-treatment process based on the chemical composition of the geothermal fluids at the project site and demonstrate its technical performance on a pilot-scale. The process will remove silica and heavy metals and essentially make the brine ready for subsequent extraction of lithium. The developed process will provide a path to a technically feasible lithium extraction process with favorable commercial scale economics.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by paving the path to the establishment of a stable, secure, low-cost source of lithium needed to manufacture lithium-ion batteries. A supply of lithium-ion batteries is paramount to the state of California achieving its renewable energy goals as increased energy storage systems will be required to integrate intermittent generation sources like wind and solar. A supply of lithium-ion batteries will also be necessary to support the emerging electric vehicle (EV) industry. It is critical for manufacturers of EV batteries to have a reliable supply of affordable lithium.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 2a, 3a, 3e, 3g

Lower Costs: Integrating lithium production with geothermal power production operations has the potential to decrease electricity prices from geothermal operations by about 35 percent.

Economic Development: Expanding geothermal operations and developing lithium production in California could produce over $10 billion of new revenue and create over 3,000 new jobs.

Public Health: Within the Salton Sea Geothermal Field, geothermal and lithium developments could be complementary to California's efforts to mitigate impacts of exposed playa. The Department of Natural Resources is developing plans to build a series of ponds to cover playa and provide habitat. There is an opportunity for the state and private development to share infrastructure and satisfy several common goals. For example, a road for a geothermal and lithium plant could be one side of a berm for a habitat pond.

Energy Security: As the state of California continues to progress towards 100 percent renewable energy, reliability and spinning reserves are going to become increasingly important. Geothermal energy provides valuable inertia and capacity required by grid operators.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$117,874

EPIC Funds Encumbered:

$1,460,735

EPIC Funds Spent:

$0

Match Partner and Funding Split:

Hatch: $300,000 (15.5 %)

Hell's Kitchen Geothermal LLC: $180,000 (9.3 %)

Match Funding:

$480,000

Leverage Contributors:

Controlled Thermal Resources: $675,000

Leveraged Funds:

$675,000

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

13 out of 13 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-018 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Several administrated tasks have been completed including the project kick-off meeting and TAC member commitment.

Project Name: EPC-19-019 - Joint Time-Lapse Acquisition and Inversion of Passive Seismic and Magnetotelluric Data for Monitoring Reservoir Processes at the Geysers Geothermal Field

Recipient/Contractor: Lawrence Berkeley National Laboratory

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/1/2020 to 3/29/2024

Program Area and Strategic Objective:

Applied Research and Development

4.3 Increase the Strategic Value of Flexible CSP and Geothermal to the Electricity System

Issue:

In operating geothermal fields, it is inherently difficult to image the movement of water and steam in a fractured geothermal reservoir in time and three-dimensional space. Tracer tests provide ground truth information about inter-well connectively, but they do not directly reveal the flow paths in the regions between the wells. Microseismicity mapped in three-dimensions can provide valuable information about fluid movement, but it is possible for water and steam to move through the fractured rock mass without triggering microseismicity, as well for microseismicity to be triggered without fluids.

Project Description:

This project will demonstrate the advantages of concurrently acquiring time-lapse magnetotelluric and passive seismic data over a producing geothermal reservoir. The data will be jointly inverted for images of resistivity and seismic velocities using workflows and algorithms that enforce structural similarity constraints between the different physical properties, and subsequently correlating the spatio-temporal information in the joint-inversion geophysical images to working reservoir models. The technical advancements of this project are provided via concurrent monitoring of time-lapse changes in both resistivity and seismic velocity and the joint inversion of the multi-physics data. Ultimately, these images can be used for better estimates of rock properties and spatial distribution of steam and water at depth, for more accurate reservoir modeling and monitoring which will lead to more accurate placement of production wells. A field demonstration at The Geysers will be carried out to evaluate the value added by applying this technology.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by assisting the continued growth of California's broad portfolio of renewable energy, including geothermal, as required to achieve the goals of SB 350. This project will demonstrate the advantages of concurrently acquiring time-lapse magnetotelluric and passive seismic data over a producing geothermal

reservoir, jointly inverting these time-lapse data for images of resistivity and seismic velocities using workflows and algorithms that enforce structural similarity constraints between the different physical properties, and subsequently correlating the spatio-temporal information in the joint-inversion geophysical images to working reservoir models to update these models and to adjust injection and production rates.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 1c, 2a, 3b

Lower Costs: Determining the siting of new injection or production wells in an operating geothermal field is an important decision that caries high financial risks. Ill-informed operation practices can lead to decreased production and financial losses. This technology will allow for remote imaging of the distribution of water and steam in the subsurface allowing for better informed decision making.

Environmental Benefits: Differentiation of the distribution of water and steam in the subsurface will reduce the number of geothermal production and injection wells that need to be drilled.

Energy Security: California has a large geothermal resource potential. Optimal management of this source of clean energy through remote subsurface imaging technologies provides energy security for future generations.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$705,287

EPIC Funds Encumbered:

$1,661,032

EPIC Funds Spent:

$300,000

Match Partner and Funding Split:

U.S. Geological Survey: $247,611 (13.0 %)

Match Funding:

$247,611

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

13 out of 13 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-019 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project recently had its kickoff in August 2020 and the project team has begun work on the project.

Project Name: EPC-19-020 - Salton Sea Geothermal Lithium Recovery Demonstration Project

Recipient/Contractor: BHER Minerals, LLC

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/1/2020 to 3/31/2024

Program Area and Strategic Objective:

Technology Demonstration and Deployment

4.4 Improve the Value Proposition of Bioenergy

Issue:

Recent estimates indicate that about six million metric tons of lithium could be recovered from presently available geothermal resources near Salton Sea, California. This resource could be used to achieve key statutory energy goals, including increasing the value of geothermal resources to California's electricity system. Yet, the major challenges for lithium production in this region relate to the harsh chemistry of the brine and the difficulty of developing a low-cost and highly-selective process for lithium recovery, preventing third-party developers from making significant investments in lithium recovery efforts.

Project Description:

BHER Minerals, LLC (BHERM) -- a wholly owned indirect subsidiary of BHE Renewables, LLC (BHER) -- will design, build, and demonstrate an integrated, 1/10-commercial-scale, geothermal brine pre-treatment and lithium recovery system at its existing geothermal power facilities in Calipatria, California, an area categorized as both a low-income and a disadvantaged community. The lithium recovery system will demonstrate on a pre-commercial scale the recovery of approximately 85 percent of the lithium in geothermal brine at a cost of less than $4,000 per metric ton. The demonstration plant will consist of brine pretreatment to remove heavy metals and onsite conversion of the initial lithium chloride solution into battery-grade lithium carbonate. Demonstrated technology could positively shift the economics of geothermal power production in California by enabling the low-cost production of a co-product with vast commercial value. The opportunity to share the cost of brine production with a lithium recovery business could open the doors to the development of new geothermal power plants, supporting achievement of the state's energy goals.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by demonstrating an advanced lithium recovery technology. The closed-loop demonstration system would become the world's most environmentally friendly lithium recovery plant and one of the most cost-effective. Thus, it could serve as the foundation for numerous new commercial-scale development projects

seeking to take advantage of the ability to share the cost of brine management with geothermal power producers. This, in turn, could lead to the construction of a regional network of lithium recovery facilities that could produce as much as 300,000 metric tons per annum of battery-grade lithium carbonate equivalent, making the Imperial Valley the foremost lithium production center in the world.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 2a, 3a, 3g

Lower Costs: By producing high-value lithium compounds, existing geothermal power plants will be able to reduce the cost of power generation by as much as 35 percent, which would enable them to stabilize or reduce ratepayer costs.

Greater Reliability: Cost-effective production of lithium carbonate from geothermal brine could support development of affordable, lithium-ion-based grid storage, which would support the ability of wind and solar generation facilities to shift their energy supply to the utility grid at times of excess production.

Increase Safety: Improving the economics associated with the construction and operation of geothermal power plants in California encourages the construction of new plants, which would enable California to shift more baseload generation capacity to geothermal power and away from nuclear, coal, and fossil-based natural gas. By reducing reliance on these polluting sources and improving grid reliability, the technology could, once commercialized, increase ratepayer safety by reducing emissions of GHGs and toxic air pollutants, thereby improving public health.

Economic Development: Full commercialization could lead to 35 new regional geothermal power plants, thereby driving ~ $1.8 billion in local economic activity, supporting ~230 workers during construction and ~400 new permanent, good full-time jobs. Importantly, annual economic activity at the plant will generate approximately $20 million in new taxes for Imperial County.

Environmental Benefits: The system has a small footprint and reduces environmental concerns through greatly reduced water usage, reliance on renewable electricity, and, once commercialized, the annual reduction of up to 4,473,889 MT CO2e per year.

Consumer Appeal: OEMs and battery manufacturers can improve the appeal of their products to consumers by "greening" their supply chains and procuring affordable, US-sourced lithium produced in an environmentally sound manner.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$6,000,000

EPIC Funds Spent:

$89,100

Match Partner and Funding Split:

ZAP Construction & Engineering: $1,606,000 (16.0 %)

Build Momentum: $101,000 (1.0 %)

Aquamin: $489,667 (4.9 %)

BHER Minerals, LLC: $1,828,333 (18.2 %)

Match Funding:

$4,025,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

13 out of 13 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-020 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project, which had its kickoff on August 12, 2020, completed some identified preliminary activities and is on schedule. This included: bench testing of system components and process simulation; electrical load study and foundation design; geotechnical assessment of the site; preliminary computational fluid dynamic modeling of the contractor design; and completion of preliminary facility layout, including piping and instrumentation diagrams.

Project Name: EPC-19-021 - High Efficiency Magnetic Refrigeration for Industrial Cryogenic Applications

Recipient/Contractor: General Engineering & Research, L.L.C.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/15/2020 to 3/31/2024

Program Area and Strategic Objective:

Applied Research and Development

1.7 Enable Cost-Effective De-carbonization of California's Industrial Sector

Issue:

Cryogenic refrigeration consumes an enormous amount of electricity and it is being increasingly utilized in the high-tech manufacturing industry. While efforts have been made to improve efficiencies of compression-based systems, the lack of existing refrigerants at cryogenic temperatures make significant improvements to these systems impossible.

Project Description:

The Recipient will develop a new magnetic refrigeration technology that will improve efficiency in the cryogenic temperature regime four times compared to the baseline compression-based technology. By replacing compression-based refrigeration with magnetic refrigeration technology both the operating and capital costs of cryogenic cooling can be reduced.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The technology is anticipated to enable high efficiency cryogenic magnetic refrigeration systems to replace energy intensive compression-based systems in California's industrial sector. The largest application for cryogenic refrigeration is in the high-tech manufacturing industry, which is also the largest and fasting growing industrial market segment in California. With a magnetic refrigeration system with 50 percent efficiency operating in the 10-80K region, the average daily electricity consumption for the standard cryogenic refrigeration units reduces from an estimated 406 kWh to 44 kWh. With successful deployment of these systems the annual energy savings by 2040 in California are estimated to be 2,500 GWh, with $270M of savings in electricity costs, and approximately 7 million metric tonnes of carbon dioxide emissions avoided.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 3a

Lower Costs: The Recipient will develop a new magnetic refrigeration technology that will improve efficiency in the cryogenic temperature regime four times compared to the baseline compression-based technology. By replacing compression-based refrigeration with magnetic

refrigeration for systems in the 10-80K range, both the operating and capital costs of cryogenic cooling can be reduced.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$1,699,066

EPIC Funds Spent:

$2,418

Match Partner and Funding Split:

General Engineering & Research, L.L.C.: $30,000 (1.3 %)

U.S. Department of Energy: $515,658 (23.0 %)

Match Funding:

$545,658

Leverage Contributors:

National Science Foundation: $546,000

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

7 out of 8 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-021 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project was approved by the CEC in May 2020 and the project was kicked off in June. Liquid nitrogen generator is back and running. Focus is currently on manufacturing the magnetocaloric powder for the first stage of refrigeration. The project is progressing according to the schedule.

Project Name: EPC-19-022 - Stirling cycle heat pumps for industrial heat recovery

Recipient/Contractor: The Regents of the University of California on behalf of the Merced Campus

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/15/2020 to 3/31/2024

Program Area and Strategic Objective:

Applied Research and Development

1.7 Enable Cost-Effective De-carbonization of California's Industrial Sector

Issue:

There are three primary challenges limiting heat pump usage in industrial heat recovery: (1) Current heat pumps are unable to provide heat at temperatures necessary for many industrial applications. (2) The efficiency of high temperature heat pumps is too low to justify their implementation in many industrial contexts. (3) Finally, the high capital cost of heat pumps makes them uncompetitive with traditional heating sources.

Project Description:

The Recipient will develop a novel Stirling cycle with liquid piston technology that: alleviates temperature limits imposed by refrigerants experiencing phase change, improves heat transfer performance, and reduces construction complexity and cost.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project could result in improvements to industrial heat pump efficiency based on the implementation of Stirling cycles and liquid piston technology. The use of industrial heat pumps for heat recovery will reduce energy usage for heating, resulting in the ratepayer benefits of reduced greenhouse gas emissions and reduced energy consumption.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h

Lower Costs: This project will implement liquid pistons to simplify construction and reduce the cost of industrial heat pumps useful for waste heat recovery. It has the potential to lower capital and installation costs by 30 percent and operational costs by 20 percent.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$656,630

EPIC Funds Spent:

$21,171

Match Partner and Funding Split:

University of California Merced: $135,927 (17.2 %)

Match Funding:

$135,927

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

7 out of 8 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-022 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project was approved in May 2020 and kicked off in June.

Project efforts focus on system modeling to enhance the porous media description of the regenerator and piston models, evaluate their transient response, and couple these to the thermodynamic system models. The project is underway according to schedule.

Project Name: EPC-19-023 - Booster Ejector Enhancement of Compressor Refrigeration Facilities Utilizing Industrial Process Waste Heat

Recipient/Contractor: Institute of Gas Technology dba Gas Technology Institute

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/15/2020 to 3/31/2024

Program Area and Strategic Objective:

Applied Research and Development

1.7 Enable Cost-Effective De-carbonization of California's Industrial Sector

Issue:

California industrial sector produces over 20 percent of the state's greenhouse gas (GHG) emissions, which represents the second largest source of emissions in California. The industrial sector also accounts for about one third of the State's energy consumption, which includes a wide variety of processes. Process heating accounts for approximately 60 percent of the total industrial energy use. The project team proposes to develop and demonstrate a new generation of highly efficient and cost-effective industrial heat pump technology that utilizes recovered low-grade waste heat to support booster ejector operation and secure at least 10 percent energy saving on refrigeration services.

Project Description:

Gas Technology Institute has partnered with Wilson Engineering Technologies, Del Real Foods (one of the largest Mexican food processors in CA), and advanced chiller manufactures to develop and install a modular Booster Ejector Enhancement of Compressor Refrigeration Facilities (BEECR) system scalable to a wide range of industrial heat pumps. This project will develop and test a novel heat recovery system which is integrated with a booster ejector enhanced refrigeration system utilizing industrial process waste heat. The proposed solution recovers waste heat from the food processing plant and configures the existing chiller plant with an ejector. The project goal includes the design, manufacture, assemble, install, and testing of a pilot unit to achieve higher integrated performance and at least 10 percent energy savings over the conventional equipment as per the targeted metrics of the solicitation.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The food processing and beverage industries in California annually consume 570 million therms and nearly 6,200 million kilowatt hours as well as 36,000 million gallons of clean water. The novel BEECR technology has the potential to reduce electrical and natural gas consumption by recovering waste heat and integrating it with a booster ejector enhanced refrigeration system. This technology is estimated to reduce energy use by over 2 percent (92 million kWh with 30

percent adoption rate). This technology also has the potential reducing clean water demand from California's food processing industry by an estimated 440 million gallons per year.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 3h, 4a

Lower Costs: Assuming 30 percent penetration, estimated annual electricity savings of 92 million kWh, natural gas savings of 14 million therms and 126,000 metric tons CO2e.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$404,995

EPIC Funds Encumbered:

$1,621,556

EPIC Funds Spent:

$33,751

Match Partner and Funding Split:

Wilson Engineering Technologies: $123,707 (6.9 %)

Del Real Foods: $50,000 (2.8 %)

Match Funding:

$173,707

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

7 out of 8 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-023 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Project was approved in May 2020 and kicked off in July. The project is in progress.

Project Name: EPC-19-024 - Development of an Advanced High Temperature Heat Pump for the Efficient Recovery of Low-Grade Industrial Waste Heat

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/15/2020 to 3/31/2024

Program Area and Strategic Objective:

Applied Research and Development

1.7 Enable Cost-Effective De-carbonization of California's Industrial Sector

Issue:

Low temperature waste heat streams account for most of the industrial waste heat recovery. Currently, there is no commercially available heat pump technology in United States that combines a single stage heat pump with a low GWP refrigerant that can cost effectively recover low grade waste heat from industrial processes to transform into useful heat such as low pressure steam.

Project Description:

This project develops and tests an advanced high temperature heat pump (HTHP) for the efficient recovery of low-grade industrial waste heat. The prototype system can produce low pressure steam for use in the industrial facilities and employs a very low global warming potential (GWP) refrigerant and offers a very high coefficient of performance (COP) that is greater than 3.4.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The recipient will develop an advanced high temperature heat pump system with the following characteristics:

1. The near-zero GWP refrigerant has characteristics to operate it in a sub-critical mode with an ability to exist in two-phases and can help to extract low grade waste heat to transform to high temperature useful steam.

2. The control system and heat pump design could deliver the temperature lift of more than 40 degrees centigrade (104 degrees Fahrenheit) with a 3.4 coefficient of performance (COP).

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1h, 2a, 3a

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$458,916

EPIC Funds Encumbered:

$1,999,483

EPIC Funds Spent:

$0

Match Partner and Funding Split:

Electric Power Research Institute, Inc.: $405,848 (16.9 %)

Match Funding:

$405,848

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

7 out of 8 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-024 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

This project kicked off in August 2020. The recipient is doing literature analysis on various newer refrigerants. The recipient has completed and submitted the initial Kick-off Benefits Questionnaire

Project Name: EPC-19-025 - Advanced Heat Exchanger Coatings to Improve Energy Efficiency of Industrial Refrigeration System

Recipient/Contractor: Nelumbo Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/15/2020 to 3/31/2024

Program Area and Strategic Objective:

Applied Research and Development

1.7 Enable Cost-Effective De-carbonization of California's Industrial Sector

Issue:

Industrial refrigeration systems rely on refrigerant-to-air heat exchangers to create temperature-controlled space. Ice continually forms on evaporator coils because their surface is below the freezing point of water and moisture from the air will condense, freeze, and form frost. Frost formation diminishes the ability of the coil to cool the air by acting as a thermal barrier and blocking the flow of air. Overtime frost diminishes system efficiency and leads to inadequate cooling and system failure which necessitates the need to defrost. Defrost is an energy intensive process which accounts for up to 21 percent of the energy consumption of refrigerated systems through direct consumption of energy.

Project Description:

Nelumbo, Inc. has developed surface modified coated evaporator coils to address the inefficiencies from frost formation and the need to defrost. To date there are no anti-ice coating products available for industrial heat exchangers. . The surface modification will utilize an innovative advanced coating comprised of a nano-structured ceramic to overcome these barriers by (1) reducing the onset of frost formation, (2) slowing the rate of frost growth, and (3) enhancing the removal of frost. The project's goal is to advance the Technology Readiness Level (TRL) of the innovative advanced coating technology from TRL 3 through TRL 5. During this process, the technology will be taken from proof of concept component to an extensively tested at the system level in a laboratory environment to develop the dataset necessary to verify performance prior to future field deployment projects.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

To date there are no anti-ice heat exchanger technologies available for industrial refrigeration heat exchangers. Previous research into anti-ice coating technologies have relied on polymers and fluorinated-compounds which are brittle at low temperatures, are not durable under the thermal cycling, and/or not chemically stable to the cleaning requirements in the industrial refrigeration sector. The competitive advantage of Nelumbo's advanced coating over other attempted anti-ice coatings is that it is a durable ceramic that is chemically bonded to the surface. The ceramic utilizes both surface chemistry and nanostructuring to reduce the rate of ice

formation and repel water. It is thin, conformal, durable, and strongly bonded to the surface which allows the coating to flex during the expansion and contraction which occurs during freeze and defrost cycles.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Demand Response (DR): R.13-09-011 Energy Efficiency Proceedings: R.13-11-005

Applicable Metrics: CPUC Metrics- 1f, 1h

Lower Costs: Internal testing at Nelumbo has shown 14 percent reduction in system electricity demand over conventional defrosting methods.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$59,837

EPIC Funds Encumbered:

$1,997,411

EPIC Funds Spent:

$133,183

Match Partner and Funding Split:

Nelumbo Inc.: $925,500 (31.7 %)

Match Funding:

$925,500

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

7 out of 8 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-025 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

This project was approved at the June 2020 CEC Business Meeting and the kick-off meeting was held in July 2020. Unfortunately, the COVID-19 shelter-in-place limited ability for the project team to work together but the team has completed the mini-coil test plan and will proceed to the actual testing of the mini coils.

Project Name: EPC-19-026 - Developing Lessons Learned, Best Practices, Training Materials, and Guidebooks for Customer Side of the Meter Energy Storage

Recipient/Contractor: Center for Sustainable Energy

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 10/28/2020 to 3/31/2023

Program Area and Strategic Objective:

Market Facilitation

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

While behind-the-meter (BTM) energy storage is experiencing rapid technological advancement, cost reductions, and customer adoption through advanced initiatives and programs, energy storage permitting practices in California lack standardized processes among the 500+ local governments responsible for permitting all BTM energy storage systems. This lack of standardization makes permitting costs higher and can result in significant delays in project deployment.

Project Description:

The project's goal is to develop a guidebook with concise, replicable permitting best practices for diverse types of BTM energy storage technologies that Authorities Having Jurisdiction (AHJ) and industry can use to develop standardized, streamlined permitting processes. The best practices will be developed using input gathered from key stakeholders such as permitting officials, energy storage developers, first responders, and codes and standards professionals. The best practices will also interface with the Solar Automated Permitting Process (SolarAPP), currently being developed by the National Renewable Energy Laboratory (NREL), to combine energy storage permitting best practices with solar PV permitting. The Guidebook and SolarAPP will advance California's energy storage permitting practices, help reduce costs and allow energy storage to provide utility bill reductions, and enhance resilience and safety considerations during Public Safety Power Shutoff (PSPS) events.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will result in a replicable, actionable set of guidelines that AHJs can implement and modify to meet local needs. This will be done via a standardized permitting review and approval process created for BTM energy storage systems. These guidelines will interface with the SolarAPP software platform. This will be provided to local governments as a free and simple online permitting tool to help provide instantaneous permitting and innovative inspection service. Stakeholders throughout the state will provide input for guidebook content and help disseminate best practices of energy storage permitting and the SolarAPP to ensure maximum adoption.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed>

Applicable Metrics: CPUC Metrics- 2a, 3e

Lower Costs: Streamlining and standardizing the permitting process for behind the meter energy storage will save customers, permitting authorities, and builders and contractors time and money.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$349,527

EPIC Funds Encumbered:

$1,000,000

EPIC Funds Spent:

$0

Match Partner and Funding Split:

Center for Sustainable Energy: $94,000 (7.6 %)

National Renewable Energy Laboratory: $150,000 (12.1 %)

Match Funding:

$244,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

5 out of 5 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-026 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project held its kickoff meeting on November 13, 2020. The project is in the beginning stages of information gathering for relevant technology types and identification of stakeholders in preparation for the first public workshops to engage stakeholders.

Project Name: EPC-19-029 - Improved Silica Removal for Enhanced Geothermal Plant Performance

Recipient/Contractor: Hell's Kitchen Geothermal LLC

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/15/2020 to 12/29/2023

Program Area and Strategic Objective:

Applied Research and Development

4.3 Increase the Strategic Value of Flexible CSP and Geothermal to the Electricity System

Issue:

Silica management in geothermal brines is a common issue for many operations. As the geothermal fluids are cooled through the power conversion process, silica begins to precipitate out of solution, causing scale deposits in equipment. This causes performance degradation and results in increased operating and maintenance costs. The methods used today to manage silica are either a controlled precipitation process called Crystallizer-Reactor-Clarifier or pH Modification which uses the continuous addition of acid to keep silica in solution. These methods have high capital and operating costs, restrict flexible power generation, and can inhibit the recovery of minerals such as lithium.

Project Description:

This project will develop and demonstrate a fundamentally new and innovative method for managing silica in geothermal operations. The new technology, Geothermal Micropillar Enabled Particle Separator (GMEPS) separates solid particles based on their size as they flow through a series of carefully positioned staggered/offset posts. The particles bouncing off the ordered array of posts are systematically moved to one side of the separator. As a result, the bulk of the flow is cleared of particles and a concentrated slurry containing the particles is separated from the stream. There is no need for addition of corrosion inhibitors or flocculants, and the separation system does not require cycling or the allowance for large settling volumes. Instead, the separation is accomplished dynamically under a wide range of flow conditions. Larger particles separate faster than smaller particles, enabling size separation and purification for value added products. Novel designs and manufacturing methods allow these GMEPS separators to be made cost effectively, at industrial scale, and in a form-factor that allows deployment within existing geothermal piping.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by improving the cost and flexibility of geothermal power through significantly advancing silica management technology in geothermal operations. This will enable flexible operations by providing an effective silica removal

system across a dynamic and wide flow regime, provide a pathway to producing value-added products from the silica and other minerals removed from the brine, and reduce the capital and operating cost requirements of geothermal plants.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard Program: R.18-07-003

Applicable Metrics: CPUC Metrics- 1c, 2a, 3a, 3b, 3g

Lower Costs: GMEPS has the potential to reduce both capital and operating costs by reducing the amount of equipment needed and eliminating the need for acid addition. It also has the potential to be constructed from less expensive materials compared to conventional methods.

Economic Development: Expanding geothermal operations and developing lithium production in California could produce over $10 billion of new revenue and 3,000 new jobs.

Environmental Benefits: There is sufficient geothermal energy resource in California for at least an additional 2,000 MW. This would help to reduce CO2 emissions by 10 million tons per year compared to gas power generation. The project will eliminate the traditional silica filter cake that is disposed in landfills and create a high-value silica product.

Public Health: Within the Salton Sea Geothermal Field, geothermal and mineral developments could be complementary to California's efforts to mitigate impacts of exposed playa. The Department of Natural Resources is developing plans to build a series of ponds to cover playa and provide habitat. There is an opportunity for the state and private development to share infrastructure and satisfy several common goals. For example, a road for a geothermal plant could be one side of a berm for a habitat pond.

Energy Security: As the state of California continues to progress towards 100 percent renewable energy, reliability and spinning reserves are going to become increasingly important. Geothermal energy provides valuable inertia and capacity required by grid operators.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$326,428

EPIC Funds Encumbered:

$2,999,599

EPIC Funds Spent:

$355,003

Match Partner and Funding Split:

Hell's Kitchen Geothermal LLC: $45,000 (1.5 %)

Match Funding:

$45,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

13 out of 13 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-029 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Several administrated tasks have been completed including the project kick-off meeting and TAC member commitment.

Project Name: EPC-19-030 - Large Capacity CO2 Central Heat Pump Water Heating Technology Evaluation and Demonstration

Recipient/Contractor: Association for Energy Affordability

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/17/2020 to 3/31/2024

Program Area and Strategic Objective:

Technology Demonstration and Deployment

1.3 Meeting the Demand for Efficient and Environmentally Friendly Heating, Ventilation and Air Conditioning and Refrigeration Systems

Issue:

The predominant fuel for heating hot water in California is natural gas. As California's electric grid moves toward zero carbon resources, water heating will make up a majority of greenhouse gas emissions within buildings if natural gas remains the predominant heating fuel. Electric heat pump water heaters designed for single-family homes are available in the market place. However, there are very few central heat pump water heating products appropriate for multifamily buildings available in the United States--and none of these central heat pump water heating products use zero- or low-global warming potential (GWP) refrigerants.

Project Description:

This project tests and demonstrates the field performance of a low-GWP variable capacity central heat pump water heating system in five multifamily building applications, each with a different design approach and configuration. The technology is highly configurable and has grid integrated controls capable of responding to time-of-use rates and enabling load shifting. The project provides field data to validate Title 24 Part 6 energy code compliance modeling assumptions and algorithms; and seeks to accelerate the market for low-GWP central heat pump water heaters by documenting best-class design and installation practices. The demonstrations are installed in and benefit low-income and disadvantaged communities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Electrification of water heating has the potential to reduce greenhouse gas emissions and provides an opportunity for grid harmonization through thermal load shifting. This project seeks to accelerate adoption of an emerging low-GWP central heat pump water heating technology to address the needs of a large percentage of California multifamily buildings. Field tests will validate system performance, and streamlined design approaches and installation practices will be developed and disseminated to increase industry adoption and proper application of this technology.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Building Decarbonization: R.19-01-011

Applicable Metrics: CPUC Metrics- 2a, 4a

Lower Costs: This project could result in greater electricity reliability, lower costs, and increased safety. Electrification of water heating in multifamily buildings represents an opportunity for grid harmonization through thermal load shifting. One of the project objectives is to optimize system design for load shifting capabilities. Off peak hot water charging is estimated to reduce costs by 10.1 kW/hour or up to 50.5 kWh/day over a five-hour peak period (4pm-9pm) and increases electricity reliability by putting less strain on the grid during peak times.

Increase Safety: Water heaters have traditionally relied on natural gas to heat water. If not fully combusted, natural gas produces harmful exhaust that can be detrimental to human health. Under the worst conditions, gas leaks from improper installation can pose an explosion risk to the building. Additionally, in the low-GWP refrigerant market, ammonia has become increasingly popular for both its efficiency and environmental benefits. This gas, like many of the traditional refrigerants is highly toxic and poses a health risk if the system is not properly operated and maintained. This project uses carbon dioxide as its low-GWP refrigerant, which is much less toxic and significantly safer to handle.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$422,709

EPIC Funds Encumbered:

$2,800,193

EPIC Funds Spent:

$112,045

Match Partner and Funding Split:

Electric Power Research Institute, Inc.: $484,916 (12.0 %)

New Buildings Institute, Inc.: $177,212 (4.4 %)

Mitsubishi: $561,000 (13.9 %)

Brightpower: $4,000 (0.1 %)

Match Funding:

$1,227,128

Leverage Contributors:

Electric Power Research Institute, Inc.: $484,916

New Buildings Institute, Inc.: $177,212

Mitsubishi: $561,000

Brightpower: $4,000

Leveraged Funds:

$1,227,128

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

17 out of 17 bidders

Rank of Selected Applicant/ Bidder:

Group 2B: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-030 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The research team is conducting site visits to collect data on existing conditions and begin system design on the first of five project sites. The project team continues engaging with property owners for the remaining demonstration sites.

Project Name: EPC-19-031 - Solid-state Long Duration Energy Storage for Industrial Applications

Recipient/Contractor: Antora Energy, Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/30/2020 to 3/31/2024

Program Area and Strategic Objective:

Applied Research and Development

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

In California, the impacts of a warming climate are already being acutely experienced in the form of increased wildfire risk. The 2018 wildfire season inflicted over 100 fatalities and $10 billion in economic damage, while a single Public Safety Power Shutoff can cost residents and businesses over $1 billion and critically endanger elderly and vulnerable populations. Existing storage technologies such as lithium-ion batteries are an order of magnitude too expensive for multi-day storage applications and are plagued by considerable safety and lifetime concerns, creating the critical need for a new, low-cost and long-duration energy storage technology.

Project Description:

The project involves development, testing, and pilot-scale demonstration of an energy storage system based on thermophotovoltaic (TPV) technology. The technology includes using electricity to heat graphite blocks, and then reconverting the heat to electricity at a later time. After development and testing of the approach in a laboratory setting, the recipient will build a pilot-scale TPV system at an existing cogeneration power plant site east of the City of San Joaquin in Fresno County. The system will be connected with existing cogeneration, solar power, and agricultural by-products processing.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Energy storage has been identified as an enabler to increase renewable penetration. Lithium Ion batteries with storage duration of up to four hours are widely accepted and dominate recent new energy storage procurement and deployment in California. However; long duration, multi-hour to multi-day energy storage will be required to meet California's future energy goals. This project will test and validate a new long duration energy storage technology that, once commercialized, has the potential to achieve an order of magnitude lower costs compared to Lithium Ion batteries.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed> Smart grid: R.08-12-009 <closed> Integration of Distributed Energy Resources (IDER): R. 14-10-003 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 1f, 4a, 4b, 5a, 5b

Lower Costs: The installed capital costs of Antora's thermal battery are anticipated to be <$0.05/kWh when commercialized, this is 20x lower than lithium-ion batteries. Antora's technology is anticipated to have the ability to cost effectively scale energy storage capacity for long duration energy storage applications.

Public Health: Antora's technology, once commercialized, will support California's future energy goals by enabling renewable generation plus storage to be deployed at scale to displace fossil fueled NOx emitting conventional generation that disproportionately impact low-income and disadvantaged communities in California.

Energy Security: Antora's thermal battery technology, once commercialized, is anticipated to have the ability to cost effectively scale for long duration multi-hour to multi-day energy resiliency applications.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$99,176

EPIC Funds Encumbered:

$1,999,787

EPIC Funds Spent:

$0

Match Partner and Funding Split:

Antora Energy, Inc.: $2,071,313 (50.9 %)

Match Funding:

$2,071,313

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

37 out of 37 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-031 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project is anticipated to start in early 2021.

Project Name: EPC-19-032 - Low-GWP Mechanical Modules for Rapid Deployment Project (LG-MM)

Recipient/Contractor: Association for Energy Affordability

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/30/2020 to 3/31/2024

Program Area and Strategic Objective:

Applied Research and Development

1.3 Meeting the Demand for Efficient and Environmentally Friendly Heating, Ventilation and Air Conditioning and Refrigeration Systems

Issue:

To reach California's building decarbonization goal, there is a strong need for innovative HVAC solutions in the retrofit market. Neither the CA market, nor the US market, currently have a fully packaged mechanical pod system that integrates space heating, cooling, domestic hot water, and ventilation with heat recovery. Although many overseas manufacturers produce combined systems that require less space, improved quality, and reduced renovation time, they are not exported to the U.S.A The demonstration and design modification of the overseas products can help the adoption of these solutions. and become commercially available.

Project Description:

The project develops a pre-fabricated central mechanical system module for retrofit applications. The mechanical module will include heating, ventilation and air conditioning (HVAC), domestic hot water, and real time energy use monitoring, control and feedback for multifamily buildings. The compact, lightweight, package will be designed to be mass produced offsite and installed quickly. All demonstration sites will be located in disadvantaged or low income communities. This agreement continues on research initiated in the EPC 17-040 grant, which identified a market gap for packaged mechanical systems in CA. The prototypes will re-tool and re-design commercially available equipment available in Sweden to accommodate the refrigerant to R32. The team will also replace the 40 gallon DHW storage tank 7 kWh of phase change material thermal energy storage which is expected to provide an equivalent volume of domestic hot water, but will occupy substantially less space than the existing tank.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project develops low GWP mechanical module prototypes, optimized for the most common multifamily building types in California. The system will show at a proof-of-concept level that these combined systems are well suited for the California market. This will serve as an example to American manufacturers, potential fabricators, and technology startups for the retrofit industry.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 1f, 1h

Lower Costs: The annual energy savings are estimated to reduce utility bills by $80-$155 per year per apartment. If all 6 million single family homes with natural gas space and water heating and 1.6 million apartments with natural gas space and water heating installed a system, it could result in an estimated $600 million or more savings in customer utility bill savings per year.

Increase Safety: The conversion from natural gas to electric will reduce gas piping and infrastructure which could result in improved safety, as well as reduced risk of indoor air quality hazards.

Assignment to Value Chain:

Transmission

Total Budgeted Project Admin and Overhead Costs:

$104,657

EPIC Funds Encumbered:

$1,499,926

EPIC Funds Spent:

$115,590

Match Partner and Funding Split:

sanden: $20,000 (1.3 %)

Mitsubishi: $11,520 (0.7 %)

Association for Energy Affordability: $27,000 (1.7 %)

Match Funding:

$58,520

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

17 out of 17 bidders

Rank of Selected Applicant/ Bidder:

Group 2A: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-032 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The Team finalized the design modification for the prototypes based on existing SystemAir product as a basis of design. Team has scheduled monthly partnership meeting with SystemAir to gain feedback regarding modifications needed. They are also developing (proactively) the future permitting data for future site demonstrations next year.

Project Name: EPC-19-033 - Demonstrating Benefits of Highly Insulating Thin-Triple Window Retrofits in California

Recipient/Contractor: DOE- Lawrence Berkeley National Laboratory

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/30/2020 to 3/31/2024

Program Area and Strategic Objective:

Technology Demonstration and Deployment

1.2 Showcase Benefits of Advanced Window and Building Envelope Systems

Issue:

Windows continue to be the poorest thermally performing envelope system. Current best practice new window is double-pane glazing. High performance triple-pane windows have a low rate of adoption due to their increased weight and cost. Currently available high-performance products require heavy glazing, leading to heavier and wider frames than industry standard, results in difficultly and greater costs to install in new and retrofit construction. Reducing the cost of high-performance windows requires reduced material costs, maintaining window weight and frame sizing comparable to existing windows for retrofit applications and maintaining long-term air filtration and structural performance.

Project Description:

This project aims to deploy and demonstrate a new thin triple-pane window system in two multi-family residences and 30 single-family homes, to demonstrate its much higher insulation properties compared to single- and double-pane windows. The thinness of the glass allows the system to function as well as traditional triple-pane windows, and by saving on weight and costs, the system becomes competitive with other energy saving envelope retrofits. The project quantifies the field performance of the window by measuring energy savings and verifies the build quality and long-term performance benefits of the triple-pane windows through accelerated aging techniques. Finally, the project team will assess window manufacturing markets and determine the current and future market potential for high performance thin-glass triple-pane windows. They will identify market barriers, opportunities, and long-term market cost of these technologies through engagement with leading window manufacturers, home builders, and retrofitters, and with market pull partners such as building codes, utility rebate/incentive programs, and ENERGY STAR. Stakeholder surveys will be given.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project demonstrates the ability of builders and remodelers to deliver high-performance window solutions at incremental costs competitive with other building envelope solutions, facilitating their use as a cost-competitive solution to reduce energy use in California homes. The thin-glass triple-pane configuration utilized for this demonstration project delivers the same

thermal performance benefits to homeowners as traditional triple-pane windows without requiring the window manufacturer to redesign the framing system, thus reducing cost and risk to the manufacturers while delivering a lower overall

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1f, 1h, 2a, 3b, 4a, 5d

Lower Costs: Thin-glass triple-pane insulating glass units allow the creation of high-performance windows of the same size and similar weight to standard double-pane windows, allowing much simpler retrofits and lowering the installed cost of high-performance products.

Environmental Benefits: Thin-glass triple-pane windows will reduce energy use for heating and cooling by reducing heat transfer through the building envelope. Lower energy consumption will mean fewer emissions from power plants and improved air quality.

Public Health: Thin-glass triple-pane windows will aid in reducing mold caused by condensation on the interior surface of windows in winter, improving indoor air quality by reduced infiltration through leaky weather seals, and increasing climate resilience by maintaining more uniform indoor temperatures through controlling heat gain in summer and heat loss in winter.

Consumer Appeal: New high-quality windows add appeal to any home, especially when the existing windows are failing, inoperable due to being painted shut, or rotting.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$465,885

EPIC Funds Encumbered:

$1,850,000

EPIC Funds Spent:

$867,608

Match Partner and Funding Split:

United States Department of Energy: $485,000 (19.6 %)

Cornerstone Building Brands/ Ply Gem: $145,000 (5.8 %)

Match Funding:

$630,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

9 out of 9 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-033 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The agreement was executed in August 2020 and recipient submitted their draft list of TAC members in September 2020 . The TAC includes window manufacturers, single-family and multifamily expert architects, and energy efficiency consultants such as Cardinal, Quanex Building Products Corporation, PDS IG Equipment, Northwest Energy Efficiency Alliance (NEEA), and Consortium for Energy efficacy. The TAC also includes staff from the US Environmental Protection Agency's Energy Star Homes Program and CEC's Existing Building Office and Equity Team. To support disadvantaged and low-income community activities, the TAC also has two DAC community-based organizations (CBO), Built It Green and Actera. Project team is still in the process of identifying 30 single family home demonstration sites located in disadvantaged

communities. Recipient will identify local community based organizations to add to the TAC, This will ensure project receives community feedback.

Project Name: EPC-19-034 - Commercialization of Lowest-Cost, Long Duration Energy Storage Systems

Recipient/Contractor: e-Zn Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/30/2020 to 3/31/2024

Program Area and Strategic Objective:

Applied Research and Development

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

In order for California to achieve its renewable energy goals, affordable long-duration energy storage is a necessity. The storage requirements to meet these goals cannot be accomplished by batteries (i.e. device-based technologies like lithium-ion) alone, given the linear price vs. energy capacity curves for these technologies, leading to very high prices for applications requiring durations of 12 hours or longer. To address long periods of limited solar or wind power generation, as well as seasonal differences, long-duration energy storage technologies that can scale in the energy capacity dimension (kWh) at a super low cost will be required.

Project Description:

This project will demonstration an e-Zn long-duration energy storage system, and test and validate the e-Zn technology at the commercial scale. e-Zn's technology is material based, as adding more hours of runtime does not require an additional device (or battery), but only additional zinc, potassium hydroxide (the electrolyte), and plastic (for containment), at a material cost of approximately $20/kWh. This makes e-Zn's technology exceptionally well suited for long-duration energy storage applications, particularly greater than 24 hours duration (at rated power), and at a power node size of 1 kW to 10 MW.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

e-Zinc's technology is a paradigm shift in energy storage. By storing electrical energy within zinc metal, the system can store hundreds of hours of energy capacity while being significantly cheaper than battery technologies. This has the potential to dramatically improve the value proposition of intermittent, renewable electricity sources such as wind and solar. e-Zinc's system uses water based electrolyte which is non-flammable and has no risk of thermal runaway or igniting in a fire. e-Zinc's storage system retains 100 percent of its usable capacity throughout its lifetime. e-Zinc's technology decouples power from energy, allowing low-cost scaling of energy capacity.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed> Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1e, 1h, 5a

Lower Costs: In addition to increased resiliency, e-Zn technology could be cycled daily to reduce costs through demand charge reduction, energy use shifting (i.e. time-of-use arbitrage), or by capturing excess onsite solar generation. Given its large energy capacity, an e-Zn system could do this while still reserving enough energy to supply the customer in the case of an unexpected outage.

Greater Reliability: e-Zn technology, given its ultra-low cost of energy capacity, can provide an affordable and reliable source of backup power for 1-2 days or longer (vs. only a few hours for commercially available batteries), in the case of a grid outage or fire-prevention public safety power shutoff.

Increase Safety: Given that e-Zn technology inherently has no risk of fire, explosion, or thermal runaway, it would be a lower risk option for Californians compared to lithium-ion, particularly fire prone areas.

Environmental Benefits: By discharging during peak periods, an e-Zn energy storage system can offset electricity otherwise supplied by fossil-fuel utility peaking units. The approximate savings per system are shown in Figure 2, with CO2e reductions of ~5000 lbs./year for a residential system and ~100,000 lbs./year for small scale commercial/industrial system.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$1,286,777

EPIC Funds Spent:

$0

Match Partner and Funding Split:

e-Zn Inc.: $411,010 (24.2 %)

Match Funding:

$411,010

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

37 out of 37 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-034 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The kick-off meeting was held on August 19, 2020. Product development and testing of e-Zinc's latest iteration of cells continues. The current focus is on building cells for e-Zinc's first in-field deployment, which will precede this CEC project and be installed in Ontario, Canada in early 2021. e-Zinc is currently renovating a new production facility, and will be moving into this new facility in early 2021. e-Zinc's business development team continues to explore and validate the use case for e-Zinc's technology in the California market, specifically for backup power with daily cycling (focused on commercial and industrial customers).

Project Name: EPC-19-035 - Advancing Energy Efficiency in Manufactured Homes Through High Performance Envelope

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/30/2020 to 7/1/2023

Program Area and Strategic Objective:

Applied Research and Development

1.2 Showcase Benefits of Advanced Window and Building Envelope Systems

Issue:

Current manufactured housing in California is subjected to national HUD standards which are significantly less stringent than CA Title 24 requirements, disproportionately increasing the energy burden of the low-income families common among manufactured homes. When compared to Title 24 compliance, HUD construction falls short and increases energy consumption while likely reducing occupant comfort. Additionally, plant acceptance and product cost remain as key barriers. Unless mandated, plants see little value to add more costly, unfamiliar technologies into their manufacturing process. Unless the technology is clearly more cost-effective, plants will likely not pursue the technology further.

Project Description:

The project integrates several advances in manufactured home design and construction that taken together will provide a model for how the industry can cost-effectively achieve the state's energy and fire safety goals. To achieve these goals, the project consists of two parallel and overlapping design-development tracks: innovative envelope (wall and roof) systems and comprehensive solutions for meeting requirements of Title 24. In crafting solutions, the team focuses on advancing envelope innovations that hold the promise of improving thermal performance without adding cost. Outreach will be held to the industry through the manufacturing subcontractors, as well as the manufacturing partners on the TAC.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Advancing the energy efficiency from national HUD standards to CA Title 24 standards while keeping both first costs and utility bills low will create efficient and healthy manufactured homes that could substantially transform the need for housing in the state and help address the affordability crisis. When adding in the costs of health impacts, resulting from better indoor air quality by eliminating combustion, it provides even greater benefits to the society and its occupants as a whole. These innovations will improve competitiveness of manufactured homes against standard single family homes, and provide ratepayers with an attractive option for housing that will simultaneously reduce energy bills.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Building Decarbonization: R.19-01-011 Mobile Home Park Pilot Program: R.18-04-018 Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 1e, 1f, 1h, 3a, 3b, 3h, 4a

Lower Costs: The increased energy efficiency of the home due to improved envelope measures will significantly reduce heating and cooling costs. Integration of other high efficiency systems including the heat pump water heater, heat pump HVAC, and the PV array will further reduce energy bills at the site. With the higher upfront cost but reduced energy bills, the project will calculate the projected return on investment of meeting Title 24 standards for manufactured housing.

Increase Safety: Improvements from the HUD fire safety standard to the 2-hour fire resilience standard set forth in this proposal improve the overall fire resilience of the manufactured home while simultaneously providing extra energy efficiency and additional occupant comfort. Moving from mixed-fuel to all-electric may also improve the indoor air quality of the homes reducing any health issues caused by combustion and/or gas leaks.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$457,245

EPIC Funds Encumbered:

$1,999,982

EPIC Funds Spent:

$0

Match Partner and Funding Split:

Electric Power Research Institute, Inc.: $299,998 (12.5 %)

Clayton Homes: $21,000 (0.9 %)

Cavco Industries, Inc.: $21,000 (0.9 %)

Champion Home Builders, Inc.: $21,000 (0.9 %)

Systems Building Research Alliance: $40,000 (1.7 %)

Match Funding:

$402,998

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

9 out of 9 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-035 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

Project is underway. The kickoff meeting was held on July 24, 2020. The project team is looking toward technologies available for multiple expected situations of amperage availability. They have begun drafting a list of potential technologies for evaluation. A TAC has been proposed which includes four additional manufacturers to help with tech transfer.

Project Name: EPC-19-036 - Varieties of Prefabricated Envelope Solutions for CA Low-Rise Buildings

Recipient/Contractor: Rocky Mountain Institute

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/30/2020 to 3/31/2024

Program Area and Strategic Objective:

Applied Research and Development

1.2 Showcase Benefits of Advanced Window and Building Envelope Systems

Issue:

Envelope improvements are rarely part of any renovation projects due to cost barriers caused by longer construction time. A Net Zero Energy model developed in the Netherlands, has developed, unitized, prefabricated exterior facade panels that can be installed on an existing building in less than a week. A unitized panel includes windows, doors, and exterior cladding such that once they are attached to the existing building, there is no other envelope work required. There is currently a lack of prefabrication unitized panels in the U.S. Most of the available products are geared toward new construction and are usually not designed for low-rise California building typology.

Project Description:

The project aims to develop and demonstrate an industrialized approach to deep carbon emission reducing retrofits, and enable the scaling of the industry to the point where mass deployment of Zero Net Carbon retrofits can occur in California. The project is centered around the utilization of two primary technologies which do not currently exist in the US market:1) pre-fabricated, unitized, high-performance retrofit envelope panels, and 2) compact, packaged, modularized, grid interactive, multi-function mechanical systems that provide heating, cooling, ventilation, and domestic hot water. The Netherland's Energiesprong model also takes a more industrialized approach to combining and installing these two systems by creating standardized retrofit packages that can be rapidly deployed on ubiquitous building typologies across California.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project designs and develops exterior envelop panels to allow the existing building to remain largely intact and retrofit work is mainly performed outside, which makes the process less disruptive and less sensitive to the building's existing conditions and tenants. Prefabricated exterior retrofit panels improves quality assurance, reduces renovation time and costs, and significantly reduces thermal loads thereby reducing HVAC energy use and allowing for full electrification of buildings without disrupting utility bill affordability. By increasing the rate of low-load, all-electric retrofits as a turnkey technology, these facade panels can enable California to transition its building stock to running on carbon neutral electricity.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy Efficiency Strategic Plan update and action plans: EE Strategic Plan docs

Applicable Metrics: CPUC Metrics- 1h, 4a

Lower Costs: The project could significantly reduce utility bills for millions of low income families in California.

Environmental Benefits: California has more than 2 million occupied units for low income multifamily buildings. If all units receive prefabricated façade panel retrofits, it could result in significant greenhouse gas emission reduction.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$269,494

EPIC Funds Encumbered:

$1,917,967

EPIC Funds Spent:

$44,659

Match Partner and Funding Split:

RDH Building Science Inc.: $25,000 (1.2 %)

Rocky Mountain Institute: $95,624 (4.6 %)

Signetron, Inc.: $35,000 (1.7 %)

Association for Energy Affordability: $15,000 (0.7 %)

Match Funding:

$170,624

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

9 out of 9 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-036 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The team is developing two prefabricated exterior retrofit panel prototypes with Dryvit/Tremco to install on two low-rise multifamily buildings. Prototype designs are being drafted. The team is collecting information about the demonstration sites in via 3D scanning, structural assessments, and an on-site walk throughs.

Project Name: EPC-19-037 - Demand Based Renewable Hydrogen Power-to-Power Project

Recipient/Contractor: DasH2energy LLC

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/30/2020 to 3/29/2024

Program Area and Strategic Objective:

Applied Research and Development

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

Achieving California's energy goals will require a diversified portfolio of energy storage technologies. At this time the energy storage market is dominated by lithium-ion energy storage technologies, and the current market does not address the need for diversification. Additionally, there is a need to address energy system resiliency as it is anticipated that California will continue to experience long duration outages associated with wildfires. Technology demonstrations are needed to validate the multi-sector benefits that hydrogen energy technologies could provide.

Project Description:

This project will field test a containerized hydrogen energy storage system integrated with renewable wind generation and a microgrid at a water district customer site. The project will validate the hydrogen system's ability to provide customer energy cost savings by improving the use of renewable generation and providing resiliency to the water district during Public Safety Power Shutoff events. The data obtained on capital cost, operating cost, performance and lessons learned will support commercial deployment.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will validate the hydrogen system's ability to: provide customer energy cost savings and price stability; resiliency during Public Safety Power Shutoff events, load follow; provide baseload renewables; and, provide long duration storage of large amounts of power. The data obtained on capital cost, operating cost, performance and lessons learned will support commercial deployment. This project will provide benefits for the Water District, utility grid, and IOU ratepayers.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Streamlining Interconnection of Distributed Energy Resources and Improvements (Rule 21): R.17-07-007

Applicable Metrics: CPUC Metrics- 1i, 5a

Lower Costs: The hydrogen energy storage system is expected to provide longer duration energy storage, which will enable greater use of on-site wind generation to reduce customer energy costs.

Energy Security: The hydrogen energy storage system, integrated with renewable generation and a microgrid, will store large amounts of power providing long duration energy resiliency for the customer site.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$70,935

EPIC Funds Encumbered:

$1,275,475

EPIC Funds Spent:

$0

Match Partner and Funding Split:

Advanced Carbon Technologies, LLC: $275,000 (17.7 %)

Match Funding:

$275,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

37 out of 37 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-037 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project was initiated late in 2020. Preliminary work is focused on gathering site energy load profiles, onsite wind power generation profiles, utility tariff data, and energy costs. The data gathered will establish project baselines and inform system design.

Project Name: EPC-19-038 - Low-Cost and Easy-to-Integrate Second-Life Battery HUB

Recipient/Contractor: Smartville, Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/30/2020 to 3/31/2024

Program Area and Strategic Objective:

Applied Research and Development

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

There is an increasing need to find alternative applications for vehicle batteries after they have reached the end-of-life in the vehicle application. By 2027, an estimated 45,000 electric vehicle (EV) batteries will be retired in California. EV batteries are typically retired when their battery capacity and/or power capability decreases to 70-80 percent of their initial capacity capability. However, many EV batteries are still capable of providing energy storage services in a stationary application when their condition is no longer suitable for the performance requirements of EVs. This presents an opportunity for EV battery reuse as low-cost stationary storage in their second life, prior to recycling.

Project Description:

Smartville Inc., the University of California San Diego (UCSD), and the Electric Power Research Institute (EPRI), in collaboration with ARPA-E research partners Utah State and Colorado State, are characterizing the degradation of repurposed Tesla Model S and Nissan Leaf battery modules and validating the ability of these resources to provide building resiliency and load shifting services (paired with solar PV) at a small/medium sized commercial building with critical 24/7 power needs. Additionally, Smartville is deploying a pilot system that demonstrates Smartville's innovative Heterogenous Unifying Battery (HUB) energy storage system. Finally, Smartville is demonstrating how such a system can simultaneously condition used batteries to ensure safety and reliability while extending battery life.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Smartville Inc., teaming with UCSD and EPRI, will develop and demonstrate a low-cost, easy-to integrate second-life HUB energy storage system. The primary innovations include the ability of the HUB system to accommodate multiple battery types (e.g., Tesla and Nissan), and the allowance of hot swapping modules to reduce downtime. The HUB system will use a unique distributed battery estimation and "life balancing" energy management system to achieve superior performance in extending battery cycle life. Last, Smartville's approach to testing second-life batteries should eliminate high labor costs and reduces "shelved time" by utilizing

independent power control and model-based estimation to automatically learn battery health information.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integration of Distributed Energy Resources (IDER): R. 14-10-003 Streamlining Interconnection of Distributed Energy Resources and Improvements (Rule 21): R.17-07-007 Development of Rates and Infrastructure for Vehicle Electrification: R.18-12-006 Net Energy Metering: R.20-08-020

Applicable Metrics: CPUC Metrics- 1b, 1c, 1e, 1f, 1h, 1i, 2a, 3a, 3b, 3e, 3f, 3h, 4a, 4b, 4c, 4d, 4e, 5b, 5d

Lower Costs: This project aims to increase the reliability of second-life batteries by identifying their state of health, swapping batteries while the system is running, and integrating various EV batteries into the same storage system. All of these objectives will lead to more reliability and lower costs.

Economic Development: Second-life batteries could lead to an entirely new value chain for EV batteries, increasing consumer spending and job creation.

Environmental Benefits: Currently there is not a recycling program that is mandated for EV batteries. By using EV batteries in a stationary storage application, demand for raw materials that need to be mined (lithium, cobalt, etc.) will decrease, thus saving finite resources and lessening the environmental (and human) impacts associated with mining. This may also allow for more time to create a mandatory recycling program for batteries to recover raw materials and avoid landfills, leading to improved water quality.

Public Health: Because of the environmental benefits of reducing batteries in landfills, public health as it relates to natural resources such as ground water should be improved. Public health and environmental health are closely linked.

Assignment to Value Chain:

Generation

Total Budgeted Project Admin and Overhead Costs:

$79,875

EPIC Funds Encumbered:

$2,035,787

EPIC Funds Spent:

$105,388

Match Partner and Funding Split:

The Regents of the University of California, San Diego: $845,176 (28.3 %)

Electric Power Research Institute, Inc.: $20,000 (0.7 %)

Big Battery: $18,480 (0.6 %)

Smartville, Inc.: $71,600 (2.4 %)

Match Funding:

$955,256

Leverage Contributors:

ARPA-E: $845,176

Leveraged Funds:

$845,176

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

10 out of 11 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-038 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

This project held its kickoff meeting on September 9, 2020. The team has purchased Nissan Leaf and Tesla battery packs and has begun electrical work at the testing lab. The team has also started to coordinate with the demonstration site manager to obtain updated facility data. Smartville has also been working on sourcing materials for the project.

Project Name: EPC-19-039 - Reuse of Electric Vehicle Batteries for Solar Energy Storage

Recipient/Contractor: RePurpose Energy, Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/30/2020 to 12/31/2023

Program Area and Strategic Objective:

Applied Research and Development

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

Repurposing used EV batteries as energy storage for PV systems represents an opportunity to divert waste batteries from disposal and significantly reduce the pending impact on recycling facilities throughout California. Unfortunately, a lack of data on second life battery degradation, performance, and cost have delayed the commercialization of this application. Without validated data, financiers and insurers are unable to effectively calculate risk to fund and insure these projects. As a result, used EV batteries are ending up in the waste stream while new lithium-ion batteries are produced for new stationary energy storage systems.

Project Description:

RePurpose Energy is conducting a series of laboratory-based cycling tests to identify the degradation rate and effective useful life of individual used EV battery cells based on a variety of control strategies. The team is creating a scale model of a second life EV storage system connected to a grid emulator to validate the optimal control strategy for a solar PV and energy storage system. Finally, the team is taking the learnings from the laboratory testing and deploying a full-scale demonstration installation to collect data on actual system performance. The demonstration site showcases resiliency and cost benefits to the identified business and local economy.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The continued adoption of electric vehicles will generate waves of lithium-ion battery waste, which is difficult and expensive to recycle. This project will facilitate diversion of battery waste and deferment of recycling costs by giving EV batteries a second life. One of the main barriers to second-life energy storage systems is the need for extensive cell testing and characterization. This traditionally requires a great deal of testing time and expense, resulting in erosion of the cost advantage of the used batteries. This project will result in a methodology to quickly and accurately estimate the remaining useful cycle life of a retired EV battery cell in a stationary energy storage system. This project will demonstrate a second-life energy storage system consisting of full EV battery packs without disassembly to reduce the time and cost of repurposing EV batteries.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Self-Generation Incentive Program: R.12-11-005 <Closed> Distribution Resources Plans (AB 327): R.14-08-013 Streamlining Interconnection of Distributed Energy Resources and Improvements (Rule 21): R.17-07-007

Applicable Metrics: CPUC Metrics- 1d, 1e, 1g, 1h, 1i, 2a, 3b, 3g, 3h, 4a, 5a

Lower Costs: The solar PV and batteries will reduce energy costs via on-site generation and time of use arbitrage, demand charges via peak load reduction and shifting, and greenhouse gas emissions via reduction in on-peak energy demand. The batteries will further reduce net energy costs via provision of demand response services. RePurpose estimates that the site will have a 37 percent reduction in its electricity bill, saving about $17,000 per year.

Greater Reliability: This project aims to deliver greater electricity reliability to the host site and its local community by providing backup power in the event of an unplanned outage or public safety power shutoff (PSPS). In 2019, many PG&E customers where the demonstration site is located experienced multiple PSPS events. For its demonstration at a co-op grocery store, the team will deploy on-site renewable generation, second-life batteries, and energy conservation as necessary to maintain the reliability of power during PSPS events.

Economic Development: The team will subcontract with a local solar installer to deploy the onsite renewable generation and energy storage, thus spurring economic development in a low-income community.

Environmental Benefits: The site will achieve greenhouse gas reductions via installation of rooftop solar PV and second-life EV batteries. RePurpose estimates that the solar + storage microgrid will reduce the site's carbon footprint by about 62,000 kg/year.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$210,998

EPIC Funds Encumbered:

$3,000,000

EPIC Funds Spent:

$0

Match Partner and Funding Split:

RePurpose Energy, Inc.: $547,666 (13.5 %)

Gridscape Solutions, Inc.: $308,300 (7.6 %)

Electric Power Research Institute, Inc.: $20,000 (0.5 %)

Chroma: $166,575 (4.1 %)

Match Funding:

$1,042,541

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

10 out of 11 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-039 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

This agreement was formally executed on October 15, 2020, and held its kick-off meeting on November 3, 2020.

Project Name: EPC-19-040 - California Zinc-ion Energy Storage Development and Validation Project

Recipient/Contractor: Salient Energy Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/30/2020 to 3/29/2024

Program Area and Strategic Objective:

Applied Research and Development

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

California currently relies on lithium-ion technology for the vast majority of its energy storage applications. However, raw materials used in lithium-ion batteries are limited and the rapidly growing demand for the technology is expected to outstrip production within the decade. In addition, there is still the risk of fire in lithium-ion battery packs. This drives the need to innovate non-lithium-ion technologies that are low-cost, abundant, and safe, and develop them for customer-side of the meter applications. Furthermore, developing non-lithium-ion solutions will help California meet important energy goals to produce carbon-free electricity by 2045.

Project Description:

The project will develop, field test, and validate a zinc-ion battery prototype for applications on the customer side of the meter. The recipient has developed a non-lithium-ion battery for residential applications that is less expensive, safer, and longer lasting than lithium-ion batteries. Using the current cell design, the recipient will produce a larger format cell design. The recipient will design, assemble and integrate the zinc-ion cells into a residential energy storage system, which will be tested by a third party. The integrated pilot-scale system will then be validated in a relevant environment. The validation environment will simulate residential applications to fully test and validate a complete zinc-ion battery storage system.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The recipient has developed and designed a unique, rechargeable zinc-ion battery built entirely of non-toxic components. A core innovation is the development of a special class of materials used at the positive electrode that can reversibly move Zn2+ into their crystal structure. The recipient has also developed unique designs/formulations for the negative electrode, electrolyte, and separator that allow the battery to be recharged thousands of times before it needs to be recycled. Developing a battery based on Zn2+ inclusion is a technological advancement that helps improve energy density, daily cycle capability, longevity, safety and, ultimately, reduce costs and further technology adoption, as compared to lithium-ion technology.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed> Energy storage: R.15-03-011 <Closed> Smart grid: R.08-12-009 <closed> Distribution Resources Plans (AB 327): R.14-08-013 Distribution Level Interconnection (Rule 21): R.11-09-011 <closed> Demand Response (DR): R.13-09-011 Net energy metering: R.14-07-002 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Streamlining Interconnection of Distributed Energy Resources and Improvements (Rule 21): R.17-07-007 Renewables Portfolio Standard Program: R.18-07-003 Long-Term Procurement Proceeding (LTPP): R.13-12-010 <Closed> Resource Adequacy (RA): R.11-10-023 <Closed> Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 1b, 1c, 1e, 1h, 1i, 2a, 3a, 3b, 3c, 3e, 3f, 3g, 3h, 4a, 4b, 4e, 5b

Lower Costs: The Project will help reduce costs and address peak load reduction and shifting through energy storage. Ratepayers will be able to store energy during low-cost hours for use during high-cost hours. Cost reductions will depend on use case(s) for the system but the low cost of zinc-ion improves the rate of return by lowering system cost. According to Bloomberg New Energy Finance's Energy Storage System Costs Survey 2018, a battery pack designed for energy storage typically costs $200/kWh; Salient Energy's battery packs will achieve a cost below $130/kWh. In larger storage systems, battery packs account for a larger portion of system cost, so the cost advantage will be more pronounced.

Environmental Benefits: The zinc-ion battery systems will also help reduce greenhouse gas emissions and other harmful pollutants. Less expensive energy storage technology will drive further deployments of energy storage technology, enabling California to generate more electricity from renewable resources, which will help dramatically reduce emissions. Energy storage technology will deliver energy that will replace energy produced by fossil fuels. Assuming daily discharge, 1 MWh of energy storage would deliver 365 MWh of clean energy. Assuming a 15-year service life, this translates to a lifetime greenhouse gas reduction of 1800 tons CO2e per MWh installed.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$64,904

EPIC Funds Encumbered:

$1,583,125

EPIC Funds Spent:

$0

Match Partner and Funding Split:

Salient Energy Inc.: $1,370,402 (46.4 %)

Match Funding:

$1,370,402

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

37 out of 37 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-040 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

This project had their kick-off meeting in November 2020 and is now working on system design.

Project Name: EPC-19-041 - Demonstrating an Aqueous Air-Breathing Energy Storage System for Multi-Day Resiliency

Recipient/Contractor: Form Energy, Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/30/2020 to 3/31/2024

Program Area and Strategic Objective:

Applied Research and Development

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

No commercially available energy storage technologies can cost-effectively provide multiple days of energy storage duration needed to achieve reliable 100 percent renewable energy over a year or to maintain energy service in the event of multi-day grid outages caused by wildfire and public safety power shutoffs or other grid outages. Existing technologies are either too expensive or geographically dispersed.

Project Description:

This project will be the first fielded and independently verified prototype-scale demonstration of a new form of low-cost, long-duration thermal energy storage that has the potential to be over 100-times cheaper per kWh than lithium-ion energy storage and provide multiple days-to-weeks of continuous zero-carbon backup power in customer and grid applications. The prototype will use breakthrough battery materials sourced from super-abundant, ultra-low-cost, globally scalable materials from existing supply chains.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will help accelerate the knowledge and understanding of long duration energy storage technologies that can operate for 100 hours or more. Additionally, this project will help understand how longer duration energy storage technologies can support rising grid resiliency challenges. If these long duration technologies can perform as they project, energy storage can also be used to replace natural gas power powerplants in the future. This effort will also provide performance information that help validate if very low-cost energy storage can actually be developed, fielded and demonstrated.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007 continued in 20-05-003: R.16-02-007

Applicable Metrics: CPUC Metrics- 1b, 1c, 1f, 3h, 4a, 4b, 5a, 5f

Lower Costs: Compared to previous low cost, long-duration energy storage technology prototypes, this module will have an improved energy footprint by 30 times, duration improved by a factor of 4, and round-trip efficiency increased by 10 percent, each of which would lead to reduced total cost of ownership (TCO) and levelized cost of energy (LCOE). In turn, lower TCO and LCOE of storage could translate to lower overall costs.

Greater Reliability: The laboratory evaluation of this novel, long-duration storage technology will provide data about the optimal use of multi-day battery energy storage under a range of simulated use cases. This information should help utilities, regulators and system operators identify least-cost energy resource solutions to address two of California's most pressing electric grid needs: zero-carbon energy resources that can cost-effectively manage the intermittency of renewable resources; and zero-carbon solutions to maintain reliable electricity service in the event of widespread power outages caused by grid outages.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$1,998,215

EPIC Funds Spent:

$0

Match Partner and Funding Split:

MGA Research: $30,000 (0.8 %)

The Regents of the University of California, Irvine: $30,000 (0.8 %)

Electric Power Research Institute, Inc.: $18,736 (0.5 %)

Form Energy, Inc.: $1,524,343 (42.3 %)

Match Funding:

$1,603,079

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

37 out of 37 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-041 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

This project had its kick-off meeting in September 2020. As part of their technology development, the project team also completed their Codes and Standards evaluation to assess how they might affect long-duration storage deployment. This included a comprehensive review of relevant safety codes for similar battery technologies, cross-referenced with an internal Failure Mode and Effects Analysis (FMEA) which ranks expected failure modes by priority. This will lead to future work supporting appropriate safety testing procedures that will be both written and executed for Sub-Scale Cells and Full-Scale Cells (FSCs). The results will be evaluated to improve safe design of FSCs.

Project Name: EPC-19-042 - Anzode: Zinc Batteries for California Electrical Customer Power Backup

Recipient/Contractor: Anzode Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/30/2020 to 3/29/2024

Program Area and Strategic Objective:

Applied Research and Development

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

We need energy storage options to fully enable solar and wind power as part of our state's goal of 100 percent renewable energy by 2045 (SB 100), and for backup power. Li-ion batteries have severe safety issues, resulting in about 600 overheating and fire incidents each year in California, and more than 250 incidents on aircraft since the mid-2000s in the U.S. Consumer gas generators need about 18 gallons of fuel per day. If 100,000 such generators are in use, our state will emit 18,000 tons of carbon dioxide in 24 hours. Gas generators also caused about 100 deaths in California from 2005 to 2017 due to carbon monoxide poisoning.

Project Description:

The purpose of this Agreement is to fund prototyping efforts of a novel rechargeable alkaline battery technology enabling reliable, and safe energy storage solutions for different applications, including storage for renewable energy generation, long-term backup power, and micro-grid applications. This technology will bring long-life rechargeability to the alkaline battery chemistry, and is environmentally benign, low-cost, and safe. The battery is built using water-based, non-flammable electrolytes and non-toxic earth-abundant electrode materials such as zinc (Zn) and manganese dioxide (MnO2). All materials are highly energy dense and low cost.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

Anzode's battery is built using water-based, non-flammable electrolytes and non-toxic earth-abundant electrode materials such as zinc (Zn) and manganese dioxide (MnO2). All materials are energy dense and low cost. While primary alkaline zinc-manganese dioxide batteries are common, it is difficult to make them rechargeable, for reasons including Zn dendrite growth. Anzode's novel approach stabilizes the anode in alkaline electrolyte by applying protective substances. As of early 2020, Zn anodes with Anzode's technology remained stable for 400 to 600 cycles, while comparison anodes lasted fewer than 50 cycles.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Self-Generation Incentive Program: R.12-11-005 <Closed> Energy storage: R.15-03-011 <Closed> Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1b, 1d, 1h, 5a, 5b, 5d, 5e, 5f

Greater Reliability: This project will result in ratepayer benefits including supplying backup power with greater electricity reliability in our state, especially among the 2.7 million Californians in fire safety electrical outage risk areas.

Increase Safety: The technology Anzode utilizes takes advantage of abundant materials (Zn and Mn) with fewer safety and supply chain risks than the elements needed for lithium-ion batteries, and our batteries can last ten years or longer with intermittent use.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$1,747,721

EPIC Funds Spent:

$31,931

Match Partner and Funding Split:

TBD- Analytics Contractor: $2,000 (0.1 %)

Lithiumion Expert Services LLC: $17,000 (0.7 %)

The University of Newcastle: $15,000 (0.6 %)

To Be Determined: $6,000 (0.3 %)

TBD - Market Analysis: $8,000 (0.3 %)

To Be Determined #2: $10,000 (0.4 %)

Anzode Inc.: $563,870 (23.8 %)

Match Funding:

$621,870

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

37 out of 37 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 5

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-042 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The kick-off meeting was held on September 4, 2020, and the project is progressing well. All planned tasks are on schedule. Technical advisers and subcontractors have been updated on the project goals and schedule. A detailed testing plan has been developed, and is currently being executed without delays. Some major analytical equipment has been purchased, commissioned, and is now fully operational and supporting further development of the technology. Scaled-up electrode fabrication for multi-layer battery cell designs has also been initiated and will continue through the end of 2020.

Project Name: EPC-19-043 - Advanced Energy-efficient and Fire-resistive Envelope Systems Utilizing Vacuum Insulation for Manufactured Homes

Recipient/Contractor: Institute of Gas Technology dba Gas Technology Institute

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/30/2020 to 3/31/2024

Program Area and Strategic Objective:

Applied Research and Development

1.2 Showcase Benefits of Advanced Window and Building Envelope Systems

Issue:

The thermal performance of the building envelope of manufactured homes is governed by the U.S. Housing and Urban Development (HUD) construction and safety standards. This is an antiquated standard that dates back to 1994. Depending on climate zone, a manufactured home built to HUD standards might only require R11 wall insulation and R19 in the ceiling. In comparison, the 2019 California Building Energy Efficiency Standards (Title 24, Part 6) requires about R20 for the majority of climate zones and a minimum higher value of R30+ for vented or unvented attics using fiberglass batt. Thus manufactured homes installed in California are less efficient than homes built to Title 24.

Project Description:

The project focuses on using vacuum insulation panel (VIP) based pre-fabricated envelope systems that can achieve R26-29 and R49 for walls and roofs, respectively.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project uses vacuum insulation panel (VIP) based pre-fabricated envelope systems that can achieve R26-29 and R49 for walls and roofs, respectively. This type of envelope system with very high insulating values are not currently used in modular construction.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Residential Zero Net Energy Action Plan (2015): Residential ZNE Action Plan (June 2015)

Applicable Metrics: CPUC Metrics- 1e

Lower Costs: The projected cost of VIPs at mass production is in the same range as foam insulations (especially on a $/ft2/R-value basis). The VIP-based envelope systems developed in this project utilizes advanced air sealing technologies. This improves the air tightness and moisture durability of manufactured homes and reduces the air infiltration. Also, with a better and tighter envelope, the HVAC equipment can be downsized saving additional costs during

manufacturing. This could result in more efficient and affordable manufactured homes that will reduce energy costs to the homeowner.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$658,603

EPIC Funds Encumbered:

$2,000,000

EPIC Funds Spent:

$0

Match Partner and Funding Split:

Dvele, Inc.: $280,000 (10.0 %)

Gas Technology Institute: $120,000 (4.3 %)

Utilization Technology Development: $65,557 (2.3 %)

Southern California Gas Company: $300,000 (10.7 %)

Microtherm: $10,000 (0.4 %)

Huber: $26,000 (0.9 %)

Match Funding:

$801,557

Leverage Contributors:

United States Department of Energy: $334,586

Leveraged Funds:

$334,586

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

9 out of 9 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-043 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project was approved at the June 2020 business meeting.

Project Name: EPC-19-044 - Ultra-high Efficiency, Lower-Cost, Green Electrolytic H2 for Microgrids in California

Recipient/Contractor: T2M Global LLC

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/30/2020 to 3/29/2024

Program Area and Strategic Objective:

Applied Research and Development

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

Achieving California's energy goals will require a diversified portfolio of energy storage technologies. At this time the energy storage market is dominated by lithium-ion energy storage technologies. The market would benefit from safer alternatives, particularly ones that have longer duration. California is in need of longer duration energy storage because the state will continue to experience long duration outages associated with wildfires. Technology demonstrations are needed to validate the multi-sector benefits that hydrogen energy technologies could provide.

Project Description:

Conventional electrolysis produces hydrogen from purified water and electricity. The hydrogen technology in this project can generate hydrogen in a conventional electrolysis configuration. The technology can also be configured in an Advanced Electrolyzer System (AES) configuration to recover dilute hydrogen from waste streams such as gasified biomass. Depending on the input waste stream, the AES may be configured to produce water as a byproduct (rather than requiring purified water as an input). This project will test and validate a laboratory scale baseline system and one with an AES to assess performance. This project will develop conceptual system designs for a commercial scale AES system. The data obtained on cost, performance and lessons learned will support commercial deployment. This project will develop an advanced energy storage technology with the potential to deliver benefits for the utility grid, and IOU ratepayers and support achieving California's energy goals.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will test and validate a laboratory scale AES. The AES hydrogen energy storage technology has the potential to integrate renewable electrical generation and capture value from waste streams such as gasified biomass, enabling the storage of large amounts of energy for providing long duration energy services to the grid.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Streamlining Interconnection of Distributed Energy Resources and Improvements (Rule 21): R.17-07-007

Applicable Metrics: CPUC Metrics- 1h

Lower Costs: The AES hydrogen energy storage technology has the potential to improve the net electrical efficiency of hydrogen production, lowering the cost of the stored energy and hence providing value to customers by taking greater advance of renewable generation.

Environmental Benefits: The AES hydrogen energy storage technology has the potential to recover dilute hydrogen from waste streams such as gasified biomass - creating value from previously wasted resources. The Advanced Electrolyzer System (AES) hydrogen energy storage technology may be configured to generate water from waste streams (rather than requiring purified water as an input).

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$117,500

EPIC Funds Encumbered:

$995,250

EPIC Funds Spent:

$134,957

Match Partner and Funding Split:

T2M Global LLC: $183,000 (15.2 %)

SAFCell, Inc.: $27,000 (2.2 %)

Match Funding:

$210,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

37 out of 37 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-044 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project started later in 2020. The project team has configured the laboratory testing facility and begun preliminary technology performance evaluations under a range of operating conditions.

Project Name: EPC-19-045 - Critical Resilience for Fire and Emergency Facilities with the Soboba Band of Luiseño

Recipient/Contractor: GRID Alternatives

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 6/30/2020 to 3/29/2024

Program Area and Strategic Objective:

Technology Demonstration and Deployment

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

The Soboba Band of Luiseño Indians is highly impacted by public safety power shut offs and grid outages. During an outage, of which there were eight in 2019 alone, the tribe's fire station and emergency response facility was without power, greatly limiting their ability to provide critical resources and potentially life-saving responses in an emergency or disaster.

Project Description:

This project will demonstrate a vanadium redox flow battery combined with solar PV at the Tribal community fire station to provide at least 10 hours of energy storage. The project will validate the system's performance as an integrated hardware and software solution that can provide: long duration energy storage, load shifting, peak shaving, and resiliency during utility power outages. The data obtained on capital cost, operating cost, performance and lessons learned will support commercial deployment.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will demonstrate the ability of a flow battery to provide at least 10 hours of duration. Additionally, the project team will test the integration of the battery energy management system and microgrid controller to provide cost savings and resilience to the fire station.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Streamlining Interconnection of Distributed Energy Resources and Improvements (Rule 21): R.17-07-007

Applicable Metrics: CPUC Metrics- 3h

Lower Costs: This project will demonstrate a solar plus long duration energy storage system to provide lower energy costs for the Soboba tribal community critical facility fire station. The project will validate performance of the system features, such as: load shifting and peak shaving. The data obtained on capital cost, operating cost, performance and lessons learned will support commercial deployment.

Energy Security: This project will demonstrate a solar plus long duration energy storage system to provide energy resiliency for the Soboba tribal community critical facility fire station. The project will validate performance of the system including islanding of the facility during utility power outages for at least ten hours.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$298,664

EPIC Funds Encumbered:

$1,710,494

EPIC Funds Spent:

$112,381

Match Partner and Funding Split:

GRID Alternatives: $280,431 (12.8 %)

The Regents of the University of California, on behalf of its Riverside campus: $101,179 (4.6 %)

Invinity Energy Systems, PLC: $91,000 (4.2 %)

Match Funding:

$472,610

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

22 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-045 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project started in late 2020. The project team began community outreach and engagement activities to establish project baselines and inform systems design.

Project Name: EPC-19-046 - Demonstrating a Long-duration Flywheel Energy Storage System

Recipient/Contractor: Indian Energy LLC

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 7/30/2020 to 7/20/2023

Program Area and Strategic Objective:

Technology Demonstration and Deployment

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

Long-duration storage of electrical energy is essential for the state to improve resiliency in the supply of power, particularly to address curtailment or respond to an unplanned grid outage, or planned Public Safety Power Shutoffs. Native American Tribes are often located in remote areas that are prone to outages where storage could provide critical functions such as increased resiliency and cost savings. This project will use a kinetic energy storage device that can provide a minimum of 10 hours of energy storage capability at a minimum rating of 50 kilowatts. One key research objective is to better understand the value that longer duration energy storage provides.

Project Description:

The Recipient will install a practical and low-cost kinetic energy flywheel energy storage system and a solar photovoltaic (PV) array to provide energy to the Viejas Tribal Land. The device consists of a rotating disk that is spun up by a motor to store energy; switching the motor to generation mode causes the disk to spin down and discharge energy to the load. Long duration is achieved by using an innovative technology that employs a large rotor with sufficient inertia to store the required energy with very low loss by employing a proprietary electromagnetic off-loading arrangement. The project will prepare a Multi-Unit Operation Report that describes the layout, instrumentation used, and Measurement and Verification data.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will install a long-duration non-Li ion energy storage system and a solar photovoltaic (PV) array to provide energy to the Viejas Tribal Land using an innovative kinetic energy storage device (flywheel) that is practical and low-cost. The device consists of a rotating disk that is spun up by a motor to store energy; switching the motor to generation mode causes the disk to spin down and discharge energy to the load. Long duration is achieved by using an innovative technology that employs a large rotor with sufficient inertia to store the required energy with very low loss by employing a proprietary electromagnetic off-loading arrangement. This Project will result in greater electricity reliability, and lower costs, by demonstrating flywheel integrated motor-generators for high round-trip efficiencies, and the use of commercial off-the-shelf technologies to minimize cost.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Self-Generation Incentive Program: R.12-11-005 <Closed> Energy storage: R.15-03-011 <Closed> Demand Response (DR): R.13-09-011 Identify Disadvantaged Communities in the San Joaquin Valley and Provide Economically Feasible Options for Affordable Energy: R.15-03-010

Applicable Metrics: CPUC Metrics- 1e, 1g, 1h, 2a, 3a, 3c, 3h, 5a

Greater Reliability: This Agreement will provide Native American Tribes and their communities increased reliability and resiliency services during times of power interruptions caused by weather, grid system failures, or public safety power shutoffs by demonstrating the use of a kinetic energy storage device to provide power during these identified events.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$1,218,374

EPIC Funds Spent:

$0

Match Partner and Funding Split:

Indian Energy LLC: $822,400 (40.3 %)

Match Funding:

$822,400

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

22 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 5

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-046 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The kick-off meeting was held on September 18, 2020. The flywheel technology provider is working on the development, design and construction of the initial unit for this project. The estimated timeframe for the construction and remote testing of this unit is January 31, 2021.

Project Name: EPC-19-047 - CATAPULT: "California Title 24 Advanced Power Utilization Technology"

Recipient/Contractor: BoxPower Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 7/18/2020 to 3/29/2024

Program Area and Strategic Objective:

Technology Demonstration and Deployment

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

The new Title 24 building standards require solar on new residential construction, paving the way for even greater solar deployment in California. At the same time, wildfires and public safety power shutoffs are creating greater interest in residential energy storage systems. There is a need to identify how solar+storage can provide value to homeowners and whether these systems can also provide grid value. Additionally, demonstrations will inform the best approaches for implementing solar+storage and may inform future changes to Title 24 standards.

Project Description:

This project will demonstrate a modular containerized solar plus energy storage system at fifteen residential customer sites. The project will demonstrate the system performance as an integrated hardware and software platform that is Title 24 compliant with the ability to provide: behind the meter customer energy cost savings; emissions savings; grid services; and resiliency during utility power outages. The data obtained on capital cost, operating cost, performance and lessons learned will support commercial deployment.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This project will develop new hardware and software integration solutions to demonstrate and validate the cost and performance of solar plus storage systems in residential behind the meter applications. The system will be able to be configured to integrate the energy storage adjacent to the home with new or existing rooftop solar. It can also be configured as a stand-alone solar plus storage unit that can be placed in the yard. The project will also develop a software platform for aggregating the distributed solar plus storage systems to provide grid services that can be dispatched like a single resource.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Streamlining Interconnection of Distributed Energy Resources and Improvements (Rule 21): R.17-07-007

Applicable Metrics: CPUC Metrics- 1h

Lower Costs: This project will demonstrate the solar plus energy storage technology and validate customer energy bill cost savings. The cost and performance data collected through this demonstration project will advance the technology readiness and support commercialization; leading to manufacturing scale-up and lower cost product offerings. Where space is available, the stand-along configuration could be an even lower cost application.

Greater Reliability: This project will demonstrate solar plus energy storage technology in residential behind the meter applications. This project will develop hardware and software platforms to facilitate enhanced systems integration, both within individual system deployments and within the management of the fleet of systems to facilitate greater reliability of the systems' interaction with the utility grid.

Energy Security: The project will demonstrate customer energy security by providing resiliency in a grid outage.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$287,885

EPIC Funds Encumbered:

$999,099

EPIC Funds Spent:

$27,342

Match Partner and Funding Split:

Evergreen Innovations LLC: $79,193 (6.3 %)

BoxPower Inc.: $173,902 (13.9 %)

Match Funding:

$253,095

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

22 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Group 4: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-047 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project started in late 2020. The project team has begun preliminary design work on the system hardware and software.

Project Name: EPC-19-050 - Rincon Long Duration Multi-Storage Solar Microgrid

Recipient/Contractor: Rincon Band of Luiseño Indians

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 7/18/2020 to 3/31/2024

Program Area and Strategic Objective:

Technology Demonstration and Deployment

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

Non-lithium energy storage technologies have faced several barriers to adoption by California utility customers. Flow batteries have suffered from limitations affecting scale, efficiency, cost, and ability to quickly ramp up to support customers in an outage. Flywheel storage systems act fast but have faced limitations in scalability and duration. Technology developers have worked to expand the scale and functionality of these systems but so far have not achieved long-duration storage capabilities or microgrid islanding functionality. As a result, customers and financiers have not considered these systems to be sufficiently mature for widespread adoption.

Project Description:

This project will demonstrate the integration of two types of non-lithium ion energy storage technologies: vanadium redox flow battery and flywheel storage systems, which will each provide 400kW of load for up to 12 hours. The two technologies will be interconnected with solar PV to create a microgrid that will provide resiliency and cost savings for multiple buildings, including a wastewater treatment plant and an emergency public shelter.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

By demonstrating the integration of these two different energy storage systems in a commercial microgrid, the project will support the understanding of how their complementary performance characteristics can be combined to support a microgrid. Commercializing these technologies will enable them to contribute more to meeting California goals for resiliency, sustainability, cost savings, and safety.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Self-Generation Incentive Program: R.12-11-005 <Closed> Energy storage: R.15-03-011 <Closed> Smart grid: R.08-12-009 <closed> Distribution Level Interconnection (Rule 21): R.11-09-011 <closed> Smart Inverter: D.14-12-035 (in R.11-09-011) Net energy metering: R.14-07-002 Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1a, 1e, 1h, 1i, 3h, 4a, 5a

Lower Costs: The project will provide onsite distributed renewable energy resources and energy storage capacity for load shifting to reduce customer electricity costs by nearly $686,645 in Year 1 and $18.944 million over the project's 25-year lifetime.

Environmental Benefits: The project will provide onsite distributed renewable energy resources and energy storage capacity for load shifting to displace utility-delivered electricity responsible for over 1 million kg of greenhouse gases in the first year of operation.

Public Health: This project will assure resilient electricity for sanitation systems that prevent the discharge of untreated wastewater during a grid outage and will reduce local criteria pollutants attributable to diesel combustion of backup generators.

Energy Security: The project will increase tribal energy security and self-reliance by providing onsite renewable generation and energy storage resources that displace consumption of imported electricity and standby diesel generation fuel. The project will also protect customer loads from Public Safety Power Shutoffs and other long-duration outage events.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$7,282,496

EPIC Funds Spent:

$0

Match Partner and Funding Split:

Rincon Band of Luiseño Indians: $8,141,014 (48.5 %)

Amber Kinetics, Inc.: $1,056,000 (6.3 %)

Invinity Energy Systems, PLC: $303,440 (1.8 %)

Match Funding:

$9,500,454

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

22 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-050 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project agreement was executed on September 22, 2020. The recipient has begun preparing the SDG&E interconnection application, and microgrid design engineering is in progress.

Project Name: EPC-19-051 - Hybrid Modular Storage System (HMSS) as a long-duration energy storage technology Demonstration

Recipient/Contractor: Indian Energy LLC

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 7/31/2020 to 3/31/2024

Program Area and Strategic Objective:

Technology Demonstration and Deployment

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

While large scale energy storage is a critical success factor in the widespread de-carbonization of the nation's electric power generation and delivery capability, single technology solutions to date do not offer the required capacity, they are too expensive, have short duty cycles, and much of their approach is harmful to the environment when decommissioning occurs. Furthermore, there is no single technology that addresses all needs when there are various applications and requirements.

Project Description:

This project will develop a highly customizable solution for energy storage that will efficiently deliver the optimal system configuration of energy storage technologies that will best fit the application needed by the DOD and other end users. The approach to dealing with a highly customized problem is to create an energy storage solution that equally customized to meet the requirements of each application. Indian Energy's solution accomplishes this through a Hybrid Modular Storage System (HMSS). The project will use the HMSS with three diverse non-Li ion energy storage technologies consisting of flow batteries, zinc hybrid cathodes batteries, and a fast responding mechanical energy storage system to determine which system or combination of systems best responds to the needs of the Marines and the DOD. The final selected systems will provide 10 hours or more of energy storage capability to a critical facility on the Pendleton Marine Corp Air Station.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by helping to characterize the performance of a few different energy storage solutions at TRL 4 in a targeted new scalable microgrid architecture that is a candidate for wide deployment over the next few years in California and worldwide, and to advance those solutions to TRL 6. By enabling more energy storage technologies to be integrated into a full solution, this project will enable greater

renewable energy penetration by creating greater flexibility for storing excess renewable energy generation.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1h, 1i, 3a, 3b, 4a, 4b, 5a

Increase Safety: The usage of non-flammable technologies in the full-scale integration ensures that the risk of thermal runaway is mitigated compared to Lithium-Ion technologies.

Environmental Benefits: An individual HMSS unit reduces 62,634 kg of CO2 emissions per year when charged with renewable energy generation and discharged at peak load hours.

Energy Security: The best HMSS will then be scaled to 400kW/4MWh to achieve the 400kW, for 10 hours.

Assignment to Value Chain:

Distribution

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$5,002,334

EPIC Funds Spent:

$0

Match Partner and Funding Split:

United States Marine Corps, Camp Pendleton: $7,321,000 (46.4 %)

Webcor Builders: $3,445,756 (21.9 %)

Match Funding:

$10,766,756

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

22 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-051 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

This grant was fully executed in November 2020 and has begun the development of the required subcontracts needed to develop and implement the Hybrid Modular Storage System.

Project Name: EPC-19-053 - Cost-Effective Integration of Second-life EV Batteries with Solar PV Systems for Commercial Buildings

Recipient/Contractor: San Diego State University Research Foundation

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 8/24/2020 to 3/31/2024

Program Area and Strategic Objective:

Applied Research and Development

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

California has the goal of 5 million zero-emission vehicles on the road by 2030, meaning that over the next few decades, a large number of used electric vehicle (EV) batteries will need to be recycled. EV batteries are typically retired from their first life when the battery performance decreases to 70-80 percent of its initial capacity. Research has indicated that second-life batteries paired with solar photovoltaics (PV) and demand response could be economical. Moreover, lower-cost second-life EV batteries may enable small businesses with buildings under 30,000 square feet to install PV-battery systems and may lower energy costs for California ratepayers.

Project Description:

This project pairs second-life EV batteries with a solar PV system and develops key technologies to quickly identify battery health and optimize usage. These key technologies include developing control and operation algorithms to enable 1) proactive maintenance, 2) predictive thermal management, 3) active cell balancing, and 4) dynamic demand response management. Together, these technological advancements extend the life of the repurposed EV batteries and lower the cost to California ratepayers. The goal is to ensure that second-life EV batteries will last for a minimum of 10 years as part of a grid storage application with a degradation rate of 3 percent or less annually.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project is developing battery management system technologies, algorithms, and operation strategies that enable second life EV batteries to last for a minimum of 10 years with a degradation rate of 3 percent or less annually. The battery management systems and second life batteries will be tested at two pilot test facilities where the battery management algorithms and hardware will be deployed. The technological developments from this project will increase the versatility, lifetime/durability, and efficiency of second life EV batteries while also lowering the total cost of these systems.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Self-Generation Incentive Program: R.12-11-005 <Closed> Distribution Resources Plans (AB 327): R.14-08-013 Net energy metering: R.14-07-002 Integration of Distributed Energy Resources (IDER): R. 14-10-003 Streamlining Interconnection of Distributed Energy Resources and Improvements (Rule 21): R.17-07-007

Applicable Metrics: CPUC Metrics- 1f, 1h, 1i, 2a, 3a, 3b, 5d

Lower Costs: This project will help commercial customers significantly reduce their electricity bills through novel battery energy storage system operating and sizing algorithms, thus promoting the deployment of lower-cost energy storage systems. The project will demonstrate total electricity cost saving of $140,000 over the life of the project. The proposed system is also targeting to be at least 30 percent cheaper than new grid-scale energy storage systems.

Greater Reliability: This project is demonstrating and validating that the second life EV battery integrated with solar PV can operate reliably, support grid needs, and provide energy resilience to commercial buildings to serve their critical energy loads during extended grid outages.

Public Health: The use of second-life EV batteries in stationary energy storage may extend the life of EV batteries for an additional 10 years. This will greatly reduce the recycling of used EV batteries, reduce the demand for raw materials needed for new EVs, and reduce the battery waste going to landfills where their chemicals can contaminate groundwater and surface water. Hence, it will generally improve public health and reduce the risk of California residents developing health-related issues due to environmental waste.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$407,945

EPIC Funds Encumbered:

$2,837,672

EPIC Funds Spent:

$6,420

Match Partner and Funding Split:

San Diego State University: $721,130 (19.6 %)

University of California, Riverside: $53,342 (1.5 %)

The Regents of the University of California, San Diego: $58,036 (1.6 %)

TBD - Contractor: $2,867 (0.1 %)

Match Funding:

$835,375

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

10 out of 11 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-053 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project kick-off meeting and technical advisory committee meeting were held in September and November 2020, respectively. The recipient has developed the battery testing plan and issued a purchased order of a Chroma 17212R-5-100 battery cycle equipment designed specifically for testing lithium-ion secondary batteries. The recipient coordinated with staff at the two demonstration sites (SDSU Children's Center and Chula Vista's Veterans Park) to determine the space needs, site deployment approaches, and finalize the site plan. The recipient finalized

the preliminary design of the container for the energy storage systems and further evaluated the benefits of various electric architecture of the energy storage system.

Project Name: EPC-19-054 - Demonstrating Code-compliant Energy Storage Systems and Their Capabilities for Grid Harmonization

Recipient/Contractor: Electric Power Research Institute, Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 8/21/2020 to 3/31/2024

Program Area and Strategic Objective:

Technology Demonstration and Deployment

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

Recent updates to the Title 24 building code requires solar PV on all new residential construction. As a result of more frequent grid outages from PSPS and wildfire events, customers are expected to be more interested in adding energy storage to their homes for resilience. However, homeowners do not fully understand the value that they can achieve by having solar plus storage in the home.

Project Description:

This project will install and connect energy storage units to existing solar panels at 13 - 18 new construction single family homes and two multifamily affordable housing units in three different California climate zones. The recipient will test and evaluate the control and operation of the systems to capture best operational practices of the systems for the residents and the grid. The recipient will also provide insight into any future changes to Title 24 building code to help realize these values.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will help overcome barriers to implementing residential storage by providing recommendations derived from field demonstrations. The project will also help to enhance Title 24 building code to better suit California's plans for decarbonizing the grid through more and better use of renewable generation. Potential new homes built in alignment with a better developed Title 24 building code favoring controllable energy storage could provide greater cost savings to homeowners and greater grid stability. This project will assess the operation of commercially available residential battery storage systems and develop new use cases through exploring tariff structures, independent control strategies (such as helping to optimize residential energy use, particularly during the evening ramp) and cost considerations that provide maximum benefits to both the customer and the grid.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed>

Applicable Metrics: CPUC Metrics- 1h, 5a

Lower Costs: Connecting energy storage systems with mandated solar energy generation systems in new residential construction can result in reducing customer demand charges by appropriately controlling the generation and storage for the customers' loads particularly during periods of peak rates.

Greater Reliability: Controlling solar-plus-storage systems in new residential construction can result in maximizing solar energy generation during high generation, low demand hours that can reduce reliance on power plants needing to ramp up production to meet demand and relieve pressure on the stressed grid infrastructure.

Energy Security: In October 2019, public safety power shutoff events left nearly two million Californian utility customers without electricity during two separate weekends. Customers with that only had solar PV were often unable to take advantage of renewable power. Adding energy storage and properly controlling the combination should ensure critical loads stay active during these types of events.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$344,172

EPIC Funds Encumbered:

$999,841

EPIC Funds Spent:

$0

Match Partner and Funding Split:

TRC Engineers, Inc.: $50,009 (4.2 %)

Electric Power Research Institute, Inc.: $150,008 (12.5 %)

Match Funding:

$200,017

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

22 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Group 4: Ranked # 3

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-054 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project agreement was executed on August 21, 2020 and the kick-off meeting was conducted on September 25, 2020. The team has identified the project sites along with participating builders. Contractual and legal terms were completed to enable data collection from customers. The team has started to evaluate various methods to control and aggregate energy storage systems behind the meter. In addition, the team has been working with various vendors and evaluating the capability and capacity of their residential energy storage systems to determine which will be installed. The first installations are in the design phase.

Project Name: EPC-19-055 - Enabling EV Battery Circular Economy

Recipient/Contractor: ReJoule Incorporated

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 7/13/2020 to 12/31/2023

Program Area and Strategic Objective:

Applied Research and Development

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

As more full electric vehicles (EVs) and plug-in hybrid EVs (PHEVs) reach their end of life, there are serious concerns regarding the enormous amount of toxic waste that decommissioned EV/PHEV batteries could produce. However, these batteries often retain 70-90 percent of their original capacity, making them ideal candidates for repurposed, second-life energy storage applications. Unfortunately, safety concerns and a lack of reliable performance projections have proven to be roadblocks for many potential customers. The biggest barriers to repurposing used EV batteries are the cost of disassembly, long test times, and uncertainty about the remaining useful life (RUL).

Project Description:

ReJoule, Inc. is developing a battery-grading tool for assessing the health of repurposed batteries and validating its battery management system's ability to extend the life and performance of second-life batteries. The research team is also piloting its operational strategy for optimizing the performance of second-life batteries to integrate solar and provide resiliency at two commercial sites located in low-income, disadvantaged communities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

ReJoule is conducting accelerated cycling testing to establish a relationship between AC impedance, DC internal resistance, and battery degradation. This degradation rate model feeds into the pilot testing phase, where the team is deploying a second-life battery system that consists of both Nissan LEAF and Ford battery modules at a multi-business commercial building and a Salvation Army Homeless Shelter, both in disadvantaged and low-income communities. Through this pilot demonstration, ReJoule is validating that its battery management system is capable of active load-balancing and real-time degradation monitoring.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Self-Generation Incentive Program: R.12-11-005 <Closed> Distribution Resources Plans (AB 327): R.14-08-013 Streamlining Interconnection of Distributed Energy Resources and Improvements (Rule 21): R.17-07-007

Applicable Metrics: CPUC Metrics- 1h, 1i, 2a, 3a, 3b, 5a, 5d

Lower Costs: This research project aims to reduce the cost of a second-life battery and solar PV installation by 30 percent compared to an equivalent installation that incorporates a brand-new battery. The reduced capital costs of a solar PV and second-life battery system will help increase the energy cost savings for project site owners.

Greater Reliability: The pilot study under this research agreement aims to validate the ability of second-life batteries to integrate solar PV and provide energy resilience to commercial buildings, with the goal of enabling the sites to serve their critical energy loads during extended grid outages.

Economic Development: The project employs GRID Alternatives as a subcontractor, which performs workforce development activities for the local community. The partnership between Salvation Army and GRID Alternatives brings together an underserved workforce with a training program that engages them in solar education and training. Additionally, the Los Angeles pilot site location is a commercial facility that houses multiple small businesses. By providing low-cost, onsite energy generation and resiliency, the pilot system will enable these small businesses to operate with lower energy bills and through grid outages.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$162,057

EPIC Funds Encumbered:

$2,970,774

EPIC Funds Spent:

$110,297

Match Partner and Funding Split:

ReJoule Incorporated: $181,022 (5.5 %)

CleanSpark LLC: $88,869 (2.7 %)

GRID Alternatives: $32,000 (1.0 %)

Ford Motor Company: $30,000 (0.9 %)

Match Funding:

$331,891

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

10 out of 11 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 4

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-055 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

ReJoule held its Kickoff Meeting for the project on August 12, 2020, and the research team procured the retired EV batteries and began the initial accelerated aging tests in November 2020.

Project Name: EPC-19-056 - Assessing Long-duration Energy Storage Deployment Scenarios to Meet California's Energy Goals

Recipient/Contractor: Energy and Environmental Economics, Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 8/17/2020 to 3/31/2024

Program Area and Strategic Objective:

Applied Research and Development

3.4 Define and Demonstrating the Locational Benefit and Best Configuration of Grid-Level Energy Storage as the California Grid Transitions to More Distributed Energy Resources

Issue:

California has established aggressive goals for greenhouse gas (GHG) reductions, both in the electric sector and economywide. Meeting these goals with current technologies would be prohibitively expensive. Long-Duration Energy Storage (LODES), with durations of up to 100 hours or more, is an important suite of emerging technologies that will avoid the infrequent, costly, and large electricity shortages that can occur on highly renewable electricity grids. Currently available planning tools cannot properly value or incorporate LODES in long-term energy planning efforts, which hinders the State's ability to realize a safe, reliable, and resilient future electricity system.

Project Description:

The E3 team is working with the CEC, technical experts, and the public to identify a realistic and appropriate range of scenarios to evaluate the role of LODES technologies in meeting the state's climate and energy goals. Analysis will evaluate tradeoffs among energy storage duration, performance, and cost against a range of resource supply options and electricity demand conditions. Through this research, the team will fill gaps in current modeling approaches to explicitly assess the role of energy storage of up to 100 hours or more of duration in California's deeply decarbonized future. With a focus on modeling emerging LODES technologies, the toolkit will also capture the operational needs

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State’s Statutory Energy Goals:

The E3 team's proposed project will help overcome barriers to achieving California's climate and energy goals by developing a clearer understanding of the role that LODES can and should play in achieving these goals.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed> Integration of Distributed Energy Resources (IDER): R. 14-10-003 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 1c, 3b, 5c

Greater Reliability: This project will promote greater reliability by developing a new modeling toolkit that can adequately assess and evaluate electric reliability on a zero-carbon grid -- taking into account variable and uncertain renewable electricity generation and electric loads -- to ensure that California's grid can maintain or exceed current levels of reliability while meeting its climate goals.

Economic Development: This project will promote economic development by recommending the most cost-effective utility grid infrastructure changes needed to reach state policy goals in 2030 and 2045. Improved electricity resource planning will lower total electricity procurement costs, which in turn will lead to lower electricity rates for customers. Additionally, this study will illustrate use-cases for long duration storage at a local scale, such as to support microgrids and other distribution utility services.

Environmental Benefits: This project will provide environmental benefits by evaluating various scenarios in which California can replace its existing fossil-based generation fleet with combinations of zero-carbon resources, reducing California's GHG impact. Additionally, the new modeling toolkit will enable planners to more easily capture a range of environmental factors, including but not limited to air quality and land-use impacts.

Energy Security: This project will point the way for California to increase its energy security by illustrating scenarios in which the state can cost-effectively and reliably reduce its reliance on fossil fuels and imported energy sources across the economy through electrification and the support of new technologies like long duration storage in the electricity sector. Additionally, this project will investigate the cost-effectiveness of long duration storage to support resilient local grids, such as those for fire-prone communities.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$540,062

EPIC Funds Encumbered:

$1,500,000

EPIC Funds Spent:

$49,621

Match Partner and Funding Split:

Form Energy, Inc.: $75,244 (4.1 %)

Energy and Environmental Economics, Inc. (E3): $230,078 (12.7 %)

UC San Diego: $10,000 (0.6 %)

Match Funding:

$315,322

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

11 out of 11 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-056 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project kicked off in September 2020 and the Initial Public Workshop took place in December 2020. The workshop engaged research stakeholders and other members of the public with the project. Feedback from the workshop informed the project's efforts in developing scenarios involving the use of emerging energy storage and generation technologies in the future of California's grid.

Project Name: EPC-19-058 - Long Duration 50 kW Energy Storage with Aquifer Pumped Hydro

Recipient/Contractor: Antelope Valley Water Storage, LLC

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 7/18/2020 to 3/31/2024

Program Area and Strategic Objective:

Technology Demonstration and Deployment

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

The emphasis on resiliency is driving longer duration energy storage capabilities. Longer duration energy storage is needed to respond to a grid outage, curtail risk, respond to Public Safety Power Shutoffs (PSPS) and to increase renewables. Disadvantaged and low-income communities are especially vulnerable to shutoffs. As wildfires increase, new storage technology is needed that provides power when the grid is down. Over 90 percent of energy storage systems built in California use lithium storage but they are limited by raw material supply, system lifetime, and discharge duration.

Project Description:

A groundwater storage facility will be developed for the demonstration. Groundwater will be used to fill and drain a small surface reservoir. An existing well with 150 kW (200 HP) nameplate capacity will be retrofitted to also act as generator. At 35 percent generation efficiency, the well will produce 52.5 kW of power. The technology is behind-the-meter and will require a Net Energy Metering (NEM) interconnection agreement with SCE. For the demonstration, the stored energy will be discharged to provide on-peak power to SCE during the evening ramp up and recharged off-peak.

The facility will be operated for one year to demonstrate that up to 25-hour discharges can be produced reliably. The regeneration well will be operated to provide 50 kW of energy discharge using local groundwater. They will also be operated with imported water to show 100+ hour energy discharge during simulated PSPS outages. The test well will be used to demonstrate both the two-way groundwater dependent aquifer pumped hydro, as well as the one-way configuration that stores energy when imported water is available.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The proposed project demonstrates a new way to implement pumped storage on a small scale and in a flat area (innovations over previous pumped storage). The project will use a well and a reservoir for stand-alone energy storage. This storage system uses local groundwater to store energy and builds on any aquifer in a distributed network. The motor on an existing well can be repurposed to act as generator to provide a 25-hour discharge duration of 50 kW. The system will

be charged (groundwater is pumped, reservoir is filled) during the weekend off-peak or super off-peak hours. Power will be discharged (reservoir water is injected) during the five on-peak hours each weekday. New storage technologies like aquifer pumped hydro will help facilitate integration of distributed renewables and create a path towards state energy goals.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Renewables Portfolio Standard: R.11-05-005 <closed>, R.15-02-020 <Closed> Energy storage: R.15-03-011 <Closed> Distribution Resources Plans (AB 327): R.14-08-013 Resource Adequacy (RA) 2016 and 2017 Compliance Years: R.14-10-010 <Closed> Integration of Distributed Energy Resources (IDER): R. 14-10-003 Identify Disadvantaged Communities in the San Joaquin Valley and Provide Economically Feasible Options for Affordable Energy: R.15-03-010 Renewables Portfolio Standard Program: R.18-07-003 Resource Adequacy (RA): R.11-10-023 <Closed>

Applicable Metrics: CPUC Metrics- 1a, 1b, 1c, 1i, 2a, 3a, 3b, 3c, 3e, 3f, 3h, 4a, 4b, 5a, 5b, 5d, 5f

Lower Costs: Aquifer pumped hydro is estimated to cost less than a lithium ion battery ($380/kWh versus $470/kWh for the battery) which can lead to lower costs for energy storage and eventually translate to bill savings. This is because it relies on existing infrastructure and proven technology. It uses durable water wells that have a long lifecycle.

Greater Reliability: The 25-hour discharge duration can provide peak power during the evening ramp up five days in a row, increasing electric reliability. It can also absorb surplus renewables during the spring period of renewables overgeneration risk.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$12,402

EPIC Funds Encumbered:

$2,000,000

EPIC Funds Spent:

$0

Match Partner and Funding Split:

Antelope Valley Water Storage, LLC: $500,000 (20.0 %)

Match Funding:

$500,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

22 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Group 3: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-058 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

This project had a kick-off meeting in August 2020. The team is in the design phase and also conducted their first technical advisory meeting in Fall 2020.

Project Name: EPC-19-059 - Residential Solar+Storage Control Unit for Providing Grid Services and Demand Side Management

Recipient/Contractor: The Regents of the University of California, Riverside

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 7/18/2020 to 3/29/2024

Program Area and Strategic Objective:

Technology Demonstration and Deployment

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

Currently, the existing methods for scheduling battery storage systems either focus on providing utility services (e.g., resource adequacy, congestion relief, voltage regulation), or focus on demand side management such as time of use (TOU) management, backup power, and maximizing solar use. Combining these two applications would maximize the value of energy storage to residents and the grid. However, there is currently no approach to optimizing energy storage operation to provide the most value.

Project Description:

A control unit will be developed and included in residential solar plus storage systems for deployment at fifteen housing units in low-income, disadvantaged, and Native American tribal communities in High Fire-Threat Zones. The combined systems will be controlled remotely by a new platform developed by the recipient. The platform will have optimization logic that will enable control of multiple solar plus storage systems to achieve benefits for the residents and the grid. The recipient will evaluate use cases and develop and test different innovative tariff options.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project will demonstrate approaches to maximize the value of energy storage systems to residential customers and the grid by optimizing participation in demand side management and grid services simultaneously. This technology will control the residential solar and storage systems to mitigate extreme voltage fluctuations, enabling safer operation on the grid. The new technology controls and reduces line and transformer losses on feeders and allows operation of the distribution grid close to the minimum allowable voltage level.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed> Distribution Resources Plans (AB 327): R.14-08-013 Demand Response (DR): R.13-09-011

Applicable Metrics: CPUC Metrics- 1e, 1h, 2a

Lower Costs: The technology developed in this project will help residential solar and storage systems manage peak electricity consumption, thereby reducing associated ratepayer electricity costs.

Greater Reliability: Voltage volatility caused by solar intermittency and reverse power flow is one of the main barriers that limits solar uptake. This new technology will control the residential systems to mitigate extreme voltage fluctuations, enabling greater reliability and safer operation on the grid.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$90,520

EPIC Funds Encumbered:

$939,232

EPIC Funds Spent:

$0

Match Partner and Funding Split:

The Regents of the University of California, Riverside: $45,825 (3.5 %)

GRID Alternatives: $239,922 (18.4 %)

Oklahoma State University - Advanced Technology Research Center: $76,503 (5.9 %)

Match Funding:

$362,250

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

22 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Group 4: Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-059 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The kickoff meeting was held recently and the project is in its beginning stages of analyzing the requirements and limitations of the technology design, development, and deployment in compliance with building code requirements.

Project Name: EPC-19-060 - Modeling of Long-Duration Storage for Decarbonization of California Energy System

Recipient/Contractor: The Regents of the University of California on behalf of the Merced Campus

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 7/31/2020 to 3/30/2023

Program Area and Strategic Objective:

Applied Research and Development

3.4 Define and Demonstrating the Locational Benefit and Best Configuration of Grid-Level Energy Storage as the California Grid Transitions to More Distributed Energy Resources

Issue:

To meet California's clean-energy goals, low-cost solar and wind electricity are a partial solution, but low-cost electricity is also needed when solar and wind electricity are not available. While many new technologies show promise to provide the needed energy storage and demand management, their paths to market are uncertain. Modeling of California's energy systems requires extensive analysis of data including weather, geography, and the mixture of energy resources across the grid. Our challenge is to aid in identifying which actions to take and what the timing of those actions should be by studying the roles and cost targets of storage technologies.

Project Description:

The project team will expand on the past work using the SWITCH model to define the role and useful cost targets for long-duration storage. The project will improve inputs to the model based on interviews with industry experts (from its Storage Advisory Board) and analysis based on those interviews. Additionally, the project will compare results from two models (RESOLVE and SWITCH) to model expansion of the grid, analyze relevant technologies, and define and analyze relevant scenarios. The project will estimate the anticipated prices of promising technologies as they are scaled to gigawatt levels, and the potential for rapid scale up will be evaluated in light of the extent to which the new technology leverages existing supply chains and other attractive market opportunities.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The project team will develop scenarios to reach California's clean-energy targets by updating modeling tools and analyzing broad datasets. Emerging LODES technologies are expected to have a critical role in achieving a zero-carbon grid by 2045, and understanding the interaction of LODES with other energy resources is an integral component of the study.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed> Integration of Distributed Energy Resources (IDER): R. 14-10-003 Integrated Resource Planning and Long-Term Procurement Proceeding. LTPP (2016) cycle: R.16-02-007: R.16-02-007

Applicable Metrics: CPUC Metrics- 1c, 3b, 5c

Economic Development: The project will inform policy decisions made by the state of California. These policy decisions can lay the foundation for the least cost solution to reaching the SB100 goals.

Environmental Benefits: The pathway to SB100 goals identified by this project will accelerate the transition to a zero carbon energy grid, leading to a reduction in greenhouse gas emissions.

Public Health: Achievement of the SB100 goals using the understanding developed by this study will substantially reduce air pollution in California, reducing the associated health impacts. A longer-term goal of SB100 is to slow global warming, which should help to avoid the extreme wildfires that have been seen in recent years, causing substantial health challenges for those sensitive to smoke. A world driven by clean energy will be a cleaner world with healthier people.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$221,519

EPIC Funds Encumbered:

$1,254,955

EPIC Funds Spent:

$7,840

Match Partner and Funding Split:

The Regents of the University of California, Merced: $315,553 (17.9 %)

UC San Diego: $77,751 (4.4 %)

The Regents of the University of California, Berkeley: $112,522 (6.4 %)

Match Funding:

$505,826

Leverage Contributors:

National Science Foundation: $100,000

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

11 out of 11 bidders

Rank of Selected Applicant/ Bidder:

Ranked # 1

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-19-060 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project began in August 2020 and its first public workshop was held in December 2020. The workshop gave research stakeholders and other members of the public an opportunity to comment on the goals and strategies of the project team prior to developing new modeling tools that are necessary for the development of potential grid scenarios involving new and emerging storage and generation technologies.

Project Name: EPC-20-001 - Energy-Water Desalination Hub

Recipient/Contractor: Lawrence Berkeley National Laboratory

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 8/30/2020 to 3/31/2025

Program Area and Strategic Objective:

Applied Research and Development

6.1 Reduce the Energy Intensity Required to Supply and Treat Water

Issue:

Current desalination technologies cannot produce clean water from most inland brackish water aquifers, industrial and municipal wastewater, produced water from oil and gas extraction, or agricultural wastewaters at a cost and energy usage comparable to existing fresh water supplies. Enabling cost-competitive access to non-traditional water sources will help address California's water and drought resiliency.

Project Description:

Lawrence Berkeley National Laboratory (LBNL) is the technical and administrative lead of the Department of Energy's Energy-Water Desalination Hub, a 5-year, $100 million contract. LBNL will lead early-stage applied research program to develop innovative new technologies to lower the cost of desalination and associated water treatment, focusing on enabling distributed desalination and localized water reuse. The program will be organized into 4 Topic Areas: Materials and Manufacturing Research and Development (R&D), Process Innovation and Intensification R&D, Modeling and Simulation R&D and Integrated Data and Analysis.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The water desalination hub will conduct research that will help develop new water sources and specific activities pertinent to California include:

1)Conduct applied research on new technologies and methods to lower the cost and energy of desalination on "non-traditional" waters such as inland brackish groundwater, oil and gas produced water and wastewater from power plants.

2)Develop and release a new database (Water-DAMS) that enable users to find current energy and cost data for water treatment in a wide variety of settings and industries

3)Develop and release a computer modeling program (PROTEUS) that enables water treatment engineers and researchers to simulate treatment operations for the purpose of energy and cost optimization

4)Conduct research into the causes and solutions for reducing mineral scaling in RO systems, a leading cause of energy loss in desalination

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Demand Response (DR): R.13-09-011 Water-Energy Nexus: R.13-12-011 <Closed>

Applicable Metrics: CPUC Metrics- 1g, 3a, 3b, 4c, 4d

Lower Costs: The recipient conducts an integrated research program focusing on new technologies and methods to lower the cost and energy use for desalination on "non-traditional" water sources. Uncovering new technologies that lower the energy and operating costs of desalination will enable use of these water sources and possibly forego the need to purchase and transport potable water to communities.

Environmental Benefits: The recipient conducts an integrated program that could result in new technologies and methods to lower the energy use associated with desalination on "non-traditional" waters such as inland brackish groundwater, oil and gas produced water, and wastewater from power plants. The recipient will focus on treating produced water, which may otherwise go untreated. Having a greater capacity to treat waters with harsh chemicals will mitigate the risks of these harsh chemicals and metals, making it into water inlets and ground water. Treating these waters gives CA more opportunities to recycle water for reuse and decrease environmental impact.

Assignment to Value Chain:

Grid Operations/Market Design

Total Budgeted Project Admin and Overhead Costs:

$1,493,597

EPIC Funds Encumbered:

$3,000,000

EPIC Funds Spent:

$1,060,000

Match Partner and Funding Split:

None

Match Funding:

$0

Leverage Contributors:

United States Department of Energy: $100,000,000

AlChE: $624,000

AIL Research: $93,500

Baylor University: $16,065

California Department of Conservation: $500,000

Colorado School of Mines: $298,589

Desalitech: $415,476

Electric Power Research Institute, Inc.: $1,520,258

Georgia Technology Research Corporation: $131,682

New Mexico State University: $71,728

Poseidon Water: $190,000

Rice University: $306,875

Rockwell Automation: $300,000

California Department of Water Resources: $20,000,000

Tennessee Valley Authority: $4,000,000

Texas A&M University: $159,042

University of Texas, Austin: $103,847

University of California, Berkeley: $36,254

The Regents of the University of California, Irvine: $264,491

California State University, Los Angeles: $40,000

University of Cincinnati: $216,710

University of Connecticut: $270,691

University of Southern California: $176,197

Washington University in St. Louis: $100,607

Water Resource Foundation: $400,000

Yale University: $383,611

Leveraged Funds:

$130,619,623

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

9 bidders

Rank of Selected Applicant/ Bidder:

N/A

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-20-001 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The project recently started with the initial kickoff meeting held in September 2020. The NAWI team has had its first request for proposals for brackish water concentrating technologies. During phase one, they received 150 applications. NAWI requested that 20 recipients provide a more detailed application for final review. The team expects to choose the proposal winners in March 2021 expects to have a final draft for their roadmap around July 2021. The project is currently on schedule.

Project Name: EPC-20-002 - Essential Power Support for the Kaiser Permanente Ontario Medical Center using Long Duration Batteries within a Renewable Energy Microgrid

Recipient/Contractor: Charge Bliss, Inc.

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 7/30/2020 to 3/29/2024

Program Area and Strategic Objective:

Technology Demonstration and Deployment

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

Integration of longer duration energy storage into renewable energy microgrids faces several hurdles. First, the value of the systems have not been demonstrated. Information is needed on the economics and environmental benefits of these systems to provide day-to-day energy and greenhouse gas reductions. Second, the control of novel energy storage systems has not been validated to ensure that they can provide long duration support to a facility, particularly during an outage.

Project Description:

The team will demonstrate a 10-hour flow battery system combined with solar PV and a microgrid controller to support the Victor Valley Global Medical Center. This builds on a prior EPIC project at a hospital in Richmond, California and allows a direct performance comparison. The recipient will measure performance by energy production, round-trip efficiency, demand reduction, islanding frequency, island duration, and ancillary services. The project will show financial benefit through the energy savings as well as ancillary services. Environmental benefits will emerge directly through reduction of on-site backup diesel generation and indirectly from reduction of power from the grid. Strategies to mitigate ”Duck Curve” impacts will be demonstrated. The system will be tested for the ability to serve nearly 100 percent of hospital loads for 12-hours or more. The team will also further develop the microgrid controller to utilize machine learning, self-diagnosis and healing, and optimize generation and storage.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State’s Statutory Energy Goals:

Deployment of an 8MWh/11-hour flow battery with a 2.2MW solar array and integrated by a microgrid controller will be connected to the hospital's critical power. The team will evaluate long-term battery performance and provide direct comparison with lithium-ion technology installed at the Richmond hospital from the prior EPIC project. The team will evaluate various scenarios of energy time-shifting, demand management, ancillary services, and facility islanding, to determine economic performance and reduction of GHG production.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed> Smart grid: R.08-12-009 <closed> Integration of Distributed Energy Resources (IDER): R. 14-10-003

Applicable Metrics: CPUC Metrics- 1a, 1b, 1c, 1d, 1e, 1g, 1h, 1i, 2a, 3c, 3e, 3f, 3h, 4a, 4b, 5a, 5b, 5d, 5f

Lower Costs: The system project will produce up to 4.1 GWh/year, or 123 GWh lifetime of clean renewable energy. This translates to an estimated savings of $328,000/year or $9.84 million over the lifetime of the system. Peak load reductions are estimated to provide an additional $132,000/year and $3.95 million over the system lifetime.

Public Health: Poor environmental quality, including air pollution, has been tied to increased health and safety impact, including higher rates of asthma, heart disease, and premature birth. Victor Valley Global Medical Center is located in area that has asthma rates in the 94th percentile, cardiovascular rates at the 93rd percentile, and a rate of low birth weight in the 86th percentile. This project will enable the medical center to continue to support the health of the community but also will reduce air quality impacts by avoiding diesel backup generation.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$142,698

EPIC Funds Encumbered:

$8,351,000

EPIC Funds Spent:

$0

Match Partner and Funding Split:

Charge Bliss, Inc.: $627,239 (3.9 %)

Charge Bliss Construction California, Inc.: $121,761 (0.8 %)

Victor Valley Global Medical Center: $6,800,000 (42.8 %)

Match Funding:

$7,549,000

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

22 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Group 1: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-20-002 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

This project had the kick-off meeting in November 2020 and the team is beginning energy system and microgrid design.

Project Name: EPC-20-003 - Pechanga Tribal Microgrid Long Duration Storage Project

Recipient/Contractor: The Pechanga Band of Luiseño Indians

Investment Plan: 2018-2020 Triennial Investment Plan

Project Term: 11/15/2020 to 3/31/2024

Program Area and Strategic Objective:

Technology Demonstration and Deployment

2.3 Define and Improve the Customer's Business Proposition of Integrated Distributed Storage

Issue:

The Pechanga Band of Luiseno Indians is located in a high fire risk area in southern Riverside County and relies significantly on a single medium-voltage transmission feeder line operated by Southern California Edison (SCE). In the event of a Public Safety Power Shutoff (PSPS) or other outage, critical emergency facilities — including the Tribe's health clinic, emergency shelter, and water, fiber, fire, and law enforcement departments — and residences could lose electrical service.

Project Description:

As a first step in providing broader resilience for the community, this project will install 2,000 kWhs of vanadium redox flow batteries at Pechanga's recreational center and emergency shelter building to provide a minimum 10 hours of backup power. This will allow the facility to remain online during both planned and unplanned outages. When not providing backup power, the battery storage system will cycle daily in order to mitigate energy price changes experienced daily. The savings in energy costs will allow the Recipient to add additional funds to important programs like Pechanga native language education and translation services, economic development, and further development of governmental services.

How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals:

The key advancement of the project is from designing a vanadium flow battery system to achieve 10-hour duration . Current electrolyte tanks for vanadium flow batteries are too small to support 10 hours of duration and the system needs to be redesigned, while taking into account ease of construction for replicability and deployment costs (shipping, installation, commissioning). The system also needs to be configured such that it enables more component integration at the factory to achieve economies of scale. Any amount of component integration in-the-field or on-site translates into additional cost burdens for project owners, developers, and/or engineering, procurement and construction.

CPUC Proceedings Addressing Issues Related to this EPIC Project:

Energy storage: R.15-03-011 <Closed>

Applicable Metrics: CPUC Metrics- 1c, 1h, 2a, 3e, 3h, 5a

Lower Costs: When not providing backup power, the battery storage system will cycle daily in order to mitigate energy price changes experienced daily by the Tribe. The savings in energy costs will allow the recipient to add additional funds to important programs like Pechanga native language education and translation services, economic development, and further development of governmental services.

Energy Security: The storage system will allow the recreational center and emergency shelter building to remain online during both planned and unplanned outages.

Assignment to Value Chain:

Demand-side Management

Total Budgeted Project Admin and Overhead Costs:

$0

EPIC Funds Encumbered:

$1,998,101

EPIC Funds Spent:

$0

Match Partner and Funding Split:

Invinity Energy Systems, PLC: $350,000 (12.3 %)

The Pechanga Band of Luiseño Indians: $499,140 (17.5 %)

Match Funding:

$849,140

Leverage Contributors:

None

Leveraged Funds:

$0

Funding Method:

Competitive

Funding Mechanism:

Grant

No. of Initial Passing Applicants/ Bidders:

22 out of 23 bidders

Rank of Selected Applicant/ Bidder:

Group 2: Ranked # 2

If not the highest scoring applicant/bidder, explain why selected:

Funds were awarded to passing proposals in rank order.

Treatment of Intellectual Property:

Pre-existing intellectual property identified in agreement EPC-20-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.

Type(s) of New Intellectual Property Developed Under this Project:

None

Description of New Intellectual Property Developed Under this Project:

None

Update:

The kickoff meeting was held in October 2020 and the project is in the beginning phase of designing the vanadium redox flow battery for 10-hour long-duration operation.

Appendix C: 2020 EPIC Project Status Report					
Investment Program Period	**Program Administrator**	**Project Name**	**Project Type**	**A brief description of the project**	**Date of the award**
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	300-15-004 Optimizing Hydropower Operations While Sustaining Stream Temperatures and Ecosystem Functions	Applied Research and Development	This project is part of the U.S.-China Clean Energy Research enter for Water-Energy Technologies (CERC-WET), co-funded by the U.S. Department of Energy and China. This project is one of several EPIC-funded research endeavors addressing sustainable hydropower under a warming climate. The project develops an optimization model to ensure efficient hydropower operations, but this model will differ from existing models by taking into account different climate scenarios and environmental and regulatory constraints.	3/9/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
300-15-004 Optimizing Hydropower Operations While Sustaining Stream Temperatures and Ecosystem Functions	No	Generation	$650,000	$650,000	$510,163	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
300-15-004 Optimizing Hydropower Operations While Sustaining Stream Temperatures and Ecosystem Functions	$510,163	$114,054	$12,500,000	None	$0	0.0%

Project Name	**Funding Mechanism**	**Intellectual Property**	**Identification of the method used to grant awards**	**If competitively selected, provide the number of bidders passing the initial pass/fail screening for project**	**If competitively selected, provide the name of selected bidder**
300-15-004 Optimizing Hydropower Operations While Sustaining Stream Temperatures and Ecosystem Functions	Contract-Interagency agreement (The Regents of the University of California, Merced)	TREATMENT OF IP: Pre-existing intellectual property identified in agreement 300-15-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Interagency Agreement	N/A	The Regents of the University of California, Merced

Project Name	**If competitively selected, provide the rank of the selected bidder in the selection process**	**If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected**	**If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization ***	**Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?**
300-15-004 Optimizing Hydropower Operations While Sustaining Stream Temperatures and Ecosystem Functions	N/A	N/A	12/21/15	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
300-15-004 Optimizing Hydropower Operations While Sustaining Stream Temperatures and Ecosystem Functions	Prior studies of the trade-offs between electricity generation and environmental protection have been based on models that do not take real-world policy constraints such as legal and regulatory limitations into account. Additionally, this research will create models to optimize hydropower generation that account for changes in precipitation and runoff due to a warming climate while sustaining downstream environments. These tools will inform decision-making in the context of trade-offs of electricity generation and environmental protection under both a changing climate and relevant legal and regulatory constraints.	2a, 3a, 3f, 4d, 5	The researchers have developed a hydropower optimization-modeling framework that considers institutional and physical constraints placed on hydropower operations. The modeling framework links energy and hydrologic models as well as permit requirements for hydropower facilities in the Upper San Joaquin, Merced, Tuolumne, and Stanislaus rivers under various climate change and management scenarios. In 2020, there has been significant progress in improving this open source model. To identify impacts at a scale relevant to facility operations, the researchers are developing and running sequences of shorter climatic periods to replicate extended droughts and various combinations of wet and dry periods. The researchers are developing and running management scenarios such as meeting flow requirements as well as simulating energy prices for 2009 and 2045. This work is on schedule for completion by March 2021.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	300-15-005 Improving Hydrologic and Energy Demand Forecasts for Hydropower Operations with Climate Change	Applied Research and Development	This project is part of the U.S.-China Clean Energy Research Center for Water-Energy Technologies (CERC-WET), co-funded by the U.S. Department of Energy and China. The main focus of this research project is to develop grid-wide forecasts of inflows and electricity demands based on ground sensors and remotely sensed data, with emphasis on the effects from temperature fluctuations on electricity demands, hydrologic conditions, and grid performance. Furthermore, the project improves the accuracy of an existing near real-time Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks (PERSIANN) product, originally developed at UC Irvine's Center for Hydrology and Remote Sensing.	3/9/16
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	300-15-006 Optimizing Use of Non-traditional Waters, Drought Proofing the Electricity System and Improving Snowpack Prediction	Applied Research and Development	This project funds research to reduce the stress on current water infrastructure in California. Research includes: (1) development of high-volume water recovery desalination processes for non-traditional waters, (2) characterizing the potential for non-traditional water use in California, (3) development of recycled water scenarios for use electricity generators and direct potable reuse(DPR) to offset other water sources, and (4) improving the characterization of California's snowpack.	3/9/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
300-15-005 Improving Hydrologic and Energy Demand Forecasts for Hydropower Operations with Climate Change	No	Generation	$720,000	$720,000	$604,475	N/A
300-15-006 Optimizing Use of Non-traditional Waters, Drought Proofing the Electricity System and Improving Snowpack Prediction	No	Demand-side Management	$1,130,000	$1,130,000	$515,226	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
300-15-005 Improving Hydrologic and Energy Demand Forecasts for Hydropower Operations with Climate Change	$604,475	$144,000	$12,500,000	None	$0	0.0%
300-15-006 Optimizing Use of Non-traditional Waters, Drought Proofing the Electricity System and Improving Snowpack Prediction	$515,226	$198,000	$12,500,000	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
300-15-005 Improving Hydrologic and Energy Demand Forecasts for Hydropower Operations with Climate Change	Contract-Interagency agreement (The Regents of the University of California, Irvine)	TREATMENT OF IP: Pre-existing intellectual property identified in agreement 300-15-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Interagency Agreement	N/A	The Regents of the University of California, Irvine
300-15-006 Optimizing Use of Non-traditional Waters, Drought Proofing the Electricity System and Improving Snowpack Prediction	Contract-Interagency agreement (The Regents of the University of California, Los Angeles)	TREATMENT OF IP: Pre-existing intellectual property identified in agreement 300-15-006 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Interagency Agreement	N/A	The Regents of the University of California, Los Angeles

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
300-15-005 Improving Hydrologic and Energy Demand Forecasts for Hydropower Operations with Climate Change	N/A	N/A	12/21/15	Yes; Calif Based Entity
300-15-006 Optimizing Use of Non-traditional Waters, Drought Proofing the Electricity System and Improving Snowpack Prediction	N/A	N/A	12/21/15	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
300-15-005 Improving Hydrologic and Energy Demand Forecasts for Hydropower Operations with Climate Change	The advancement of tools for hydropower scheduling and prediction will facilitate power exchanges in the electricity markets, reduce unnecessary consumption of non-renewable energy sources, and increase the reliability of energy generation. California will be the study region, helping inform California utilities in the management of hydropower resources.	3f, 5c	Hydropower scheduling, particularly in a short-term time frame is one of the most crucial issues in reservoir operation and clean energy supply. This research project will provide decision makers with information for short-term hydropower scheduling and improve the efficiency and reliability of hydropower forecasts. The research team is continuing work to develop short-term precipitation forecasting framework for key regions in California with a lead time of up to 6 hours. In addition, the team designed a new framework to allow forecasting cloud-top brightness temperatures and facilitate the generation of the spatial-temporal information that can be extrapolated for the future precipitation events. Researchers are currently testing multiple GMT algorithm settings for both benchmark data and real-case studies, and is on schedule for completion by March 2021.
300-15-006 Optimizing Use of Non-traditional Waters, Drought Proofing the Electricity System and Improving Snowpack Prediction	This project develops flexible, integrated approaches that can reduce energy use and costs associated with the use of non-traditional waters, and minimize the volume of wastewater produced from their treatment. In addition, guidance to be provided on the "best-fit" technologies for California based on geographic area, energy resources and water quality available. Additional research will provide reliability benefits including improving water-forecasting scenarios pertaining to recycled water for electricity generation and snowpack forecasting for hydropower operations.	1f, 1h, 3a, 4a, 4c, 4d, 5a, 5c	Draft report is under development. -market characterization of non-traditional waters: finalizing assessment of sources of nontraditional waters including identification of water systems affected by drought, and providing a list of treatment technologies and associated energy costs. -recycled water scenarios for direct potable reuse (DPR): Results show that switching to DPR could increase local treatment energy by a factor of 3 but using DPR to offset more energy intensive water supplies will result in a net savings. -characterization of snowpack and snowmelt: results are ongoing and information sharing continues; the real-time snow-water-equivalent diagnostic models for the hydropower plants were completed. -high-volume water recover desalination: completed -testing bench-scale membrane performance.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	300-15-007 ** California Sustainable Energy Entrepreneurial Development (CalSEED) Initiative	Applied Research and Development	The CalSEED Initiative helps develop California's next generation of clean energy entrepreneurs, providing seed funding as well as mentoring, technical consulting, and business development services to support energy entrepreneurs and research teams in their quest to develop breakthrough solutions that will benefit electric ratepayers in Pacific Gas and Electric, Southern California Edison, and San Diego Gas and Electric service territories. Entrepreneurs receive funding in two stages. Concept Awards provide funding of up to $150,000 and are conducted through open solicitations; Prototype Awards provide funding of up to $450,000, but are only available to companies who have received a Concept Award.	3/9/16
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	300-15-007 ** California Sustainable Energy Entrepreneurial Development (CalSEED) Initiative	Applied Research and Development	The CalSEED Initiative helps develop California's next generation of clean energy entrepreneurs, providing seed funding as well as mentoring, technical consulting, and business development services to support energy entrepreneurs and research teams in their quest to develop breakthrough solutions that will benefit electric ratepayers in Pacific Gas and Electric, Southern California Edison, and San Diego Gas and Electric service territories. Entrepreneurs receive funding in two stages. Concept Awards provide funding of up to $150,000 and are conducted through open solicitations; Prototype Awards provide funding of up to $450,000, but are only available to companies who have received a Concept Award.	3/9/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
300-15-007 ** California Sustainable Energy Entrepreneurial Development (CalSEED) Initiative	No	Demand-side Management	$9,788,043	$9,788,043	$9,788,043	N/A
300-15-007 ** California Sustainable Energy Entrepreneurial Development (CalSEED) Initiative	No	Demand-side Management	$20,211,957	$20,211,957	$2,289,753	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
300-15-007 ** California Sustainable Energy Entrepreneurial Development (CalSEED) Initiative	$9,788,043	$1,563,250	$749,608	California Clean Energy Fund dba CalCEF Ventures; Los Angeles Cleantech Incubator; Elemental Excelerator; The Grant Farm, Inc; Umberg Zipser; Greenlining Institute	$3,396,223	10.2%
300-15-007 ** California Sustainable Energy Entrepreneurial Development (CalSEED) Initiative	$2,289,753	$0	$0	California Clean Energy Fund dba CalCEF Ventures; Los Angeles Cleantech Incubator; Elemental Excelerator; The Grant Farm, Inc; Umberg Zipser; Greenlining Institute	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
300-15-007 ** California Sustainable Energy Entrepreneurial Development (CalSEED) Initiative	Contract	TREATMENT OF IP: Pre-existing intellectual property identified in agreement 300-15-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	5 out of 7 bidders	California Clean Energy Fund dba CalCEF Ventures
300-15-007 ** California Sustainable Energy Entrepreneurial Development (CalSEED) Initiative	Contract	TREATMENT OF IP: Pre-existing intellectual property identified in agreement 300-15-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	5 out of 7 bidders	California Clean Energy Fund dba CalCEF Ventures

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
300-15-007 ** California Sustainable Energy Entrepreneurial Development (CalSEED) Initiative	Ranked # 1	N/A	N/A	None
300-15-007 ** California Sustainable Energy Entrepreneurial Development (CalSEED) Initiative	Ranked # 1	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
300-15-007 ** California Sustainable Energy Entrepreneurial Development (CalSEED) Initiative	CalSEED addresses a critical gap in the early technology development phase where small amounts of funding can have a significant impact in bringing new ratepayer-beneficial innovations to market by providing seed funding as well as mentoring, technical consulting, and business development services to support energy entrepreneurs and research teams in their quest to develop breakthrough clean energy solutions.	2a, 3e	In 2020, grants totaling over $7 million have been awarded to 34 entrepreneurs throughout the State for a range of projects including a low-cost, high performance hydrogen electrolyzer and a transparent solar control coating that can be painted directly onto rough surfaces and achieve a 50% reflection in heat energy. Almost 100 entrepreneurs have been awarded $150,000 small grants under CalSEED - constituting $21,450,000 awarded in total - with $5.4 million of that amount awarded to underrepresented groups. Ten Prototype Awards for an additional $450,000 each have been awarded under CalSEED - given as follow-on funding to CalSEED entrepreneurs whose technologies have the strongest impact and commercial potential.
300-15-007 ** California Sustainable Energy Entrepreneurial Development (CalSEED) Initiative	CalSEED addresses a critical gap in the early technology development phase where small amounts of funding can have a significant impact in bringing new ratepayer-beneficial innovations to market by providing seed funding as well as mentoring, technical consulting, and business development services to support energy entrepreneurs and research teams in their quest to develop breakthrough clean energy solutions.	2a, 3e	In 2020, grants totaling over $7 million have been awarded to 34 entrepreneurs throughout the State for a range of projects including a low-cost, high performance hydrogen electrolyzer and a transparent solar control coating that can be painted directly onto rough surfaces and achieve a 50% reflection in heat energy. Almost 100 entrepreneurs have been awarded $150,000 small grants under CalSEED - constituting $21,450,000 awarded in total - with $5.4 million of that amount awarded to underrepresented groups. Ten Prototype Awards for an additional $450,000 each have been awarded under CalSEED - given as follow-on funding to CalSEED entrepreneurs whose technologies have the strongest impact and commercial potential.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	300-15-008 Research Roadmap for Getting to Zero Net Energy Buildings	Applied Research and Development	Itron worked with Energy Commission staff to develop a gaps analysis that identifies, describes and prioritizes research, development, demonstration, and deployment (RDD&D) gaps that need to be addressed to achieve the state's goals for ZNE buildings in a safe, equitable and cost-beneficial manner. The gaps analysis was developed in consultation with stakeholders and subject matter experts through interviews, written comments, and public workshops.	4/13/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	300-15-009 ** Connecting Emerging Energy Technologies and Strategies to Market Needs and Opportunities	Market Facilitation	This contract will provide market analysis that will address the barriers that hamper commercial development of emerging energy technologies. Tasks under this work authorization contract could include tracking past and current award EPIC technology solutions to monitor successes, more accurately consider future EPIC funding opportunities, inform technology gap analyses, and develop online resources. The deliverables from this project will help prioritize future Energy Commission funding towards technologies that solve the addressed issues.	4/13/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
300-15-008 Research Roadmap for Getting to Zero Net Energy Buildings	No	Demand-side Management	$999,884	$999,884	$982,214	N/A
300-15-009 ** Connecting Emerging Energy Technologies and Strategies to Market Needs and Opportunities	No	Demand-side Management	$6,825,763	$6,825,763	$4,549,649	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
300-15-008 Research Roadmap for Getting to Zero Net Energy Buildings	$982,214	$171,332	$0	None	$0	0.0%
300-15-009 ** Connecting Emerging Energy Technologies and Strategies to Market Needs and Opportunities	$4,549,649	$2,714,986	$0	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
300-15-008 Research Roadmap for Getting to Zero Net Energy Buildings	Contract	TREATMENT OF IP: Pre-existing intellectual property identified in agreement 300-15-008 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	5 out of 6 bidders	Itron, Inc., dba IBS
300-15-009 ** Connecting Emerging Energy Technologies and Strategies to Market Needs and Opportunities	Contract	TREATMENT OF IP: Pre-existing intellectual property identified in agreement 300-15-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	3 out of 4 bidders	Guidehouse Inc. f/k/a Navigant Consulting, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
300-15-008 Research Roadmap for Getting to Zero Net Energy Buildings	Ranked # 1	N/A	N/A	Yes; Calif Based Entity
300-15-009 ** Connecting Emerging Energy Technologies and Strategies to Market Needs and Opportunities	Ranked # 1	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
300-15-008 Research Roadmap for Getting to Zero Net Energy Buildings	This project analyzed the most critical RDD&D gaps that need to be addressed to achieve California's goals for ZNE buildings for all new construction of residential buildings by 2020 and commercial buildings by 2030. Results of the analyses will be used to strategically target future EPIC investments in a manner that provides optimal benefits to IOU electric ratepayers, and maximizes the use of public research and development investments.	3e	This project was completed in May 2018. As a result of this contract, Energy Commission staff have over 60 technology briefs for high potential technologies that require more research. The technology briefs identify research gaps as well as the cost and performance targets needed for broad adoption. This contract also produced a prioritization tool that dynamically sorts the technologies based on weights assigned to priorities such as electrification, impact to the grid, and technology readiness level. The final report is being prepared for publishing on the Commission website.
300-15-009 ** Connecting Emerging Energy Technologies and Strategies to Market Needs and Opportunities	This project will benefit California IOU electricity ratepayers through the increased probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. Recommendations resulting from this agreement will help the Energy Commission better direct EPIC Program technologies towards addressing customer needs and becoming widespread, commercially available products.	2a, 3e	The project team has nineteen work authorization projects that are either active, in development, or have been completed. These work authorizations assist Energy Commission staff to appropriately target investments in microgrids, energy efficiency technologies, low-income/disadvantaged community research, and other topics. Additionally, a currently active work authorization has launched an online platform that facilitates tailored connections between investors, entrepreneurs, customer adopters and field test sites, and mentors and community based organizations. Over 400 members have joined the platform in the first two months since launch and they have been able to network with each other to form stronger proposal teams for Energy Commission and non-Energy Commission funding opportunities.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	300-15-009 ** Connecting Emerging Energy Technologies and Strategies to Market Needs and Opportunities	Market Facilitation	This contract will provide market analysis that will address the barriers that hamper commercial development of emerging energy technologies. Tasks under this work authorization contract could include tracking past and current award EPIC technology solutions to monitor successes, more accurately consider future EPIC funding opportunities, inform technology gap analyses, and develop online resources. The deliverables from this project will help prioritize future Energy Commission funding towards technologies that solve the addressed issues.	4/13/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	300-15-010 Research Roadmap for Advancing Technologies in California's Industrial, Agricultural, and Water Sectors	Applied Research and Development	Energetics Incorporated developed a technical assessment and gaps analysis to identify the research needs for advancing technologies in the IAW sectors. They collected information from literature searches and feedback from stakeholders and subject matter experts to identify critical needs and currently available emerging technologies. Together with Energy Commission staff, the team prioritized the technologies for key research, development, demonstration, and deployment areas. Finally, they incorporated the recommendations into a research roadmap that will help inform future EPIC investments for the IAW sectors.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
300-15-009 ** Connecting Emerging Energy Technologies and Strategies to Market Needs and Opportunities	No	Demand-side Management	$112,126	$112,126	$112,126	N/A
300-15-010 Research Roadmap for Advancing Technologies in California's Industrial, Agricultural, and Water Sectors	No	Demand-side Management	$647,728	$647,728	$607,470	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
300-15-009 ** Connecting Emerging Energy Technologies and Strategies to Market Needs and Opportunities	$112,126	$0	$0	None	$0	0.0%
300-15-010 Research Roadmap for Advancing Technologies in California's Industrial, Agricultural, and Water Sectors	$607,470	$122,646	$0	TSS Consultants; Energetics Incorporated; Taylor Biomass Energy, LLC; Renewable Oil International LLC	$29,610	4.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
300-15-009 ** Connecting Emerging Energy Technologies and Strategies to Market Needs and Opportunities	Contract	TREATMENT OF IP: Pre-existing intellectual property identified in agreement 300-15-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	3 out of 4 bidders	Guidehouse Inc. f/k/a Navigant Consulting, Inc.
300-15-010 Research Roadmap for Advancing Technologies in California's Industrial, Agricultural, and Water Sectors	Contract	TREATMENT OF IP: Pre-existing intellectual property identified in agreement 300-15-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	3 out of 4 bidders	Energetics Incorporated

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
300-15-009 ** Connecting Emerging Energy Technologies and Strategies to Market Needs and Opportunities	Ranked # 1	N/A	N/A	None
300-15-010 Research Roadmap for Advancing Technologies in California's Industrial, Agricultural, and Water Sectors	Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
300-15-009 ** Connecting Emerging Energy Technologies and Strategies to Market Needs and Opportunities	This project will benefit California IOU electricity ratepayers through the increased probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. Recommendations resulting from this agreement will help the Energy Commission better direct EPIC Program technologies towards addressing customer needs and becoming widespread, commercially available products.	2a, 3e	The project team has nineteen work authorization projects that are either active, in development, or have been completed. These work authorizations assist Energy Commission staff to appropriately target investments in microgrids, energy efficiency technologies, low-income/disadvantaged community research, and other topics. Additionally, a currently active work authorization has launched an online platform that facilitates tailored connections between investors, entrepreneurs, customer adopters and field test sites, and mentors and community based organizations. Over 400 members have joined the platform in the first two months since launch and they have been able to network with each other to form stronger proposal teams for Energy Commission and non-Energy Commission funding opportunities.
300-15-010 Research Roadmap for Advancing Technologies in California's Industrial, Agricultural, and Water Sectors	This project analyzed the most critical RD&D gaps in the industrial, agricultural, water and bioenergy sectors that need to be addressed to achieve California's goals for doubling energy efficiency by 2030. Results of the analyses will be used to strategically target future EPIC investments in a manner that provides optimal benefits to IOU electric ratepayers, and maximizes the use of public research and development investments.	2a, 3e	The project ended in May 2018. Energetics conducted additional surveys and webinars to get stakeholder input on high-impact emerging technologies, the barriers to market entry for these technologies, as well as actions that can support market entry, and the success indicators. Feedback from 249 surveys and 19 webinars was analyzed and incorporated into a final research roadmap. The roadmap identifies critical technology gaps, possible solutions, and analysis for six major technology areas: industrial processing, industrial facilities, industrial power, agriculture, bioenergy, and water and wastewater. Energetics recommended a total of 123 energy-saving technologies that were prioritized for the six technology areas. Of these recommendations, 42 technologies are still in the RD&D stage. The roadmap will help inform the Energy Commission's future EPIC investments for the IAW sectors.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	300-15-011 California Commercial End-Use Survey	Market Facilitation	The Energy Commission conducted a CEUS in 2006, since then the energy landscape in California has changed dramatically including the deployment of advanced energy efficiency and renewable generation technologies. This project is updating the CEUS while adding additional granularity by (1) developing a methodology to conduct a survey of the characteristics of commercial utility customers that will serve as a baseline and support the Energy Commission's work on the demand forecast, (2) implementing the survey, and (3) providing an unbiased, comprehensive analysis of the data. When completed, the CEUS will provide a clearer picture of commercial energy end-use which will allow better strategic targeting of policies and incentives which will help facilitate the commercial success and market adoption of technologies, strategies, and other innovations.	5/17/16
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	300-15-013 California Investor-Owned Utility Electricity Load Shapes	Market Facilitation	This project will develop analysis to characterize existing and future electricity load in the service territories of Pacific Gas and Electric Company, Southern California Edison Company, and San Diego Gas and Electric Company that will inform the Energy Commission's demand forecast. This information will, by including a mix of emerging energy trends and demand-side innovations, be used to identify and target opportunities to further reduce cost, improve safety, and improve reliability through clean energy technology research, development, deployment, and market facilitation opportunities.	6/14/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
300-15-011 California Commercial End-Use Survey	No	Demand-side Management	$7,990,063	$7,990,063	$7,990,054	N/A
300-15-013 California Investor-Owned Utility Electricity Load Shapes	No	Grid Operations/Market Design	$1,147,406	$1,147,406	$1,127,082	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
300-15-011 California Commercial End-Use Survey	$7,990,054	$3,426,324	$0	ADM Associates, Inc.	$100,893	1.2%
300-15-013 California Investor-Owned Utility Electricity Load Shapes	$1,127,082	$430,673	$0	ADM Associates, Inc.	$58,330	4.8%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
300-15-011 California Commercial End-Use Survey	Contract	TREATMENT OF IP: Pre-existing intellectual property identified in agreement 300-15-011 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	4 out of 4 bidders	ADM Associates, Inc.
300-15-013 California Investor-Owned Utility Electricity Load Shapes	Contract	TREATMENT OF IP: Pre-existing intellectual property identified in agreement 300-15-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	5 out of 5 bidders	ADM Associates, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
300-15-011 California Commercial End-Use Survey	Ranked # 1	N/A	N/A	Yes; Small Business, Micro Business, Calif Based Entity
300-15-013 California Investor-Owned Utility Electricity Load Shapes	Ranked # 1	N/A	N/A	Yes; Small Business, Micro Business, Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
300-15-011 California Commercial End-Use Survey	The CEUS will provide a more disaggregated sampling of the state's end-uses in the commercial sector, than was historically collected. This level of granularity will lead to more accurate energy forecasts which can assist in keeping rates low as forecasts are used to determine infrastructure needs in long term procurement planning by the CPUC. Furthermore, the data can assist the state in achieving the energy efficiency reduction goals outlined in Senate Bill 350 by supporting the identification and accurate characterization of opportunities for demand-side management, energy efficiency program planning, load shifting, and demand response.	1c, 2a, 5c	For 2020, ADM continued implementing the commercial survey. Surveys in the investor-owned utility (IOU) electric service territories were scheduled to be finalized during this time, coinciding with the expiration of EPIC funds. However, shelter in-place restrictions stemming from COVID-19 impacted the schedule and prevented the team from finishing on time. The CEC was able to get an extension for the EPIC funding and the team plans to finalize the surveys in early 2021. ADM started drafting the final report, focusing on the IOU results as a priority for EPIC. Once all survey work is concluded, ADM will submit a report with the final results for the entire statewide survey, including the publicly owned utility and gas service territories.
300-15-013 California Investor-Owned Utility Electricity Load Shapes	DER technology has advanced significantly over the past decade and current loadshapes used to inform the Energy Commission's demand forecast do not account for the current and future deployment of demand-side innovations. Developing improved loadshapes will provide an accurate assessment of the contributions of clean energy technologies to reducing peak demand, integrating renewable energy, and maintaining electricity system reliability as the deployment of clean energy technologies and strategies increases over time. This information will be used to improve the Energy Commission's demand forecast and analysis, and identify and target opportunities for future EPIC research funding to further reduce cost, improve safety, and improve reliability.	1c, 5c	This project concluded in 2018. The Recipient developed updated baseline end-use load profiles and well as new load profiles characterizing electric vehicle use, photovoltaic use, and additional achievable energy efficiency. The Recipient also developed an updated version of the Hourly Electric Load Model. The Energy Commission's Energy Assessments Division will use this information to develop an annual peak forecast for the California Energy Demand (CED) forecasts, develop monthly peak forecasts for resource adequacy and CED forecasts, develop hourly forecasts to support peak shift analysis for annual peak forecasts, analyze various impacts, including AAEE and electric vehicles, to measure their impact on load shapes, and to provide end-user and other load shapes to outside stakeholders and other analysts.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	300-17-003 Distributed Energy Resources (DER) Roadmap	Market Facilitation	This project developed, in consultation with stakeholders and subject matter experts, a research roadmap that identified, described, and prioritized key RDD&D needs to enable high penetration of distributed energy resources (DERs). The roadmap assessed the current status of DERs in California; assessed current research efforts, including those at the state and federal level; identified performance and cost targets and research needs; estimated rates for technology performance improvement, cost reduction, and adoption; developed a methodology for prioritizing research needs in the near-, mid-, and long-term; apply the methodology to research gaps to prioritize near, mid-, and long-term research needs; and identified critical cost and performance indicators of success and methodology to estimate research benefits. Finally, the roadmap identified the type and amount of data needed to advance DER policy and availability of DER financing, particularly for low-income customers; conducted public workshops; and documented the roadmapping process.	5/9/18
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	300-17-004 Measuring Innovation Progress to Guide Future Investment: Evaluation of EPIC Benefits Methodology	Market Facilitation	This project will provide guidance and independent analysis to develop a robust, standardized methodology to evaluate the electric ratepayer benefits attributable to EPIC-funded projects based on best-in-class methods, data, and analytical tools. This methodology will help the Energy Commission better evaluate how well the EPIC program is meeting its goals and removing barriers to further implementation of advanced technologies to meet the state's energy and climate policy goals.	5/9/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
300-17-003 Distributed Energy Resources (DER) Roadmap	No	Demand-side Management	$499,065	$499,065	$424,657	N/A
300-17-004 Measuring Innovation Progress to Guide Future Investment: Evaluation of EPIC Benefits Methodology	No	Demand-side Management	$3,000,000	$3,000,000	$2,970,595	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
300-17-003 Distributed Energy Resources (DER) Roadmap	$424,657	$242,382	$0	None	$0	0.0%
300-17-004 Measuring Innovation Progress to Guide Future Investment: Evaluation of EPIC Benefits Methodology	$2,970,595	$1,716,826	$0	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
300-17-003 Distributed Energy Resources (DER) Roadmap	Contract	TREATMENT OF IP: Pre-existing intellectual property identified in agreement 300-17-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	5 out of 5 bidders	Guidehouse Inc. f/k/a Navigant Consulting, Inc.
300-17-004 Measuring Innovation Progress to Guide Future Investment: Evaluation of EPIC Benefits Methodology	Contract	TREATMENT OF IP: Pre-existing intellectual property identified in agreement 300-17-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	3 out of 3 bidders	Industrial Economics, Incorporated

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
300-17-003 Distributed Energy Resources (DER) Roadmap	Ranked # 1	N/A	N/A	None
300-17-004 Measuring Innovation Progress to Guide Future Investment: Evaluation of EPIC Benefits Methodology	Ranked # 1	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
300-17-003 Distributed Energy Resources (DER) Roadmap	This project informed the strategic and effective targeting of future EPIC investments to maximize the use of public research and development investments. The resulting roadmap identified and prioritized research on the most critical RDD&D technology gaps to enable transformation of the grid to increasingly integrate DERs. The results of the analysis provided further detail in the integration into utility planning and operational policies that are critical to the technological improvements and physical connections to the grid.	2a	The California Energy Commission (CEC) staff conducted a workshop to summarize the DER Research Roadmap in May 2020. The roadmap identified key research priorities needed to enable high penetrations of DERs. The workshop provided an overview of the project approach, reviewed the screening and prioritization process, and presented the project results. Guidehouse Inc. completed and submitted the final roadmap report in September 2020.
300-17-004 Measuring Innovation Progress to Guide Future Investment: Evaluation of EPIC Benefits Methodology	This project will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the state's statutory energy goals by developing tools to quantify the benefits of EPIC projects and identifying technologies that are likely to have the greatest impacts.	3e	In 2020, the project team completed a suite of tools and methodologies for evaluating EPIC's benefits to ratepayers and conducted a number of case studies demonstrating the application of the tools; the case studies estimate benefits from a selection of EPIC projects including energy efficiency and renewable generation technologies. The project team presented the suite of tools, methodologies, and results to CEC staff as well as at a public workshop hosted by the CEC. EPIC staff will conduct the final review of the projects tools, methodologies, and results to provide feedback as the project team finalizes their deliverables and final reports due in the first half of 2021.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	300-17-005 Research Roadmap for Cost and Technology Breakthroughs for Renewable Energy Generation	Market Facilitation	This project aims to develop a research roadmap to strategically frame research priorities, potential partnerships, and critical technology milestones to support EPIC portfolio decisions and accelerate progress toward more cost-competitive, flexible and reliable renewable energy generation, operation, and storage.	5/9/18
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	300-18-001 Technology Transfer for EPIC Research Projects	Market Facilitation	The purpose of this Agreement is to fund technology transfer services to ensure that the results of EPIC-funded projects are effectively disseminated and communicated to stakeholders. The contractors will work closely with Energy Commission staff to: 1) develop and implement a digital technology transfer strategy for EPIC, including redesigning and increasing the functionality of the Energy Commission-owned Energy Innovation Showcase website to improve its effectiveness and usefulness as a technology transfer tool; 2) conduct up to nine topical forums across the state, discussing key issues affecting the electricity sector; and 3) plan, produce, and manage two EPIC Symposium events.	4/10/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
300-17-005 Research Roadmap for Cost and Technology Breakthroughs for Renewable Energy Generation	No	Generation	$338,059	$338,059	$330,465	N/A
300-18-001 Technology Transfer for EPIC Research Projects	No	Grid Operations/Market Design	$3,788,265	$3,788,265	$1,814,206	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
300-17-005 Research Roadmap for Cost and Technology Breakthroughs for Renewable Energy Generation	$330,465	$86,365	$0	None	$0	0.0%
300-18-001 Technology Transfer for EPIC Research Projects	$1,814,206	$881,903	$0	Gladstein, Neandross and Associates LLC; Larta Institute; Sensis Agency	$1,310,568	25.7%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
300-17-005 Research Roadmap for Cost and Technology Breakthroughs for Renewable Energy Generation	Contract	TREATMENT OF IP: Pre-existing intellectual property identified in agreement 300-17-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	4 out of 4 bidders	Energetics Incorporated
300-18-001 Technology Transfer for EPIC Research Projects	Contract	TREATMENT OF IP: Pre-existing intellectual property identified in agreement 300-18-001 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	5 out of 6 bidders	Gladstein, Neandross & Associates LLC

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
300-17-005 Research Roadmap for Cost and Technology Breakthroughs for Renewable Energy Generation	Ranked # 1	N/A	N/A	None
300-18-001 Technology Transfer for EPIC Research Projects	Ranked # 1	N/A	N/A	Yes; Small Business, Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
300-17-005 Research Roadmap for Cost and Technology Breakthroughs for Renewable Energy Generation	This Research Roadmap aims to strategically frame research priorities, potential partnerships, and critical technology milestones to help inform EPIC research development, demonstration, and deployment (RDD&D) portfolio decisions and accelerate progress toward more cost competitive, flexible and reliable renewable energy generation, operation, and storage. A roadmap is an effective tool for laying out RDD&D pathways. A robust roadmap considers a spectrum of technology complexity, the current state of the art, rapid expansion of scientific knowledge, competition for RDD&D funding, dynamic customer expectations, and the cost and risk of research.	2a	Through a literature review, expert interviews and surveys, and multiple expert and public webinars, the roadmapping project produced both a Technical Assessment and Research Roadmap. While the Technical Assessment focused on the current state of renewable energy resources and research efforts in both California and nationally, the research roadmap pinpoints recommended initiatives which fill current technology gaps. The roadmap includes 17 recommended initiatives, with supporting background information including generation trends, resource assessment, cost and performance metrics, and technology area considerations. Two research initiatives are recommended for the following technologies: solar PV, concentrated solar power, land-based wind, geothermal, bioenergy, grid integration, and energy storage. The team recommended three research initiatives for offshore wind energy.
300-18-001 Technology Transfer for EPIC Research Projects	This Agreement will lead to increased benefits for EPIC ratepayers by accelerating the development and deployment of new emerging clean energy technologies.	2a	In 2020, the team conducted two technical forums and the EPIC Symposium. The first technical forum was held in person in Long Beach (February 25), and focused on energy resilience. Due to COVID-19, the team had to pivot to conduct virtual events. They worked with staff to plan and facilitate a second forum on low-carbon buildings (September 2-4), and the EPIC Symposium (October 19-21). Additionally, Phase I of the new EPIC project website, EnergizeInnovation. Fund, was launched in August. Phase I includes information on the program, project statistics, investment areas, relevant news articles, and links to EPIC events. In 2021, the team will launch Phase II of the site that includes individual project pages, search and sorting functionality, and translation capability.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-001 Improving Solar & Load Forecasts: Reducing the Operational Uncertainty Behind the Duck Chart	Applied Research and Development	This project aimed to reduce the operational uncertainty in both PV and net load forecasts by producing high accuracy forecasts and linking them to net load forecasts at finer time intervals. This increased accuracy in estimation and incorporation within net load forecasts will enable better integration of intermittent PV generation in California and lead to substantial savings in the associated wholesale energy market costs. The results of this agreement contribute to reduced operational uncertainty behind the Duck Chart by producing high accuracy solar generation forecasts for utilities and the CAISO, and linking these generation forecasts to methods for forecasting net loads at higher temporal resolution. This increased fidelity and connection to net load forecasts will provide critical insights to better manage the rapidly evolving grid in California.	12/10/14
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-002 Investigating Flexible Generation Capabilities at the Geysers	Applied Research and Development	This project seeks to expand flexible generation capabilities of The Geysers geothermal facilities and support electrical grid reliability. The current operational configuration of The Geysers were thoroughly evaluated through modeling and field testing to determine ways to expand flexible generation capabilities. Steam field and power plant equipment were modified and tested in various load cycling scenarios to determine operating capabilities and limitations of equipment to achieve flexible generation while avoiding or minimizing any potential damage to facilities. The project team concluded that individual Geysers power plants can operate in a flexible or cyclic operating mode down to their existing minimum generating operating limits. However, when multiple power plants are in cyclic operating mode at the same time, operators were challenged by the required monitoring and related manual adjustments.	12/10/14

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-001 Improving Solar & Load Forecasts: Reducing the Operational Uncertainty Behind the Duck Chart	No	Generation	$998,926	$998,926	$925,538	N/A
EPC-14-002 Investigating Flexible Generation Capabilities at the Geysers	No	Generation	$3,000,000	$3,000,000	$2,822,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-001 Improving Solar & Load Forecasts: Reducing the Operational Uncertainty Behind the Duck Chart	$925,538	$268,243	$0	Clean Power Research; Itron, Inc., dba IBS	$453,462	31.2%
EPC-14-002 Investigating Flexible Generation Capabilities at the Geysers	$2,822,000	$0	$0	Geysers Power Company, LLC; Multiple Equipment Suppliers; Multiple Mechanical Subcontractors; Reservoir Engineering Contractor	$4,362,373	59.3%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-001 Improving Solar & Load Forecasts: Reducing the Operational Uncertainty Behind the Duck Chart	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-001 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	18 out of 18 bidders	Itron, Inc., dba IBS
EPC-14-002 Investigating Flexible Generation Capabilities at the Geysers	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-002 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	18 out of 18 bidders	Geysers Power Company, LLC

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-001 Improving Solar & Load Forecasts: Reducing the Operational Uncertainty Behind the Duck Chart	Group 2: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-14-002 Investigating Flexible Generation Capabilities at the Geysers	Group 3: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-001 Improving Solar & Load Forecasts: Reducing the Operational Uncertainty Behind the Duck Chart	The project showed that improvements in solar and net load forecasting methods can provide positive financial impacts in the scheduling and procurement of electricity in the wholesale electric market within the State. The results of this research have shown that, just in the period covered by this analysis, the potential savings to all stakeholders would have been on the order of $9 million. With further growth in solar and improvements in integrating behind the meter solar into the California ISO net load forecasts, the team anticipates it can achieve even greater cost reductions. This research sets the groundwork for further research on developing a framework to optimize the use of alternative forecasts by the California ISO into its net load forecast. It may be possible to develop a framework for choosing when to use the alternative forecast to optimize its value to all stakeholders.	1c, 4a, 5c	The project incorporated several forecast improvements by advancing methods for determining BTM system specifications and shading based on measured production inputs, integrating irradiance measurements to improve aerosol optical depth and cloud albedo aspects, and by incorporating near real-time metered PV generation data to fine-tune fleet forecasts of both grid-connected and BTM PV solar. Researchers evaluated three alternative model approaches for extending the CAISO load forecast framework and present the alternative load forecast frameworks for incorporating BTM solar PV forecasts. The study showed that improvements in solar and net load forecasting can provide positive financial impacts in the scheduling and procurement of electricity in the wholesale electric market within the State. The potential savings would have been on the order of $9 million just in the covered period.
EPC-14-002 Investigating Flexible Generation Capabilities at the Geysers	The technical and economic benefits of this study will come from expanding the flexible generation capabilities of The Geysers generation facilities to maintain grid reliability and help support additional variable renewables to meet the state's RPS goals.	2a, 4a, 5a, 5b	The project conducted a study to investigate flexible electrical generation capabilities at The Geysers. The modeling work performed in this project resulted in successful development and application of a simulation-optimization framework for the optimal control of the steam field under load curtailment. Upgrades installed during this study removed turbine related constraints, made it feasible to achieve rapid cutbacks using existing ramp rates, and provided an incremental increase in existing flexible generation capabilities. Field-testing and modeling results show that steam well and pipeline corrosion is a major constraint on steam-field operations. However, results from this study will guide economic evaluations and future capital improvements needed to expand the flexible generation capabilities at The Geysers.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-003 Low- Cost Thermal Energy Storage for Dispatchable CSP	Applied Research and Development	The purpose of this project was the development and demonstration of a robust, low-cost thermal energy storage (TES) fluid -- elemental sulfur. Use of sulfur as a TES fluid will enable overall low system costs, long lifetime, and scalability for a wide range of concentrating solar power (CSP) applications and temperatures.	12/10/14
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-004 Systems Integration of Containerized Molten Salt Thermal Energy Storage in Novel Cascade Layout	Applied Research and Development	The project aimed to build, validate, thermally cycle, and pilot test a modular 75 kW, 6 hour (500 kWh) molten salt thermal energy storage (TES) system, using standard shipping containers and commercially available tanks and insulation. The project leverages a novel cascaded tank arrangement and high-volume manufacturing and factory assembly, to significantly reduce the installed cost of TES for concentrating solar power (CSP).	12/10/14

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-003 Low- Cost Thermal Energy Storage for Dispatchable CSP	No	Generation	$1,497,024	$1,497,024	$1,331,726	N/A
EPC-14-004 Systems Integration of Containerized Molten Salt Thermal Energy Storage in Novel Cascade Layout	No	Generation	$1,500,000	$1,500,000	$377,870	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-003 Low- Cost Thermal Energy Storage for Dispatchable CSP	$1,331,726	$198,528	$0	Southern California Gas Company	$300,000	16.7%
EPC-14-004 Systems Integration of Containerized Molten Salt Thermal Energy Storage in Novel Cascade Layout	$377,870	$283,080	$0	Halotechnics	$19,038	1.3%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-003 Low- Cost Thermal Energy Storage for Dispatchable CSP	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	18 out of 18 bidders	University of California, Los Angeles
EPC-14-004 Systems Integration of Containerized Molten Salt Thermal Energy Storage in Novel Cascade Layout	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	18 out of 18 bidders	Halotechnics

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-003 Low- Cost Thermal Energy Storage for Dispatchable CSP	Group 1: Ranked # 2	N/A	N/A	None
EPC-14-004 Systems Integration of Containerized Molten Salt Thermal Energy Storage in Novel Cascade Layout	Group 1: Ranked # 1	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-003 Low- Cost Thermal Energy Storage for Dispatchable CSP	This project will develop a low-cost thermal storage fluid, elemental sulfur, which enables overall low system costs, long lifetime, and scalability for a wide range of concentrating solar power applications.	2a, 3a, 3b, 3h, 4a, 4b	The project performed detailed heat transfer modeling and simulation, laboratory-scale material compatibility experiments, and laboratory-scale thermal battery testing. Results from the laboratory-scale (10 kWh capacity) system were very promising. The system was successfully operated at high temperature (600 degrees Centigrade) over multiple thermal cycles and demonstrated higher energy density and faster dynamic response (speed of charge and discharge) compared to conventional molten salt technology. A pilot-scale (30 kWh capacity) thermal battery system was designed, built, and field tested with CSP in December 2018. Testing the system in a real-world environment validated performance with actual solar energy input and provided valuable validation of system-level analysis and heat transfer tools. Researchers are now scaling up the technology.
EPC-14-004 Systems Integration of Containerized Molten Salt Thermal Energy Storage in Novel Cascade Layout	The Halotechnics thermal storage system sought to improve system design and modularity and reduce the cost of molten salt energy storage by 25% by reducing the required storage volume. However, researchers found that the innovative storage technology would have to be very large to cost competitive with battery storage and, therefore, would not effectively reduce the cost of small CSP plants to make them competitive in the market.	1i, 2a, 3b	The project was approved at the December 10, 2014 Energy Commission Business Meeting and the project work was started in January 2015. The process design and the mechanical design of all major components were completed, along with specified control system requirements which included the use of three tanks, the minimum number prescribed to evaluate the operation and viability of a multiple tank system. Halotechnics terminated the project after 10 months prior to the procurement of any hardware due to insufficient commercial traction from customers in the concentrated solar power industry.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-005 Solar Forecast Based Optimization of Distributed Energy Resources in the LA Basin and UC San Diego Microgrid	Applied Research and Development	This project aimed to integrate high-accuracy solar forecasting to optimize the operation of distributed energy resources, and utilize the value of solar forecasting in utility grid operations to improve grid reliability, reduce ratepayer costs and increase safety. The objectives were to apply forecasts to inform control and scheduling decisions for distributed energy resources with emphasis on energy storage and electric vehicle charging control at warehouse photovoltaic clusters in the LA-Orange-Riverside-San Bernardino-San Diego Counties as well as the UCSD microgrid.	12/10/14
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-007 Improving Short-Term Wind Power Forecasting through Measurements and Modeling of the Tehachapi Wind Resource Area	Applied Research and Development	This project comprises coordinated atmospheric field measurements and computational modeling improvements to improve the accuracy of prediction of short-term wind ramps (i.e. large, rapid changes in wind power production). The Tehachapi Pass Wind Resource Area is the focus of the project. Since the area features complex terrain and meteorology, the findings can be readily adapted and applied to many other regions.	12/10/14

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-005 Solar Forecast Based Optimization of Distributed Energy Resources in the LA Basin and UC San Diego Microgrid	No	Generation	$999,984	$999,984	$726,345	N/A
EPC-14-007 Improving Short-Term Wind Power Forecasting through Measurements and Modeling of the Tehachapi Wind Resource Area	No	Generation	$1,000,000	$1,000,000	$993,172	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-005 Solar Forecast Based Optimization of Distributed Energy Resources in the LA Basin and UC San Diego Microgrid	$726,345	$157,282	$0	San Diego Gas and Electric Company; Itron, Inc. dba IBS; University of California, San Diego, San Diego Supercomputer Center; Strategen	$999,984	50.0%
EPC-14-007 Improving Short-Term Wind Power Forecasting through Measurements and Modeling of the Tehachapi Wind Resource Area	$993,172	$247,542	$84,888	Department of Mechanical and Aerospace Engineering - UC Davis	$90,325	8.3%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-005 Solar Forecast Based Optimization of Distributed Energy Resources in the LA Basin and UC San Diego Microgrid	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	18 out of 18 bidders	The Regents of the University of California, San Diego
EPC-14-007 Improving Short-Term Wind Power Forecasting through Measurements and Modeling of the Tehachapi Wind Resource Area	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	18 out of 18 bidders	University of California - Davis

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-005 Solar Forecast Based Optimization of Distributed Energy Resources in the LA Basin and UC San Diego Microgrid	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-14-007 Improving Short-Term Wind Power Forecasting through Measurements and Modeling of the Tehachapi Wind Resource Area	Group 2: Ranked # 4	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-005 Solar Forecast Based Optimization of Distributed Energy Resources in the LA Basin and UC San Diego Microgrid	The uncontrollable generation of renewable energy sources, such as solar photovoltaics poses numerous challenges to the electric grid. The large growth of electric vehicles (EV) has potential to exacerbate those challenges due to increases in load, especially at inopportune times. However, the flexibility of scheduling EV charging around forecasted PV production provides a solution to this problem. Furthermore, the project improved solar energy forecast accuracy by 10% over the existing persistence forecast method for 10 minute ahead to optimize the operation of distributed energy resources. It will mitigate the concerns of electric operations over the variable nature of solar power that contributes to net load variability, causing voltage issues affecting service quality and reliability.	1c, 4a, 5c	The utility customers who use solar forecasting and smart EV charging could achieve a 67% reduction in energy costs over the year, reducing monthly peak demand by 63%. This study reveals that using aggregated vehicle load large enough to absorb the solar output on the studied circuit is years in the future. The studied circuit showed that connected PV output created an energy valley of 64.5 MWh. Using a typical commuter PEV requiring 7 kWh means that roughly 9,200 vehicles must be connected during the solar output period to create an adequately sized energy sink to absorb the full amount of this oversupply. The executive order B-48-18 will improve the perspectives for EV charging and grid net load balancing in California. But at 929,000 commercial buildings in California, Oregon, and Washington, even 250,000 chargers will fall short of the amounts required in this example.
EPC-14-007 Improving Short-Term Wind Power Forecasting through Measurements and Modeling of the Tehachapi Wind Resource Area	Improvements to accuracy of short-term (3-15 hours) and very short-term (0-3 hours) wind ramp forecasting would reduce generating reserves scheduled by grid operators, with corresponding decreases in grid operating costs and greenhouse gas emissions, and, simultaneously, increased grid reliability.	1c, 3b, 5c	The project team has completed the measuring program that included sodar, ceilometer, radiometer, radar wind profiler, and radio acoustic sounder measurements scattered over six sites and completed a forecast sensitivity study of wind ramping behavior based on suite of physics-based predictive models versus observed sodar data, including obtaining results for a sensitivity study of observed bias of mean absolute error of 0-15 hour energy forecast for Tehachapi wind resource area.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-008 High-Fidelity Solar Power Forecasting Systems for the 392 MW Ivanpah Solar Plant (CSP) and the 250 MW California Valley Solar Ranch (PV)	Applied Research and Development	The purpose of this project is to develop and validate tools capable of monitoring and forecasting DNI and POA irradiance and the power generation accurately, from 5 minutes out to 72 hours in the future, at the Ivanpah Solar Thermal plant as well as at the California Valley Solar Ranch (CVSR) plant. The project also included the development of tools for predicting wind speed, which affects the heliostats' deployment, and the improvement of the power generation forecast via Resource-to-Power Model (RTP) for Ivanpah (CSP) and CVSR (Tracking PV) plants. The goal of this system is to reduce uncertainties associated with operation, regulation, and scheduling.	12/10/14
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-009 Optimizing Radiant Systems for Energy Efficiency and Comfort	Applied Research and Development	This project develops new design and operation tools for radiant cooling and heating systems in order to provide standardized guidance for radiant systems in commercial buildings. The agreement includes full-scale laboratory experiments, whole-building simulations, development of simplified models for radiant system controls, validation of these new methods in field studies, occupant satisfaction surveys, and an update to Title-24 for radiant systems. The project produced: 1) a simplified tool for calculating the cooling load and cooling capacity of a radiant slab system, including calculation methods with significant direct solar radiation, 2) a simplified online operational tool for radiant slab systems, and 3) updates to the Title 24 Alternative Calculation Method Reference Manual to enable improved modeling capabilities of radiant systems.	2/25/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-008 High-Fidelity Solar Power Forecasting Systems for the 392 MW Ivanpah Solar Plant (CSP) and the 250 MW California Valley Solar Ranch (PV)	No	Grid Operations/Market Design	$999,898	$999,898	$998,828	N/A
EPC-14-009 Optimizing Radiant Systems for Energy Efficiency and Comfort	No	Demand-side Management	$2,939,964	$2,939,964	$2,774,084	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-008 High-Fidelity Solar Power Forecasting Systems for the 392 MW Ivanpah Solar Plant (CSP) and the 250 MW California Valley Solar Ranch (PV)	$998,828	$168,624	$0	Itron, Inc. dba IBS; NRG Energy, Inc.	$764,019	43.3%
EPC-14-009 Optimizing Radiant Systems for Energy Efficiency and Comfort	$2,774,084	$450,466	$0	Regents of the University of California, Berkeley (Center for the Built Environment); Price Industries	$299,194	9.2%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-008 High-Fidelity Solar Power Forecasting Systems for the 392 MW Ivanpah Solar Plant (CSP) and the 250 MW California Valley Solar Ranch (PV)	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-008 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	18 out of 18 bidders	The Regents of the University of California, San Diego
EPC-14-009 Optimizing Radiant Systems for Energy Efficiency and Comfort	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	The Regents of the University of California on behalf of the Berkeley campus

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-008 High-Fidelity Solar Power Forecasting Systems for the 392 MW Ivanpah Solar Plant (CSP) and the 250 MW California Valley Solar Ranch (PV)	Group 2: Ranked # 3	N/A	N/A	Yes; Calif Based Entity
EPC-14-009 Optimizing Radiant Systems for Energy Efficiency and Comfort	Group 1: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-008 High-Fidelity Solar Power Forecasting Systems for the 392 MW Ivanpah Solar Plant (CSP) and the 250 MW California Valley Solar Ranch (PV)	This project introduced a new generation of forecasting methods that fill in a technology gap in the prediction of DNI and POA irradiance as well as solar power generation from PV tracking and CSP. This critical need is evident by the relative scarcity of DNI forecasting algorithms discussed in the scientific literature and the absence of DNI information from the majority of numerical weather prediction models. The development of a network of low-cost sensors for distributed monitoring at California Valley Solar Ranch (CVSR) provides a solution to the need for high-density ground telemetry at low cost. The devices provide an unprecedented level of irradiance sensor density. Forecasting research not only enhances the ability of power plant managers, utility companies and the California ISO to reduce solar costs to ratepayers, but it can also enable higher penetration of renewables.	1c, 4a, 5c	The project demonstrated that the forecasting accuracy for DNI and POA irradiance across all time-scales (intra-hour, intra-day, day-ahead) can be improved using forecasting models that blend local and remote telemetry. The project results demonstrated the importance of having a rich set of input data to improve forecasting. This conclusion was more pronounced for the intra-hour time scale, in which multiple solar sensor data -- including sky images and high-resolution satellite images -- are essential to reduce forecasting errors. The tools developed were used in two very distinct testbeds (Ivanpah and CVSR) to predict irradiance and power generation. In both cases, the forecasting accuracy was improved relative to baseline models. The models were successfully applied to other locations, showing that they can be used in other grid-connected solar farms.
EPC-14-009 Optimizing Radiant Systems for Energy Efficiency and Comfort	Radiant systems can be an integral part of ZNE and other advanced high performance buildings and reduce energy and peak energy use and cost compared to conventional HVAC systems.	1e, 1f, 1h, 4a	The project is complete. The recipient developed: sizing and operation tools to provide reliable methods to calculate energy performance of radiant systems while maintaining comfort, energy, cost, and comfort data to provide real world examples of energy efficient, affordable, and comfortable buildings using radiant systems, and recommendations for Title-24 and ASHRAE Standards advancements. The research team used full-scale laboratory experiments, whole-building energy simulations and tool development, and field studies and control demonstrations to develop guidance and tools to help the building industry adopt radiant systems. Recommendations for revisions to relevant codes and standards will continue to be communicated to the responsible organizations by the research team, who regularly participate in committees and conferences related to Title-24 and ASHRAE.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-010 Solar-Reflective "Cool" Walls: Benefits, Technologies, and Implementation	Applied Research and Development	This project (a) quantifies the energy savings, peak demand reduction, urban cooling, and air quality improvements attainable from cool walls in California; (b) assesses the performance of existing cool wall technologies, develops innovative cool wall solutions, and (c) facilitates collaboration among government agencies, utilities, and industry to create a cool-wall infrastructure that includes application guidelines, a product rating program, incentives, and building code credits.	2/25/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-011 From the Laboratory to the California Marketplace: A New Generation of LED Lighting Solutions	Applied Research and Development	This project focuses on the design and development of innovative LED lighting solutions for three key general illumination product categories. These solutions are a best-in-class medium, screw-base replacement lamp, linear tubular light emitting diode (TLED) replacement lamps and spectrally optimized, dedicated LED luminaires. Product design requirements are based on consumer light quality and functional performance preferences determined through a series of unique laboratory-based consumer preference and product characterization studies.	2/25/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-010 Solar-Reflective "Cool" Walls: Benefits, Technologies, and Implementation	No	Demand-side Management	$2,500,000	$2,500,000	$2,500,000	N/A
EPC-14-011 From the Laboratory to the California Marketplace: A New Generation of LED Lighting Solutions	No	Demand-side Management	$2,995,187	$2,995,187	$2,826,674	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-010 Solar-Reflective "Cool" Walls: Benefits, Technologies, and Implementation	$2,500,000	$908,941	$0	_3M; BEHR; Metal Construction Association; PPG Industries; Saint-Gobain; Sherwin Williams; Tex-Cote; Valspar	$610,800	19.6%
EPC-14-011 From the Laboratory to the California Marketplace: A New Generation of LED Lighting Solutions	$2,826,674	$557,072	$5,000	Regents of the University of California, Davis - California Lighting Technology Center	$5,000	0.2%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-010 Solar-Reflective "Cool" Walls: Benefits, Technologies, and Implementation	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	Lawrence Berkeley National Laboratory
EPC-14-011 From the Laboratory to the California Marketplace: A New Generation of LED Lighting Solutions	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-011 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	Regents of the University of California, Davis - California Lighting Technology Center

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-010 Solar-Reflective "Cool" Walls: Benefits, Technologies, and Implementation	Group 1: Ranked # 3	N/A	N/A	Yes; Calif Based Entity
EPC-14-011 From the Laboratory to the California Marketplace: A New Generation of LED Lighting Solutions	Group 1: Ranked # 4	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-010 Solar-Reflective "Cool" Walls: Benefits, Technologies, and Implementation	The project is advancing scientific knowledge by quantifying the potential benefits of cool walls, assessing the performance of existing and prototype cool wall technologies, and developing innovative cool wall solutions. High wall albedo can be attained with a reflective coating (e.g., paint or stucco) or cladding. Cool wall products available today include light-colored paints that reflect up to 80% of sunlight when new, but may lose reflectance as they soil; and darker cool colored paints that come in a wide palette, but typically reflect less than 50% of sunlight when new. This project will provide information to building owners, facility managers, and the paint industry on the direct and indirect energy and environmental benefits of solar reflecting walls, assessing and advancing available and emerging cool wall tech	1e, 1f, 1h, 4a, 5d	The project has been completed. The findings from this project indicate that cool walls can reduce whole-building annual HVAC use by up to 25% in single-family, 3.7% in medium offices, and 9% in stand-alone retail stores. The final report will be published in January 2019.
EPC-14-011 From the Laboratory to the California Marketplace: A New Generation of LED Lighting Solutions	This project could improve understanding of metrics and test procedures associated with LED quality and performance, increase lamp manufacturer's ability to comply with future energy codes and standards and produce good quality LED products and increase consumer acceptance and satisfaction of LED lamps.	1f, 1h, 4a	Widespread adoption of LED lighting for general illumination applications is one of the largest advances in lighting building efficiency. However the focus on cost reductions at the expense of product quality has led to a lack of consumer satisfaction, and minimal market share for LED products in residential and commercial applications. This project designed and developed novel, energy-efficient, LED lighting solutions with quality and performance features that align with consumer expectations. Key research outcomes include: proposed changes to ANSI LED color bins to address consumer expectations, documented consumer preferences for color fidelity, quantification of the impact of color fidelity on visual acuity, and consumer preferences for lighting product packaging and information. These outcomes informed product specifications for linear LED lamps, retrofit kits and luminaires.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-012 Comparing Attic Approaches for Zero Net Energy Homes	Applied Research and Development	The project focused on the performance of different attic assemblies and their associated heating, ventilating and air conditioning (HVAC) systems. Field measurements of attic and HVAC system performance were conducted in two new high performance homes in California with sealed and insulated attics. One home was built to be about 30 percent better than Title 24 and the other is a ZNE home. The attic insulation approach involved a new lower-cost approach using blown insulation that does not use expensive spray-foam. The results of the measurements are used directly to provide technical support for potential changes to Title 24 and provide information to contractors and builders on sealed and insulated attic performance and alternative approaches.	2/25/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-013 Very Low-cost MEMS-based Ultrasonic Anemometer for Use Indoors and in HVAC Ducts	Applied Research and Development	This project develops and tests prototype room and duct anemometers that are low-cost, low power, accurate, calibration-free and compact. The anemometers are wireless, able to be inexpensively installed in existing buildings, can operate on a battery for years and communicate wirelessly via the internet to the building's control system. The technology is expected to save energy by using collected data to correct wasteful HVAC malfunctions that result in inefficient systems and uncomfortable buildings.	2/25/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-012 Comparing Attic Approaches for Zero Net Energy Homes	No	Demand-side Management	$1,000,000	$1,000,000	$1,000,000	N/A
EPC-14-013 Very Low-cost MEMS-based Ultrasonic Anemometer for Use Indoors and in HVAC Ducts	No	Demand-side Management	$2,488,964	$2,488,964	$2,462,263	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-012 Comparing Attic Approaches for Zero Net Energy Homes	$1,000,000	$563,439	$0	None	$0	0.0%
EPC-14-013 Very Low-cost MEMS-based Ultrasonic Anemometer for Use Indoors and in HVAC Ducts	$2,462,263	$214,202	$0	Regents of the University of California, Berkeley (Center for the Built Environment); BAF Technologies Inc.; Vigilent; Chirp Microsystems, Inc.; Price Industries	$249,000	9.1%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-012 Comparing Attic Approaches for Zero Net Energy Homes	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-012 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	Lawrence Berkeley National Laboratory
EPC-14-013 Very Low-cost MEMS-based Ultrasonic Anemometer for Use Indoors and in HVAC Ducts	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	The Regents of the University of California on behalf of the Berkeley campus

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-012 Comparing Attic Approaches for Zero Net Energy Homes	Group 3: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-14-013 Very Low-cost MEMS-based Ultrasonic Anemometer for Use Indoors and in HVAC Ducts	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-012 Comparing Attic Approaches for Zero Net Energy Homes	This project will lead to technological advancement by offering alternative construction techniques for sealing and insulating attics, compared to conventional methods. The alternative technique involves the use of sealed attics and could lead to electricity savings and peak demand savings when compared to conventional duct systems, and also increase occupant comfort. The recipient is working with building developers on these new techniques which will contribute to achieving ZNE goals for new construction. The techniques can also be applied to home retrofits with HVAC equipment.	1f, 1h, 4a	Staff is reviewing the final report and a final project presentation occurred on 12/19/18. The Fresno test home was monitored continuously from September 2016 to the end of April 2018, and the Clovis test home was monitored from June 2017 through mid-May 2018. The Fresno home exceeds California Title 24 energy performance requirements by 30%, while the Clovis home is designed as a net zero-energy home. Over 100 sensors were installed per home, monitoring temperature, relative humidity, heat flux, surface condensation, moisture and HVAC energy use. An improved version of a sophisticated and mature model called Register Capacity (REGCAP) was used to extend results to all of California's 16 climate zones. Preliminary results indicate an average of 18 percent savings in HVAC energy use using these approaches.
EPC-14-013 Very Low-cost MEMS-based Ultrasonic Anemometer for Use Indoors and in HVAC Ducts	The ability to accurately control airflow with these low cost sensors can expand the comfortable temperature setpoint range in air-conditioned buildings, such as allowing the setting higher indoor temperatures while still being comfortable. Based on industry feedback, the most promising application is to incorporate the sensors into HVAC system. Assuming a 15 percent market penetration for applications, and a 10 percent penetration for retrofit the estimated total statewide savings could be 265 gigawatt hours per year and 38 million therms per year, based upon an estimated level of market penetration 10 years.	1f, 1h, 2a, 3a, 4a	This project has completed and the final report is under review. The recipient produced a prototype anemometer that is disruptively low cost, calibration free, accurate and uses low energy. A number of manufacturers may be interested in the ultrasonic technology and a provision patent was filed through University. A major control manufacturer signed a Non-Disclosure Agreement. The agreement laid the groundwork for further commercial development. The recipient continues to engage with potential manufacturers.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-015 Direct Current as an Integrating and Enabling Platform	Applied Research and Development	This project evaluates DC and AC-DC hybrid applications to determine market segments where projects are technically and economically feasible. The research covers existing and new buildings. For the market segments identified, the Team is developing and piloting tools to help building developers incorporate these systems into their building designs. The tools include DC and AC-DC hybrid design guidelines, and design templates.	2/25/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-016 Cost- and Energy-Efficient Attic Designs for California Homes	Applied Research and Development	This project evaluates, tests and refines two different attic designs in California homes, and recommends the best approaches to home builders addressing cost-effectiveness and energy-efficiency. The baseline will be the current energy efficiency code practices for ventilated roof attics with no additional attic insulation and ducts within the attic that comply with the current energy code (2013) requirements for ducting.	2/25/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-015 Direct Current as an Integrating and Enabling Platform	No	Demand-side Management	$1,000,000	$1,000,000	$1,000,000	N/A
EPC-14-016 Cost- and Energy-Efficient Attic Designs for California Homes	No	Demand-side Management	$1,000,000	$1,000,000	$774,029	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-015 Direct Current as an Integrating and Enabling Platform	$1,000,000	$495,365	$0	EMerge Alliance; California LMCC IBEW-NECA	$100,000	9.1%
EPC-14-016 Cost- and Energy-Efficient Attic Designs for California Homes	$774,029	$228,148	$0	Owens Corning	$265,000	20.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-015 Direct Current as an Integrating and Enabling Platform	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-015 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	Lawrence Berkeley National Laboratory
EPC-14-016 Cost- and Energy-Efficient Attic Designs for California Homes	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-016 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	BIRA Energy

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-015 Direct Current as an Integrating and Enabling Platform	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-14-016 Cost- and Energy-Efficient Attic Designs for California Homes	Group 3: Ranked # 2	N/A	N/A	Yes; Small Business, Micro Business, Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-015 Direct Current as an Integrating and Enabling Platform	The potential energy savings and interoperability advantages of DC and AC-DC hybrid systems are estimated to be significant, especially for zero net energy (ZNE) buildings that integrate on-site renewable energy with battery storage and electric vehicle (EV) charging. Prior research estimates energy savings potential of 10% to 30% for DC-powered ZNE buildings that incorporate storage and or EV charging. This project will help accelerate the adoption of DC and AC-DC hybrid applications by compiling existing knowledge, identifying standards and technology gaps, designing tools and identifying a path forward to help ensure successful outcomes for DC and AC-DC hybrid applications in key market segments from which these systems can scale.	1f, 1h	The project is complete. Results indicate that no technology breakthroughs are needed to make DC power distribution a viable option for zero net energy buildings. There are, however, many barriers to the adoption of DC power, with product availability and cost as the most significant ones. There also is a general unfamiliarity with DC power in the building community, from designers to code officials, contractors, tradespeople, maintenance staff, building owners, occupants, and policy makers. The recipient indicates that there is a real need for DC power market development in the form of product standards, building and fire codes that explicitly account for DC systems, DC specific design practices, improved trade familiarity, and a wider variety of DC ready products in a range of product categories, feature sets and capacities. The final report will be published in January 2019.
EPC-14-016 Cost- and Energy-Efficient Attic Designs for California Homes	Methods to improve the efficiency of building envelopes have included sealed, insulated attics as well as standard vented attics but are in limited use in the market today. However, these approaches add considerable cost to builders under current practices. The research team is employing new and novel installation methods and materials, which include low cost fiberglass insulation with boxed netting and integral vapor retarder, that have the potential for energy savings on par with ducts in the conditioned space, but at a cost similar to current construction practices.	1f, 1h, 4a	The recipient instrumented three existing homes in the City of Rio Vista with the following attic approaches: Vented with R-38 on the ceiling, Sealed with box netted R-38 under roof deck, and vented with R-38 on the ceiling and R-19 under roof deck. The monitoring started in August 2018. Unfortunately, the grant expired on June 30, 2018. The Energy Commission staff and the recipient are exploring options for obtaining the monitored data and results for the homes and concluding the project.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-017 Developing Flexible, Networked Lighting Control Systems That Reliably Save Energy	Applied Research and Development	The recipient is developing low-cost lighting components with open communication interfaces, that allow seamless integration into whole-building control and automation systems. The project targets future California Building Energy Efficiency Standards (Title 24), and establish methods by which the site-specific configuration and operation of networked lighting controls systems can be effectively addressed, and more easily implemented in the marketplace.	2/25/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-019 Validated and Transparent Energy Storage Valuation and Optimization Tool	Applied Research and Development	This project developed, tested, and validated a publicly available computer model for the CPUC's energy storage use cases that determines the most optimal energy storage systems. This software model successfully assesses costs and benefits and guides energy storage projects with respect to location, size, and type. The software is publicly released as a cloud-hosted tool.	3/11/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-017 Developing Flexible, Networked Lighting Control Systems That Reliably Save Energy	No	Demand-side Management	$1,875,000	$1,875,000	$1,875,000	N/A
EPC-14-019 Validated and Transparent Energy Storage Valuation and Optimization Tool	No	Grid Operations/Market Design	$1,000,000	$1,000,000	$1,000,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-017 Developing Flexible, Networked Lighting Control Systems That Reliably Save Energy	$1,875,000	$216,162	$0	None	$0	0.0%
EPC-14-019 Validated and Transparent Energy Storage Valuation and Optimization Tool	$1,000,000	$482,416	$0	Electric Power Research Institute, Inc.	$901,944	47.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-017 Developing Flexible, Networked Lighting Control Systems That Reliably Save Energy	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-017 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	Lawrence Berkeley National Laboratory
EPC-14-019 Validated and Transparent Energy Storage Valuation and Optimization Tool	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-019 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	35 out of 38 bidders	Electric Power Research Institute, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-017 Developing Flexible, Networked Lighting Control Systems That Reliably Save Energy	Group 1: Ranked # 6	N/A	N/A	Yes; Calif Based Entity
EPC-14-019 Validated and Transparent Energy Storage Valuation and Optimization Tool	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-017 Developing Flexible, Networked Lighting Control Systems That Reliably Save Energy	The research focus is on how low cost sensing and distributed intelligence can enhance energy efficiency and enable distributed points of controls that result in greater energy savings and more accurate energy reporting. The research will result in the design and development of a new innovative desk lamp with localized sensing and user control of overhead ambient lighting. This innovative technology alters the lighting retrofit landscape by inexpensively enabling highly granular lighting control at the occupant's fingertips (previously only zone-level control existed), to control overhead lighting. In addition, this technology can be enhanced with sensors to measure occupants circadian lighting exposure to enable system control to ensure human health and productivity is optimized while maximizing energy efficiency attributes.	1f, 1h, 4a	This project developed a suite of networked lighting solutions to reduce lighting energy use in buildings: a) a low-cost sensing, distributed intelligence and communications platform, the "PermaMote," b) a task ambient daylighting system that integrates sensors with data-driven daylighting control using an open API, c) a new method for evaluating and specifying lighting systems' performance, d) a proposed lighting data model and user interface elements, which contributed to the ANSI Lighting Systems Committee (C137), and e) a metric for capturing the actual energy impact of a lighting system over time. Laboratory validation of the technologies showed significant energy savings, up to 73% for the PermaMote sensor system. These advanced technologies can reduce California commercial-building lighting energy use by 60-80% or about 1,500 GWh/year in savings.
EPC-14-019 Validated and Transparent Energy Storage Valuation and Optimization Tool	This agreement developed a "first of its kind" publically available tool that determines the value of energy storage with respect to location, size, and type.	1c, 1i, 2a, 4a, 5b	The project successfully ended on December 30, 2016, and the final report was published. The final report can be seen at: http://www.energy.ca.gov/2017publications/CEC-500-2017-016/CEC-500-2017-016.pdf. After project was completed, ongoing outreach activities continue. For example, the tool was presented to NYSERDA for testing, and a meeting was held between the CEC and CPUC staff to present the tool's capabilities and its potential adoption for future procurement decisions. Additionally, the California Energy Commission held a public workshop for the purpose of training and obtaining feedback for future refinement of the tool.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-021 Development and Testing of the Next Generation Residential Space Conditioning System for California	Applied Research and Development	This project is designing and testing a residential heat pump space-conditioning system at 3 homes across California. The advanced efficiency solutions integrated into the HVAC system will include: variable-capacity compressor and variable-speed fans using state-of-the-art inverter technology; integrated ventilation to harness fresh air for "free cooling;" intelligent dual-fuel technology to decrease energy cost and empower consumers to choose between electricity and natural gas; zonal control to prevent conditioning of unoccupied rooms; demand-response interactivity to grid flexibility and reliability; advanced fault detection and diagnostics to ensure proper installation, operation, and maintenance; and alternative refrigerants for improved operation and significant reductions in the potential for global warming.	4/8/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-022 The Lakeview Farms Dairy Biogas - To - Electricity Project	Technology Demonstration and Deployment	ABEC #3 LLC, DBA Lakeview Farms Dairy Biogas is installing and demonstrating an innovative covered lagoon digester system that will process dairy manure into biogas to generate renewable electricity for export to the electricity distribution grid. This particular project is located near 11 other dairies and will help launch the state's first "hub-and-spoke" dairy digester cluster by preparing the 1 MW generator platform to accept 2 MWs of future capacity, potentially utilizing biogas from neighboring dairies and providing a means to off-take gas for vehicle fuel use. This hub and spoke approach was initially proposed in a case study prepared for the USDA on the economic feasibility of dairy digester clusters in California. The idea is to allow the dairies to benefit from the aggregation of capital investment and reduce operation and management costs by centrally locating the generators and associated electrical equipment.	3/11/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-021 Development and Testing of the Next Generation Residential Space Conditioning System for California	No	Demand-side Management	$2,993,005	$2,993,005	$2,981,202	N/A
EPC-14-022 The Lakeview Farms Dairy Biogas - To - Electricity Project	No	Generation	$4,000,000	$4,000,000	$3,951,593	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-021 Development and Testing of the Next Generation Residential Space Conditioning System for California	$2,981,202	$1,072,105	$0	Electric Power Research Institute, Inc.	$322,281	9.7%
EPC-14-022 The Lakeview Farms Dairy Biogas - To - Electricity Project	$3,951,593	$29,498	$2,000,000	ABEC #3 LLC, dba Lakeview Farms Dairy Biogas	$4,500,000	52.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-021 Development and Testing of the Next Generation Residential Space Conditioning System for California	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-021 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	Electric Power Research Institute, Inc.
EPC-14-022 The Lakeview Farms Dairy Biogas - To - Electricity Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-022 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 23 bidders	ABEC #3 LLC, dba Lakeview Farms Dairy Biogas

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-021 Development and Testing of the Next Generation Residential Space Conditioning System for California	Group 1: Ranked # 8	N/A	N/A	Yes; Calif Based Entity
EPC-14-022 The Lakeview Farms Dairy Biogas - To - Electricity Project	Group 3: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-021 Development and Testing of the Next Generation Residential Space Conditioning System for California	This project developed a climate optimized HVAC system that includes advanced energy efficiency features integrated into a single unit. The technology could reduce electricity use, demand and costs, enhance occupant comfort, and allow the use of alternative refrigerants that reduce the potential for global warming.	1e, 1f, 1g, 1h, 4a	The project has been completed. The recipient developed a residential space conditioning system that integrates advanced HVAC technologies including: a variable capacity compressor and blower, automated demand response, fault detection and diagnostics, intelligent dual fuel heating, integrated ventilation, and zonal control. An alternative refrigerant, R-32, was evaluated as a possible future enhancement. An assessment was performed on duct losses for single versus multi-zone duct configurations with variable capacity equipment. The report find that the system could potentially save 22-32% of cooling energy compared to a 14 SEER single speed system, as well as satisfying over 90% of annual heating load for most of California without electrical or natural gas back-up. Daikin/Goodman, the product's manufacturer, will take the project results to consider iterations of their future products.
EPC-14-022 The Lakeview Farms Dairy Biogas - To - Electricity Project	The project will significantly reduce methane emissions and generate renewable electricity, helping to achieve the state's greenhouse gas emission reductions and renewable electricity goals. Demonstrating the effectiveness of the innovative hub and spoke model could lead to the development of more California dairy digester biogas-to-electricity and biogas-to-fuels projects. The improved digester design will decrease dairy operating costs and provide valuable co-products, such as nutrient-rich irrigation water.	3a, 4a, 4e	The project broke ground in fall 2016 and construction was completed. The project accepted a PG&E 20-year Power Purchase Agreement and began testing in the fourth quarter 2017, with full operation and data collection commencing in the first quarter of 2018. A ribbon-cutting event was held in February 2018. The project has been operating and has collected operational data for one year. Electrical production from the digester exceeded expected production during 2018. Annual electrical production was more than 1,500 kilowatt-hours per milk cow equivalent. The project was completed in March 2019.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-023 Utility Demonstration of Znyth Battery Technology to Characterize Performance and Grid Benefits	Applied Research and Development	The purpose of this agreement is to further develop an emerging energy storage technology, a zinc hybrid cathode battery (Znyth), and evaluate the performance of this technology for distribution-connected applications in partnership with a utility. The test results of this grant are important to confirm the safety and performance of the system when grid connected.	4/8/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-024 Modular Biomass Power Systems to Facilitate Forest Fuel Reduction Treatment	Applied Research and Development	This project develops and tests a modular biomass gasification system that can be rapidly deployed to communities across California to promote and support fire-safe management activities.	3/11/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-023 Utility Demonstration of Znyth Battery Technology to Characterize Performance and Grid Benefits	No	Distribution	$2,156,704	$2,156,704	$1,927,382	N/A
EPC-14-024 Modular Biomass Power Systems to Facilitate Forest Fuel Reduction Treatment	No	Generation	$2,000,000	$2,000,000	$1,944,894	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-023 Utility Demonstration of Znyth Battery Technology to Characterize Performance and Grid Benefits	$1,927,382	$691,504	$0	Electric Power Research Institute, Inc.; Eos Energy Storage, LLC	$1,167,607	35.1%
EPC-14-024 Modular Biomass Power Systems to Facilitate Forest Fuel Reduction Treatment	$1,944,894	$330,466	$1,200,001	TSS Consultants; West Biofuels, LLC ; Christiana Darlington; Soper-Wheeler Co. LLC	$730,148	26.7%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-023 Utility Demonstration of Znyth Battery Technology to Characterize Performance and Grid Benefits	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-023 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	35 out of 38 bidders	Eos Energy Storage, LLC
EPC-14-024 Modular Biomass Power Systems to Facilitate Forest Fuel Reduction Treatment	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-024 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25 out of 27 bidders	West Biofuels, LLC

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-023 Utility Demonstration of Znyth Battery Technology to Characterize Performance and Grid Benefits	Group 2: Ranked # 1	N/A	N/A	None
EPC-14-024 Modular Biomass Power Systems to Facilitate Forest Fuel Reduction Treatment	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-023 Utility Demonstration of Znyth Battery Technology to Characterize Performance and Grid Benefits	Eos is the only company offering a zinc hybrid cathode battery. This is an aqueous, zinc-based battery technology that is inherently safer than competing technologies. This technology is non-flammable and non-toxic. In addition to being backed by UL- and ISO-certified quality assurance and control, the manufacturing process involves no toxic or hazardous materials. This demonstration provides information and data to assess the value and cost savings of utility-scale battery energy storage when interconnected to the grid.	1c, 1i, 2a, 4a, 5b	Following decommissioning of the system at PG&E, Eos installed a 100kW/300kWh system utilizing the subsequent generation of battery technology at SDG&E's Pala Energy Storage Yard. The system achieved full commissioning completion and began daily automatic charge, discharge, and data collection on June 24, 2020. The system was tested primarily in the peak shifting use case: charging in the morning and discharging during the late afternoon peak demand period. The system also responded to four CAISO Flex Alerts for available energy capacity during the rolling blackouts in the week of August 17th, being dispatched without interruption for cycles lasting 3, 4, and 5 hours. The system was decommissioned on October 23 after 75 successful charge-discharge cycles.
EPC-14-024 Modular Biomass Power Systems to Facilitate Forest Fuel Reduction Treatment	This project is driving innovation in the bioenergy market for forest residue conversion to renewable grid power by advancing the modular gasification technology system design and integration with a high-efficiency lean-burn engine. The modular system has the potential to reduce the cost and increase the benefits of forest fuel reduction projects in high fire risk regions of the state. The project sought a technological solution to support California goals including healthy forest management, protection of electricity infrastructure, and production of renewable electricity.	1a, 1c, 4a	The project yielded important results that did not support the initial hypothesis that the recipient's CircleDraft gasification system was appropriate for the California market. However, the project did result in the development of a more robust modular system (rotary gasifier integrated to an Organic Ranking cycle (ORC) generator) that addressed critical technical challenges experienced with the initial system including material flow issues associated with forest material, associated producer gas output and quality fluctuations, and high engine generator maintenance requirements. Based on testing done with match funds, the rotary gasifier + ORC generator configuration is ready for a commercial technology demonstration in a California forest sector community.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-025 Mass-manufactured, Air Driven Trackers for Low Cost, High Performance Photovoltaic Systems	Applied Research and Development	The project aimed to install and test a 300 kW photovoltaic solar system with air-driven trackers. Two key technical innovations were demonstrated. First, the use of mass-manufacturing for the drive system results in an extremely low cost structure and very low part count. Second, only tubing is connected to each actuator, removing requirements for outdoor wiring or individual control hardware. The research involved collecting six months of performance data for the solar PV tracking technology.	3/11/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-026 Examining the Heterogeneity of Energy Efficiency Adoption and Savings Across Socio-Economic and Ethnic Groups Using a Large Scale Quasi-Experiment	Market Facilitation	This project conducted a quasi-experimental, econometric study of energy efficiency adoption and energy savings with a focus on differences between social, cultural, and socio-economic groups. The study applied modern economic methods to Southern California Edison's Quality Installation Program, including regression-discontinuity and propensity score matching. The large data sets and rigorous methods resulted in estimates to improve demand forecasts, energy efficiency program design, and future energy studies concerning social, cultural, and socioeconomic groups.	4/8/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-025 Mass-manufactured, Air Driven Trackers for Low Cost, High Performance Photovoltaic Systems	No	Generation	$1,000,000	$1,000,000	$989,116	N/A
EPC-14-026 Examining the Heterogeneity of Energy Efficiency Adoption and Savings Across Socio-Economic and Ethnic Groups Using a Large Scale Quasi-Experiment	No	Demand-side Management	$360,632	$360,632	$360,584	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-025 Mass-manufactured, Air Driven Trackers for Low Cost, High Performance Photovoltaic Systems	$989,116	$157,497	$0	PV Evolution Labs; Sunfolding, Inc.	$1,171,565	54.0%
EPC-14-026 Examining the Heterogeneity of Energy Efficiency Adoption and Savings Across Socio-Economic and Ethnic Groups Using a Large Scale Quasi-Experiment	$360,584	$65,406	$0	The Regents of the University of California, Berkeley Campus	$150,784	29.5%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-025 Mass-manufactured, Air Driven Trackers for Low Cost, High Performance Photovoltaic Systems	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-025 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25 out of 27 bidders	Sunfolding Inc.
EPC-14-026 Examining the Heterogeneity of Energy Efficiency Adoption and Savings Across Socio-Economic and Ethnic Groups Using a Large Scale Quasi-Experiment	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-026 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12 out of 12 bidders	The Regents of the University of California, Berkeley Campus

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-025 Mass-manufactured, Air Driven Trackers for Low Cost, High Performance Photovoltaic Systems	Group 4: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-14-026 Examining the Heterogeneity of Energy Efficiency Adoption and Savings Across Socio-Economic and Ethnic Groups Using a Large Scale Quasi-Experiment	Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-025 Mass-manufactured, Air Driven Trackers for Low Cost, High Performance Photovoltaic Systems	The PV solar tracking technology tested and validated in this project will result in ratepayer benefits of reduced cost of energy and increased energy supply reliability. The air-driven trackers not only reduce the direct product cost to the customers, but also simplify every step in the project lifecycle (i.e., development, construction, and operation). The reduced cost of energy will be achieved by the innovative solar tracking technology that adds 15-25% more power over fixed tilt systems at a cost that is well below the cost of current solar trackers. The increases in energy supply reliability will be achieved by delivering additional power that occurs in the late afternoon to the grid.	2a, 3b, 4a	The project team successfully installed and tested the 300kW PV tracking system in the field. The site was instrumented with sensors, cameras, and data collection equipment. The team installed distributed position sensors to gather temporal positioning and providing tracker consistency data, high accuracy air pressure sensors to assess pneumatic performance, and a video monitoring system to enable remote visual monitoring. The team collected data for more than six months and concluded that the system exceeded expectations in tracker performance, accuracy, and uptime. The team developed several generations of the actuator over the life of the project, which did not experience component failures during the demonstration activities. EPIC funding was critical to advancing Sunfolding's commercialization efforts, allowing to build a track record and establish reliability and bankability.
EPC-14-026 Examining the Heterogeneity of Energy Efficiency Adoption and Savings Across Socio-Economic and Ethnic Groups Using a Large Scale Quasi-Experiment	Senate Bill 350 (De Leon, 2015) set energy efficiency targets for 2030 and allowed for the targets to be achieved, in part, from utility programs that provide financial incentives and rebates to their customers to increase energy efficiency. This project team recommended designing future residential energy efficiency programs that target low-income customers in hot climate zones, and account for time-of-use rates in California. Key findings that led to these recommendations were that hot climate zone was a huge factor in getting customers to participate in this HVAC program, low-income households experienced greater savings because existing household appliances were usually less efficient and more noticeably improved, and that energy savings, due to participating in the program, were the greatest between the hours of 3-9 pm in the months of August and September due to peak demand rates.	2a, 5c	The project team submitted its Final Report in March 2017, and had its final meeting in July 2017. Project findings suggest that: climate is the strongest variable for customer participation in t SCE's Quality Installation Program (participants in hot areas saved ~1100 kWh annually, compared to 300 kWh in warm areas and 0 in mild areas), savings were higher for lower income homes than for high income homes but lower income homes participated less frequently, the most significant hours for achieving energy savings were shown to be 3-9 pm, and that future energy efficiency programs should be focused on increasing participation of low-income homes in hot areas.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-027 High Temperature Hybrid Compressed Air Energy Storage (HTH-CAES)	Applied Research and Development	This project designed a low-cost 74kW pilot High Temperature Hybrid Compressed Air Energy Storage (HTH-CAES) system that can efficiently store grid-level energy and release that energy when it is needed to meet peak demand, particularly for ancillary services and load following use-cases. This project documented and reported on the design, anticipated performance and lessons learned of the HTH-CAES system to increase knowledge and understanding of how these storage systems perform and the barriers to siting and operations.	4/8/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-027 High Temperature Hybrid Compressed Air Energy Storage (HTH-CAES)	No	Distribution	$1,621,628	$1,621,628	$632,754	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-027 High Temperature Hybrid Compressed Air Energy Storage (HTH-CAES)	$632,754	$206,222	$0	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-027 High Temperature Hybrid Compressed Air Energy Storage (HTH-CAES)	Grant	NEW IP TYPE(S): System Patent NEW IP DESCRIPTION: Patent 10,415,431. Low-cost hybrid energy storage system. This invention was made with State of California support under contract number EPC-14-027 awarded by the California Energy Commission. TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-027 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	35 out of 38 bidders	Regents of the University of California, Los Angeles

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-027 High Temperature Hybrid Compressed Air Energy Storage (HTH-CAES)	Group 2: Ranked # 3	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-027 High Temperature Hybrid Compressed Air Energy Storage (HTH-CAES)	Compressed air energy storage may be a viable solution for long-term and large-scale storage applications. HTH-CAES potentially has lower capital and maintenance cost and less geographic restrictions than other storage technologies. In the HTH-CAES technology, compressors are used to convert inexpensive off-peak electric power into compressed air and thermal reservoirs.	1c, 1i, 2a, 4a, 5b	The design of a 74kW HTH-CAES system was completed and is ready for a future demonstration. The final report includes a description of the piping and instrumentation, the mechanical/thermal design of the energy storage, and the completed 3D layout of the plant. All major components for construction were purchased, several patents were developed and journal articles were published. The final report is being prepared for publishing on the Commission website.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-028 Low Cost Biogas Power Generation with Increased Efficiency and Lower Emissions	Applied Research and Development	This project deployed a pre-commercial technology demonstrating a sorbent-based biogas purification process for combined heat and power generation at the pilot scale that removes multiple troublesome impurities from biogas, upgrading the fuel to near-pure methane for combustion in conventional prime movers. The pilot plant was installed and tested at a landfill site to demonstrate the environmental and cost benefits of biogas purification prior to use in combined heat and power applications.	3/11/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-029 The West Star North Dairy Biogas-to - Electricity Project	Technology Demonstration and Deployment	This project advances digester design by building and demonstrating an innovative, double-cell covered lagoon digester and 1-megawatt (MW) generation system. The system will convert dairy manure into biogas and store the biogas above the primary and secondary lagoons under an inflatable cover. The biogas will be converted into renewable electricity and sold for export to the PG&E distribution grid. Further, dairy biogas systems qualify for participation in the CPUC's Assembly Bill (AB) 2514 electricity storage program. In a future phase, the biogas system may compete for an energy storage contract. The project will also improve groundwater protection by minimizing leaching of manure into the groundwater.	3/11/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-028 Low Cost Biogas Power Generation with Increased Efficiency and Lower Emissions	No	Generation	$1,318,940	$1,318,940	$1,236,591	N/A
EPC-14-029 The West Star North Dairy Biogas-to - Electricity Project	No	Generation	$4,000,000	$4,000,000	$3,998,164	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-028 Low Cost Biogas Power Generation with Increased Efficiency and Lower Emissions	$1,236,591	$105,570	$0	ES Engineering, Inc. formerly Environ Strategy Consultants, Inc.; Waste Management of California, Inc; InnoSepra, LLC	$959,150	42.1%
EPC-14-029 The West Star North Dairy Biogas-to - Electricity Project	$3,998,164	$32,107	$0	ABEC #2 LLC, dba West Star North Dairy Biogas	$5,000,000	55.6%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-028 Low Cost Biogas Power Generation with Increased Efficiency and Lower Emissions	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-028 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25 out of 27 bidders	InnoSepra, LLC
EPC-14-029 The West Star North Dairy Biogas-to - Electricity Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-029 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 23 bidders	ABEC #2 LLC, dba West Star North Dairy Biogas

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-028 Low Cost Biogas Power Generation with Increased Efficiency and Lower Emissions	Group 2: Ranked # 4	N/A	N/A	Yes; Calif Based Entity
EPC-14-029 The West Star North Dairy Biogas-to - Electricity Project	Group 3: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-028 Low Cost Biogas Power Generation with Increased Efficiency and Lower Emissions	The project is advancing an innovative gas clean-up system based on a temperature swing adsorption concept that adsorbs carbon dioxide and other contaminants while letting methane pass through and that regenerates the adsorbent bed, resulting in lower cost of operation. Converting biogas to high purity biomethane enables its use in premium efficient devices for power generation, thereby helping reduce the cost of electricity. This technological approach will help meet renewable electricity goals at a lower cost and will enable use of marginal biogas sources for power generation applications using conventional natural-gas fired prime movers.	1a, 1b, 3g, 4a, 4b	InnoSepra's gas conditioning system was upgraded and delivered to the Simi Valley landfill in September, 2018. The system has been functioning as designed, and the project team has focused on accumulating hours of operation. InnoSepra was unable to make a second deployment at a digester site due to time constraints. The outcome at the landfill site shows that the absorption process is capable of upgrading landfill gas with up to 200 ppm hydrogen sulphide to renewable natural gas. Economic modeling suggests that the temperature swing regeneration will reduce process power consumption by 50%, resulting in significant cost reduction compared to alternative processes (amine absorption, membranes, pressure-swing absorption).
EPC-14-029 The West Star North Dairy Biogas-to - Electricity Project	This project demonstrates an improved digester design with a double cell lagoon for greater biogas storage and on-demand generation potential and, if successfully scaled up, establishes dairies as competitors for storage contracts. The improved system will decrease dairy and digester operating costs while also enhancing the protection of groundwater. Other important benefits include: lowered manure handling costs and valuable co-products, such as nutrient-rich irrigation water.	3a, 4a, 4e	The project broke ground in fall 2016 and construction is complete. The project accepted a 20-year PG&E BioMAT Power Purchase Agreement and is collecting data, with full operation commencing in the first quarter of 2018. The project has collected operational data for a full year. The data collection system built into this digester and engine-generator system will be valuable in operating the digester technology. The project was completed in March, 2019.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-030 Paths to Sustainable Distributed Generation Through 2050: Matching Local Waste Biomass Resources with Grid, Industrial, and Community Levels	Applied Research and Development	This project highlights locations where waste biomass can be used most efficiently and sustainably for distributed generation by developing scenarios through 2050 that identify the most promising opportunities for waste biomass distributed generation (DG), identifying key technical and regulatory hurdles to waste biomass DG utilization, developing tools for matching available waste biomass resources with energy production opportunities, and suggesting solutions for achieving cost parity with fossil fuels.	3/11/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-031 Pollution Control and Power Generation for Low Quality Renewable Fuel Streams	Technology Demonstration and Deployment	The project proposed to use a 250 kW gas turbine system that converts relatively dirty, low heating value fuels into heat using gradual oxidation. This gradual oxidation technology was developed by Ener-Core, a California company, and has been demonstrated in operating systems for well over 500 hours, but has not yet been commercially deployed in California. The site for the demonstration was a closed landfill producing low quality gas that was flared. This site was a good match for the 250 kW demonstration as it eliminated the need for flaring of the otherwise unusable gas while generating electricity. However, due to issues with the major subcontractor and technology provider Ener-Core, the project scope was not completed by the end of the agreement term.	4/8/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-030 Paths to Sustainable Distributed Generation Through 2050: Matching Local Waste Biomass Resources with Grid, Industrial, and Community Levels	No	Generation	$1,500,000	$1,500,000	$1,500,000	N/A
EPC-14-031 Pollution Control and Power Generation for Low Quality Renewable Fuel Streams	No	Generation	$1,499,386	$1,499,386	$1,020,425	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-030 Paths to Sustainable Distributed Generation Through 2050: Matching Local Waste Biomass Resources with Grid, Industrial, and Community Levels	$1,500,000	$670,276	$900,000	Energy Bioscience Institute; Allotrope Partners; PepsiCo RD&D	$282,000	15.8%
EPC-14-031 Pollution Control and Power Generation for Low Quality Renewable Fuel Streams	$1,020,425	$145,560	$0	Advanced Power and Energy Program (APEP) - University of California, Irvine; ES Engineering, Inc. formerly Environ Strategy Consultants, Inc.; Ener-Core, Inc.	$438,345	22.6%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-030 Paths to Sustainable Distributed Generation Through 2050: Matching Local Waste Biomass Resources with Grid, Industrial, and Community Levels	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-030 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25 out of 27 bidders	Lawrence Berkeley National Laboratory
EPC-14-031 Pollution Control and Power Generation for Low Quality Renewable Fuel Streams	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-031 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 23 bidders	University of California, Irvine

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-030 Paths to Sustainable Distributed Generation Through 2050: Matching Local Waste Biomass Resources with Grid, Industrial, and Community Levels	Group 2: Ranked # 3	N/A	N/A	Yes; Calif Based Entity
EPC-14-031 Pollution Control and Power Generation for Low Quality Renewable Fuel Streams	Group 1: Ranked # 1	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-030 Paths to Sustainable Distributed Generation Through 2050: Matching Local Waste Biomass Resources with Grid, Industrial, and Community Levels	This analysis (1) identifies high-priority areas within California and feedstock types for further public deployment funding, (2) highlights promising geographic areas or available technologies to encourage increased investment in waste biomass DG by the private sector, and (3) improves efficiency and reduces environmental burdens by helping to minimize biomass transportation distances and maximize the efficiency of power production and waste heat utilization.	3c, 4a	The project team developed 2020 (near-term) and 2050 (long-term) scenario projections for waste biomass supply in California. They also developed a county-level monthly wet and dry California biomass inventory and assessed the energy generation potential from food waste in California. The team has estimated energy demand density and identified areas with district heating and cooling potential by using a building stock turnover model along with energy use intensity factors. The project developed a biositing tool for evaluation of potential waste-to-energy sites based on resource availability, potential for waste heat use, and economic and environmental metrics. The project was completed in March, 2019. The information is available, e.g. biositing is a web-based tool, and is planned to be used by various biomass associations, project developers and other stakeholders.
EPC-14-031 Pollution Control and Power Generation for Low Quality Renewable Fuel Streams	If the project was successful, it would have demonstrated and deployed a novel gradual oxidation system in conjunction with a gas turbine that is capable of converting low-grade, and otherwise unusable, landfill biogas into renewable electricity.	1a, 1c, 3a, 3h, 4a, 4b	Site engineering, drawings, and permitting requirements were completed in early 2016. An interconnection study with two supplemental reviews was completed by Southern California Edison in late 2016. The study identified the need for substation upgrades and an interconnection cost which far exceeded the budgeted amount. Consequently, the project sought a new landfill host site to demonstrate the novel gradual oxidation technology. A new site (with an existing interconnection agreement) was found and confirmed in mid-2017. However, the equipment installation continued to be delayed due to issues with a major subcontractor and the equipment developer, Ener-Core. In December 2018, CEC staff learned that due to funding issues, Ener-Core was not able to move forward with the project. A stop work order was issued in December 2018 and the project term ended with an unfulfilled scope.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-032 Capturing Cultural Diversity in California Residential Energy Efficiency Potential: An Energy Ethnography of Hispanic Households	Market Facilitation	This project focused on reaching Hispanic subpopulations in California to better understand the social, cultural, and behavioral aspects of their decisions to adopt energy efficient technologies and behaviors. The study combined data collected from participants via energy usage journals, in-home interviews, and energy meters to further the knowledge of Hispanic cultural associations and beliefs related to energy use decisions and choices. The information gathered in this study can be used to improve the metrics and assumptions underlying energy demand forecasting and energy efficiency potential and goals studies. In addition, the study provided information that can be used for targeted marketing of energy efficiency programs to the Hispanic population and improved levels of service to these households.	4/8/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-033 ** North Fork Community Power Forest Bioenergy Facility Demonstration	Technology Demonstration and Deployment	The goal of the North Fork Forest Bioenergy project is to demonstrate a 1-megawatt (MW) forest waste bioenergy gasification-to-electricity facility. The biomass gasification facility is targeted to be a commercial-scale, community-based facility capable of accepting and processing wood waste from forest management that would otherwise create wildfire and air quality challenges, and generating renewable grid-connected electricity. Once the gasification is fully installed and operational, the project team will investigate critical performance parameters and evaluate individual components and protocols to improve performance and reduce operating costs.	4/8/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-032 Capturing Cultural Diversity in California Residential Energy Efficiency Potential: An Energy Ethnography of Hispanic Households	No	Demand-side Management	$224,593	$224,593	$224,370	N/A
EPC-14-033 ** North Fork Community Power Forest Bioenergy Facility Demonstration	No	Generation	$3,225,773	$3,225,773	$3,225,773	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-032 Capturing Cultural Diversity in California Residential Energy Efficiency Potential: An Energy Ethnography of Hispanic Households	$224,370	$10,681	$0	None	$0	0.0%
EPC-14-033 ** North Fork Community Power Forest Bioenergy Facility Demonstration	$3,225,773	$87,680	$0	TSS Consultants; The Watershed Research and Training Center; North Fork Community Development Council; Phoenix Energy; Yosemite Sequoia Resource Conservation and Development Council; Penn Power Group, LLC d/b/a Western Energy Systems; USDA Forest Service - Sierra National Forest; Kamalesh Doshi	$1,361,360	21.5%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-032 Capturing Cultural Diversity in California Residential Energy Efficiency Potential: An Energy Ethnography of Hispanic Households	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-032 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12 out of 12 bidders	Inova Energy Group, LLC
EPC-14-033 ** North Fork Community Power Forest Bioenergy Facility Demonstration	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-033 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 23 bidders	The Watershed Research and Training Center

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-032 Capturing Cultural Diversity in California Residential Energy Efficiency Potential: An Energy Ethnography of Hispanic Households	Ranked # 3	N/A	N/A	Yes; Calif Based Entity
EPC-14-033 ** North Fork Community Power Forest Bioenergy Facility Demonstration	Group 4: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-032 Capturing Cultural Diversity in California Residential Energy Efficiency Potential: An Energy Ethnography of Hispanic Households	Senate Bill 350 (De Leon, 2015) sets energy efficiency targets for 2030 and allows for the targets to be achieved, in part, from utility programs that provide financial incentives and rebates to their customers to increase energy efficiency. This project will help increase customer participation in utility efficiency programs by better understanding the social, cultural and behavior aspects of the Hispanic subpopulation that discourage or prevent their participation.	1f, 1h, 5c	This project was completed in 2018. Key findings show that participants' energy-related behaviors were heavily influenced by family and community. For example, extended family members living under the same roof lead to variances in energy behaviors. Subtler implications include the use of energy to prioritize comfort for elderly family members. The study also found that participants did not tend to focus on the technical capabilities of energy-efficiency equipment or home envelope improvements, instead the focus was on behavior. For example, participants reported manually turning on and off their air conditioners rather than relying on the thermostat. The results of this project have been shared with IOU energy efficiency program managers and community based organizations to help increase Hispanic participation in energy efficiency programs.
EPC-14-033 ** North Fork Community Power Forest Bioenergy Facility Demonstration	This commercial-ready gasification technology has not been previously demonstrated in California. Combined with the producer gas cleanup system, automation and control, and optimized operation, this innovative system will prove distributed, woody biomass-fueled electricity to be economically feasible and capable of operating for 7,000 hours a year. The project will be grid-connected and will provide immediate benefits, including increased renewable generation capacity, expanded technical resources, and community environmental, wildfire, and economic development benefits.	1a, 1c, 2a	The project obtained financing which includes Green Bond financing for a total of $10.4M in tax-exempt bonds and $4.7M in taxable bonds, a CalFIRE loan of $1.2M and equity investment of $2.2M from the gasifier company EQTEC. The project has also obtained a PPA with PG&E. Equipment from GE was delivered to the site but was never installed because GE withdrew from its gasifier business and decided not to move forward. Phoenix Energy has since been working with EQTEC; the replacement equipment are being prepared at an EQTEC site and in process for delivery. While site preparations in North Fork have resumed, the project activities were also slowed down by the effects of the covid-19 pandemic.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-14-033 ** North Fork Community Power Forest Bioenergy Facility Demonstration	Technology Demonstration and Deployment	The goal of the North Fork Forest Bioenergy project is to demonstrate a 1-megawatt (MW) forest waste bioenergy gasification-to-electricity facility. The biomass gasification facility is targeted to be a commercial-scale, community-based facility capable of accepting and processing wood waste from forest management that would otherwise create wildfire and air quality challenges, and generating renewable grid-connected electricity. Once the gasification is fully installed and operational, the project team will investigate critical performance parameters and evaluate individual components and protocols to improve performance and reduce operating costs.	4/8/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-034 Interra Reciprocating Reactor for Low-Cost & Carbon Negative Bioenergy	Applied Research and Development	The purpose of this was to install and demonstrate an advanced modular bioenergy technology. The pilot-scale demonstration was intended to help determine if the performance of the technology, along with biomass co-product value creation enhancement strategy, was sufficiently powerful to overcome the affordability burdens that currently block the feasibility of distributed generation bioenergy projects in California.	4/8/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-033 ** North Fork Community Power Forest Bioenergy Facility Demonstration	No	Generation	$1,739,647	$1,739,647	$479,749	N/A
EPC-14-034 Interra Reciprocating Reactor for Low-Cost & Carbon Negative Bioenergy	No	Generation	$2,000,000	$2,000,000	$1,353,332	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-033 ** North Fork Community Power Forest Bioenergy Facility Demonstration	$479,749	$0	$0	TSS Consultants; The Watershed Research and Training Center; North Fork Community Development Council; Phoenix Energy; Yosemite Sequoia Resource Conservation and Development Council; Penn Power Group, LLC d/b/a Western Energy Systems; USDA Forest Service - Sierra National Forest; Kamalesh Doshi	$0	0.0%
EPC-14-034 Interra Reciprocating Reactor for Low-Cost & Carbon Negative Bioenergy	$1,353,332	$264,400	$0	Interra Energy, Inc.	$4,627,400	69.8%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-033 ** North Fork Community Power Forest Bioenergy Facility Demonstration	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-033 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 23 bidders	The Watershed Research and Training Center
EPC-14-034 Interra Reciprocating Reactor for Low-Cost & Carbon Negative Bioenergy	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-034 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25 out of 27 bidders	Interra Energy, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-033 ** North Fork Community Power Forest Bioenergy Facility Demonstration	Group 4: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-14-034 Interra Reciprocating Reactor for Low-Cost & Carbon Negative Bioenergy	Group 1: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-033 ** North Fork Community Power Forest Bioenergy Facility Demonstration	This commercial-ready gasification technology has not been previously demonstrated in California. Combined with the producer gas cleanup system, automation and control, and optimized operation, this innovative system will prove distributed, woody biomass-fueled electricity to be economically feasible and capable of operating for 7,000 hours a year. The project will be grid-connected and will provide immediate benefits, including increased renewable generation capacity, expanded technical resources, and community environmental, wildfire, and economic development benefits.	1a, 1c, 2a	The project obtained financing which includes Green Bond financing for a total of $10.4M in tax-exempt bonds and $4.7M in taxable bonds, a CalFIRE loan of $1.2M and equity investment of $2.2M from the gasifier company EQTEC. The project has also obtained a PPA with PG&E. Equipment from GE was delivered to the site but was never installed because GE withdrew from its gasifier business and decided not to move forward. Phoenix Energy has since been working with EQTEC; the replacement equipment are being prepared at an EQTEC site and in process for delivery. While site preparations in North Fork have resumed, the project activities were also slowed down by the effects of the covid-19 pandemic.
EPC-14-034 Interra Reciprocating Reactor for Low-Cost & Carbon Negative Bioenergy	If successful, this project could help stabilize the grid, improve service reliability, and reduce the risk of forest fire. Advanced bioenergy systems that produce useful co-products can also reduce the cost of renewable energy procurement and mitigate the GHG impacts of energy generation.	1c, 4a, 4b	The project faced serious technological challenges and Interra Energy was unable to demonstrate progress towards meeting the project requirements. The Energy Commission determined that results from the bioenergy system are not satisfactory and the interim reports are technically deficient. As a result, the Energy Commission staff terminated the agreement at the August 2017 Business Meeting.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-035 Demonstration of integrated photovoltaic systems and smart inverter functionality utilizing advanced distribution sensors	Applied Research and Development	The project team developed, demonstrated, and evaluated at the LBNL Facility for Low Energy Experiments (FLEXLAB) test bed the ability of a smart inverter controller to enhance and optimize grid support and system performance of an integrated pilot scale of an advanced PV and storage system. The system includes a 14 kilowatt (kW) PV system and 19 kWh of battery storage. The project team evaluated the use of distribution synchrophasor unit data to support specific visualization and control applications on distribution circuits.	4/8/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-036 Smart Inverter Interoperability Standards and Open Testing Framework to Support High-Penetration Distributed Photovoltaics and Storage	Applied Research and Development	The project developed a smart solar PV-based DER system showing a pathway for distributed energy resources to achieve critical mass and enable solutions for California's grid. The work included the development of a CA Rule 21 test framework and test scripts; compliance testing of smart inverters with functionality as described in the CPUC CA Rule 21 Smart Inverter Working Group (SIWG) recommendations; monitor and control inverter operating functions, including participation in ancillary service for diverse DER assets. The project delivered a smart inverter test framework and open-source software tools to enable rapid product development and safety testing and demonstrated the benefits to all stakeholders including ratepayers, utilities, manufacturers, investors and operators.	4/8/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-035 Demonstration of integrated photovoltaic systems and smart inverter functionality utilizing advanced distribution sensors	No	Grid Operations/Market Design	$1,000,000	$1,000,000	$1,000,000	N/A
EPC-14-036 Smart Inverter Interoperability Standards and Open Testing Framework to Support High-Penetration Distributed Photovoltaics and Storage	No	Grid Operations/Market Design	$2,000,000	$2,000,000	$1,992,095	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-035 Demonstration of integrated photovoltaic systems and smart inverter functionality utilizing advanced distribution sensors	$1,000,000	$375,000	$0	Tesla, Inc	$25,000	2.4%
EPC-14-036 Smart Inverter Interoperability Standards and Open Testing Framework to Support High-Penetration Distributed Photovoltaics and Storage	$1,992,095	$162,005	$0	SunSpec Alliance; Kitu Systems	$2,066,875	50.8%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-035 Demonstration of integrated photovoltaic systems and smart inverter functionality utilizing advanced distribution sensors	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-035 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25 out of 27 bidders	Lawrence Berkeley National Laboratory
EPC-14-036 Smart Inverter Interoperability Standards and Open Testing Framework to Support High-Penetration Distributed Photovoltaics and Storage	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-036 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25 out of 27 bidders	SunSpec Alliance

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-035 Demonstration of integrated photovoltaic systems and smart inverter functionality utilizing advanced distribution sensors	Group 4: Ranked # 3	N/A	N/A	Yes; Calif Based Entity
EPC-14-036 Smart Inverter Interoperability Standards and Open Testing Framework to Support High-Penetration Distributed Photovoltaics and Storage	Group 3; Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-035 Demonstration of integrated photovoltaic systems and smart inverter functionality utilizing advanced distribution sensors	The project advanced the state of technology by introducing a smart inverter with an embedded synchrophasor that is scalable across investor-owned utility territory, enabling well-coordinated and managed high-density PV installations. The technology is particularly interesting to PV inverter manufacturers and system integrators of combined PV and battery storage systems. The information delivered by this technology informs inverter settings, in accordance with California Rule 21, with the overall objective to improve the reliability of the electrical grid.	1e, 2a, 3c, 3d, 3f, 4a, 5b	The project team built a central infrastructure and models for power systems study, mitigation strategies and control schemes. This project is pushing the state of the art by developing a new controller architecture based on model predictive control (MPC) methods to provide optimal control of the entire system of battery storage, PV, and the building load, subject to a variety of power constraints, with the objective of minimizing the total energy cost for the customer. The results of this project are multifold and well aligned with the overall objective of enabling large renewable generation on the electrical power grid. The controller was field tested and improved over the course of 3 months. The team published the developed tools and models on four public repositories on GitHub; and presented project findings, and results at two technical conferences.
EPC-14-036 Smart Inverter Interoperability Standards and Open Testing Framework to Support High-Penetration Distributed Photovoltaics and Storage	The project team developed smart inverter testing scripts for CA Rule 21 Phase 1 compliance. Testing proved that smart inverters made by different manufacturers perform CA Rule 21 Phase 1 autonomous functions in a manner consistent with the UL 1741 SA standard, thus increasing interoperability across PV system configurations and expanding customer choice. Project results showed that smart inverters compliant with CA Rule 21 Phase 1 requirements can be installed safely. Knowledge gained from the project informed the development of the Common Smart Inverter Profile that forms the basis of CA Rule 21 Phase 2 compliance.	1b, 3d, 3f, 4a, 5b	The project developed, demonstrated, and evaluated CA Rule 21 Phase 1 and Phase 2 new smart-inverter standards that enable high photovoltaic penetration at penetration levels of 100 percent or more while simultaneously eliminating reverse energy flow and mitigating thermal problems associated with non-smart inverters. Financial analysis of using smart inverters showed annual saving of $640 million to $1.4 billion. The knowledge gained from the project is available to inverter and DER manufacturers, aggregators, end users, utilities, regulatory agencies, and other members of the public via SunSpec Alliance distribution channels including its website, newsletters, educational events, media outreach, and promotional events with the goal of promoting how open communication standards can positively impact the grid.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-037 Home Energy Efficiency Retrofits in California: An Analysis of Sociocultural Factors Influencing Customer Adoption	Market Facilitation	This project conducted a multidisciplinary, data driven study to understand the role and interactions of various factors influencing the adoption and utilization of residential energy efficiency measures. The study provided awareness into the stand alone and interactive effects of factors such as income, ethnicity, language, and political orientation on the adoption of energy efficient technologies, with a primary focus on the Latino population in the Fresno area. Knowledge gained from this study can be used to enhance energy policy and program design to account for social, cultural, and behavioral factors.	4/8/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-038 Fieldwork to Document Technology Adoption and Behavior Change Across Diverse Geographies and Populations to Inform Energy Efficiency Program Design	Market Facilitation	This project uses empirical research methods grounded in anthropology and other social and behavioral sciences to explore the factors affecting behavior beyond simple economic rationale. This practice is achieved by documenting and analyzing emerging attitudes, emotions, experience, habits, and practices around technology adoption for purposes of devising predictive indicators for on-going potential studies regarding energy consumption in California.	4/8/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-037 Home Energy Efficiency Retrofits in California: An Analysis of Sociocultural Factors Influencing Customer Adoption	No	Demand-side Management	$599,924	$599,924	$570,017	N/A
EPC-14-038 Fieldwork to Document Technology Adoption and Behavior Change Across Diverse Geographies and Populations to Inform Energy Efficiency Program Design	No	Demand-side Management	$574,545	$574,545	$573,944	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-037 Home Energy Efficiency Retrofits in California: An Analysis of Sociocultural Factors Influencing Customer Adoption	$570,017	$166,993	$0	Renovate America	$214,000	26.3%
EPC-14-038 Fieldwork to Document Technology Adoption and Behavior Change Across Diverse Geographies and Populations to Inform Energy Efficiency Program Design	$573,944	$40,208	$0	Indicia Consulting; California State University San Marcos	$52,500	8.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-037 Home Energy Efficiency Retrofits in California: An Analysis of Sociocultural Factors Influencing Customer Adoption	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-037 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12 out of 12 bidders	Center for Sustainable Energy
EPC-14-038 Fieldwork to Document Technology Adoption and Behavior Change Across Diverse Geographies and Populations to Inform Energy Efficiency Program Design	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-038 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12 out of 12 bidders	Indicia Consulting

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-037 Home Energy Efficiency Retrofits in California: An Analysis of Sociocultural Factors Influencing Customer Adoption	Ranked # 4	N/A	N/A	Yes; Calif Based Entity
EPC-14-038 Fieldwork to Document Technology Adoption and Behavior Change Across Diverse Geographies and Populations to Inform Energy Efficiency Program Design	Ranked # 5	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-037 Home Energy Efficiency Retrofits in California: An Analysis of Sociocultural Factors Influencing Customer Adoption	Senate Bill 350 (De Leon, 2015) sets energy efficiency targets for 2030 and allows for the targets to be achieved, in part, from utility programs that provide financial incentives and rebates to their customers to increase energy efficiency. This project will help increase customer participation in utility efficiency programs by better understanding the social, cultural and behavior aspects of the Hispanic subpopulation that discourage or prevent their participation.	2a, 5c	CSE's analysis of 704 records sample revealed that using brochures with imagery of modest houses and families that appeared Hispanic (as opposed to imagery of large homes and non-Hispanic, Caucasian families) had a positive impact on sign-up rates in census tracts with a high concentration of Hispanics. Despite this increased number of sign-ups, phone interviews with 30 self-identified Hispanic participants found few had completed or planned major upgrades based on the energy audit recommendations, though minor upgrades like weather-stripping or light bulb replacements were more common. These results highlight the importance of tailoring outreach materials for energy efficiency programs, and the efficiency potential that can be accessed through improved program outreach.
EPC-14-038 Fieldwork to Document Technology Adoption and Behavior Change Across Diverse Geographies and Populations to Inform Energy Efficiency Program Design	Senate Bill 350 (De Leon, 2015) sets energy efficiency targets for 2030 and allows for the targets to be achieved, in part, from utility programs that provide financial incentives and rebates to their customers to increase energy efficiency. This project will help increase customer participation in utility efficiency programs by better understanding the social, cultural and behavior aspects of various subpopulations that discourage or prevent their participation.	1f, 1h, 5c	This project investigated the engagement of households with personal consumer electronics (e.g. smartphones, tablets, laptops) in two utility territories in California. Through extensive analysis of interview data, the research team identified a psycho-social characteristic termed "cybersensitivity". Cybersensitives are people who appear to exhibit a greater emotional connection to their phones, tablets, and other personal technology. The research team found that the sample groups segmented according to differentiated behaviors and attitudes related to engagement with devices and attitudes around electricity consumption and conservation. The research team recommend that utilities and other policy-makers, who are seeking larger energy savings, begin by targeting Cybersensitives for participation in feedback programs, using opt-in program design. The Final Report has been received.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-039 Cultural Factors in the Energy Use Patterns of Multifamily Tenants	Market Facilitation	This project examined the cultural and demographic factors that correlate with multifamily tenants' electric energy use patterns, before and after energy efficiency upgrades, and tenant engagement activities. Using multilevel tenant surveys and interval meter data analytics this study investigated the who, what, and why variations in multifamily energy use patterns. The large data sets will help to improve demand forecasts and energy efficiency program design by providing lessons learned and guidance for how social, cultural, and socioeconomic groups use energy differently in multifamily settings.	4/8/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-040 Self-Tracking Concentrator Photovoltaics for Distributed Generation	Applied Research and Development	This research project developed, tested, and demonstrated a self-tracking concentrator photovoltaic (ST-CPV) system -- a new concentrator photovoltaic technology that does not require a precision mechanical tracker to keep it aligned to the sun. The ST-CPV panel contains a thin layer of fluids that passively respond to the changing solar angle, automatically adjusting optical pathways within the device to ensure that incident sunlight is captured and concentrated over a wide range of angles. The passive internal tracking allows ST-CPV panels to be mounted in a stationary configuration or with a simple single axis tracker. This makes the system highly economical, greatly reduces installation and maintenance complexity, and enables distributed generation with higher efficiency CPV modules.	5/13/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-039 Cultural Factors in the Energy Use Patterns of Multifamily Tenants	No	Demand-side Management	$379,019	$379,019	$368,358	N/A
EPC-14-040 Self-Tracking Concentrator Photovoltaics for Distributed Generation	No	Generation	$999,940	$999,940	$999,939	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-039 Cultural Factors in the Energy Use Patterns of Multifamily Tenants	$368,358	$107,714	$0	Pacific Gas and Electric Company	$100,000	20.9%
EPC-14-040 Self-Tracking Concentrator Photovoltaics for Distributed Generation	$999,939	$282,545	$200,000	United States Department of Energy; U.S. Department of Energy	$2,500,000	71.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-039 Cultural Factors in the Energy Use Patterns of Multifamily Tenants	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-039 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12 out of 12 bidders	TRC Engineers, Inc.
EPC-14-040 Self-Tracking Concentrator Photovoltaics for Distributed Generation	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-040 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25 out of 27 bidders	Glint Photonics, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-039 Cultural Factors in the Energy Use Patterns of Multifamily Tenants	Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-14-040 Self-Tracking Concentrator Photovoltaics for Distributed Generation	Group 4: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-039 Cultural Factors in the Energy Use Patterns of Multifamily Tenants	Senate Bill 350 (De Leon, 2015) sets energy efficiency targets for 2030 and allows for the targets to be achieved, in part, from utility programs that provide financial incentives and rebates to their customers to increase energy efficiency. This project provides program developers information on how social, cultural, and behavior aspects of multi-family building tenants impact participation in utility efficiency programs. The findings in the survey will help design utility efficiency programs to better engage customers in multifamily units to increase participation and achieve greater energy savings.	2a, 5c	This project was completed in December 2017. The project surveyed energy use in multi-family units in the Bay Area and the Central Valley. The project found that the differences between load profiles are also correlated with demographic and cultural factors such as race/ethnicity of the occupants as well as the amount of plug loads they use. These are second order effects though to the weather-dependent energy use such as use of cooling energy in the hot Central Valley versus relatively mild coastal areas. The multivariate analysis shows that no single demographic or cultural factor (nor interactions with others) by themselves explain the differences more than or as much as the effects of location and climate. The initial finding of the TRC survey were presented at the BECC Conference on October 17, 2017 in Sacramento, CA.
EPC-14-040 Self-Tracking Concentrator Photovoltaics for Distributed Generation	The project team estimates that 50% of rooftops would be appropriate for ST-CPV systems in California, where the average direct solar resource is 78% or more of the total solar resource. The successful development of this technology will bring significant manufacturing employment opportunities to California. Unlike conventional PV modules, ST-CPV modules are well-suited to local manufacturing because they do not benefit significantly from colocation with the semiconductor foundry. CPV cell technology is an area where U.S. manufacturers have a substantial technical advantage over foreign competitors. An additional benefit conferred by this technology is an improved energy solution for remote off-grid communities. Many of such communities are located in desert areas of California that are particularly well-suited to the use of ST-CPV panels as a result of the high direct solar resource.	1a, 4a	The project team built and tested the three generations of prototypes, and all met or exceeded their target performance. In extended outdoor testing, the final prototype provided consistent performance and demonstrated a peak electrical conversion efficiency of 22.5 percent, similar to the top performing silicon modules. The cost model for the CPV modules estimated a cell cost of $1/cm2 in large volume. The novel optical and mechanical architecture developed in this program also has useful application in the lighting field. Glint has spun off two new research projects from this work to provide novel adjustable high-efficiency lighting fixtures. Both of these projects offer substantial energy savings impact, and have strong commercial opportunities due to the design and functionality benefits they offer. Final Report is in review for publication.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-041 Installation of a Lean Burn Biogas Engine with Emissions Control to Comply with Rule 1110.2 at a Wastewater Treatment Plant in South Coast Air Quality Management District	Technology Demonstration and Deployment	This project aimed to design, build and install a continuously operating commercial scale emissions reduction system for the lean burn biogas engine(s) at a municipal wastewater treatment plant in Palm Springs California. If successful, the project would have enable lean burn biogas engines to comply with existing and future air quality regulations when deployed at wastewater treatment plants, resulting in reduced flaring and net reductions in emissions.	4/8/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-044 Enabling Anaerobic Digestion Deployment for Municipal Solid Waste-to-Energy	Technology Demonstration and Deployment	The purpose of this project is to enable environmentally and economically sustainable deployment of technology that transforms organic municipal solid waste into heat, electricity, and compost via dry anaerobic digestion. A dry anaerobic digestion and composting facility processing the organic fraction of MSW has been scaled up from 40,000 tons/year to 90,000 tons/year to increase production of renewable electricity and heat.	4/8/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-041 Installation of a Lean Burn Biogas Engine with Emissions Control to Comply with Rule 1110.2 at a Wastewater Treatment Plant in South Coast Air Quality Management District	No	Generation	$2,249,322	$2,249,322	$11,858	N/A
EPC-14-044 Enabling Anaerobic Digestion Deployment for Municipal Solid Waste-to-Energy	No	Generation	$4,300,000	$4,300,000	$4,300,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-041 Installation of a Lean Burn Biogas Engine with Emissions Control to Comply with Rule 1110.2 at a Wastewater Treatment Plant in South Coast Air Quality Management District	$11,858	$0	$0	Anaergia Technologies, LLC	$450,000	16.7%
EPC-14-044 Enabling Anaerobic Digestion Deployment for Municipal Solid Waste-to-Energy	$4,300,000	$1,497,504	$0	Zero Waste Energy Development Company	$1,500,000	25.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-041 Installation of a Lean Burn Biogas Engine with Emissions Control to Comply with Rule 1110.2 at a Wastewater Treatment Plant in South Coast Air Quality Management District	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-041 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 23 bidders	Biogas & Electric, LLC
EPC-14-044 Enabling Anaerobic Digestion Deployment for Municipal Solid Waste-to-Energy	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-044 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 23 bidders	Lawrence Berkeley National Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-041 Installation of a Lean Burn Biogas Engine with Emissions Control to Comply with Rule 1110.2 at a Wastewater Treatment Plant in South Coast Air Quality Management District	Group 3: Ranked # 5	N/A	N/A	Yes; Calif Based Entity
EPC-14-044 Enabling Anaerobic Digestion Deployment for Municipal Solid Waste-to-Energy	Group 3: Ranked # 6	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-041 Installation of a Lean Burn Biogas Engine with Emissions Control to Comply with Rule 1110.2 at a Wastewater Treatment Plant in South Coast Air Quality Management District	The technology that was to be demonstrated was a low cost NOx and SOx reduction wet scrubbing technology called NOxRx (a registered trademark) which can be used in conjunction with all biogas engines and anaerobic digesters in the market today. NOxRx has a patented method of utilizing the effluent stream from an anaerobic digester to reduce emissions from biogas engines. Unlike SCR, it does not produce N2O and does not require H2S removal or biogas conditioning prior to combustion. Therefore, NOxRx represents a significant cost savings over competing NOx reduction solutions. The goal of this project was to demonstrate the commercial viability of NOxRx for biogas-fired lean burn engines to comply with CARB NOx and SOx standards, and SCAQMD Rule 1110.2.	1a, 1c, 1f, 3a, 3b, 4b, 4e	Biogas and Electric was unable to demonstrate its emission reduction system at the Palm Springs and the project termed-out.
EPC-14-044 Enabling Anaerobic Digestion Deployment for Municipal Solid Waste-to-Energy	This project provides valuable insight to identify optimum pathways that overcome barriers for large-scale deployment of biomass conversion technologies. The research has focused on overcoming barriers for urban stakeholders, including odor, access to the utility grid, and improved utilization of waste heat.	2a, 3g, 4a	The project team measured NOx emissions during several flaring events to establish primary NOx formation pathways, which may include thermal, fuel, and prompt NOx formation. The team performed air emission measurements and modeling to minimize odors and greenhouse gases from anaerobic digestion and the composting facility. The project team has also updated a Life Cycle Assessment model to identify opportunities for improved economic and environmental performance by quantifying the life-cycle cost, energy demand, and the greenhouse gas impacts of the existing ZWEDC facility and paths to scale-up. ZWEDC has interconnected to PG&E grid and enrolled in CAISO to enable sale of net electricity. This project was completed in March, 2019.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-045 Advanced Recycling to 1-MW Municipal Solid Waste of Electricity Generation	Applied Research and Development	This project designs, develops and tests a waste-to-energy Process Development Unit (PDU), involving conversion of Refuse Derived Biomass into clean fuel gas by thermal-catalytic gasification, reforming, and pulse detonation technology. This is a two-stage process, with a primary gasification stage, followed by a reforming stage; and hot filtration, followed by wet scrubbing of the process gas. This project tests a 3-pound per minute PDU, evaluates the results, and provides engineering data to design a 30 ton/day plant generating 1-MW electric power.	4/8/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-046 Lowering Food-Waste Co-digestion Costs through an Innovative Combination of a Pre-Sorting Technique and a Strategy for Cake Solids Reduction	Technology Demonstration and Deployment	The project demonstrated two complementary approaches to lower the overall cost of co-digestion: a new technology to lower preprocessing cost of food wastes, and a new strategy to lower the mass of cake solids requiring disposal. The new technology for the preprocessing of food wastes uses an organic waste preprocessing technique known as an organic extrusion press (OEP) for selective extrusion of organic materials and is capable of recovering 95% of organics. The project applies a new strategy in operating co-digestion systems that involves optimizing the organic waste loading in a way that will lower the mass of cake solids requiring disposal relative to the conventional process.	4/8/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-045 Advanced Recycling to 1-MW Municipal Solid Waste of Electricity Generation	No	Generation	$1,499,481	$1,499,481	$1,499,480	N/A
EPC-14-046 Lowering Food-Waste Co-digestion Costs through an Innovative Combination of a Pre-Sorting Technique and a Strategy for Cake Solids Reduction	No	Generation	$1,496,902	$1,496,902	$1,382,677	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-045 Advanced Recycling to 1-MW Municipal Solid Waste of Electricity Generation	$1,499,480	$168,742	$0	Taylor Energy	$46,616	3.0%
EPC-14-046 Lowering Food-Waste Co-digestion Costs through an Innovative Combination of a Pre-Sorting Technique and a Strategy for Cake Solids Reduction	$1,382,677	$323,906	$0	Silicon Valley Clean Water (SVCW); Water Environment and Reuse Foundation	$2,630,000	63.7%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-045 Advanced Recycling to 1-MW Municipal Solid Waste of Electricity Generation	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-045 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25 out of 27 bidders	Taylor Energy
EPC-14-046 Lowering Food-Waste Co-digestion Costs through an Innovative Combination of a Pre-Sorting Technique and a Strategy for Cake Solids Reduction	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-046 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 23 bidders	Kennedy/Jenks Consultants

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-045 Advanced Recycling to 1-MW Municipal Solid Waste of Electricity Generation	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-14-046 Lowering Food-Waste Co-digestion Costs through an Innovative Combination of a Pre-Sorting Technique and a Strategy for Cake Solids Reduction	Group 3: Ranked # 4	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-045 Advanced Recycling to 1-MW Municipal Solid Waste of Electricity Generation	The project researches, develops, and verifies thermal catalytic gasification technology that will overcome technical and economic barriers preventing the use of refuse derived biomass (RDB) as an energy resource in California. Completion of the current gasification/reforming test program enables future scale-up to 30-ton/day RDB-to-energy (1-MWe scale), in preparation for commercial scale design at 300-ton/day, generating 10-MW of electricity with costs of less than $3,750/kWh of installed capacity.	2a, 4a, 4e	Design, fabrication and installation of the major equipment, consisting of Process Development Unit, reformer, gas-flare and gas conditioning, at the host site was completed. Testing of the gasification system was completed. Initial startup of the gasification was performed using 8 lbs. of wood pellets, and then refuse derived biomass. The rate of char conversion was increased to 9.47% by operating pulse burner at 900 degrees C and a modification to the gasifier that allows char particles to stay longer in the gasification zone. This modification also resulted in increased syngas production. The Levelized Cost of Electricity was estimated at $118/MWh for 10-MW scale compared to grid supplier power that will likely average $150/MWh through 2024. This project was completed in March, 2019. The gasifier technology is now being refined and upgraded for future commercialization.
EPC-14-046 Lowering Food-Waste Co-digestion Costs through an Innovative Combination of a Pre-Sorting Technique and a Strategy for Cake Solids Reduction	This project developed a reliable and cost-effective bioenergy from wastewater treatment plants (WWTP) through the integration of an organic waste preprocessing technique known as organic extrusion press and co-digestion of locally available food waste and restaurant fats, oil, and grease (FOG) in an optimized manner that lowers the mass of cake solids that needs disposal. Though there is some seasonal variation, the supply of wastewater, food waste and FOG are very reliable.	3a, 4a, 4e	Project successfully demonstrated two complementary approaches to lower the overall cost of co-digestion: a new technology to lower preprocessing cost of food wastes (FW), and a new strategy for the addition of Fats, Oil, Grease (FOG) or FW to lower the mass of cake solids requiring disposal. The technology uses an organic waste separation technique known as an organic extrusion press (OEP/OREX) for selective extrusion of organic materials that has a higher efficiency than conventional techniques. Also, the technology is more economical than typical source separation programs since it requires minimal preprocessing. Results indicated 54% savings compared to source separation and polishing of FW currently practiced. Economic evaluation of a 100 MGD plant indicated $8.9 to $9.3 million worth of energy savings by energy recovery, due to increased gas production.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-047 Dairy Waste-to-Bioenergy via the Integration of Concentrating Solar Power and a High Temperature Conversion Process	Applied Research and Development	The goal of the project is to integrate Concentrating Solar Power (CSP) and Hydrothermal Processing (HTP) into a single, integrated system; confirm that it can convert dairy manure into renewable natural gas (RNG) and bio-crude; study the economics of integrated CSP-HTP systems sited at dairy farms; and confirm that the RNG produced meets pipeline-transmission and geological-storage quality standards. The project seeks to prove that it is possible to store the energy contained in dairy manure waste in a manner that enables California natural gas plants to produce readily dispatchable, ultra-low-emissions renewable electricity.	4/8/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-047 Dairy Waste-to-Bioenergy via the Integration of Concentrating Solar Power and a High Temperature Conversion Process	No	Generation	$1,494,736	$1,494,736	$1,490,418	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-047 Dairy Waste-to-Bioenergy via the Integration of Concentrating Solar Power and a High Temperature Conversion Process	$1,490,418	$96,773	$0	Southern California Gas Company (SoCalGas)	$600,000	28.6%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-047 Dairy Waste-to-Bioenergy via the Integration of Concentrating Solar Power and a High Temperature Conversion Process	Grant	NEW IP TYPE(S): Other: Device and Method Patent NEW IP DESCRIPTION: Patent Application 20200370788. SECONDARY REFLECTORS FOR SOLAR COLLECTORS AND METHODS OF MAKING THE SAME. The United States Government has rights in this disclosure under Contract No. DE-AC36-08GO28308 between the United States Department of Energy and the Alliance for Sustainable Energy, LLC, the Manager and Operator of the National Renewable Energy Laboratory. This invention was made with State of California support under California Energy Commission grant number EPC-14-047. The Energy Commission has certain rights to this invention. TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-047 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property	Competitive	25 out of 27 bidders	Southern California Gas Company (SoCalGas)

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-047 Dairy Waste-to-Bioenergy via the Integration of Concentrating Solar Power and a High Temperature Conversion Process	Group 2: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-047 Dairy Waste-to-Bioenergy via the Integration of Concentrating Solar Power and a High Temperature Conversion Process	This project will develop and demonstrate a new bioenergy pathway which utilizes hydrothermal processing and concentrating solar power to convert dairy manure into bio-crude and renewable natural gas that will enable dispatchable and low emissions renewable electricity.	1a, 1i, 2a, 3g, 4a, 4b, 4e	Redesign of the CSP receiver was completed by the National Renewable Energy Laboratory (NREL), resulting in fabrication of the receiver in 2017. Design and fabrication of the Genifuel hydrothermal processing (HTP) unit was completed with input from the Pacific Northwest National Laboratories (PNNL). Construction of the HTP system was completed and the Hyperlight CSP facility was expanded to a half acre in size using redesigned collectors and receivers. The HTP system was commissioned and testing was completed after integration with the Hyperlight system. This is the first project where CSP and HTP technologies have been integrated. This project was completed in March, 2019. Southern California Gas Company is planning to use HTP system in the future for other projects.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-050 City of Fremont Fire Stations Microgrid Project	Technology Demonstration and Deployment	The project team designed and built microgrids at three fire stations in Fremont, California. Each microgrid consists of a microgrid energy management system, a parking lot canopy photovoltaic system, and a battery energy storage system. The automated microgrid control system manages local energy resources and loads. The microgrids are designed to provide at least three hours a day of power for critical loads during a utility power outage.	4/8/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-051 Cleaner Air, Cleaner Energy: Converting Forest Fire Management Waste to On Demand Renewable Energy	Applied Research and Development	This project aims to design, deploy, and test a 150 kilowatt-electric (kWe) modular, mobile biomass gasification generator (the Powertainer) that converts forest slash biomass into on-demand renewable energy that meets the California Air Emission Standards. The results of the demonstration will inform the optimal siting of such systems to enhance grid stability and the impact of monetizing current forest waste as fuel on forest thinning, hydrological resources, and wildfire risk.	4/8/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-050 City of Fremont Fire Stations Microgrid Project	No	Distribution	$1,817,925	$1,817,925	$1,817,671	N/A
EPC-14-051 Cleaner Air, Cleaner Energy: Converting Forest Fire Management Waste to On Demand Renewable Energy	No	Generation	$1,890,125	$1,890,125	$1,881,963	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-050 City of Fremont Fire Stations Microgrid Project	$1,817,671	$73,475	$0	City of Fremont; Gridscape Solutions, Inc.; Delta Products Corporation; Microgrid Energy	$657,260	26.6%
EPC-14-051 Cleaner Air, Cleaner Energy: Converting Forest Fire Management Waste to On Demand Renewable Energy	$1,881,963	$311,727	$225,000	All Power Labs, Inc.	$686,038	26.6%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-050 City of Fremont Fire Stations Microgrid Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-050 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31 out of 40 bidders	Gridscape Solutions, Inc.
EPC-14-051 Cleaner Air, Cleaner Energy: Converting Forest Fire Management Waste to On Demand Renewable Energy	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-051 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25 out of 27 bidders	All Power Labs, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-050 City of Fremont Fire Stations Microgrid Project	Group 1: Ranked # 2	N/A	N/A	Yes; Calif Based Entity, Minority Owned
EPC-14-051 Cleaner Air, Cleaner Energy: Converting Forest Fire Management Waste to On Demand Renewable Energy	Group 1: Ranked # 3	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-050 City of Fremont Fire Stations Microgrid Project	Critical facilities, such as fire stations, are vulnerable to power outages, so having local, renewable generation decreases their dependence on outside electricity sources. This is the first implementation of microgrids for several fire stations in the region and creates a great opportunity for proof of concept to overcome risk and knowledge barriers to adopting high penetration solar PV systems and energy storage, demonstrate energy efficiency by optimizing power generation and loads, and provide increased energy security during utility power outages. The microgrids help reduce grid congestion and increase grid reliability.	1e, 1h, 4a, 5a	Gridscape Solutions successfully completed the microgrid project in March 2019. Because of the widespread awareness of the public safety power shutoff, these microgrids at Fremont fire stations received a lot of interest, and were featured in several news articles and reports. Gridscape Solutions is expecting to have more than 25 microgrids designed and deployed by the end of 2020. The final report, Solar Emergency Microgrids for Fremont Fire Stations - Demonstrating Energy Savings and Grid Resilience for Critical Facilities has been published.
EPC-14-051 Cleaner Air, Cleaner Energy: Converting Forest Fire Management Waste to On Demand Renewable Energy	This project develops and demonstrates a high-capacity, mobile conversion system capable of cost-effectively converting forest biomass near where it is sourced into renewable, on-demand energy to help address a myriad of issues associated with climate change, including drought, fires, and the need for more renewable energy.	1a, 1c, 4a	The 150-kW Powertainer (PT) demonstrated how a containerized and portable gasification system could address the tree mortality crisis by converting forestry waste into clean, renewable energy and sequestering carbon at locations that can best utilize available fuel. During the 40 hours of performance testing, the technology met the majority of the performance targets set in the testing plan; however, the PT was not able to reach the expected electrical output of 150 kW during this test period. The system achieved 100 kW at maximum power with stable power production at 50 kW. The PT progressed from a technology readiness level of 4 to 6. The next generation of the Powertainer is targeted to advance the TRL to a commercial readiness level.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-051 Cleaner Air, Cleaner Energy: Converting Forest Fire Management Waste to On Demand Renewable Energy	Applied Research and Development	This project aims to design, deploy, and test a 150 kilowatt-electric (kWe) modular, mobile biomass gasification generator (the Powertainer) that converts forest slash biomass into on-demand renewable energy that meets the California Air Emission Standards. The results of the demonstration will inform the optimal siting of such systems to enhance grid stability and the impact of monetizing current forest waste as fuel on forest thinning, hydrological resources, and wildfire risk.	4/8/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-052 Community Scale Digester with Advanced Interconnection to the Electrical Grid	Technology Demonstration and Deployment	The project installed and operated an innovative anaerobic digestion system using a high-rate biodigester technology that will process approximately 50 tons per day (TPD) of organic waste from a large supermarket distribution center and 50 TPD (20,000 gallons) of high-strength slurry created by recovering and concentrating organics in wastewater streams. This project is co-located with the Co-West Commodities Wastewater Pre-Treatment Facility - an operation that collects wastewater (carbs, sugar, protein, and fat, grease, and oil) from industrial businesses and pre-treats the material for disposal into the local sewer system.	4/8/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-051 Cleaner Air, Cleaner Energy: Converting Forest Fire Management Waste to On Demand Renewable Energy	No	Generation	$0	$0	$0	N/A
EPC-14-052 Community Scale Digester with Advanced Interconnection to the Electrical Grid	No	Generation	$5,000,000	$5,000,000	$4,283,553	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-051 Cleaner Air, Cleaner Energy: Converting Forest Fire Management Waste to On Demand Renewable Energy	$0	$0	$0	All Power Labs, Inc.	$0	0.0%
EPC-14-052 Community Scale Digester with Advanced Interconnection to the Electrical Grid	$4,283,553	$252,977	$0	CleanWorld; Organic Energy Solutions	$7,775,939	60.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-051 Cleaner Air, Cleaner Energy: Converting Forest Fire Management Waste to On Demand Renewable Energy	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-051 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25 out of 27 bidders	All Power Labs, Inc.
EPC-14-052 Community Scale Digester with Advanced Interconnection to the Electrical Grid	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-052 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 23 bidders	Organic Energy Solutions, LLC

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-051 Cleaner Air, Cleaner Energy: Converting Forest Fire Management Waste to On Demand Renewable Energy	Group 1: Ranked # 3	N/A	N/A	Yes; Calif Based Entity
EPC-14-052 Community Scale Digester with Advanced Interconnection to the Electrical Grid	Group 3: Ranked # 3	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-051 Cleaner Air, Cleaner Energy: Converting Forest Fire Management Waste to On Demand Renewable Energy	This project develops and demonstrates a high-capacity, mobile conversion system capable of cost-effectively converting forest biomass near where it is sourced into renewable, on-demand energy to help address a myriad of issues associated with climate change, including drought, fires, and the need for more renewable energy.	1a, 1c, 4a	The 150-kW Powertainer (PT) demonstrated how a containerized and portable gasification system could address the tree mortality crisis by converting forestry waste into clean, renewable energy and sequestering carbon at locations that can best utilize available fuel. During the 40 hours of performance testing, the technology met the majority of the performance targets set in the testing plan; however, the PT was not able to reach the expected electrical output of 150 kW during this test period. The system achieved 100 kW at maximum power with stable power production at 50 kW. The PT progressed from a technology readiness level of 4 to 6. The next generation of the Powertainer is targeted to advance the TRL to a commercial readiness level.
EPC-14-052 Community Scale Digester with Advanced Interconnection to the Electrical Grid	The project demonstrated the use of electrical generation powered by digester gas to provide reliable power to a critical facility during outages on the grid. The electricity from this project will be exported to the SoCal Edison distribution grid through a SB 1122 Bioenergy Feed-in Tariff. The system will also be equipped with islanding capability to support the critical facility during an interruption in the grid.	1b, 1c, 2a	By the end of the extended term (March 2020), the project team successfully installed, and is now operating, the innovative anaerobic digester system incorporating CleanWorld's high-rate biodigester technology to process organic wastes from a local waste hauler and high-strength slurry. The project demonstrated the capability to produce at least 8,760 MWh of renewable electricity to be sold to Southern California Edison under the SB 1122 Bioenergy Feed-in Tariff. It also demonstrated the concept of load-following power output without excessive on-site storage.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-053 A Renewable Based Direct Current Building Scale Microgrid	Technology Demonstration and Deployment	The team developed a DC microgrid that connects on-site generation directly with loads and provides a low cost, energy-efficient solution for warehouse facilities. Solar PV is directly connected to energy-efficient DC lighting, a DC energy storage system, and ventilation to form a DC building microgrid.	4/8/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-054 Demonstrating a renewable based microgrid for a critical facility at the Blue Lake Rancheria	Technology Demonstration and Deployment	This project team developed and demonstrated a microgrid at an American Red Cross evacuation center. The microgrid included renewables and energy storage to bolster the resiliency of this critical support facility and the capability of the microgrid to power itself with a high penetration of local renewable resources.	6/10/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-053 A Renewable Based Direct Current Building Scale Microgrid	No	Distribution	$2,817,566	$2,817,566	$2,389,216	N/A
EPC-14-054 Demonstrating a renewable based microgrid for a critical facility at the Blue Lake Rancheria	No	Distribution	$5,000,000	$5,000,000	$5,000,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-053 A Renewable Based Direct Current Building Scale Microgrid	$2,389,216	$276,825	$0	Maxwell Technologies; AMERICAN HONDA MOTOR COMPANY, INC.; Robert Bosch LLC; Regents of the University of California, Davis - California Lighting Technology Center; Imergy Power Systems	$1,797,544	38.9%
EPC-14-054 Demonstrating a renewable based microgrid for a critical facility at the Blue Lake Rancheria	$5,000,000	$832,908	$0	Humboldt State University Foundation, Schatz Energy Research Center; Pacific Gas and Electric Company; Siemens Energy and Automation, Inc.; Tesla, Inc; Serraga Energy, LLC at Blue Lake Rancheria; GHD, Inc.	$1,318,422	20.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-053 A Renewable Based Direct Current Building Scale Microgrid	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-053 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31 out of 40 bidders	Robert Bosch LLC
EPC-14-054 Demonstrating a renewable based microgrid for a critical facility at the Blue Lake Rancheria	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-054 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31 out of 40 bidders	Humboldt State University Sponsored Programs Foundation

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-053 A Renewable Based Direct Current Building Scale Microgrid	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-14-054 Demonstrating a renewable based microgrid for a critical facility at the Blue Lake Rancheria	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-053 A Renewable Based Direct Current Building Scale Microgrid	This project demonstrated the feasibility and benefits of a commercial-scale DC building microgrid that uses multiple DC technologies to provide reliable power to the loads on DC circuits, resilience during grid outages, increased energy efficiency and renewable energy utilization with lower losses. Additionally, the project team was able to obtain Title 24 approval for their DC design and an interconnection agreement with the local utility. Both steps were first of a kind approvals for a facility such as the large automotive distribution facility used for the demonstration.	1e, 1h, 4a, 5a, 5d	The project is complete and the final report is in the publication process. The microgrid, operated by a Bosch microgrid controller system, reduced the need for inverters for PV and rectification equipment for the loads. The microgrid improved the overall utilization of solar energy by roughly 7-10% as compared to conventional AC systems, while lowering component complexity and costs.
EPC-14-054 Demonstrating a renewable based microgrid for a critical facility at the Blue Lake Rancheria	The project advanced microgrid technology by demonstrating a new microgrid controller and integrating a set of equipment that had not previously been combined in a microgrid setting. The project demonstrated the ability to integrate solar electric power with battery energy storage, conventional generators, and dispatchable demand into a microgrid to support a certified American Red Cross shelter, with an added benefit of relegating the existing fossil fueled generators to a deep backup role where they rarely run. A microgrid control system was successfully implemented using protection relays to provide safe and reliable microgrid operation. It was able to perform automated transitions from grid connected to islanded states in response to the state of the area electric power system.	1e, 1h, 4a, 5a, 5d	The project was completed in March 2018. The Blue Lake Rancheria renewable microgrid has demonstrated a robust, renewable-based microgrid system that provides costs savings for the facility during normal operation and successfully islanded during a grid outage. As a result of knowledge transfer and outreach activities, the microgrid project received the Federal Emergency Management Agency's 2017 Whole Community Preparedness Award and POWERGRID International's Project of the Year (2018) award for Distributed Energy Resource Integration, marking the first time that a non-utility won the award. The final report is available at: https://www.energy.ca.gov/2019publications/CEC-500-2019-011/CEC-500-2019-011.pdf; https://www.energy.ca.gov/2019publications/CEC-500-2019-011/CEC-500-2019-011.pdf.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-055 Las Positas College Microgrid	Technology Demonstration and Deployment	Las Positas College Microgrid	4/8/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-056 Demonstrating Plug-in Electric Vehicles Smart Charging and Storage Supporting the Grid	Technology Demonstration and Deployment	This project installed PEV charging equipment in five sites in Santa Monica to demonstrate scenarios that represented new power needs, including smart charging, peak shaving, load management, and load smoothing while improving power quality and grid stability. The selected sites reflected a variety of scenarios including public charging, fleet charging, integration of solar generation with charging, and integration of energy storage with fast charging. Further, the project assessed the usefulness of vehicle to grid and vehicle to building technologies for allowing bi-directional energy flow and using PEVs as distributed energy storage. The project objective was to provide a model (using simulations to predict grid behavior and emulations using real-world power flows) that could be used by fleet owners or building owners for grid planning, pricing, and incentive decisions.	4/8/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-055 Las Positas College Microgrid	No	Distribution	$1,522,591	$1,522,591	$1,431,911	N/A
EPC-14-056 Demonstrating Plug-in Electric Vehicles Smart Charging and Storage Supporting the Grid	No	Demand-side Management	$1,989,432	$1,989,432	$1,844,906	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-055 Las Positas College Microgrid	$1,431,911	$260,719	$0	Chabot-Las Positas Community College District	$450,000	22.8%
EPC-14-056 Demonstrating Plug-in Electric Vehicles Smart Charging and Storage Supporting the Grid	$1,844,906	$358,770	$500,000	City of Santa Monica; The Regents of the University of California, Los Angeles; Korea Institute of Energy Research (KIER); California Lithium Battery; Proximetry	$500,000	20.1%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-055 Las Positas College Microgrid	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-055 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31 out of 40 bidders	Chabot-Las Positas Community College District
EPC-14-056 Demonstrating Plug-in Electric Vehicles Smart Charging and Storage Supporting the Grid	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-056 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31 out of 40 bidders	Regents of the University of California, Los Angeles

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-055 Las Positas College Microgrid	Group 2: Ranked # 3	N/A	N/A	Yes; Calif Based Entity
EPC-14-056 Demonstrating Plug-in Electric Vehicles Smart Charging and Storage Supporting the Grid	Group 3: Ranked # 3	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-055 Las Positas College Microgrid	The project identified and measured the benefits of microgrids for customers to shift peak energy use to coincide with peak solar production and reduce peak demands by demonstrating the capability of microgrids made from a mix of new and legacy equipment. This project measured the microgrid's benefits by using existing retail utility rates as well as simulating a demand response market.	1e, 1h, 4a, 5a, 5d	The project team completed the microgrid in March 2019. A final report titled "Making a Microgrid From Legacy Systems - Las Positas Microgrid" was posted and is available online.
EPC-14-056 Demonstrating Plug-in Electric Vehicles Smart Charging and Storage Supporting the Grid	Most current electric vehicle service equipment (EVSE) provide uncontrolled charging without using smart algorithms, software, or standard network technologies. This project demonstrated a pre-commercial PEV infrastructure that used a control center, communicating over a wireless communication network, to control the charging operations of the EVSEs using smart charging algorithms. The pre-commercial infrastructure (WINSmartEV TM) developed by UCLA was advanced so that it is able to determine optimized charging and/or vehicle to grid services based on PEV profiles, user preferences, grid-related events, and grid capacities.	1h, 3f, 4b	The final report was published in August 2018 at: http://www.energy.ca.gov/2018publications/CEC-500-2018-020/CEC-500-2018-020.pdf. The research demonstrated that large numbers of PEVs can be managed for the benefit of the PEV and facility owners. The recipient successfully developed a system, utilizing existing charging infrastructure and without adding large amounts of power capacity, that could control and balance charging through scheduling algorithms that met the needs of the PEV and facility owners. The recipient also demonstrated how the system can be used by facility (e.g., garage) owners to save money through demand charge reduction and demand response, while supporting their employees or customers.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-057 Smart Charging of Plug-in Vehicles with Driver Engagement for Demand Management and Participation in Electricity Markets	Technology Demonstration and Deployment	This project developed and demonstrated a managed charging system applied to more than 25 Alameda County fleet electric vehicles and charging stations. The researchers also developed approaches to engage non-fleet electric vehicle owners who charge their vehicles at Alameda County's publicly available charging stations and managed their charging station loads to further reduce utility costs. Although the project focused on one-way (uni-directional) charging, the approach is compatible with future vehicles and chargers that may have two-way (bi-directional) charging capability. The research had three main technical tasks: Task 1 - Characterize site and fleet, collect charging session and meter data, and analyze data for control strategies; Task 2 - Implement and demonstrate fleet and public electric vehicles managed charging control system; Task 3 - Quantify the potential of fleet and non-fleet electric vehicles in the managed charging system as demand response capabilities in the retail and wholesale electricity markets.	4/8/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-059 Laguna Wastewater Treatment Plant Microgrid	Technology Demonstration and Deployment	This project upgraded a wastewater treatment plant to use a microgrid with a solar photovoltaic system, energy storage, and a microgrid controller for increased resiliency and to participate in energy markets.	4/8/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-057 Smart Charging of Plug-in Vehicles with Driver Engagement for Demand Management and Participation in Electricity Markets	No	Demand-side Management	$1,993,355	$1,993,355	$1,794,690	N/A
EPC-14-059 Laguna Wastewater Treatment Plant Microgrid	No	Distribution	$4,999,804	$4,999,804	$4,983,459	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-057 Smart Charging of Plug-in Vehicles with Driver Engagement for Demand Management and Participation in Electricity Markets	$1,794,690	$812,829	$0	Bay Area Climate Collaborative; The Regents of the University of California, Berkeley Campus; Kisensum; ChargePoint, Inc.; County of Alameda, General Services Agency	$536,761	21.2%
EPC-14-059 Laguna Wastewater Treatment Plant Microgrid	$4,983,459	$187,080	$0	City of Santa Rosa; Parker Hannifin Corp; Nuvation Engineering	$2,290,000	31.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-057 Smart Charging of Plug-in Vehicles with Driver Engagement for Demand Management and Participation in Electricity Markets	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-057 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31 out of 40 bidders	Lawrence Berkeley National Laboratory
EPC-14-059 Laguna Wastewater Treatment Plant Microgrid	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-059 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31 out of 40 bidders	Trane U.S., Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-057 Smart Charging of Plug-in Vehicles with Driver Engagement for Demand Management and Participation in Electricity Markets	Group 3: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-14-059 Laguna Wastewater Treatment Plant Microgrid	Group 1: Ranked # 3	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-057 Smart Charging of Plug-in Vehicles with Driver Engagement for Demand Management and Participation in Electricity Markets	This project developed an aggregation system for smart charging PEV vehicles to provide demand response, mitigate demand charges, and leverage time of use rates. A charging control system was applied to a fleet of vehicles owned by Alameda County and to charging stations that are used by both county vehicles and the public. The project added systems for intelligent prediction of PEV loads and control algorithms to create a flexible, modular, and scalable solution for smart charging county fleet and public PEVs. The managed charging control system will enable growth in PEV adoption without straining current grid infrastructure. These approaches can also be applied to commercial and workplace charging and provide large benefits in managing peak electricity demand across California by helping consumers reduce or shift their electricity use during times when electricity demand is high.	1g, 1h, 2a, 3f, 4a, 4b, 5b	The project successfully demonstrated a set of smart charging strategies at an Alameda County parking garage. Highlights include development of separate smart charging system platforms to meet the different requirements of each application (i.e., fleet vehicles, public vehicles, and the direct current fast charger); recruitment of public charging users to participate; public PEV managed charging to achieve utility bill savings by managing peak demand; and quantification of the potential of the fleet PEV managed charging system for multiple demand response products in California electricity markets. As a result of this project, LBNL was able to further build out the MyFleetBuy tool to help fleet owners incorporate PEVs into their fleet. LBNL is working with Alameda, Oakland, and Caltrans to help facilitate PEV smart charging technologies into their large-scale fleet procurement processes.
EPC-14-059 Laguna Wastewater Treatment Plant Microgrid	This project demonstrated that a microgrid at a wastewater treatment plant can operate without compromising water quality or negatively affecting plant operations. The EPIC funds demonstrated a functional microgrid by integrating energy storage, on-site generation, and control components and improved resilience.	1e, 1h, 4a, 5a, 5d	The project completed in March 2019 and the Final Report was published. The project successfully demonstrated a microgrid for a wastewater-treatment facility.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-060 Demonstrate a utility-owned renewable based community microgrid at Borrego Springs California	Technology Demonstration and Deployment	SDG&E and the project team demonstrated a utility-owned renewable based community microgrid at Borrego Springs California. The renewable based microgrid is able to island the entire community with a peak load of approximately 14 MW, serving approximately 2,500 residential and 300 commercial and industrial customers. The SDG&E microgrid utilizes a 26 MW PV system, two substation batteries, three distributed batteries and an ultracapacitor.	4/8/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-061 Learning from Real-World Experience to Understand Renewable Energy Impacts to Wildlife	Applied Research and Development	This research used real-world data to understand renewable energy impacts to wildlife. The researchers analyzed data on wildlife fatalities and habitat loss to determine the significance of fatalities to population persistence; compared pre-construction predicted and post-construction actual impacts (fatalities) to sensitive species, as a foundation for improving predictive accuracy; and compared predicted and actual benefits of mitigation to sensitive species, as a foundation for improving predictive accuracy. The research goal was to gain a better understanding of the actual environmental impacts of renewable energy generation for wildlife. The information gathered through this process can then be used by land and wildlife managers and permitting and regulatory agencies to reduce those environmental impacts, thus lowering financial and environmental costs from energy generation.	6/10/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-060 Demonstrate a utility-owned renewable based community microgrid at Borrego Springs California	No	Distribution	$4,724,802	$4,724,802	$4,454,034	N/A
EPC-14-061 Learning from Real-World Experience to Understand Renewable Energy Impacts to Wildlife	No	Generation	$1,000,000	$1,000,000	$978,402	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-060 Demonstrate a utility-owned renewable based community microgrid at Borrego Springs California	$4,454,034	$923,165	$0	San Diego Gas and Electric Company; SMA America; OSISoft, LLC	$1,739,560	26.9%
EPC-14-061 Learning from Real-World Experience to Understand Renewable Energy Impacts to Wildlife	$978,402	$262,924	$400,000	US Geological Survey; University of Maryland Center for Environmental Studies Appalachian Laboratory; NextEra Energy	$1,617,177	61.8%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-060 Demonstrate a utility-owned renewable based community microgrid at Borrego Springs California	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-060 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31 out of 40 bidders	San Diego Gas & Electric Company
EPC-14-061 Learning from Real-World Experience to Understand Renewable Energy Impacts to Wildlife	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-061 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12 out of 14 bidders	U.S. Geological Survey (Forest and Rangeland Ecosystem Science Center - FRESC)

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-060 Demonstrate a utility-owned renewable based community microgrid at Borrego Springs California	Group 2: Ranked # 4	N/A	N/A	Yes; Calif Based Entity
EPC-14-061 Learning from Real-World Experience to Understand Renewable Energy Impacts to Wildlife	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-060 Demonstrate a utility-owned renewable based community microgrid at Borrego Springs California	The project demonstrated improved grid resiliency from using a high penetration renewable based microgrid. There was an immediate benefit to the Borrego Springs community of non-interrupted energy resources during power outages. The microgrid controller was also able to make greater use of the large local solar plant's renewable energy while avoiding adverse grid impacts by coordinating the operation of the various energy storage units with the solar energy output.	1e, 1h, 4a, 5a, 5d	The project was completed in July 2018. The Borrego Springs Microgrid project demonstrated a robust, renewable-based system that provides critical power during emergencies and planned outages, which are necessary when system upgrades and maintenance work are needed. Unlike behind the meter microgrids, the Borrego Springs Microgrid is the first true community microgrid for an entire city and not just for a single metered customer. A unique aspect of this microgrid is that the microgrid assets are located throughout the community where they are able to provide the greatest support. The final report is available at: https://www.energy.ca.gov/2019publications/CEC-500-2019-011/CEC-500-2019-011.pdf.
EPC-14-061 Learning from Real-World Experience to Understand Renewable Energy Impacts to Wildlife	This project developed and applied a unique combination of stable isotope analysis and demographic modeling to characterize wildlife populations of interest affected by fatalities at renewable energy facilities in California. The project also developed a novel application of techniques that evaluates statistical models to improve forecasting of wildlife fatality rates and mitigation outcomes. The approach was high-tech, scientifically-innovative, and ultimately subject to peer-review via publication in scientific journals. Implementation of this set of tools will benefit ratepayers by streamlining permitting and reducing costs of energy development and electricity.	2a, 3a, 4f, 4g	The project was completed in 2019, and the final report was received. Despite compiling more than 600 environmental reports, researchers concluded that it is largely impossible to assess the utility of pre-construction wildlife surveys to predict post-construction effects because of the lack of standardization. About 3,000 samples were prepared for isotopic analysis to determine the geographic origin of individuals. The research team developed populations models for 29 species to estimate the effect of fatalities at renewable energy facilities. Of the birds killed, those of predominantly local origin were especially likely to have lower population growth rates (they are declining) and greater adult survival (they are long-lived). The team shared sample material from carcasses with the team from EPC-15-043. The study published two journal articles, with several more underway.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-062 Energy Efficiency in California's Water Sector Using Customized Energy Management and Supervisory Control and Data Acquisition Systems	Technology Demonstration and Deployment	This project involves setting up links using software and hardware at pumping stations for water delivery, storage or treatment that enable the integration and transmission of data from energy meters directly or indirectly into Supervisory Control and Data Acquisition (SCADA) systems that are traditionally set up to monitor water quality parameters in real time. Combined with historical energy use data on the platform, operators can manage systems in real time to monitor and control peak demand.	5/13/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-063 Advance Wastewater Treatment Using Forward Osmosis to Produce High Quality Water	Technology Demonstration and Deployment	This project demonstrates an advanced wastewater treatment technology, the PFO Recycler, that produces high quality water while reducing energy, chemicals and maintenance required for treatment of industrial wastewaters. The PFO Recycler uses forward osmosis to extract the water from the waste stream and reverse osmosis to extract the water out of the forward osmosis draw solution. If the project is successful then this technology could be used to treat challenging wastewaters to achieve high purity and provide high temperature water for reuse while using less energy than other processes. Reclaiming water for onsite reuse will reduce the need for fresh water purchases.	5/13/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-062 Energy Efficiency in California's Water Sector Using Customized Energy Management and Supervisory Control and Data Acquisition Systems	No	Demand-side Management	$3,017,034	$3,017,034	$2,274,513	N/A
EPC-14-063 Advance Wastewater Treatment Using Forward Osmosis to Produce High Quality Water	No	Demand-side Management	$3,230,420	$3,230,420	$3,230,164	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-062 Energy Efficiency in California's Water Sector Using Customized Energy Management and Supervisory Control and Data Acquisition Systems	$2,274,513	$452,544	$0	Inland Empire Utilities; OSISoft, LLC; Regents of the University of California, Riverside Campus; Opto 22; Cucamonga Valley Water District; Olivehain Municipal Water District	$1,722,732	36.3%
EPC-14-063 Advance Wastewater Treatment Using Forward Osmosis to Produce High Quality Water	$3,230,164	$964,131	$0	To Be Determined; Porifera, Inc.; CDM Smith, Inc. ; Dr. Bronner's Magic Soaps ; Jackson Family Wines	$646,493	16.7%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-062 Energy Efficiency in California's Water Sector Using Customized Energy Management and Supervisory Control and Data Acquisition Systems	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-062 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 43 out of 46 bidders; phase 2: 10 out of 13 bidders	University of California, Riverside
EPC-14-063 Advance Wastewater Treatment Using Forward Osmosis to Produce High Quality Water	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-063 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 43 out of 46 bidders; phase 2: 10 out of 13 bidders	Porifera, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-062 Energy Efficiency in California's Water Sector Using Customized Energy Management and Supervisory Control and Data Acquisition Systems	Ranked # 6	N/A	N/A	Yes; Calif Based Entity
EPC-14-063 Advance Wastewater Treatment Using Forward Osmosis to Produce High Quality Water	Ranked # 2	N/A	N/A	Yes; Calif Based Entity, Minority Owned, Woman Own

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-062 Energy Efficiency in California's Water Sector Using Customized Energy Management and Supervisory Control and Data Acquisition Systems	This project highlighted a pathway for water and wastewater agencies in California to increase energy efficiency and reduce their peak energy consumption with no decrement in service or reliability by monitoring real time energy consumption. This project provided equipment energy data to the water district operators, who can make decisions on optimal equipment operation. The direct benefits to water districts were demand charge savings, O&M savings, and improved operational efficiency.	1e, 1h, 4a	This project was completed in March 2019. All water districts were able to successfully integrate the energy management system (EMS) into their existing SCADA system with the ability to integrate other pumping and treatment sites into the EMS. There were several benefits to the water districts including energy savings, reduction in demand charges, and operations and maintenance savings. All water district operators were able to monitor energy demand in real time to operate the system more efficiently. The EMS deployment at Cucamonga Valley Water District resulted in a 41 percent peak demand reduction from one pumping site. This correlates to annual cost savings, based on demand charges, of $149,146 for one pumping site. To share the results of the project, the Recipient hosted a workshop that brought together local officials, water system integrators and water districts.
EPC-14-063 Advance Wastewater Treatment Using Forward Osmosis to Produce High Quality Water	The project includes technological advancements in membrane development and module design in forward osmosis to address cost and performance issues. The demonstration projects are located at a winery, frozen food facility and a soap company. Each demonstration is documenting energy savings and potential for this technology to purify, concentrate and reuse challenging wastewaters that contains high levels of contaminants. This technology has the potential for application in the food and beverage, oil and gas, and other industrial sectors.	1f, 1h, 4a, 4c	Final report is under review for publication. Demonstration results show energy savings of at least 20% when targeting 70% water recovery and at least 40% energy savings when targeting 90% water recovery. The technology has been showcased at the California League of Food Processors Expo for several years and has gotten some interest from the industry to do more projects.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-064 Aerosol Impacts on the Hydrology and Hydropower Generation in California	Applied Research and Development	The research team enhanced and used a fully coupled aerosol-meteorology-snowpack forecast model for hydropower applications, using observational datasets (precipitation, snowpack, stream inflow) for Southern California Edison's hydropower plant on Big Creek. The main goal was to estimate the impacts of aerosols on hydropower generation and explore the use of improved forecasts to improve the management of hydropower units.	5/13/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-065 Demonstration of Forward Osmosis to Produce Juice Concentrate, Purify and Reuse Wastewater and Reduce Energy Use	Technology Demonstration and Deployment	This project is demonstrating a new technology innovation, the PFO Concentrator, to reduce the energy, chemicals, and maintenance required for food and beverage processing and waste concentration. The PFO concentrator dewaters fruits and vegetables for production of food and beverage concentrates and purees and could replace energy intensive thermal evaporators. Additionally, water is extracted from the concentrated product for reuse on-site.	5/13/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-064 Aerosol Impacts on the Hydrology and Hydropower Generation in California	No	Generation	$399,818	$399,818	$379,062	N/A
EPC-14-065 Demonstration of Forward Osmosis to Produce Juice Concentrate, Purify and Reuse Wastewater and Reduce Energy Use	No	Demand-side Management	$2,499,289	$2,499,289	$2,499,284	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-064 Aerosol Impacts on the Hydrology and Hydropower Generation in California	$379,062	$92,951	$0	University of California, Riverside; University of California Los Angeles	$306,237	43.4%
EPC-14-065 Demonstration of Forward Osmosis to Produce Juice Concentrate, Purify and Reuse Wastewater and Reduce Energy Use	$2,499,284	$621,536	$0	Porifera, Inc.; CDM Smith, Inc. ; Los Gatos Tomato	$628,568	20.1%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-064 Aerosol Impacts on the Hydrology and Hydropower Generation in California	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-064 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12 out of 14 bidders	Regents of the University of California, Riverside Campus
EPC-14-065 Demonstration of Forward Osmosis to Produce Juice Concentrate, Purify and Reuse Wastewater and Reduce Energy Use	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-065 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 43 out of 46 bidders; phase 2: 10 out of 13 bidders	Porifera, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-064 Aerosol Impacts on the Hydrology and Hydropower Generation in California	Group 3: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-14-065 Demonstration of Forward Osmosis to Produce Juice Concentrate, Purify and Reuse Wastewater and Reduce Energy Use	Ranked # 7	N/A	N/A	Yes; Calif Based Entity, Minority Owned, Woman Own

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-064 Aerosol Impacts on the Hydrology and Hydropower Generation in California	The proposed research is intended to significantly advance our knowledge of aerosol impacts on the hydrology and hydropower generation in California. The results of this project are expected to improve the management of hydropower units which should reduce overall electricity generation costs and assist with adaptation under a changing climate.	1c, 4a, 5c	The research team successfully ran a chemistry-aerosol-meteorological model and coupled this model with a model used by Southern California Edison (SCE) to operate their Big Creek Hydroelectric System. The modeling results suggest that aerosols induce a reduction of annual inflows on the order of 4% to 14% but that the reductions are more significant in the summer. The research team calculated the loss of generation and revenue and found that aerosols reduce hydropower generation by about 6%, which is equivalent to an annual loss of about $3 million a year. The final report was submitted and will be posted in the near future. The researchers have shared results with others via scientific conferences and journal publications. SCE was heavily involved with the research team during the execution of the project and co-authored a conference paper with the research team.
EPC-14-065 Demonstration of Forward Osmosis to Produce Juice Concentrate, Purify and Reuse Wastewater and Reduce Energy Use	The technology uses forward osmosis and reverse osmosis in an energy efficient way to achieve the equipment performance of an evaporator and, in addition, generates purified water streams for reuse. This technology could lower energy use and costs for food processing and industrial operations through replacement of energy intensive thermal evaporators and reuse of wastewater streams onsite, rather than disposed through the municipal system.	1f, 1h, 4a, 4c	Project has been completed and the final report is under review for publication. The results show annual energy savings of up to 72 percent for wineries, 80 percent for industries with brine wastes, and 75 percent for tomato processing. There has been interest in continuing testing of other wine grape juice and even wine concentrate from Jackson Family Wines after the project.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-066 High-Performance Integrated Window and Facade Solutions for California Buildings	Applied Research and Development	This project develops, validates and quantifies energy impacts of a new generation of high performance building envelope systems such as highly insulating windows, novel window-integrated local ventilation, and dynamic daylight-redirection. It will provide design and management toolkits that will enable the building industry to meet challenging energy performance goals leading to zero net energy buildings. This project considers cost-effective integrated system approaches to reduce energy use associated with HVAC and lighting while improving occupant comfort.	5/13/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-067 Improving Hydrological Snowpack Forecasting for Hydropower Generation Using Intelligent Information Systems	Applied Research and Development	The project will advance hydrologic modeling and improve the Precipitation-Runoff Modeling System (PRMS) used by PG&E, allowing for more effective management of hydropower resources. The project features an innovative smart wireless sensor network made up of small sensor stations mounted on poles linked by low-power radio, which produces real-time hydrologic data. These data, blended with satellite and Light Detection And Ranging (LiDAR) remote sensing data, have the potential to greatly improve hydrologic forecasting for the Sierra Nevada and other areas in California.	5/13/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-066 High-Performance Integrated Window and Facade Solutions for California Buildings	No	Demand-side Management	$3,000,000	$3,000,000	$3,000,000	N/A
EPC-14-067 Improving Hydrological Snowpack Forecasting for Hydropower Generation Using Intelligent Information Systems	No	Generation	$1,100,000	$1,100,000	$944,195	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-066 High-Performance Integrated Window and Facade Solutions for California Buildings	$3,000,000	$1,308,929	$450,000	United States Department of Energy	$450,000	13.0%
EPC-14-067 Improving Hydrological Snowpack Forecasting for Hydropower Generation Using Intelligent Information Systems	$944,195	$205,897	$0	California Department of Water Resources; University of California Merced	$236,263	17.7%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-066 High-Performance Integrated Window and Facade Solutions for California Buildings	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-066 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	Lawrence Berkeley National Laboratory
EPC-14-067 Improving Hydrological Snowpack Forecasting for Hydropower Generation Using Intelligent Information Systems	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-067 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12 out of 14 bidders	The Regents of the University of California, Berkeley Campus

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-066 High-Performance Integrated Window and Facade Solutions for California Buildings	Group 1: Ranked # 10	N/A	N/A	Yes; Calif Based Entity
EPC-14-067 Improving Hydrological Snowpack Forecasting for Hydropower Generation Using Intelligent Information Systems	Group 3: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-066 High-Performance Integrated Window and Facade Solutions for California Buildings	This project further developed highly insulating windows (advanced TRL to 7), window-integrated ventilation systems (advanced TRL to 6), dynamic daylight redirecting systems (advanced TRL to 4), and dynamic, integrated window and facades through advanced controls (advanced TRL to 5). Technology enhancements include thermal improvements to glazing and frame, better management of air flow, ventilation and heat exchange in perimeter zones, doubling the depth of the perimeter zone that is effectively daylighted, and active load management controls in response to whole-building energy and grid needs. This project also improved modeling capabilities for advanced shading and daylighting systems which is a key interest to DOE moving forward. Project simulations indicate these technologies could reduce HVAC energy use up to 39 percent, and lighting energy use up to 54 percent.	1e, 1f, 1h, 2a	Project completed in March 2019. This project advanced knowledge and technologies in five areas: highly insulating windows; energy recovery-based facade ventilation systems (low-energy air flow through the facade); daylight redirecting systems (sunlight from windows reflected deep into the building); daylighting and shading optimization methods (daylight and solar heat gain models for simulating light-scattering shading and daylighting technologies); and integrated window and facades through advanced controls. Since these technologies are early prototypes, the team is continuing to pursue commercial development partners. The California Partnership for Advanced Windows was also formed to identify and overcome market barriers to facilitate market transformation toward highly insulating windows.
EPC-14-067 Improving Hydrological Snowpack Forecasting for Hydropower Generation Using Intelligent Information Systems	The project provides improved predictive planning and scheduling tools to manage hydroelectric resources that are needed to adapt to increasing vulnerabilities and uncertainties of a changing climate. This project specifically targets powerhouses operated by PG&E.	2a, 3a, 5c	Project was successfully completed in 2019. The research team installed hardware and collected hydrologic data for water years 2016, 2017, 2018 from four project sites: Grizzly Ridge, Kettle Rock, Buck's Lake, and Humbug. Data from in-situ snowpack measurements helped to improve Snowpack Water Equivalent (SWE) maps by 55%. The project team worked closely with hydrologists from PG&E and updated their working model of the Precipitation Runoff Modeling System (PRMS) from version 2 to version 4, which features updated topographical, climate, and vegetation data. Project results were published in the California 4th Climate Change Assessment Report. In addition, the project team published two peer-reviewed papers.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-068 Evaluation of Cost, Performance and Water Conserving Capability of Hybrid Cooling	Applied Research and Development	This project analyzed the design, performance, and cost of optimized hybrid cooling systems at utility power plant scale to illustrate the potential benefits of hybrid cooling in California. This project uses an existing Excel spreadsheet-based computational tool with the capability of specifying, at an "engineering-level", design parameters for optimized closed-cycle wet, direct dry, and parallel wet/dry hybrid cooling systems. The tool's output is checked against information from participating plants equipped with wet, dry, and hybrid cooling systems. The capability to make rigorous, reliable evaluations of hybrid cooling systems and the trade-offs between economic power production and water resource conservation enables the selection of preferred cooling systems for the economic and environmental benefit of California.	5/13/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-069 Develop Analytical Tools and Technologies to Plan for and Minimize the Impacts of Climate Change on the Electricity System	Applied Research and Development	This project advances the understanding of key parameters of long-term energy scenarios and greenhouse gas abatement options in the California energy system. Researchers further developed detailed scenarios and modeling capabilities of the California electricity sector, as well as interactions between the electricity sector and other sectors, and explored the implications of particular policy choices on the electricity system in the medium (2020-2030) and long term (2050). This project provides critical insight into some of the key challenges facing the low carbon transition in the electricity system, the options for addressing these challenges, and the dynamic interactions among these options, which are likely to grow more important over time.	5/13/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-068 Evaluation of Cost, Performance and Water Conserving Capability of Hybrid Cooling	No	Generation	$581,580	$581,580	$545,174	N/A
EPC-14-069 Develop Analytical Tools and Technologies to Plan for and Minimize the Impacts of Climate Change on the Electricity System	No	Grid Operations/Market Design	$700,000	$700,000	$699,921	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-068 Evaluation of Cost, Performance and Water Conserving Capability of Hybrid Cooling	$545,174	$0	$0	None	$0	0.0%
EPC-14-069 Develop Analytical Tools and Technologies to Plan for and Minimize the Impacts of Climate Change on the Electricity System	$699,921	$286,936	$0	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-068 Evaluation of Cost, Performance and Water Conserving Capability of Hybrid Cooling	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-068 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12 out of 14 bidders	Maulbetsch Consulting
EPC-14-069 Develop Analytical Tools and Technologies to Plan for and Minimize the Impacts of Climate Change on the Electricity System	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-069 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12 out of 14 bidders	Energy and Environmental Economics, Inc. (E3)

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-068 Evaluation of Cost, Performance and Water Conserving Capability of Hybrid Cooling	Group 4: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-14-069 Develop Analytical Tools and Technologies to Plan for and Minimize the Impacts of Climate Change on the Electricity System	Group 5: Ranked # 3	N/A	N/A	Yes; Small Business, Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-068 Evaluation of Cost, Performance and Water Conserving Capability of Hybrid Cooling	Hybrid cooling can save substantial amounts of water compared to the traditional wet cooling systems, although there are increased system costs and potentially reduced hot day generating capacity and annual energy production. The results of this study provide information validated by a computer methodology to determine quantitative estimates of the trade-offs among cooling system cost, annual energy production, and water consumption. State regulatory agencies, power system developers and owners, and community groups can use this information to make informed decisions about the most suitable cooling equipment to use at future steam power generating facilities in California. This will help ensure the appropriate balance among the supply of electrical generation, the cost of electricity, and conserving water resources.	2a, 3a, 4c	The final report was submitted in December of 2017 and published in July 2018 at: https://www.energy.ca.gov/2018publications/CEC-500-2018-015/CEC-500-2018-015.pdf; https://www.energy.ca.gov/2018publications/CEC-500-2018-015/CEC-500-2018-015.pdf. Results included: 1. Validating the tool output against existing cooling systems. The estimates generated by the tool were comparable to the design and performance of existing systems at full-scale power plants. 2. Comparing costs, performance, and water consumption in differing meteorological conditions as illuminated in the case studies. The team concluded that while the installed cost and the turbine output reduction vary significantly with cooling system choice, the annualized costs do not. 3. Projecting effects of using hybrid cooling at California power plants in the future.
EPC-14-069 Develop Analytical Tools and Technologies to Plan for and Minimize the Impacts of Climate Change on the Electricity System	This project developed options for improving electricity planning methodologies, such that they better incorporate knowledge of how the electricity system will need to evolve over the next 15 to 30 years. The analysis includes a better understanding of how current policy choices will impact long-term climate outcomes, providing critical policy-relevant information to state energy agencies that will be implementing the Governor's energy and climate goals over the next 15 years. The research team estimated the potential costs of reducing GHG emissions by 80% by 2050 and compared these costs with the public health benefits of improved air quality reported by others. They found that the potential public health benefits are in the same order of magnitude than the potential GHG reduction costs.	3f, 4a	The researchers improved their models and data sets, for example, improving the linkage between the E3 model of the electricity system and their PATHWAY model. E3 briefed Chair Weisenmiller and the project's Policy Advisory Committee in November 2017. The final project report is published on the Energy Commission website. Key findings of the long-term energy scenarios research include: 1) renewable power generation needs to exceed the current RPS requirement of 50% set for 2030 if the 2030 emissions reductions goal is to be met; 2) to meet California's 2050 goal of 80% emissions reductions relative to 1990 levels, the electricity system must be comprised of 85-95% zero-carbon electricity by 2050; 3) consumer behavior is the lynchpin to meeting 2030 targets; and 4) additional RD&D is needed to chart a path for hard-to-electrify end-uses (e.g., heavy-duty trucks, industry).

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-070 Wexus Energy and Water Management Mobile Software for the Agricultural Industry	Technology Demonstration and Deployment	This project deploys the Wexus (Water-Energy Nexus) mobile, cloud-based software platform in California's agricultural industry. The Wexus platform leverages existing utility meter infrastructure and helps agribusinesses to quickly assess energy (and water) usage and cost from virtually anywhere on any mobile device. Through customized alerts and reporting, the platform allows farms to quickly respond to changes in energy usage, adjust and optimize equipment in the field, and reduce operational expenses due to energy costs. Through collaboration with project partners, this project will further extend existing water-energy data analysis, visualization and remote controlling capabilities to the Wexus platform to further optimize water-energy resource management in the agribusiness sector.	5/13/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-071 Rotor-Mounted Bat Impact Deterrence System Design and Testing	Applied Research and Development	The project designed and tested (in lab and field) a new system to discourage bats from colliding with wind turbines. The system uses ultrasound transmitters mounted in an array along the rotor blades, providing complete coverage over the entire rotor and nacelle envelope. A field test study using substantially similar methods to prior bat impact studies was implemented post-installation at the test site to measure the effectiveness of the new ultrasound system.	5/13/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-070 Wexus Energy and Water Management Mobile Software for the Agricultural Industry	No	Demand-side Management	$4,000,000	$4,000,000	$3,943,801	N/A
EPC-14-071 Rotor-Mounted Bat Impact Deterrence System Design and Testing	No	Generation	$862,875	$862,875	$713,707	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-070 Wexus Energy and Water Management Mobile Software for the Agricultural Industry	$3,943,801	$571,397	$0	Wexus Technologies, Incorporated	$1,000,000	20.0%
EPC-14-071 Rotor-Mounted Bat Impact Deterrence System Design and Testing	$713,707	$31,238	$249,000	Frontier Wind; Bruce Walker	$36,313	4.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-070 Wexus Energy and Water Management Mobile Software for the Agricultural Industry	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-070 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 43 out of 46 bidders; phase 2: 10 out of 13 bidders	Wexus Technologies, Incorporated
EPC-14-071 Rotor-Mounted Bat Impact Deterrence System Design and Testing	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-071 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12 out of 14 bidders	Frontier Wind

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-070 Wexus Energy and Water Management Mobile Software for the Agricultural Industry	Ranked # 4	N/A	N/A	Yes; Calif Based Entity
EPC-14-071 Rotor-Mounted Bat Impact Deterrence System Design and Testing	Group 6: Ranked # 3	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-070 Wexus Energy and Water Management Mobile Software for the Agricultural Industry	The Wexus software platform has leveraged existing AMI infrastructure and utility Green Button data platforms extensively to offer initial savings to partner farms without the need for additional hardware installations on site. The Wexus platform has also integrated this electricity data into tariff engines to compare rates and to estimate water usage for reporting.	1e, 1f, 1h	In terms of savings results, three of the four farms had substantially lower average electricity usage during the project period, thus achieving the targeted ten percent (10%) reduction from pre-project baseline values. In total, partner farms reduced electricity usage by 1.14 GWh/year or 17.2% on average unadjusted and by 38 MWh/year and one percent on average, when modeled as adjusted. The adjusted results are based upon several statistical models, which attempt to estimate the impact of factors outside the scope of the project (e.g. major farm operation/crop changes, weather, drought conditions, and EE equipment or renewable energy installations). The Wexus team looks forward to continuing to pioneer and refine this M&V/savings model for the agricultural industry and to implement it in new California third party energy efficiency programs.
EPC-14-071 Rotor-Mounted Bat Impact Deterrence System Design and Testing	This project created an innovative bat impact deterrent system that may effectively prevent fatal bat interactions with wind turbines. The system has potential to yield a transformational impact on the field of bat impact mitigation. An effective, practical, cost-effective system design and test can enable commercialization and broad deployment of this technology. As a system that can be retrofitted into existing turbines and installed in new wind turbines, this technology could materially overcome a significant challenge of the wind power industry by reducing bat fatalities and injuries from turbine strikes while avoiding costly curtailments.	2a, 3a, 4g	The project concluded in 2019, and the final report was received. Researchers completed the design stage for the system and tested it in their lab. The full system was installed on twelve turbines at Hatchet Ridge in 2016. Bat fatality surveys were conducted on the test turbines and control turbines during the fall 2016 bat migration season. Power supply problems disrupted the field testing, limiting the amount of useful data. Problems with the power supplies were diagnosed and resolved in 2018, but smoke from the Carr Fire prevented installation in time for the 2018 bat migration season. Therefore the team was unable to complete bat fatality surveys in 2019 to collect sufficient data to give a statistically robust estimate of the effectiveness of the system to reduce fatalities.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-072 Building a Healthier and More Robust Future: 2050 Low Carbon Energy Scenarios for California	Applied Research and Development	The researchers developed long-term energy scenarios for California that comply with GHG emission targets and goals. The scenarios provide new insights about technology options and by when some of this options should be implemented.	5/13/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-073 Monitoring the Urban Heat Island Effect and the Efficiency of Future Countermeasures	Applied Research and Development	This project evaluates the distribution of air temperatures within urban heat islands in California and enhances the foundation for location-specific assessments of mitigation strategies. In collaboration with local governments and organizations in the Los Angeles Basin, the research team designed and implemented siting of fixed high-quality monitoring stations, supplemented with mobile monitoring and data from existing weather-station networks. This research assesses spatial and temporal variations in near-surface air temperature and recasts these observations for use in validating and calibrating the climate/meteorological models applied to assess potential benefits of urban heat island countermeasures throughout the state.	5/13/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-072 Building a Healthier and More Robust Future: 2050 Low Carbon Energy Scenarios for California	No	Generation	$700,000	$700,000	$700,000	N/A
EPC-14-073 Monitoring the Urban Heat Island Effect and the Efficiency of Future Countermeasures	No	Grid Operations/Market Design	$500,000	$500,000	$500,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-072 Building a Healthier and More Robust Future: 2050 Low Carbon Energy Scenarios for California	$700,000	$236,701	$0	University of California, Berkeley	$65,000	8.5%
EPC-14-073 Monitoring the Urban Heat Island Effect and the Efficiency of Future Countermeasures	$500,000	$116,818	$0	Altostratus, Inc.	$4,000	0.8%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-072 Building a Healthier and More Robust Future: 2050 Low Carbon Energy Scenarios for California	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-072 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12 out of 14 bidders	Lawrence Berkeley National Laboratory
EPC-14-073 Monitoring the Urban Heat Island Effect and the Efficiency of Future Countermeasures	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-073 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12 out of 14 bidders	Lawrence Berkeley National Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-072 Building a Healthier and More Robust Future: 2050 Low Carbon Energy Scenarios for California	Group 5: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-14-073 Monitoring the Urban Heat Island Effect and the Efficiency of Future Countermeasures	Group 7: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-072 Building a Healthier and More Robust Future: 2050 Low Carbon Energy Scenarios for California	The researchers developed a stochastic version of their electricity model to explore issues such as path dependences. The preliminary final results indicates, among other things, that achieving the 2030 GHG target will be extremely difficult with a high percentage of natural gas appliances still in operation. However, this target can be met if California starts electrifying energy services and decarbonize power generation at a fast rate. The electrification of the industrial sector will be difficult even though the electrification technical potential is high. This is mostly due to the costs associated with electrification of the industrial sector. The use of PVs in disadvantages communities may not substantially improve local air quality or public health.	2a, 3f, 3h, 4a	LBNL and UC Berkeley have developed several long-term energy scenarios for California. The team attempted to harmonize assumptions with E3 and UC Irvine. These two entities performed similar analyses (long-term energy scenarios) than LBNL/UCB, but using different tools. The LBNL/UCB team is modeling the entire Western Electric Coordinating Council (WECC) to investigate if a changing of geographical coverage can affect the long-term energy scenarios. They also used a more granular model of the electricity system both in space and time with, for example, several load centers in the WECC instead of representing California as one block.
EPC-14-073 Monitoring the Urban Heat Island Effect and the Efficiency of Future Countermeasures	Research improves on-the-ground benefits from urban heat island (UHI) mitigation by verifying relationships between the UHI effect and land use/land cover; using these measurements to calibrate and validate models that estimate benefits of mitigation measures; establishing a baseline of today's UHI effect against which the efficacy of future UHI mitigation (cool community) programs can measured; and leaving in place a set of research-grade monitors that can be used to track changes in the UHI effect.	4a	Having successfully engaged the LA Unified School District in siting of research grade weather stations and developed a mobile monitoring platform for monitoring urban heat island (UHI) effects through strategically charted transects, the team completed its collection and analysis of empirical data portraying urban heat island phenomena in the Los Angeles basin. A final report passed the rigorous peer review process associated with California's Fourth Climate Change Assessment. New findings include identification of dominant determinants of urban heat island impacts in the San Fernando Valley and downtown Los Angeles study areas, namely low vegetation canopy cover and low albedo, respectively. Another key contribution was development of a methodological framework for siting weather stations, monitoring urban heat islands, and empirically substantiating strategies to address UHI.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-074 Building a Climate Change Resilient Electricity System for Meeting California's Energy and Environmental Goals	Applied Research and Development	The project used climate change simulations to model conditions that disrupt electricity system generation, renewable capacity potential, and demand for the years of 2030, 2040, and 2050. The combined effect of these impacts was then simulated on the electricity system using an integrated electric grid modeling platform to determine the shortfall in achieving California's greenhouse gas emissions goals. The project then analyzed the potential benefits of additional mitigation strategies, such as additional energy storage, on reducing emissions.	5/13/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-075 Unlocking Industrial Energy Efficiency Through Optimized Energy Management Systems	Technology Demonstration and Deployment	The University of California at Berkeley, Massachusetts Institute of Technology, and the University of Chicago, have partnered with Lightapp Technologies to demonstrate a pre-commercial, software-based, optimized energy management system in industrial facilities. Together, they will demonstrate Lightapp's energy-monitoring system on compressed air systems in 100 California industrial plants served by the state's investor-owned utilities.	5/13/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-074 Building a Climate Change Resilient Electricity System for Meeting California's Energy and Environmental Goals	No	Generation	$698,792	$698,792	$698,792	N/A
EPC-14-075 Unlocking Industrial Energy Efficiency Through Optimized Energy Management Systems	No	Demand-side Management	$4,981,729	$4,981,729	$4,816,314	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-074 Building a Climate Change Resilient Electricity System for Meeting California's Energy and Environmental Goals	$698,792	$181,613	$750,000	Southern California Gas Company (SoCalGas); Southern California Edison	$300,000	30.0%
EPC-14-075 Unlocking Industrial Energy Efficiency Through Optimized Energy Management Systems	$4,816,314	$451,253	$0	University of California, Berkeley	$1,530,590	23.5%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-074 Building a Climate Change Resilient Electricity System for Meeting California's Energy and Environmental Goals	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-074 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12 out of 14 bidders	The Regents of the University of California, Irvine
EPC-14-075 Unlocking Industrial Energy Efficiency Through Optimized Energy Management Systems	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-075 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 43 out of 46 bidders; phase 2: 10 out of 13 bidders	The Regents of the University of California, Berkeley Campus

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-074 Building a Climate Change Resilient Electricity System for Meeting California's Energy and Environmental Goals	Group 5: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-14-075 Unlocking Industrial Energy Efficiency Through Optimized Energy Management Systems	Ranked # 8	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-074 Building a Climate Change Resilient Electricity System for Meeting California's Energy and Environmental Goals	The primary benefit of this study was addressing a knowledge gap that has hampered energy planners and policy makers. Previous energy planning studies for the state assumed that future climate would be the same as historical or that climate change would have no impact on the energy system. This study revealed that feedback from climate change could disrupt strategies designed to meet California's greenhouse gas reduction and renewable energy goals for 2050. The study also found that the potential shortfalls caused by climate change could be overcome with existing technologies, perhaps aided by policy changes.	2a, 4a	The project was completed in 2018 and provided an understanding of the specific effects of climate change on the electricity system by 2050 and the resulting ability of the system to satisfy California's GHG reduction target. Because the baseline energy scenario did not account for climate change and fell short of the GHG target, the project team explored a set of energy technologies and resource management strategies to determine if they could offset the shortfall. The project generated a more realistic energy scenario for achieving the 2050 GHG target at the lowest cost. This project was conducted in collaboration with two related studies led by Energy and Environmental Economics (EPC-14-069) and Lawrence Berkeley National Laboratory (EPC-14-072), and results of these three studies have been presented to policy makers and legislative staff. Three journal papers were published.
EPC-14-075 Unlocking Industrial Energy Efficiency Through Optimized Energy Management Systems	The Lightapp technology takes an innovative approach by relating electricity use and operating measurements to the production outputs of specific facility systems. This project monitored compressed air systems over time, looking at both the supply side (the compressor) and the demand side (production). The software tool then identifies anomalies and makes recommendations to lower the overall energy intensity of production and save energy and money. This project demonstrates the operational effectiveness and financial viability of deploying a more developed version of the technology in California industries and optimizes electricity consumption in compressed air systems, a common system in many industries.	1f, 1h, 4a	Final report is in ERDD pubs unit and invoices all received and processed. Nothing new as of 7/16/2020. The project is complete. The Lightapp energy management system collected and analyzed data from sensors installed in 102 industrial facilities. The energy management system provided real-time data to facility personnel and customized recommendations on how to reduce energy use and optimize equipment performance. Annualized energy cost savings are estimated to be $812,000 and greenhouse gas reductions estimated to be 1,500 tons for the facilities analyzed. The industrial customer demand for the software-based system was high, with 22 percent of all eligible sites ageing to join the project 41 percent of all project participants opting to subscribe to the service at the end of the project. The Lightapp brand was changed to Zira in September 2019.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-076 Raw Wastewater Filtration to Increase Organic Removal Efficiency and Achieve Significant Electrical Savings	Technology Demonstration and Deployment	This project is extending the application of Cloth Depth Filters (CDF) to raw wastewater filtration at three wastewater treatment plants in California. The CDF concept replaces the current technology of primary clarification by offering the following advantages: (1) substantially higher removal of organic load resulting in significantly lower aeration electrical power demand, and (2) smaller footprint requirements both for primary and secondary treatment steps. CDF employs established principles of gravitational forces which results in minimal operational and maintenance complexities. The unique attribute which offers promise for CDF technology in raw wastewater is the vertical placement of the filter medium and flow direction of this filtration process. Unlike prevailing filtration systems, the vertical orientation of the filter medium permits heavy solids to settle within the tank.	5/13/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-077 Enable Standardized Vehicle-Grid Integration through Development of Universal Standard	Applied Research and Development	The project was intended to design and develop a Demand Clearing House (DCH) to monitor published energy pricing from the California Independent System Operator's Fifteen-Minute Energy Market as well as load forecasts from San Diego Gas and Electric and other participating utilities through an Application Programming Interface translation from Open ADR 2.0b, a Demand Response protocol used by all California Investor Owned Utilities. The DCH would have then used algorithms that convert grid conditions into ISO/IEC 15118 "grid profiles," or Tariff Tables, which in turn would be communicated to 15118-capable charging stations and vehicles. A fully developed DCH would allow utilities to respond to supplemental energy market prices, proving a viable and scalable pathway toward using plug-in electric vehicles to manage variable grid conditions, solar oversupply, and other system wide challenges. This project was terminated early and will not complete.	6/10/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-076 Raw Wastewater Filtration to Increase Organic Removal Efficiency and Achieve Significant Electrical Savings	No	Demand-side Management	$3,476,085	$3,476,085	$3,392,789	N/A
EPC-14-077 Enable Standardized Vehicle-Grid Integration through Development of Universal Standard	No	Grid Operations/Market Design	$1,499,999	$1,499,999	$356,872	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-076 Raw Wastewater Filtration to Increase Organic Removal Efficiency and Achieve Significant Electrical Savings	$3,392,789	$1,184,735	$0	Kennedy/Jenks Consultants; Water Environment Research Foundation; Regents of University of California, Davis; Aqua-Aerobic Systems, Inc.; Process Wastewater Technologies LLC; Linda County Water District	$1,288,340	27.0%
EPC-14-077 Enable Standardized Vehicle-Grid Integration through Development of Universal Standard	$356,872	$193,033	$0	Energy Solutions International; Center for Sustainable Energy; Broadband Telcom Power Inc.; KnGrid	$162,474	9.8%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-076 Raw Wastewater Filtration to Increase Organic Removal Efficiency and Achieve Significant Electrical Savings	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-076 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 43 out of 46 bidders; phase 2: 10 out of 13 bidders	Kennedy/Jenks Consultants
EPC-14-077 Enable Standardized Vehicle-Grid Integration through Development of Universal Standard	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-077 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25 out of 25 bidders	Center for Sustainable Energy

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-076 Raw Wastewater Filtration to Increase Organic Removal Efficiency and Achieve Significant Electrical Savings	Ranked # 5	N/A	N/A	Yes; Calif Based Entity
EPC-14-077 Enable Standardized Vehicle-Grid Integration through Development of Universal Standard	Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-076 Raw Wastewater Filtration to Increase Organic Removal Efficiency and Achieve Significant Electrical Savings	This project uses cloth depth filtration (CDF) for raw wastewater filtration to reduce the organic load on the secondary wastewater treatment step, which is the most energy intensive step in the treatment process. This breakthrough treatment using CDF has never been tested nor implemented at wastewater treatment plants. Project results from the 18-month pilot demonstration at Linda County showed that a full-scale primary filtration using CDF technology is a feasible replacement of primary clarification process in the treatment of wasterwater in California.	1f, 1h, 4a	Project results have shown that primary filtration consistently removed 75-85 percent of suspended solids and 40-63 percent of organics from screened raw wastewater. Based on the 18-month demonstration at Linda County, full-scale primary filtration is a feasible replacement of primary clarification. Primary filtration is expected to have estimated annual energy savings ranging from $22,000 to $35,000 per million gallons per (mgd) day of facility average capacity. The project has also shown wastewater capital costs can be reduced in the range of $640,000 to $1.1 million per mgd of facility average capacity. The capital cost savings come from the 60-70 percent reduction in primary treatment footprint and increased secondary treatment capacity. Project team will continue to market this technology to interested water utilities.
EPC-14-077 Enable Standardized Vehicle-Grid Integration through Development of Universal Standard	Had the project been successful, this project would have advanced the adoption of an open protocol that enables large amounts of new, low cost flexible capacity on the grid. The open protocol could potentially minimize stranded investments in less cost effective forms of flexible grid resources, maximize renewable and PEV integration, and promote a safer, more reliable low carbon future.	2a, 4a, 4b	CSE was unsuccessful in completing this project to develop, test and demonstrate an open-source Demand Clearing House (DCH). CSE experienced numerous project delays due to the loss of a major subcontractor and subsequently their demonstration site. CSE and the Energy Commission determined that the project could not satisfactorily complete before the grant funds expired. These delays ultimately led to the proposed termination of this grant agreement. The only deliverable brought to completion was the DCH Server Specifications, which detail the design capabilities and functionality of the DCH. Work progressed on the DCH software, but was only completed up to 25%. The Server Specifications and "work in progress" software are available to the public for use and continued development. Energy Commission Audit staff concluded their audit and identified unresolved questioned costs.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-078 Next-Generation Grid Communication for Residential PEVs	Applied Research and Development	The project develops communication interfaces between PEV customers and utilities using cloud-to-cloud OpenADR 2.0b communication with a vehicle charging network and will leverage emerging means for retrieving vehicle information via the ISO/IEC 15118 standard for consideration in the decision process. The communication will be able to gather customer data and receive signals from a third party (utility) for the purpose of optimizing PEV charging in a mutually beneficial manner to the customer and the utility. In addition to investigation and implementation of the ISO/IEC 15118 standard, the project will also investigate using control methods that do not require having vehicle charging information. This may be done through statistical estimation, rate of charge output from charging stations or driver opt-in based on maximum charge needed.	6/10/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-079 Assessing the Ability of Smart Inverters and Smart Consumer Devices to Enable more Residential Solar Energy	Applied Research and Development	The purpose of this project is to resolve the limiting conditions that occur on California distribution systems when many PV systems are installed behind a single residential distribution transformer by evaluating advanced inverter functionality with the specific goal of enabling higher penetration of photovoltaics on the grid. The project is identifying, implementing, and testing (both in lab and field) optimal methods by which smart inverters can mitigate the issues that otherwise would limit local high penetrations of residential PV. The process will identify how California Rule 21 functions can be used and configured so that multiple smart inverters work in harmony and will also identify how other naturally-occurring consumer devices, such as electric vehicle chargers and other smart loads, can serve to further enable high-levels of solar PV.	6/10/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-078 Next-Generation Grid Communication for Residential PEVs	No	Demand-side Management	$1,500,000	$1,500,000	$1,339,131	N/A
EPC-14-079 Assessing the Ability of Smart Inverters and Smart Consumer Devices to Enable more Residential Solar Energy	No	Grid Operations/Market Design	$1,705,478	$1,705,478	$1,504,926	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-078 Next-Generation Grid Communication for Residential PEVs	$1,339,131	$139,418	$0	ChargePoint, Inc.	$142,500	8.7%
EPC-14-079 Assessing the Ability of Smart Inverters and Smart Consumer Devices to Enable more Residential Solar Energy	$1,504,926	$400,537	$0	Electric Power Research Institute, Inc.; Sacramento Municipal Utility District; Underwriters Laboratories, Inc.; Southern California Edison Advanced Technology Organization; Intwine Connect; ClipperCreek, INC.; Pentair; A. O. Smith Corporate Technology Center; Emerson Climate Technologies	$891,414	34.3%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-078 Next-Generation Grid Communication for Residential PEVs	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-078 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25 out of 25 bidders	ChargePoint, Inc.
EPC-14-079 Assessing the Ability of Smart Inverters and Smart Consumer Devices to Enable more Residential Solar Energy	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-079 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25 out of 27 bidders	Electric Power Research Institute, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-078 Next-Generation Grid Communication for Residential PEVs	Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-14-079 Assessing the Ability of Smart Inverters and Smart Consumer Devices to Enable more Residential Solar Energy	Group 3: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-078 Next-Generation Grid Communication for Residential PEVs	This project will lower or defer costs in upgrading local distribution infrastructure by providing a mechanism for demand management for local distribution networks, specifically managing PEV charging with input from PEV customers, vehicles, and utility signals. The results from this project would allow the utility to optimize a residential customers night time charging while still satisfying the driver mobility needs. The driver will have the same driving experience, generation and transmission resources can be optimized, and the grid costs and emissions can be reduced. ChargePoint determined that pilot participants experienced an average savings of 45 percent and there is potential for increased savings if the participants had increased visibility to monitor their vehicle's SOC, which is enabled by integrating the 15118 standard in the charging station and the PEV.	1g, 1h, 2a, 3f, 4a, 5b	This project was completed in 2018. The final report is going through the Energy Commission's publication process. ChargePoint completed 15118 testing on the Daimler vehicle to send charging schedules to the vehicle and receive them back from the station. The three-month pilot program consisted of 1,005 charging events across 27 drivers in the San Diego Gas and Electric service territory who used the controlled charging schedule 58 percent of the time. Several participants indicated they were interested in using the controlled schedule more if the vehicle's state of charge (SOC) was more visible. Multiple drivers noted that they wished to limit their SOC at 80 percent to take advantage of the vehicle's regenerative braking capabilities or to protect their battery health. ChargePoint determined the pilot participants achieved a 45 percent average bill savings on their vehicle charging.
EPC-14-079 Assessing the Ability of Smart Inverters and Smart Consumer Devices to Enable more Residential Solar Energy	As the penetration of autonomous (Rule 21) inverters increases, their interactions will grow in importance. This project will help provide a clear understanding of inverter characteristics and of their potential interactions that may help preserve the stability and reliability of the grid, benefiting both consumers and operators. Consumers who invest in solar PV systems (and utilities that provide incentives or expect benefits from PV) wish to maximize the power they can realize from their system. Sharing excess PV generation with local loads may increase the utilization of such systems without negatively impacting the distribution grid.	1b, 3d, 4a, 5a, 5b	This project focused on understanding advanced smart-inverter functions, as defined in California's Rule 21 tariff, to effectively enable higher use of solar PV to customers and on the grid. Specific residential smart load management algorithms and communications architecture were developed for smart loads and inverters to enable higher PV penetration. This approach increases the solar PV value to the homeowners, while adhering to distribution grid requirements. Field testing demonstrated that optimization of residential smart loads could consume excess solar PV. Solar PV generation capacity and the availability of flexible or demand-responsive loads play a pivotal role in determining the amount of increase in the hosting capacity. Results from this project will help regulators and grid operators evaluate regulatory changes needed to scale deployment of Rule 21-compliant inverters and assess the outcomes that are relevant to their DR programs and reliable grid operations.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-080 Renewable Microgrid for a Medical Center	Technology Demonstration and Deployment	This project is demonstrating the ability of a microgrid to support and sustain the functions of a healthcare facility and to overcome barriers to its deployment. The Charge Bliss team successfully designed, engineered, procured, constructed, and commissioned the microgrid systems at the Kaiser Permanente Hospital in Richmond, California. This included developing a next-generation microgrid controller capable of optimizing renewable energy generation, storage, and delivery and islanding and providing critical system support.	6/10/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-080 Renewable Microgrid for a Medical Center	No	Distribution	$4,776,171	$4,776,171	$4,776,171	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-080 Renewable Microgrid for a Medical Center	$4,776,171	$729,842	$0	Princeton Power Systems, Inc.; OSISoft, LLC; Kaiser Permanente Medical Center	$2,095,835	30.5%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-080 Renewable Microgrid for a Medical Center	Grant	NEW IP TYPE(S): System Patent, Other: Method Patent NEW IP DESCRIPTION: Patent Application 20200195011. BATTERY ENERGY STORAGE SYSTEM AND MICROGRID CONTROLLER. A control system for a microgrid was developed for use at the Kaiser Permanente Richmond Medial Center (KPRMC). The microgrid controller was developed by the partnership of the University of California San Diego (UCSD), OSISoft and Florida State University (FSU) Center for Advanced Power Systems (CAPS) team using Virtual Microgrid (VM) Real-Time Digital Simulator (RTDS) test at FSU CAPS. This development of the microgrid controller has been executed under the auspices of Charge Bliss, Inc. and funded by the California Energy Commission (EPC-14-080) and match funding from various sources. TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-080 (Confidential Products and	Competitive	31 out of 40 bidders	Charge Bliss, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-080 Renewable Microgrid for a Medical Center	Group 1: Ranked # 4	N/A	N/A	Yes; Micro Business, Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-080 Renewable Microgrid for a Medical Center	This project demonstrates the value of a microgrid to healthcare facilities, including the reduction in energy costs, which are substantial for healthcare facilities, and the ability to support life and safety functions for three hours or longer to supplement existing backup generation and improve the energy reliability of hospitals in crisis situations. In collaboration with the governing agency Office of Statewide Health Planning and Development (OSHPD), the CEC and Charge Bliss are forging new methods and standards to support the resiliency and autonomy of critical healthcare facilities. This project helps inform deliberation of the requirement for healthcare facilities to have diesel backup.	1e, 1h, 4a, 5a	In 2018, the Charge Bliss team continued to make adjustments to the microgrid controller software developed under the agreement to optimize the hospital's energy savings and to increase system run time to 98%. There has been a considerable amount of publicity and information shared with the public. Since the opening ceremony, the project has been highlighted in several articles from local media to industry magazines. The team has performed several presentations to interested groups including the California Society of Hospital Engineers (CSHE) and the Hospital Building Safety Board (HBSB), a division of California's Office of Statewide Health Planning and Development (OSHPD). The final report was received and is available online.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-081 Irrigation Optimization and Well Pump Monitoring to Reduce Energy and Water Consumption	Technology Demonstration and Deployment	This project is demonstrating a software tool that links groundwater extraction with smart meter data to provide growers with automated information on energy and water consumption. This data is augmented by weather data and optional soil moisture data from local sensors to provide information to growers regarding irrigation needs. Use of the software program could help inform growers and reduce irrigation while maintaining or optimizing yield. This technology is being applied over 1,000 acres of farms owned by several growers of alfalfa, tomato, pistachios and almonds.	6/10/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-082 Advancing Biomass Combined Heat and Power Technology to Support Rural California, the Environment, and the Electrical Grid	Technology Demonstration and Deployment	This project is deploying a biomass-fired combined heat and power system to provide heat and power to Plumas County health facilities. Biomass from local forest clearing operations will be used by a new biomass boiler to supply heat to an Organic Rankine Cycle (ORC) power unit. Waste heat from the ORC will be used as a heat source for heat pumps, improving their performance for the winter heating season.	6/10/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-081 Irrigation Optimization and Well Pump Monitoring to Reduce Energy and Water Consumption	No	Demand-side Management	$2,292,829	$2,292,829	$2,250,763	N/A
EPC-14-082 Advancing Biomass Combined Heat and Power Technology to Support Rural California, the Environment, and the Electrical Grid	No	Generation	$2,385,261	$2,385,261	$2,385,261	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-081 Irrigation Optimization and Well Pump Monitoring to Reduce Energy and Water Consumption	$2,250,763	$332,162	$370,000	UC Santa Barbara; UC Davis; PowWow Energy, Inc.	$535,568	18.9%
EPC-14-082 Advancing Biomass Combined Heat and Power Technology to Support Rural California, the Environment, and the Electrical Grid	$2,385,261	$262,813	$0	Plumas County; Sierra Institute for Community and Environment	$593,316	19.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-081 Irrigation Optimization and Well Pump Monitoring to Reduce Energy and Water Consumption	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-081 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 43 out of 46 bidders; phase 2: 10 out of 13 bidders	PowWow Energy, Inc.
EPC-14-082 Advancing Biomass Combined Heat and Power Technology to Support Rural California, the Environment, and the Electrical Grid	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-082 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	16 out of 22 bidders	Sierra Institute for Community and Environment

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-081 Irrigation Optimization and Well Pump Monitoring to Reduce Energy and Water Consumption	Ranked # 1	N/A	N/A	Yes; Small Business, Calif Based Entity
EPC-14-082 Advancing Biomass Combined Heat and Power Technology to Support Rural California, the Environment, and the Electrical Grid	Group 2: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-081 Irrigation Optimization and Well Pump Monitoring to Reduce Energy and Water Consumption	Reduced irrigation techniques have not been adopted by growers because of perceived risks associated with lower crop yield and quality, and lack of equipment and labor to measure water consumption. This project is developing a unique software tool for measuring groundwater extraction and water application, by leveraging smart meter data, as well as existing water data in the cloud and at the farm sites. The tool is unique because it uses smartmeter data to measure water volumes from pumps without installing hardware devices on site. The tool also communicates with the farmer and irrigator to optimize crop yields and water applications.	1f, 1h, 4a, 4c	The project demonstrated on average 13% improvement in energy efficiency (energy savings for the same level of production performance) across a variety of crops and geographies. Project also achieved 9% in water use efficiency improvement (water savings for the same level of yield). If this innovation was implemented successfully across 20% of the farms in California, an estimated annual reduction of more than 66 GWh and 120,000 acre-feet in water use could be achieved. This project also demonstrated that smart meter data can be used to provide daily water records that help with water management on the farm. The project team continues to work with California electric utilities and host on farm workshops to engage new clients. This technology was used to document energy and water savings in the California Department of Food and Agriculture's State Water Efficiency and Enhancement Program.
EPC-14-082 Advancing Biomass Combined Heat and Power Technology to Support Rural California, the Environment, and the Electrical Grid	This project will link emerging technology with opportunities to advance renewable energy, distributed generation, and clean energy job creation. The first-of-its-kind project combines a biomass-fired boiler with an Organic Rankine Cycle electric generator that diverts waste heat to source heat pumps, supplying economical heat and power to a community-scale entity currently experiencing high energy costs. The project will help sustain a market for locally-sourced, sustainable forest biomass, providing jobs to the community and helping to reduce the risk of catastrophic wildfires that threaten transmission infrastructure and public safety.	1f, 1h, 4a, 4b	Facility construction occurred in the first and second quarters of 2018, with all equipment installed and commissioning completed in June, 2018. A ribbon-cutting ceremony was held in April, 2018, which included participants from the Sierra Institute, Plumas County, US Forest Service, community advocates, project developers, and the Energy Commission. Over the summer and early fall of 2018, Sierra Institute secured a steady fuel supply and trained County technicians to operate the system. The system was operated over the heating season from the fall of 2018 through the spring of 2019.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-082 Advancing Biomass Combined Heat and Power Technology to Support Rural California, the Environment, and the Electrical Grid	Technology Demonstration and Deployment	This project is deploying a biomass-fired combined heat and power system to provide heat and power to Plumas County health facilities. Biomass from local forest clearing operations will be used by a new biomass boiler to supply heat to an Organic Rankine Cycle (ORC) power unit. Waste heat from the ORC will be used as a heat source for heat pumps, improving their performance for the winter heating season.	6/10/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-083 College of San Mateo Internet of Energy	Technology Demonstration and Deployment	This project was initiated to demonstrate an integrated solar PV, energy storage, and advanced power electronics within a single module to significantly increase overall efficiencies by minimizing conversion losses. The demonstration was to include the integration of a 250 kW pre-commercial high-yield PV system from Flex, a 500 kWh stationary battery energy storage system, and advanced HVAC system and controls, with an advanced energy management system that uses the Internet of Energy concept to optimize performance of distributed energy resources and the local grid.	6/10/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-082 Advancing Biomass Combined Heat and Power Technology to Support Rural California, the Environment, and the Electrical Grid	No	Generation	$0	$0	$0	N/A
EPC-14-083 College of San Mateo Internet of Energy	No	Generation	$2,999,601	$2,999,601	$402,626	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-082 Advancing Biomass Combined Heat and Power Technology to Support Rural California, the Environment, and the Electrical Grid	$0	$0	$0	Plumas County; Sierra Institute for Community and Environment	$0	0.0%
EPC-14-083 College of San Mateo Internet of Energy	$402,626	$411,350	$0	Growing Energy Labs, Inc.; San Mateo County Community College District	$1,235,000	29.2%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-082 Advancing Biomass Combined Heat and Power Technology to Support Rural California, the Environment, and the Electrical Grid	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-082 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	16 out of 22 bidders	Sierra Institute for Community and Environment
EPC-14-083 College of San Mateo Internet of Energy	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-083 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	16 out of 22 bidders	Prospect Silicon Valley

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-082 Advancing Biomass Combined Heat and Power Technology to Support Rural California, the Environment, and the Electrical Grid	Group 2: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-14-083 College of San Mateo Internet of Energy	Group 2: Ranked # 4	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-082 Advancing Biomass Combined Heat and Power Technology to Support Rural California, the Environment, and the Electrical Grid	This project will link emerging technology with opportunities to advance renewable energy, distributed generation, and clean energy job creation. The first-of-its-kind project combines a biomass-fired boiler with an Organic Rankine Cycle electric generator that diverts waste heat to source heat pumps, supplying economical heat and power to a community-scale entity currently experiencing high energy costs. The project will help sustain a market for locally-sourced, sustainable forest biomass, providing jobs to the community and helping to reduce the risk of catastrophic wildfires that threaten transmission infrastructure and public safety.	1f, 1h, 4a, 4b	Facility construction occurred in the first and second quarters of 2018, with all equipment installed and commissioning completed in June, 2018. A ribbon-cutting ceremony was held in April, 2018, which included participants from the Sierra Institute, Plumas County, US Forest Service, community advocates, project developers, and the Energy Commission. Over the summer and early fall of 2018, Sierra Institute secured a steady fuel supply and trained County technicians to operate the system. The system was operated over the heating season from the fall of 2018 through the spring of 2019.
EPC-14-083 College of San Mateo Internet of Energy	If successful, this project was projected to result in a 10% reduction in utility demand charges for the College of San Mateo campus in addition to saving another 8% in energy charges from peak demand reduction and efficient energy management measures. In addition, the PV and energy storage system was to be designed in a modular fashion by housing the Energy Storage System and Power Conversion System in a standard 20-foot container enclosure that was being produced to dramatically reduce balance of system costs.	1a, 1b, 1e, 1f, 1h, 1i, 2a, 3a, 3e, 4a	The College of San Mateo released an RFP for construction and installation of the project in February 2017 and selected Opterra in April 2017, but the project experienced several delays related to equipment sourcing and legal requirements. In late July 2017, the College of San Mateo decided to withdraw from the project, because the perceived risks were too great, and they did not believe that the full scope of the agreement could be completed within the agreement term. As the College of San Mateo was providing the demonstration site for the project as well as the majority of the match funds, Energy Commission staff and PSV decided to mutually terminate the project. The Energy Commission issued a Stop Work Order to PSV on August 7, 2017, and the Commission formally terminated the agreement at the October 11, 2017, business meeting.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-084 ABEC #4 Renewable Combined Heat and Power Project	Technology Demonstration and Deployment	The project uses biogas derived from on-site dairy manure to generate low-carbon, renewable electricity and to achieve high overall efficiency by capturing waste heat from the power generation system and using it to drive an absorption chiller. The absorption chiller is designed to convert waste heat into chilling capacity, which will be used to chill milk produced by the dairy cows. New absorption chiller capacity directly offsets electricity consumption from existing electric chillers. Combining renewable generation with waste heat collection and cooling, the project increases energy efficiency of the existing dairy by an estimated 10% or more, while also reducing peak grid power demand.	6/10/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-085 Demonstration of Community Scale Low Cost Highly Efficient PV and Energy Management System	Technology Demonstration and Deployment	This project is demonstrating a combination of advanced PV generation, energy storage, and an energy management system to reduce average daily power and daily peak energy demand by more than 10%. The project includes a smart electrical energy storage system that integrates retired electric vehicle batteries. The generator and storage system are controlled by a commercial-grade microgrid controller. The demonstration site is in the Robert Mondavi Institute at the UC Davis campus.	6/10/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-084 ABEC #4 Renewable Combined Heat and Power Project	No	Generation	$3,000,000	$3,000,000	$2,984,446	N/A
EPC-14-085 Demonstration of Community Scale Low Cost Highly Efficient PV and Energy Management System	No	Generation	$1,238,491	$1,238,491	$1,227,762	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-084 ABEC #4 Renewable Combined Heat and Power Project	$2,984,446	$0	$1,000,000	ABEC #4 LLC CEandS Dairy Biogas	$4,983,619	62.4%
EPC-14-085 Demonstration of Community Scale Low Cost Highly Efficient PV and Energy Management System	$1,227,762	$124,883	$0	UC Davis; SMA America; OSISoft, LLC; Nissan North America	$739,726	37.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-084 ABEC #4 Renewable Combined Heat and Power Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-084 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	16 out of 22 bidders	ABEC #4 LLC CE&S Dairy Biogas
EPC-14-085 Demonstration of Community Scale Low Cost Highly Efficient PV and Energy Management System	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-085 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	16 out of 22 bidders	UC Davis

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-084 ABEC #4 Renewable Combined Heat and Power Project	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-14-085 Demonstration of Community Scale Low Cost Highly Efficient PV and Energy Management System	Group 2: Ranked # 5	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-084 ABEC #4 Renewable Combined Heat and Power Project	The project represents a significant advance in dairy energy management by combining renewable generation with waste heat collection and cooling to increase energy efficiency of the existing dairy by an estimated 10% or more, while also reducing peak grid power demand. The project benefits include substantial reductions in greenhouse gas emissions, lower manure handling costs, and generation and distribution of technical and economic data on community scale power production.	3a, 4a, 4e	The project accepted a PG&E 20-year Power Purchase Agreement with full operation and has collected operational data for one year commencing in the first quarter of 2018. Electrical production from the digester exceeded expected production during 2018. Monthly gross electrical production was more than 680,000 kWh. The project was completed in March, 2019.
EPC-14-085 Demonstration of Community Scale Low Cost Highly Efficient PV and Energy Management System	The combination of advanced PV and the energy management system will result in a significant reduction in annual grid electricity consumption - estimated at over 80% or a cost savings of roughly $29,000 per year with associated greenhouse gas reductions of about 250 tons per year. Furthermore, the success of this project will provide follow-on benefits to California's large wine industry by proving that winemaking can be carried out with sustainable energy solutions.	1b, 1e, 1f, 1h, 2a, 3b, 4a	The energy system was installed in December 2018 and commissioned in January 2019. The system has been operating and collecting data since the beginning of 2019 and enabled analysis of the reduction in facility's energy demand. The project's success in utilizing second-life batteries for energy storage led to a start-up company to commercialize the idea. UC Davis has a collaboration with Case Western University to share data from the system to aid in developing battery models used to predict the lifetime of these batteries as well as the life-cycle emissions from electric vehicle batteries. Results indicate up to $2,000 per month in bill savings and up to 3000 kg CO2/month in emissions reductions, with additional savings possible with further controller optimization. The project has hosted a number of tour groups to share the project approach and outcomes. Additionally, the project has provided some reliability support for the electrical grid, including in September 2020.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-086 Distribution System Aware Vehicle to Grid Services for Improved Grid Stability and Reliability	Applied Research and Development	The project developed an integrated vehicle-to-grid (V2G) system that was tested and demonstrated to be distribution-aware, self-regulating, interoperable, secure and open as well as scalable and flexible. These real-world test and demonstration results can provide confidence in the V2G systems that provide grid support functions and possibly influence investor owned utilities (IOUs) to add them to their Assembly Bill 2514 Storage Mandate compliance plans. The data gathered and analysis validated the cost effectiveness models through direct engagement with the IOUs' existing infrastructure and distribution networks, combined with simulated independent system operator interaction.	6/10/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-088 Demonstration of Low-Cost Liquid Cooling Technology for Data Centers	Technology Demonstration and Deployment	This project is validating the performance, reliability, cost savings and payback of a data center efficiency technology that uses direct-to-chip liquid-cooling to cut data center cooling energy use. The technology is being demonstrated at two full scale data centers with the goal of minimal operational disruptions during installation. Energy consumption, load, reliability and server performance are being monitored. The results of the demonstrations, along with "lessons learned", will be made broadly available to the data center community and public-policy makers to stimulate adoption of this technology.	6/10/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-14-086 Distribution System Aware Vehicle to Grid Services for Improved Grid Stability and Reliability	No	Grid Operations/Market Design	$1,499,977	$1,499,977	$1,483,659	N/A
EPC-14-088 Demonstration of Low-Cost Liquid Cooling Technology for Data Centers	No	Demand-side Management	$3,552,678	$3,552,678	$3,103,726	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-14-086 Distribution System Aware Vehicle to Grid Services for Improved Grid Stability and Reliability	$1,483,659	$666,988	$5,760,000	Electric Power Research Institute, Inc.	$795,754	34.7%
EPC-14-088 Demonstration of Low-Cost Liquid Cooling Technology for Data Centers	$3,103,726	$1,038,931	$0	Lawrence Livermore National Laboratory; Asetek USA, Inc.	$1,519,738	30.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-14-086 Distribution System Aware Vehicle to Grid Services for Improved Grid Stability and Reliability	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-086 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25 out of 25 bidders	Electric Power Research Institute, Inc.
EPC-14-088 Demonstration of Low-Cost Liquid Cooling Technology for Data Centers	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-14-088 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 43 out of 46 bidders; phase 2: 10 out of 13 bidders	Asetek USA, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-14-086 Distribution System Aware Vehicle to Grid Services for Improved Grid Stability and Reliability	Ranked # 3	N/A	N/A	Yes; Calif Based Entity
EPC-14-088 Demonstration of Low-Cost Liquid Cooling Technology for Data Centers	Ranked # 3	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-086 Distribution System Aware Vehicle to Grid Services for Improved Grid Stability and Reliability	PEVs with integrated V2G systems have the potential to simultaneously improve air quality, reduce vehicle operational costs and to reduce grid stress and increase grid reliability and stability. Monitoring at the transformer level with control of V2G provides enhanced local situational awareness and real-time responsiveness to distribution grid conditions. The developed management and monitoring system will have awareness of load, power, temperature, current, voltage, frequency, and PEV customer constraints-information to be utilized to determine need for V2G resource. This approach provides a potentially significant solution for integration of a viable energy efficient energy storage technology into a decentralized grid structure, and with the ability to operate as a unified distributed energy resource aggregation system.	1c, 1e, 2a, 3f	This project was completed in 2018. The final report is undergoing the Energy Commission publication process. EPRI developed an end-to-end capable V2G system that demonstrated grid condition awareness in a safe and outage-immune method. Aerovironment and Kitu completed integration and assembly of J3072 and SEP 2.0b software into the 10 demonstration EVSEs. The research team developed the on-board V2G communication module for the PEV and demonstrated the functionality at UCSD. The value analysis showed a cumulative maximum benefit to the grid (net of cost increment) to range between $450-$1,850/year per vehicle in defrayed or deferred infrastructure upgrade costs, which is about five times more valuable than smart charging for similar grid service applications. The project partners, including the University of Delaware and U.S. DOE, are using the findings to further advance VGI research.
EPC-14-088 Demonstration of Low-Cost Liquid Cooling Technology for Data Centers	If successful, the project will validate the performance, reliability, cost savings and payback of a data center efficiency technology that could reduce cooling costs while being able to be installed as a retrofit. This could lead to overcoming barriers to adoption by minimizing operational disruptions and costs compared with conventional installations and retrofits.	1f, 1h, 4a	The project is complete. All data centers are different, and the actual energy saved will vary, based on location and data center design. Demonstration results showed that the technology, RackCDU, is most cost-effectively deployed as a pre-installed solution with the greatest savings in high utilization data centers running high performance computing and high-density data centers. While there is performance improvement and energy savings, retrofits are disruptive and not economically viable. The analysis on one of the data center sites showed 5 percent energy savings. Greater savings of up to 10 percent is possible if the chilled water system was not used for heat rejection or if the data center was designed with the RackCDU technology. Knowledge from this project has been distributed at conferences and to data center operators, industry partners, customers and others.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-003 Demonstration of Community Scale Generation System at the Chemehuevi Community Center	Technology Demonstration and Deployment	The purpose of this project is to demonstrate a community microgrid to improve site power reliability and resiliency. The Chemehuevi Indian Tribe Community Center microgrid incorporates a 90 kW solar PV system, a 25 kW/125 kWh battery energy storage combined and integrated with an energy management system to reduce peak energy demand for the center by utilizing battery storage to shift building and community loads. The system will also provide uninterruptible power for the center and serve as an Emergency Response Center for the tribe during blackouts or loss of power.	10/14/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-004 Climate appropriate HVAC Systems for Commercial Buildings to Reduce Energy Use and Demand	Applied Research and Development	This project developed and demonstrated a Climate Appropriate Air Conditioning system for commercial buildings that optimizes occupant comfort and can reduce energy use and peak demand. The project applies a combination of Variable Refrigerant Flow (VRF) technology with Indirect Evaporative Cooling (IEC) integrated and operationally optimized through the building control system. The project also investigated alternative non- Ozone Depleting Potential (ODP) or low global warming (GWP) refrigerants and HVAC system designs that could enable their usage in commercial buildings. This project will benefit small and medium commercial buildings, such as retail stores, offices buildings and food service and could be implemented in existing and new commercial buildings through direct replacement of rooftop packaged air conditioners. It is estimated that the HVAC systems for these sectors use 7,000 GWh and contributes 5 GW of peak demand.	7/8/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-003 Demonstration of Community Scale Generation System at the Chemehuevi Community Center	No	Distribution	$2,588,906	$2,588,906	$2,051,182	N/A
EPC-15-004 Climate appropriate HVAC Systems for Commercial Buildings to Reduce Energy Use and Demand	No	Demand-side Management	$2,834,721	$2,834,721	$2,786,826	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-003 Demonstration of Community Scale Generation System at the Chemehuevi Community Center	$2,051,182	$525,157	$0	Primus Power; The Regents of the University of California - Riverside; OSISoft, LLC; Chemehuevi Indian Tribe	$802,478	23.7%
EPC-15-004 Climate appropriate HVAC Systems for Commercial Buildings to Reduce Energy Use and Demand	$2,786,826	$1,088,673	$0	Electric Power Research Institute, Inc.	$440,509	13.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-003 Demonstration of Community Scale Generation System at the Chemehuevi Community Center	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	16 out of 22 bidders	The Regents of the University of California - Riverside
EPC-15-004 Climate appropriate HVAC Systems for Commercial Buildings to Reduce Energy Use and Demand	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	Electric Power Research Institute, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-003 Demonstration of Community Scale Generation System at the Chemehuevi Community Center	Group 2: Ranked # 3	N/A	N/A	Yes; Calif Based Entity
EPC-15-004 Climate appropriate HVAC Systems for Commercial Buildings to Reduce Energy Use and Demand	Group 1: Ranked # 9	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-003 Demonstration of Community Scale Generation System at the Chemehuevi Community Center	The project will result in greater electricity reliability, lower electricity costs, reduced peak energy demand, and avoidance of failures and outages by integrating a scalable system in both size and quantity and demonstrating the commercial feasibility to deploy many megawatt-hours of dispatchable energy integrated in a photovoltaic-battery storage configuration.	1e, 1g, 1h, 2a, 3f, 4a, 5a	The project executed deployment and demonstration of a microgrid integrating energy storage, solar energy generation, and energy management strategies with the goal of improving resiliency, reliability, and reduce number of power outages at the Chemehuevi Indian Tribe community center. While the battery unit adds additional resiliency to the building as an energy back-up, the energy storage control strategy aims at optimal utilization of renewable solar energy through means of load shifting, peak shaving, and demand response. The site dedicated to this project consists of a single facility with an average energy consumption 100,000 kWh/year. The total annual electricity was reduced by nearly 50 percent.
EPC-15-004 Climate appropriate HVAC Systems for Commercial Buildings to Reduce Energy Use and Demand	The technology advancement is the intelligent HVAC controller that processes signals from building sensors and system feed-back to maximize system efficiency while also synchronizing operation of the VRF and IEC to reduce energy use and peak energy demand and maximize occupant comfort. The innovative control system utilizes cloud based optimization using weather, grid conditions and occupancy (CO2) as inputs to optimally operate a VRF and the IEC system to reduce both energy and water use. The IEC was set up as a dedicated outdoor air system and incorporated variable speed blower and heat recovery ventilation. These subsystems were intelligently controlled by the building controller. This project evaluated and provided system designs that use alternative refrigerants that have zero ODP or low GWP.	1f, 1h, 4a	The project is complete. The test sites were in San Diego, Aliso Viejo and Davis. Bundgard propane chiller, CO2 system and ammonia chillers were tested. Test results show electric savings of about 33 percent. Minor issues were experienced with new Melrok controller.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-005 Potential Impacts and Adaptation Options for the Electricity System from Sea Level Rise in the San Diego Area.	Applied Research and Development	The project evaluated SLR vulnerability and adaptation options in the SDG&E service area at a level of detail appropriate for informing electricity sector policy and planning. ICF International partnered with SDG&E to conduct a detailed and robust sea level rise vulnerability assessment and to identify and evaluate appropriate adaptation measures. This project identified adaptation measures for the electrical system that are actionable and aligned with existing policies, based on a comprehensive understanding of the vulnerabilities of specific assets, how these combine at a system level, and significant feedback from the utilities. The results were formed with significant input from the IOU to ensure the adaptation measures are actionable.	10/14/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-006 Modeling the Impact of Wildfires on California's Transmission and Distribution Grid	Applied Research and Development	This study advanced scientific knowledge by combining and enhancing several state-of-the-art models to produce the most detailed analysis to-date of California's current and future electric transmission and distribution grid and fire risk under alternative conditions of climate change and grid evolution.	10/14/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-005 Potential Impacts and Adaptation Options for the Electricity System from Sea Level Rise in the San Diego Area.	No	Generation	$499,929	$499,929	$478,037	N/A
EPC-15-006 Modeling the Impact of Wildfires on California's Transmission and Distribution Grid	No	Distribution	$500,000	$500,000	$500,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-005 Potential Impacts and Adaptation Options for the Electricity System from Sea Level Rise in the San Diego Area.	$478,037	$240,425	$0	San Diego Gas and Electric Company	$166,200	25.0%
EPC-15-006 Modeling the Impact of Wildfires on California's Transmission and Distribution Grid	$500,000	$169,786	$0	University of Hawaii at Manoa	$17,157	3.3%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-005 Potential Impacts and Adaptation Options for the Electricity System from Sea Level Rise in the San Diego Area.	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12 out of 13 bidders	ICF Incorporated, L.L.C.
EPC-15-006 Modeling the Impact of Wildfires on California's Transmission and Distribution Grid	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-006 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12 out of 13 bidders	Lawrence Berkeley National Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-005 Potential Impacts and Adaptation Options for the Electricity System from Sea Level Rise in the San Diego Area.	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-15-006 Modeling the Impact of Wildfires on California's Transmission and Distribution Grid	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-005 Potential Impacts and Adaptation Options for the Electricity System from Sea Level Rise in the San Diego Area.	Detailed SLR inundation modeling that builds on previous studies is used to identify the SDG&E infrastructure that will be exposed to coastal flooding and assess how the electricity system could be affected. Impacts of coastal inundation and possible adaptation measures are determined using literature reviews, interviews with key experts, modeling, and workshop elicitation. Potential direct and indirect impacts are used at an asset-by-asset level and through system-wide assessment, including power flow modeling to support a "value of lost load" analysis. This level of information was not previously available to SDG&E for use in its planning.	5a, 5d	Working closely with SDG&E, the research team first collected information on specific infrastructure assets and operations, and identified potential climate impacts. The climate impact vulnerabilities of the electricity system were then identified and discussed with the utilities. A matrix of assets and electricity service categories was developed in 2016. The research team collected information on electricity system adaptation measures and presented them to the utilities at a series of workshops to obtain feedback in summer and fall of 2017. The utilities are already using some of the results from this study for adaptation planning.
EPC-15-006 Modeling the Impact of Wildfires on California's Transmission and Distribution Grid	The project identified segments of the electric grid that are now or will become most vulnerable to increasing wildfire risk. This knowledge allows operators to improve maintenance of grid reliability and safety while adapting to the challenge of changing climate. Researchers applied a unique methodology to measure wildfire risk, allowing them to relate an evolving wildfire probability over time with an evolving electricity grid. The methodology analyzed the cost benefits of grid adaptations for minimizing the risk associated with future wildfires.	2a, 5a, 5d	This project was completed in 2018. The final report, included in California's Fourth Climate Change Assessment, is available online at: http://www.climateassessment.ca.gov/techreports/docs/20180827-Energy_CCCA4-CEC-2018-002.pdf. The researchers obtained the maps of future burned area being used for California's Fourth Climate Change Assessment as the basis for their study of future risk to the transmission and distribution system. They mapped current and future exposure of operationally significant segments of transmission paths to wildfire. They used land use projections of urban expansion as a proxy for the extension of the distribution grid. Then they used the PLEXOS model to estimate the cost of fire-caused outages with and without wildfire forecasts, such as the change in generation costs as other power plants are dispatched to replace the stranded generators during the outage.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-007 Climate Change in Los Angeles County: Grid Vulnerability to Extreme Heat	Applied Research and Development	This project developed a sophisticated description of future electric grid demand, response, and vulnerability due to increased (and prolonged) heat events in Southern California Edison territory under current and future climate scenarios. It will enable innovative grid management and operation strategies and will identify adaptation guidance. Researchers provided the information to local governments, regional and state agencies, utilities, and the general public in tangible, easy-to-understand policy briefs to enhance local and state capacity to respond to potential disruptions in distribution due to climate change.	10/14/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-007 Climate Change in Los Angeles County: Grid Vulnerability to Extreme Heat	No	Distribution	$500,000	$500,000	$383,671	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-007 Climate Change in Los Angeles County: Grid Vulnerability to Extreme Heat	$383,671	$84,000	$0	County of Los Angeles; The Regents of the University of California, Los Angeles	$183,753	26.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-007 Climate Change in Los Angeles County: Grid Vulnerability to Extreme Heat	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12 out of 13 bidders	The Regents of the University of California, Los Angeles

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-007 Climate Change in Los Angeles County: Grid Vulnerability to Extreme Heat	Group 3: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-007 Climate Change in Los Angeles County: Grid Vulnerability to Extreme Heat	The project integrated a set of models in a novel way to link new results on extreme heat events in Los Angeles County with electricity demand projections that respond to these events and then to model how these climate impacts would affect the vulnerability of electricity supply and the transmission and distribution networks. Doing so created a greater level of understanding on where the grid is most vulnerable, which neighborhoods each circuit serves, and what types of adaptation measures may need to be taken by the utility as well as state, regional, and local actors. The project can equally help guide investments in distributed generation that could alleviate pressure on the conventional electricity generation system.	1e, 2a, 5a, 5d	This project was completed in 2018. The final report is available online as part of California's Fourth Climate Change Assessment at: http://www.climateassessment.ca.gov/techreports/docs/20180827-Energy_CCCA4-CEC-2018-013.pdf; http://www.climateassessment.ca.gov/techreports/docs/20180827-Energy_CCCA4-CEC-2018-013.pdf. The research team projected peak demand for Los Angeles County due to climate change. An 8-11% increase of substation capacity, DER, or peak load shifting will be needed throughout Los Angeles County to keep substation load factors at or below 1 during the worst-case heat waves by 2060. The team conducted an extensive outreach effort to inform utilities and others. The team is briefing CPUC for R.18-04-019 on strategies and guidance for climate change adaptation. Three journal papers will be published. The South Bay Cities Council of Governments intends to use the electricity demand and grid vulnerability projections in developing their climate action plan.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-008 Visualizing Climate-Related Risks to the Electricity System using Cal-Adapt	Applied Research and Development	This project developed an interactive web-based platform to provide electricity system stakeholders with actionable data pertaining to local climate risks. The project developed web-based visualization applications depicting climate-related risks of relevance to the electricity infrastructure. The project also provided for access to climate, sea-level rise, hydrological, and wildfire projections associated with California's Fourth Climate Change Assessment. Data access is key to enabling integration of projected climate into infrastructure planning and risk management. As articulated by electricity investor-owned utilities in the 2017 IEPR Adaptation Workshop, Cal-Adapt 2.0 is an instrumental tool for developing and implementing locally-appropriate adaptation options in the electricity sector.	11/12/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-008 Visualizing Climate-Related Risks to the Electricity System using Cal-Adapt	No	Grid Operations/Market Design	$400,000	$400,000	$398,891	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-008 Visualizing Climate-Related Risks to the Electricity System using Cal-Adapt	$398,891	$74,324	$0	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-008 Visualizing Climate-Related Risks to the Electricity System using Cal-Adapt	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-008 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	12 out of 13 bidders	The Regents of the University of California, Berkeley Campus

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-008 Visualizing Climate-Related Risks to the Electricity System using Cal-Adapt	Group 4: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-008 Visualizing Climate-Related Risks to the Electricity System using Cal-Adapt	The platform developed in part by funds from this project continues to provide interactive visualizations and tools for download of data that directly support electricity sector decision-making with regard to infrastructure planning and management. In September, 2019, CPUC's decision on Topics 1 and 2 of its adaptation rulemaking anchored acceptable data for use by investor-owned utilities in California's Climate Change Assessment process. CPUC's decision points to Cal-Adapt as a key data source, as free access to the data recommended by California's most recent (fourth) climate change assessment is provided on Cal-Adapt. Use of Cal-Adapt 2.0 to build climate resilience contributes multiple benefits to California's electricity ratepayers by helping to stabilize the grid, improve service reliability, and reduce financial losses associated with power outages.	5a, 5d	In November 2019, CPUC issued Decision 19-10-054 (Phase 1 of Adaptation Rulemaking18-04-019), which defines climate adaptation for investor-owned energy utilities in the state and directs IOUs to Cal-Adapt as a source of acceptable data for making resilient investments. In summer of 2019, the project final report was developed and submitted for publication.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-009 Workforce Instruction for Standards and Efficiency (WISE)	Market Facilitation	This project provided education, outreach, and resources for California's new residential building industry on high performance attics (HPA) and high performance walls (HPW), two new requirements in the state's 2016 Building Energy Efficiency Standards (BEES). The project helped the new residential building industry better understand new requirements and options for compliance and provided them with technical support to enable the transition to the new requirements. Additionally, the project team provided some on-the-job training on the proper installation of insulation and changes to other building systems necessary for meeting the code requirements.	11/12/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-009 Workforce Instruction for Standards and Efficiency (WISE)	No	Demand-side Management	$4,431,918	$4,431,918	$4,135,877	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-009 Workforce Instruction for Standards and Efficiency (WISE)	$4,135,877	$1,667,291	$0	ConSol ; BASF; Owens Corning; KB Home; California Building Industry Association (CBIA); APA - Engineered Wood Association; Bayer Material Science; Ensoltis Green Hybrid Roofing; Panasonic Eco Solutions North America; PCBC; QC Manufacturing; Shea Homes; SIPA - Structural Insulated Panel Association; SPFA - Spray Polyurethane Foam Alliance; Taylor Morrison Homes of California, LLC; Tru Team of California	$15,685,075	78.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-009 Workforce Instruction for Standards and Efficiency (WISE)	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	4 out of 4 bidders	California Homebuilding Foundation (CHF)

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-009 Workforce Instruction for Standards and Efficiency (WISE)	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-009 Workforce Instruction for Standards and Efficiency (WISE)	The California Energy Code requires new homes to be constructed with HPA and HPW to meet energy efficiency standards. This project helped overcome market barriers of the measures by providing the industry with on-the-job training and tools on the best available technologies, techniques, and practices for complying with the new requirements.	1c, 1e, 1f, 1h, 2a, 3c, 4a, 4b	The project ended in June and the team submitted a final report. The WISE team provided 141 trainings to the building industry on HPA and HPW practices, including impacts of the 2019 Title 24 requirements on code compliance. Most leading builders of the state's new single-family housing market received training. Additionally, the high school training program (BITA) will provide the new curriculum on HPA and HPW to 1,140 students in the next 3 years. Market trends found the inclusion of HPA built in single-family homes increased from 3 to 45 percent between 2016-2019, and from 0 to 10 percent for HPW. However, the use of 2x6-inch studs in walls (critical for HPW compliance) increased from a tenth of the market to a third. Likely, the temporary solar trade-off option prevented bigger penetration of both measures. The team plans to maintain the WiseWarehouse.org website to offer educational materials and promote certification trainings as a valuable resource to the industry.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-010 Expanding Energy-Related Career Pathways in the Electrical Industry: Increasing Workforce Development Opportunities in Disadvantaged Communities and Delivering Training on Automated Demand Response Communication Equipment to Inside Wireman Apprentice	Market Facilitation	The project recruited workers from disadvantaged communities into apprenticeship programs at California Joint Apprentice Training Centers (JATCs), providing them with comprehensive classroom and on-the-job training on the installation and maintenance of AutoDR communications equipment. By addressing the acute skills gap by producing a workforce qualified to install and maintain cutting-edge AutoDR communications equipment, the project helped enable demand response to be deployed in the market at scale.	11/12/15
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-012 Improving Membrane Treatment Energy Efficiency through Monitoring the Removal of Colloidal Particle Foulants	Technology Demonstration and Deployment	The project demonstrated an online monitoring technology for wastewater treatment plants to directly measure colloidal particle concentrations in order to lower membrane fouling and reduce energy use and maintenance costs. Direct detection of colloidal particles will help determine the optimal pretreatment needed to minimize deposition of colloidal particles in membrane pores.	12/9/15

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-010 Expanding Energy-Related Career Pathways in the Electrical Industry: Increasing Workforce Development Opportunities in Disadvantaged Communities and Delivering Training on Automated Demand Response Communication Equipment to Inside Wireman Apprentice	No	Demand-side Management	$4,476,189	$4,476,189	$2,860,379	N/A
EPC-15-012 Improving Membrane Treatment Energy Efficiency through Monitoring the Removal of Colloidal Particle Foulants	No	Demand-side Management	$1,167,034	$1,167,034	$831,246	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-010 Expanding Energy-Related Career Pathways in the Electrical Industry: Increasing Workforce Development Opportunities in Disadvantaged Communities and Delivering Training on Automated Demand Response Communication Equipment to Inside Wireman Apprentice	$2,860,379	$863,874	$0	California LMCC IBEW-NECA	$16,165,080	78.3%
EPC-15-012 Improving Membrane Treatment Energy Efficiency through Monitoring the Removal of Colloidal Particle Foulants	$831,246	$429,784	$0	Orange County Water District; West Basin Municipal Water District; Evoqua Water Technologies; Malvern	$336,000	22.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-010 Expanding Energy-Related Career Pathways in the Electrical Industry: Increasing Workforce Development Opportunities in Disadvantaged Communities and Delivering Training on Automated Demand Response Communication Equipment to Inside Wireman Apprentice	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	4 out of 4 bidders	Center for Sustainable Energy
EPC-15-012 Improving Membrane Treatment Energy Efficiency through Monitoring the Removal of Colloidal Particle Foulants	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-012 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 43 out of 46 bidders; phase 2: 10 out of 13 bidders	Kennedy/Jenks Consultants

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-010 Expanding Energy-Related Career Pathways in the Electrical Industry: Increasing Workforce Development Opportunities in Disadvantaged Communities and Delivering Training on Automated Demand Response Communication Equipment to Inside Wireman Apprentice	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-15-012 Improving Membrane Treatment Energy Efficiency through Monitoring the Removal of Colloidal Particle Foulants	Ranked # 9	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-010 Expanding Energy-Related Career Pathways in the Electrical Industry: Increasing Workforce Development Opportunities in Disadvantaged Communities and Delivering Training on Automated Demand Response Communication Equipment to Inside Wireman Apprentice	The California Energy Code was updated in 2013 to require lighting systems in large buildings to be capable of receiving and automatically responding to at least one standards-based messaging protocol which enables demand response. This project helped ensure a workforce that is trained in the proper installation and maintenance of AutoDR communications equipment exists to meet California Energy Code requirements for commercial buildings.	1e, 1g, 1h, 2a, 3f	The project ended in June and a final report was submitted. Development and implementation of the training was a success with all seven partner JATCs providing the new CALCTP-AutoDR course to 4th or 5th year apprentices. Since 2017, 655 electricians completed the in-person training (378 resided in or near DACs). A total of 329 technicians and sales staff passed the online course exam with another 818 pending the final exam. Also, 637 workers residing in or near DACs were recruited into the apprenticeship program. However, challenges prevented efforts to recruit small and medium buildings in DACs to participate in the AutoDR incentive programs and these efforts were discontinued. Most notably were changes in the programs' payment structures, higher overhead, and upfront costs. Overall, the project developed specialized training on load management technologies and created new career paths, building workforce capacity necessary for meeting the Title 24 DR capability requirements.
EPC-15-012 Improving Membrane Treatment Energy Efficiency through Monitoring the Removal of Colloidal Particle Foulants	Nationwide there are over 100 microfiltration/ultrafiltration treatment plants and there are over 100 reverse osmosis facilities in California using membranes. Membrane treatment for wastewater treatment is very energy intensive due to fouling of membranes over time. This project could overcome the barriers to use of membrane treatment by demonstrating a technology that can detect colloidal particles in membrane feed water. This can facilitate an optimal pretreatment process for their removal and reduce membrane fouling and energy costs.	1f, 1h, 4c	Project is complete. Results indicate that the fouling potential for the microfiltration (MF) membranes tested at Orange County Water District (OCWD) was mitigated through use of targeted chemical addition. Test results show that fouling is reduced by 60% compared to the no coagulant addition. Energy and economic evaluation at OCWD indicated that the approach can reduce energy consumption due to MF by 28% and can result in 2,940 MWh/year savings. OCWD staff has made internal presentation of the project findings to its management. Recipient has presented the project results at five conferences attended by water/wastewater treatment plant staff, regulators and vendors. This project will be published in "Water World" either as a podcast/article.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-013 Open Source Platform For Plug-in Electric Vehicle Smart Charging in California	Applied Research and Development	The project developed a one-way charging concept for PEVs that maximized intermittent renewable generation and minimized impacts to the distribution grid. The project focused on controlling the charging of plug-in electric vehicles (PEVs) in residential and small commercial settings using a novel and flexible open-source, open-software architecture charge communication and control platform. This software-based platform was embedded in the context of overall utility and residential and business electrical and building automation systems, lending itself to potential broad implementation by commercial interests due to its flexible architecture and "agnostic" approach to communications standards. Control strategies and applications were guided by an assessment of user needs and grid operation and ratepayer benefits, and the potential for one-way PEV charge control to lead to increased ability to accept intermittent renewable energy for California's electrical grid.	2/10/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-015 Grid Communication Interface for Smart Electric Vehicle Services Research and Development	Applied Research and Development	Andromeda Power developed an advanced smart grid communication interface that allows utilities to send dispatch signals to PEVs in real-time to optimize the bidirectional power flow of PEV battery packs depending on local power conditions such as congestion, power quality, voltage and frequency, while maintaining the driver's mobility needs. The grid communication interface operates with a virtual machine that is able to interface with PEVs of any standard. The real-time monitoring and control of the stations provided the California electric investor-owned utilities with a means of quick, automated demand response.	1/13/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-013 Open Source Platform For Plug-in Electric Vehicle Smart Charging in California	No	Demand-side Management	$1,500,000	$1,500,000	$1,357,291	N/A
EPC-15-015 Grid Communication Interface for Smart Electric Vehicle Services Research and Development	No	Demand-side Management	$681,693	$681,693	$681,683	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-013 Open Source Platform For Plug-in Electric Vehicle Smart Charging in California	$1,357,291	$262,826	$0	BMW of North America	$90,000	5.7%
EPC-15-015 Grid Communication Interface for Smart Electric Vehicle Services Research and Development	$681,683	$223,081	$0	Suncharge; Verdek	$465,000	40.6%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-013 Open Source Platform For Plug-in Electric Vehicle Smart Charging in California	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25 out of 25 bidders	The Regents of the University of California, Berkeley Campus
EPC-15-015 Grid Communication Interface for Smart Electric Vehicle Services Research and Development	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-015 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	25 out of 25 bidders	Andromeda Power, LLC

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-013 Open Source Platform For Plug-in Electric Vehicle Smart Charging in California	Ranked # 4	N/A	N/A	Yes; Calif Based Entity
EPC-15-015 Grid Communication Interface for Smart Electric Vehicle Services Research and Development	Ranked # 5	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-013 Open Source Platform For Plug-in Electric Vehicle Smart Charging in California	This project focuses on controlling the charging of plug-in electric vehicles PEVs at residential and small commercial settings using a novel and flexible open-source, open-architecture charge communication and control platform. This XBOS-V platform is embedded in the context of overall utility and residential and business electrical and building automation systems, lending itself to potential broad implementation by commercial interests. This integrated project also focuses on the development of the open-source platform including assessment of user needs and grid operation and ratepayer benefits, grid security considerations, and the potential for PEV charge control to lead to increased ability to accept intermittent renewable energy for California's electrical grid. The platform is flexible to adoption and inclusion of several communication protocols.	2a, 3h, 4a	This project was completed in 2019. This project developed and demonstrated electric vehicle charging and building load aggregation and management in response to 15-minute ahead grid condition signals. The research team demonstrated local load optimization to reduce site energy consumption while meeting driver mobility needs, building functionality, and building occupant comfort. Load management strategies such as the one demonstrated in this project can have the potential to save ratepayers $15M per year in 2024 in lowered utility costs (at 1 percent market penetration). The research team has released the source code on GitHub for public consumption, which has been downloaded about 50 times. About 20 buildings are currently capable of integrating the developed charging communication and control platform. The research team cannot track the number deployments.
EPC-15-015 Grid Communication Interface for Smart Electric Vehicle Services Research and Development	This project enables the harmonization of V2G services, removing the communication barrier between PEVs of different standards and the grid. The communication interface enables Smart Demand Side Management benefits to the ratepayer with the possibility of using PEVs as distributed energy storage and controllable load. Local PEVs can mitigate the renewable over-generation and intermittency by storing renewable energy and delivering it to the grid on demand, potentially saving $1,861 per year for each PEV. The additional smart charging incentive can accelerate PEV adoption to achieve the targeted 1.5 million ZEVs on the road by 2025 and 5 million by 2030. Using PEVs as an energy storage resource can reduce energy demand and stress of the grid, making the load predictable and more manageable.	1g, 2a, 4a, 5b	This project was completed in 2019. The project team designed and prototyped two models of Level 2 chargers capable of demand response according to the V1G (managed charging) use cases defined by SCE and PG&E. The project team conducted fast charge and discharge simulation of the PEVs using OpenADR signals and collected performance data. The EVSEs (Level 2 and Level 3) were integrated in a microgrid with 110 kW solar panels to demonstrate the feasibility of the InCISIVE system in mitigating renewable energy overgeneration. Using low-priced renewable energy stored in PEVs instead of energy from natural gas peakers results in energy savings of 21.9 MWh and about a $3,700 savings per PEV per year for California ratepayers.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-016 A Transformative Flywheel R&D Project	Applied Research and Development	This project developed advanced manufacturing processes and improved the flywheel rotor geometries. The project built on developments that the Amber Kinetics flywheel team has made in the areas of enhanced materials processing for better strength, longer life, and improved rotor geometries to maximize energy storage density and reduce the costs. The team also conducted extensive performance testing.	1/13/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-018 Pilot Testing of Eos' Znyth Battery Technology in Distributed Energy Storage Systems	Applied Research and Development	This project is developing and testing behind-the-meter residential and C&I battery storage applications, on both a stand-alone basis and modeled with solar PV. This project is utilizing several kW-scale, AC-integrated Znyth battery technology storage systems. The project team is developing, modeling, and testing experimental rate designs and evaluating the impact on customer load profiles; developing control algorithms and demonstrating aggregation of multiple storage units to create virtual power plants that maximize the value of behind-the-meter storage to the utilities; and modeling, simulating, and extrapolating the economic impacts of installed systems and quantifying the benefits to California utilities and ratepayers.	1/13/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-016 A Transformative Flywheel R&D Project	No	Demand-side Management	$2,000,000	$2,000,000	$1,997,631	N/A
EPC-15-018 Pilot Testing of Eos' Znyth Battery Technology in Distributed Energy Storage Systems	No	Grid Operations/Market Design	$1,894,866	$1,894,866	$1,655,433	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-016 A Transformative Flywheel R&D Project	$1,997,631	$388,000	$0	Amber Kinetics, Inc.	$7,500,000	78.9%
EPC-15-018 Pilot Testing of Eos' Znyth Battery Technology in Distributed Energy Storage Systems	$1,655,433	$218,866	$0	Eos Energy Storage, LLC	$1,436,801	43.1%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-016 A Transformative Flywheel R&D Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-016 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	35 out of 38 bidders	Amber Kinetics, Inc.
EPC-15-018 Pilot Testing of Eos' Znyth Battery Technology in Distributed Energy Storage Systems	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-018 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	35 out of 38 bidders	Eos Energy Storage, LLC

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-016 A Transformative Flywheel R&D Project	Group 2: Ranked # 7	N/A	N/A	Yes; Calif Based Entity
EPC-15-018 Pilot Testing of Eos' Znyth Battery Technology in Distributed Energy Storage Systems	Group 2: Ranked # 4	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-016 A Transformative Flywheel R&D Project	This project is built on developments that the Amber Kinetics team has made in the areas of improved materials processing for better strength and longer life, as well as improved rotor geometries to maximize energy storage density, thus reducing the cost of the system. The project adds to the energy storage portfolio of options necessary to meet California's storage needs.	1c, 1i, 2a, 4a, 5b	Amber Kinetics completed their commercial readiness tests of more than 25,000 operating hours. They performed safety validation with burst tests to analyze and improve the flywheel containment design. For grid connection using multi-unit arrays, Amber Kinetics developed communication protocols, multi-array connectivity, charge and discharge operations, and control algorithms for coordinating multiple flywheels, which would be needed in a utility scale deployment. They collected flywheel operational data under real-world conditions to prove the design robustness, reliability, round-trip efficiency, and the ability to balance power and control the state of charge. As a result, Amber Kinetics is expanding its business opportunities in Massachusetts and Australia. A final report was published at: https://www.energy.ca.gov/2019publications/CEC-500-2019-012/CEC-500-2019-012.pdf; https://www.energy.ca.gov/2019publications/CEC-500-2019-012/CEC-500-2019-012.pdf.
EPC-15-018 Pilot Testing of Eos' Znyth Battery Technology in Distributed Energy Storage Systems	This project aims to validate the safety, reliability, and performance of a new aqueous, zinc-based battery technology to support customer adoption in behind-the-meter energy storage markets and applications. Behind-the-meter application of energy storage has been identified as a major commercial market for energy storage, which requires detailed field performance data to open up this market for new and emerging energy storage technologies.	1c, 1i, 2a, 4a, 5b	Eos completed the installation, commissioning, testing, and data collection at UCSD for the CandI system in June 2020. Eos is nearing completion of testing the residential system at its facility in New Jersey. Eos will finish the data analysis and complete the final report in early 2021.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-019 Low Cost, Large Diameter, Shallow Ground Loops for Ground-Coupled Heat Pumps	Applied Research and Development	This project is researching shallow (20-30 feet deep) and large diameter (2-3 feet diameter) helical coil, ground heat exchanger designs for ground source heat pumps. This project seeks to fill the current informational void with the materials and tools needed to eliminate the risks involved with engineering this new technology into homes. To this end, the project analyzed the performance of different designs of large diameter shallow bore GHEs, produced a calibrated model that can predict the performance of these GHEs and incorporate them into industry-standard design tools, and produced the materials that the industry needs to confidently move forward with the deployment of this technology. Also, a draft compliance option was prepared to facilitate this technology's incorporation into the California Energy Commission's residential energy compliance process. Determining a path of compliance of this technology will allow it to receive proper credit for incentives under the California Advanced Home Program, and will give policymakers the information they need to make policy decisions that will encourage the adoption of this technology	3/9/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-019 Low Cost, Large Diameter, Shallow Ground Loops for Ground-Coupled Heat Pumps	No	Demand-side Management	$1,212,186	$1,212,186	$1,137,234	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-019 Low Cost, Large Diameter, Shallow Ground Loops for Ground-Coupled Heat Pumps	$1,137,234	$338,049	$0	Frontier Energy, Inc.	$18,826	1.5%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-019 Low Cost, Large Diameter, Shallow Ground Loops for Ground-Coupled Heat Pumps	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-019 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	Regents of University of California, Davis

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-019 Low Cost, Large Diameter, Shallow Ground Loops for Ground-Coupled Heat Pumps	Group 1: Ranked # 12	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-019 Low Cost, Large Diameter, Shallow Ground Loops for Ground-Coupled Heat Pumps	The project spurs the market for high efficiency GCHPs by evaluating and testing an innovative method to reduce the cost, which has been a barrier to more installations. The current method requires costly, specialized deep drilling rigs, that often must be transported from out of state. Using common, locally available drilling equipment for shallow bores, GHE bore drilling can be done at lower cost. This technology will be made ready for commercialization by developing modeling tools needed to properly design, size, and evaluate energy savings and to facilitate use with Title 24 compliance tools . The team plans to submit a Statewide Utility Codes and Standards Enhancement (CASE) report to the CEC as a pathway to add to their model to future Title 24 models. The project team was able to successfully integrate their model to the Department of Energy's EnergyPlus simulation program.	1e, 1f, 1h	The project is complete. Current GCHP model is improved by enabling better prediction of fluid temperatures in the bore. The simulated results show good agreement with field and laboratory data. This provides more accurate estimates of energy use for the system. The model was shared at ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) conferences. ASHRAE's guidelines on heat pumps and other measures were considered a primary reference in the industry. The recipient presented its model to the CEC's Building Standards Office and discussed updating Title 24's models. The Building Standards Office will include improved performance maps which could accommodate ground couple heat pumps in future versions of the Residential ACM Reference Manual. The project team intents to submit a Statewide Utility Codes and Standards Enhancement Report in the next Title 24 update.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-020 Intelligent HVAC Controls for Low Income Households: A Low Cost Non-connected Device that Understands Consumer Preferences and Performs Adaptive Optimization	Applied Research and Development	This project developed a low-cost smart thermostat with a simplified user interface. It was tested in low-income and senior housing, with the intention of being readily adaptable to other building sectors, including small commercial. The smart thermostat tracked user preferences and managed indoor conditions to optimize energy use. A main feature of the prototype was the ability to function without internet connectivity. By automatically optimizing thermostat settings, this project sought to determine if smart thermostats can be a cost-effective method to address HVAC energy use in sectors where cost-of-ownership boundaries are not well defined.	2/10/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-020 Intelligent HVAC Controls for Low Income Households: A Low Cost Non-connected Device that Understands Consumer Preferences and Performs Adaptive Optimization	No	Demand-side Management	$2,705,759	$2,705,759	$2,476,739	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-020 Intelligent HVAC Controls for Low Income Households: A Low Cost Non-connected Device that Understands Consumer Preferences and Performs Adaptive Optimization	$2,476,739	$903,766	$0	Electric Power Research Institute, Inc.	$427,072	13.6%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-020 Intelligent HVAC Controls for Low Income Households: A Low Cost Non-connected Device that Understands Consumer Preferences and Performs Adaptive Optimization	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-020 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 48 out of 120 bidders; phase 2: 32 out of 44 bidders	Electric Power Research Institute, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-020 Intelligent HVAC Controls for Low Income Households: A Low Cost Non-connected Device that Understands Consumer Preferences and Performs Adaptive Optimization	Group 1: Ranked # 11	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-020 Intelligent HVAC Controls for Low Income Households: A Low Cost Non-connected Device that Understands Consumer Preferences and Performs Adaptive Optimization	This project bridges a technology connectivity gap in low-income and senior communities. Current smart thermostats are expensive, and a lack of broadband internet access makes these devices a bad fit for the low-income market. Developing a low-cost, internet-independent device creates opportunities to capture energy savings associated with automated controls in hard to reach building sectors without broadband access.	1f, 1g, 1h, 3a, 4a	The decision tradeoffs presented challenges during the project, such as the balance between functionality, affordability and usability. During the design development, the recipient conducted field activities including fielding recruitment, tenant surveys and installing a small number of pilot devices. The field activities provided valuable lessons for future device deployment and future implementation. Considering the refinement of the reference design, a working low cost prototype was developed but after field performance and testing was determined to be deficient. However, the recipient has developed a future-state design that considers lessons learned from development and testing. The intent is to be able to provide this future-state design and potential design improvements in a manner that an interested party can take the lessons learned and incorporate it into its existing thermostat design and/or pick up where this project left off.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-021 Mobile Efficiency for Plug Load Devices	Applied Research and Development	This project designed a methodology guideline for plug load manufacturers to use in developing energy efficient plug load devices. In developing the guideline, the recipient will evaluate mobile design practices, hardware components, and power management software kernels to prove their effectiveness. The results were used to develop the first virtual prototypes and reference designs for energy optimized hardware and software that can guide plug load device manufacturers to reach mobile energy efficiency levels. Manufacturers will use these reference designs to develop and mass deploy energy efficient plug load devices into the marketplace. When these reference designs are used there should be a reduction of energy consumption of residential and commercial plug load devices, such as set-top boxes, TVs, computers, and game consoles. The project defined and introduce a widely accepted industry standard through the Institute of Electrical and Electronics Engineers (IEEE) to support the newly developed unified design methodology and secure its long-term adoption and further evolution.	3/9/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-022 Power Management User Interface	Applied Research and Development	This project seeks to reduce energy consumption in personal computers by improving how users employ existing power management capabilities. Although all computers have the capacity to enter low-power modes such as sleep, and can be shut down when not in use, this potential for energy savings has not been realized in the majority of desktop computers. These computers remain on at full power when they are not used. The problem is one of user behavior. The project uses a software solution to change user behavior by changing the tool they are using. This approach is firmly based in behavior theory and human-computer interaction research, which have long demonstrated that the interface of a device can change users' behavior.	3/9/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-021 Mobile Efficiency for Plug Load Devices	No	Demand-side Management	$1,996,999	$1,996,999	$1,996,036	N/A
EPC-15-022 Power Management User Interface	No	Demand-side Management	$785,124	$785,124	$775,216	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-021 Mobile Efficiency for Plug Load Devices	$1,996,036	$136,800	$0	AGGIOS, Inc; Freescale; International Rectifier; Keysight; Mentor Graphics; Synopsys	$6,030,450	75.1%
EPC-15-022 Power Management User Interface	$775,216	$300,159	$0	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-021 Mobile Efficiency for Plug Load Devices	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-021 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 19 bidders	AGGIOS, Inc
EPC-15-022 Power Management User Interface	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-022 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 19 bidders	The Regents of the University of California, Irvine

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-021 Mobile Efficiency for Plug Load Devices	Group 1: Ranked # 1	N/A	N/A	Yes; Micro Business, Calif Based Entity
EPC-15-022 Power Management User Interface	Group 1: Ranked # 6	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-021 Mobile Efficiency for Plug Load Devices	This project advanced a methodology guideline to help plug load manufactures develop energy efficient plug load devices. The recipient is conducted detailed technical analysis on new software, hardware and power management design and verification methodology, conducted tests on virtual prototypes, verified energy savings, and developed reference designs, in the form of design guidelines. This information is available to the plug load device manufacturers and their suppliers to help accelerate the adoption of mobile efficiency practices across multiple product categories in the shortest time and the lowest costs. As many current plug load devices in the market lack any power management capabilities, similar to those in smart phones, this project paved the way for plug load manufacturers to advance those capabilities into other plug load devices.	1f, 1h	The project is complete and the final report will be published January 2019. The project team completed the energy modeling of the power management system and its use. The team completed an application to IEEE to create standardized energy efficient specifications for plug load devices. This process may take up to two years. The standardization efforts are a key factor in enabling wider adoption of efficiency reference designs to allow a standard, comparable assessment of energy use of various plug load devices. Increased use of reference designs and programming of more efficient standby modes has the potential to reduce annual energy consumption by 20-50%.
EPC-15-022 Power Management User Interface	The Recipient developed an open source software call Power Management User Interface (PMUI) that is easy to use and provides feedback to the user on their energy use settings.	1f, 1h	Project is complete. The research examined power management behaviors in a large sample of desktop computers. The recipient developed an open source power user management interface software. More than half of computers with sleep enabled experienced at least one problem with sleep transitions being blocked, and 27 percent exhibited substantially higher idle time and lower sleep time than expected. These sleep blockers reduced the effects of enabling sleep settings. However, treatment subjects still saved an average of 23.7 percent more energy than control subjects with no sleep enabled controls. CalPlug has been demonstrating

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-023 Gaming System Energy Efficiency without Performance Compromises	Applied Research and Development	This project provided a detailed market segmentation and baseline energy demand assessment of the gaming market, including development of measurement and benchmarking protocols for gaming software and hardware. Top-selling gaming PCs and games are then cross-benchmarked and retrofitted to achieve maximum energy savings beyond what commercialized products currently can attain.	3/9/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-024 Efficient and ZNE-Ready Plug Loads	Applied Research and Development	This project researches and develops new technologies and strategies to eliminate or significantly reduce energy use in standby mode by redesigning the power supply for plug load devices. This project also develops and demonstrates strategies to remove plug load devices from grid AC power by redesigning these devices to use DC power from photovoltaic power sources.	3/9/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-023 Gaming System Energy Efficiency without Performance Compromises	No	Demand-side Management	$1,386,530	$1,386,530	$1,386,530	N/A
EPC-15-024 Efficient and ZNE-Ready Plug Loads	No	Demand-side Management	$1,600,000	$1,600,000	$1,600,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-023 Gaming System Energy Efficiency without Performance Compromises	$1,386,530	$658,250	$0	None	$0	0.0%
EPC-15-024 Efficient and ZNE-Ready Plug Loads	$1,600,000	$634,531	$900,000	Lawrence Berkeley National Laboratory; EMerge Alliance; Power Integrations; Delta Electronics	$495,000	23.6%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-023 Gaming System Energy Efficiency without Performance Compromises	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-023 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 19 bidders	Lawrence Berkeley National Laboratory
EPC-15-024 Efficient and ZNE-Ready Plug Loads	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-024 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 19 bidders	Lawrence Berkeley National Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-023 Gaming System Energy Efficiency without Performance Compromises	Group 1: Ranked # 5	N/A	N/A	Yes; Calif Based Entity
EPC-15-024 Efficient and ZNE-Ready Plug Loads	Group 1: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-023 Gaming System Energy Efficiency without Performance Compromises	This project advanced the design of energy efficient of video gaming computers and consoles by demonstrating system designs that are significantly more efficient than current market offerings. The research results may influence component and integrated system manufacturers and game developers to bring more energy efficient video game computers and consoles into the market without sacrificing the gaming experience. The project identified potential opportunities for codes and standards improvements and/or utility incentives. California ratepayers may benefit by having lower energy use and costs associated with their gaming systems without compromising their video game choices and experience.	1f, 1h	This project is completed and the final report will be published in January 2019. The team conducted energy use testing and analysis of video game computers and consoles, including testing the same game on various devices. The team found no relationship between energy use and device type. There is no regulation affecting this industry yet, so the team recommends establishing voluntary standards similar to Energy Star. The standards would cover: energy ratings, power component rankings, and energy game ratings. The information from this project is available and has been shared to the California Energy Commission to influence codes and standards for computers and video game consoles, and encourage manufacturers to reduce the energy use of these devices.
EPC-15-024 Efficient and ZNE-Ready Plug Loads	Standby power use is the electricity consumed by almost every electrical consumer device plugged in to an electrical outlet. Standby power is responsible for about 3 to 16 percent of residential electricity use. Earlier reductions in standby energy use by single devices have been offset by the growth in the number of devices having standby power use. This project is developing methods to reduce standby power use to zero or near zero. Saving 1 watt corresponds to 8.8 kWh/yr or about $1.50 per device. Developing an innovative family of zero-standby technology solutions and will enable the next generation of electrical devices to draw zero standby power while providing the full range of functionality that are desired by consumers.	1f, 1h, 4a	This project developed technologies to reduce standby power use to near zero watts. Burst mode, sleep transistors, wake-up radio, energy harvesting and storage combinations appear most promising for zero standby power. Coordinated improvements in efficiency, energy harvesting and energy storage will be best strategy to achieve zero standby power use. DC connected loads can be designed to connect directly to DC distribution, thus providing higher efficiency at lower cost. Networks of DC-powered devices can provide other benefits, such as resiliency during power outages. A unique category of energy using devices was identified that provide life safety, health and security to building occupants. The findings of the research were marketed to California based plug load devices manufacturers, as well as to the Energy Commission appliance standards office.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-025 Plug Load Reduction App:RYPL	Applied Research and Development	This project researches methods to reduce home idle loads by utilizing smart meter analytics, an engaging smart phone app, a new online crowd-sourced database of miscellaneous electric loads, and an online efficient product marketplace to educate California residents about the idle load of their home and ways to reduce it. The system is to be piloted within all three electric investor owned utility territories and measure actual energy savings through smart meter data.	3/9/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-026 Unlocking Plug Load Energy Savings through Energy Reporting	Applied Research and Development	This project is developing an interoperable protocol that can be implemented in all plug-load devices, unhampered by proprietary restrictions which will implement energy reporting to enable plug-load devices to transmit operating information - such as identity, power consumption, and functional state - through a communications network to a central entity. After a communication infrastructure is established for plug-load devices, the data flow can be reversed to send control signals to individual devices. The central management system that this project will demonstrate is well positioned to provide comprehensive control over diverse plug-load devices.	3/9/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-025 Plug Load Reduction App:RYPL	No	Demand-side Management	$884,100	$884,100	$884,089	N/A
EPC-15-026 Unlocking Plug Load Energy Savings through Energy Reporting	No	Demand-side Management	$1,630,699	$1,630,699	$1,630,699	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-025 Plug Load Reduction App:RYPL	$884,089	$634,531	$0	Home Energy Analytics; Enervee Corporation	$350,000	28.4%
EPC-15-026 Unlocking Plug Load Energy Savings through Energy Reporting	$1,630,699	$123,700	$0	Lawrence Berkeley National Laboratory; Energy Solutions International; The Watt Stopper	$494,318	23.3%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-025 Plug Load Reduction App:RYPL	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-025 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 19 bidders	Home Energy Analytics
EPC-15-026 Unlocking Plug Load Energy Savings through Energy Reporting	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-026 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 19 bidders	Lawrence Berkeley National Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-025 Plug Load Reduction App:RYPL	Group 1: Ranked # 2	N/A	N/A	Yes; Small Business, Micro Business, Calif Based Entity, Woman Own
EPC-15-026 Unlocking Plug Load Energy Savings through Energy Reporting	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-025 Plug Load Reduction App:RYPL	Idle load is a new concept to most residential energy users and includes appliances and equipment in the off or standby mode but still drawing power. The recipient has developed an innovative smart phone app called Dr. Power which provides residents with information about their idle loads, provides ideas and a plan to reduce the idle loads, and correlates any energy saving actions with smart meter data. This simple to use app tests the theory that if accurate information about energy use is provided to consumers, they will be more likely to engage and take action. This technology has the potential to advance consumer knowledge and overcome barriers to reducing idle loads that could hinder the State's goal of doubling energy efficiency by 2030 and/or achieving zero net energy buildings in the future.	1f, 1h	Dr. Power was designed to and built to reduce residential idle load through user education and behavioral science. It was designed to incorporate smart meter data and measured standby power for specific devices. Over 800 PG&E and SCE customers created Dr. Power accounts. Across 341 PG&E Dr. Power Users, idle load was reduced by an average of 5.4 watts which equates to 47 kWh/yr. The open source database used by Dr. Power contains nearly 170,000 appliances. The public API has been used by three different applications including the AskDrPower.com, which is a unique and comprehensive on-line resource for exploring residential energy use. To have significant impact, more California residents need to know about Dr. Power. This can be done by including Dr. Power in statewide outreach programs, such as EnergyUpgradeCA and for SCE and SDG&E to provide easy data access for their customers.
EPC-15-026 Unlocking Plug Load Energy Savings through Energy Reporting	The recipient is developing inexpensive, proprietary-free technologies that can acquire energy use data for networked plug load devices and make them available to building owners. The technologies will be able to identify abnormally large plug load energy use and enable building owners to react to its energy use. The technology could be incorporated directly into California's building codes and other energy efficiency standards.	1f, 1h, 3a, 4a	The recipient demonstrated a set of devices with energy reporting features. The devices covered a wide range, including HVAC, lighting, a vehicle charger, a water heater, electronics (notebook computer and universal serial bus charger), and three external meters. To show these devices operating live, the team created a management system that queries the energy reporting devices for their data, stores the data, and displays it in compelling visualizations. The final report reviews existing communication protocols that support energy reporting and describes how to use them with a proposed reference data model for energy reporting. It also assesses ways that energy codes and standards processes can be leveraged to drive energy reporting technology into the market. The recipient continues to advocate energy reporting, recently forming a committee to revising the existing standard CTA-20147.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-027 Electric Plug Load Savings Potential of Commercial Foodservice Equipment	Applied Research and Development	This project assesses the reduction potential of electric commercial plug load foodservice equipment at 29 different commercial kitchens and demonstrates the potential for reduced energy consumption through the use of pre-commercial appliance designs and control technologies.	4/13/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-028 Real World Electrification Options of Energy Services and Environmental Justice (EJ) Considerations	Applied Research and Development	The research team conducted a detailed study about the air quality implications of electrifying energy services such as transportation and space heating. The research team used, as a starting point, E3's prior EPIC study on Deep Decarbonization in a High Renewables Future (EPC-14-069). Estimates of how emissions of criteria air pollutants such as oxides of nitrogen and particulate matter would change with electrification were used as input to a sophisticated air quality model to estimate air quality impacts. The research team evaluated the implications of these air quality improvements on public health.	4/13/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-027 Electric Plug Load Savings Potential of Commercial Foodservice Equipment	No	Demand-side Management	$937,469	$937,469	$936,072	N/A
EPC-15-028 Real World Electrification Options of Energy Services and Environmental Justice (EJ) Considerations	No	Generation	$799,444	$799,444	$799,098	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-027 Electric Plug Load Savings Potential of Commercial Foodservice Equipment	$936,072	$392,763	$0	Fisher-Nickel, Inc.; Pacific Gas and Electric Company; NAFEM; Dalla Corte; Nuova Simonelli; Hatco	$202,450	17.8%
EPC-15-028 Real World Electrification Options of Energy Services and Environmental Justice (EJ) Considerations	$799,098	$234,351	$0	Electric Power Research Institute, Inc.; South Coast Air Quality Management District	$759,213	48.7%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-027 Electric Plug Load Savings Potential of Commercial Foodservice Equipment	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-027 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 19 bidders	Fisher-Nickel, Inc.
EPC-15-028 Real World Electrification Options of Energy Services and Environmental Justice (EJ) Considerations	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-028 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45 out of 45 bidders	Electric Power Research Institute, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-027 Electric Plug Load Savings Potential of Commercial Foodservice Equipment	Group 1: Ranked # 4	N/A	N/A	Yes; Calif Based Entity
EPC-15-028 Real World Electrification Options of Energy Services and Environmental Justice (EJ) Considerations	Group 2: Ranked # 1	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-027 Electric Plug Load Savings Potential of Commercial Foodservice Equipment	This project bridges the knowledge gap and supports accelerated adoption of advanced appliances and controls by better understanding operator behavior and operational changes that can be made to successfully use new lower energy appliances. The results of this effort will be used to develop real world case studies of successful implementation of next generation plug load appliances, and provide training to food service operators to maximize energy reduction potential for food service equipment. In addition to food service operators, the research results will assist equipment manufacturers in further product development of energy efficient food service equipment and help justify development of utility incentives for purchasing and installing energy efficient foodservice equipment.	1e, 1f, 1h	The project is complete and had demonstrations at 29 different sites. The recipient collected baseline data and installed new, high efficiency electric equipment, such as toaster ovens, soup warmers, rice cookers, and espresso machines at 18 of these restaurants. Cumulative energy savings for all plug load equipment can be substantial. The appliance with the highest average daily energy use and potential for energy savings was the conveyor toaster. It uses more than 20 times the energy on average than the appliance with the lowest average daily energy use, the soup warmer. Frontier also tested induction and conduction cook tops. The COVID-19 pandemic has had a substantial impact on the food service industry and leaving a glut of used equipment on the market. The recipient has pivoted to meet the changing needs of industry by providing on-line webinars and developing virtual tools that focus on energy efficient equipment and low-carbon solutions.
EPC-15-028 Real World Electrification Options of Energy Services and Environmental Justice (EJ) Considerations	The analysis of health and air quality benefits alongside costs of electrification under this agreement is forming the basis for new cost-benefit metrics that can be used to assess the economic viability of breakthrough technologies. Cost-benefit analyses of this sort can be used to make evidence-based decisions regarding technology financing and deployment.	1f, 1h, 2a, 4a, 4b	The research team delineated long-term electrification scenarios for the residential, commercial, and transportation sectors. For each scenario, researchers estimated emissions of criteria air pollutants at relatively fine geographical resolution and with the necessary temporal resolution for sophisticated photochemical modeling. Results suggest that electrification would result in substantial improvements in air quality and public health based on estimated reductions in maximum summertime 8-hour average ozone concentrations and wintertime PM2.5 concentrations. This analysis of health and air quality benefits alongside costs of electrification offers a basis for new cost-benefit metrics that can be used to assess the economic viability of breakthrough technologies

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-029 Distributed Generation Environmental Planner	Applied Research and Development	This project developed a tool to identify environmentally preferred areas for distributed solar generation (DG). The project demonstrated how disparate spatial information, such as solar capacity, environmental data, and utility infrastructure, can be combined in a site screening tool for effective local DG planning. The project aimed to expand energy planning tools at the local level by leveraging the ongoing development of a statewide planning tools. The existing statewide tool (prototype currently called the "RE Infrastructure Planning Assistant") focuses primarily on environmental screening for utility scale renewable energy development. This project adds more detailed energy and economic information appropriate for distribution-scale solar siting and most importantly incorporates distributed generation into the prototype interactive mapping tool and tests it in Lancaster, California.	4/13/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-029 Distributed Generation Environmental Planner	No	Generation	$199,976	$199,976	$199,536	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-029 Distributed Generation Environmental Planner	$199,536	$44,350	$0	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-029 Distributed Generation Environmental Planner	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-029 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45 out of 45 bidders	Black & Veatch Corporation

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-029 Distributed Generation Environmental Planner	Group 5: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-029 Distributed Generation Environmental Planner	This agreement created a prototype, public tool (http://dg-solar.org/) that enables DG PV site selection by providing users both environmental and engineering geospatial data. Having proven the concept in Lancaster, CA, the tool may be expanded to other areas of California that have similar availability of input data. Making information more comprehensive and accessible at the DG level will improve market functioning, while also enabling better DG infrastructure planning that incorporates environmental conservation.	2a, 4f	This project was completed in 2018. The final report is available online at: http://www.energy.ca.gov/2018publications/CEC-500-2018-010/CEC-500-2018-010.pdf. The research team designed the technical specifications of the planning tool, developed the web-based application, and compiled and processed spatial data. The tool combines solar resource, environmental sensitivity, cost, and interconnection spatial data layers in a single GIS application. The format of the tool allows user-entered values for a variety of screening parameters that may be of interest to developers, local planners, and government officials. The tool returns maps and lists of parcels that match the user-entered criteria and then generates reports. The completed tool went live online in 2017. The TAC member from sPower is interested in using the tool to guide future solar development in Lancaster.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-030 ** San Diego Regional Energy Innovation Cluster	Applied Research and Development	This project established the Southern California Energy Innovation Cluster (SCIEN) as a regional incubator program that provides commercialization support services to clean energy entrepreneurship in San Diego, Imperial, Riverside and San Bernardino Counties. This program will leverage the region's universities, industries, businesses, economic development organizations, and other key stakeholder groups to foster collaborations across the private-public-academic landscape and accelerate equitable deployment of clean technology innovations.	4/13/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-030 ** San Diego Regional Energy Innovation Cluster	No	Demand-side Management	$3,000,000	$3,000,000	$3,000,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-030 ** San Diego Regional Energy Innovation Cluster	$3,000,000	$880,681	$749,802	Cleantech San Diego Association; CONNECT	$3,097,934	38.3%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-030 ** San Diego Regional Energy Innovation Cluster	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-030 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	6 out of 12 bidders	Cleantech San Diego Association

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-030 ** San Diego Regional Energy Innovation Cluster	Group 3: Ranked # 1	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-030 ** San Diego Regional Energy Innovation Cluster	This project is advancing the goals of SB 350 (2015) by accelerating the commercialization of new clean energy technologies that can enable the integration of high-penetrations of renewables and distributed energy resources. This project will increase the probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. Intangible benefits to California ratepayers will result from broader, indirect, and multiplicative economic effects that occur from the successful establishment of California-based technology companies.	2a, 3b, 3e	In 2020, Southern California Energy Innovation Network (SCEIN) expanded the number of active startups to 35-member companies. These companies are developing breakthrough innovations to accelerate building decarbonization, transportation electrification, 100% RPS, resiliency, safety and equity. Collectively, these companies have attracted over $51 million in private follow-on funding and $23.5 million in public follow-on funding since being accepted into the program. This combined $74.5 million represents a doubling of the capital that these companies came into the program with, and a 20x ROI on the $3.4 million in total program expenditures to date. A series of 3 SCEIN Public Showcase Events were conducted to support 17 SCEIN member companies that are currently raising an additional $60 million in capital. To cap 2020 off, SCEIN companies Aquacycl, Nuvve (2) and Ivy Energy won 4 of the 5 inaugural California Energy Commission Visionary Awards at the 6th annual CEC EPIC Symposium.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-15-030 ** San Diego Regional Energy Innovation Cluster	Market Facilitation	This project established the Southern California Energy Innovation Cluster (SCIEN) as a regional incubator program that provides commercialization support services to clean energy entrepreneurship in San Diego, Imperial, Riverside and San Bernardino Counties. This program will leverage the region's universities, industries, businesses, economic development organizations, and other key stakeholder groups to foster collaborations across the private-public-academic landscape and accelerate equitable deployment of clean technology innovations.	4/13/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-030 ** San Diego Regional Energy Innovation Cluster	No	Demand-side Management	$2,000,000	$2,000,000	$689,833	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-030 ** San Diego Regional Energy Innovation Cluster	$689,833	$0	$0	Cleantech San Diego Association; CONNECT	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-030 ** San Diego Regional Energy Innovation Cluster	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-030 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	6 out of 12 bidders	Cleantech San Diego Association

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-030 ** San Diego Regional Energy Innovation Cluster	Group 3: Ranked # 1	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-030 ** San Diego Regional Energy Innovation Cluster	This project is advancing the goals of SB 350 (2015) by accelerating the commercialization of new clean energy technologies that can enable the integration of high-penetrations of renewables and distributed energy resources. This project will increase the probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. Intangible benefits to California ratepayers will result from broader, indirect, and multiplicative economic effects that occur from the successful establishment of California-based technology companies.	2a, 3b, 3e	In 2020, Southern California Energy Innovation Network (SCEIN) expanded the number of active startups to 35-member companies. These companies are developing breakthrough innovations to accelerate building decarbonization, transportation electrification, 100% RPS, resiliency, safety and equity. Collectively, these companies have attracted over $51 million in private follow-on funding and $23.5 million in public follow-on funding since being accepted into the program. This combined $74.5 million represents a doubling of the capital that these companies came into the program with, and a 20x ROI on the $3.4 million in total program expenditures to date. A series of 3 SCEIN Public Showcase Events were conducted to support 17 SCEIN member companies that are currently raising an additional $60 million in capital. To cap 2020 off, SCEIN companies Aquacycl, Nuvve (2) and Ivy Energy won 4 of the 5 inaugural California Energy Commission Visionary Awards at the 6th annual CEC EPIC Symposium.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-031 Flexible Control Strategies for Plug Loads with Context-Aware Smart Power Outlets to Mitigate Electricity Waste and Support Demand Response	Applied Research and Development	This agreement develops integrated plug load control strategies for different spaces within multiple types of commercial buildings. The project implements a flexible energy management system (FEMS) to monitor and/or automate switching operation of equipment plugged into outlets. The project's goal was to advance the control strategies to reduce at least 10% energy use in assigned spaces (e.g., offices, research labs) as well as common areas (e.g., break rooms, shared equipment areas), and to develop and assess demand response strategies for plug loads with 10% demand reduction. The research was conducted by first establishing a baseline period with no interventions. Next, during the treatment period, control strategies were applied to selected equipment, and the impacts of energy and demand savings were calculated.	4/13/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-032 ** Bay Area Regional Energy Innovation Cluster	Applied Research and Development	This project established the Bay Area Regional Energy Innovation Cluster by expanding the Cyclotron Road program to provide commercialization support services to Bay Area entrepreneurs developing breakthrough materials and hardware devices in energy efficiency, energy storage, distribution, grid management, and power generation. Cyclotron Road provides entrepreneurs access to world-class laboratory facilities, and key services, such as business model development, customer discovery, and intellectual property protection to enable energy entrepreneurs in the Bay Area region.	4/13/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-031 Flexible Control Strategies for Plug Loads with Context-Aware Smart Power Outlets to Mitigate Electricity Waste and Support Demand Response	No	Demand-side Management	$1,050,022	$1,050,022	$945,018	N/A
EPC-15-032 ** Bay Area Regional Energy Innovation Cluster	No	Demand-side Management	$2,000,000	$2,000,000	$2,000,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-031 Flexible Control Strategies for Plug Loads with Context-Aware Smart Power Outlets to Mitigate Electricity Waste and Support Demand Response	$945,018	$366,082	$0	Electric Power Research Institute, Inc.; San Diego Gas and Electric Company; To Be Determined; Enmetrics Systems; Ibis Networks; SkyCentrics; TBD - Technical Writer	$335,120	24.2%
EPC-15-032 ** Bay Area Regional Energy Innovation Cluster	$2,000,000	$282,411	$978,736	Autodesk, Inc.; Lawrence Berkeley National Laboratory; Activate Global, Inc; DLA Piper LLP	$9,000,000	64.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-031 Flexible Control Strategies for Plug Loads with Context-Aware Smart Power Outlets to Mitigate Electricity Waste and Support Demand Response	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-031 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 19 bidders	Electric Power Research Institute, Inc.
EPC-15-032 ** Bay Area Regional Energy Innovation Cluster	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-032 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	6 out of 12 bidders	Activate Global, Inc

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-031 Flexible Control Strategies for Plug Loads with Context-Aware Smart Power Outlets to Mitigate Electricity Waste and Support Demand Response	Group 2: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-15-032 ** Bay Area Regional Energy Innovation Cluster	Group 4: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-031 Flexible Control Strategies for Plug Loads with Context-Aware Smart Power Outlets to Mitigate Electricity Waste and Support Demand Response	In order to reduce plug load energy use and increase the energy efficiency of buildings, load sensing plug load automation strategy was used on workstation equipment and time scheduling automation was used on shared equipment. Also, a trial of a mobile application enabling occupant designation of equipment to opt into demand response strategies during DR events was implemented.. The results of this project can potentially reduce electricity use by 10% in office buildings and 18% in laboratory buildings particularly during low-occupancy times and in user-assigned spaces, thereby achieving lower electricity costs for the ratepayer.	1e, 1f, 1h	The team is re-evaluating the M&V period due to the demonstration sites being unoccupied as a result of the COVID-19 pandemic. The term was extended to provide more time to evaluate the demand response capabilities. The research team has developed heat maps at each site. The heat map provides a graphical visualization of user presence and plug load energy usage atop a building floorplan, enabling analyses of relationships between presence and energy usage to inform strategies for deeper savings. This provides charting capability to target equipment and time schedules for automation (e.g., equipment that is used heavily during times of lack of presence). This can be useful for minimizing wasted energy and also understanding which equipment to target for load shifting during demand response events. The team is finalizing the Final Report and is getting feedback from the TAC members.
EPC-15-032 ** Bay Area Regional Energy Innovation Cluster	This project will help advance the goals of Senate Bill 350 (De Leon, 2015) by accelerating the commercialization of clean energy technologies, including energy efficiency, demand response, renewable generation, energy storage, and smart-grid integration. This project will increase the probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. Intangible benefits to California ratepayers will result from broader, indirect, and multiplicative economic effects that occur from the successful establishment of California-based technology companies.	2a, 3b, 3e	In 2020, Cyclotron Road accepted its sixth cohort of fellows into its program. This latest round of entrepreneurs is developing innovations in areas such as high-efficiency wireless charging, predictive platforms to improve exploration of geothermal resources, and additive manufacturing for high-efficiency electric motors. The fellows will spend the next two years working on bringing their technologies closer to market. Fellows supported by CEC funding have attracted over $33 million in public and private follow-on funding since being accepted into the Cyclotron Road Program. The project team also transferred previously developed in-person curriculum and programing for the fellows into a completely remote experience in response to COVID-19. In 2021, Cyclotron Road will continue to accept a new cohort of fellows.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-15-032 ** Bay Area Regional Energy Innovation Cluster	Market Facilitation	This project established the Bay Area Regional Energy Innovation Cluster by expanding the Cyclotron Road program to provide commercialization support services to Bay Area entrepreneurs developing breakthrough materials and hardware devices in energy efficiency, energy storage, distribution, grid management, and power generation. Cyclotron Road provides entrepreneurs access to world-class laboratory facilities, and key services, such as business model development, customer discovery, and intellectual property protection to enable energy entrepreneurs in the Bay Area region.	4/13/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-033 Ventilation Solutions for Energy Efficient California Schools: Improving Indoor Air Quality through Advanced, High Performance HVAC	Applied Research and Development	The project includes three phases: 1) conduct energy and indoor air quality measurements in California classrooms to establish baseline data; 2) identify and install new, highly efficient HVAC technologies at selected schools and collect data from these schools; 3) conduct energy consumption and indoor air quality simulations based on information collected from previous two phases in representative climate zones in California, and compare simulation results with field data. The identified technologies in this study include heat recovery ventilators, air economizers, demand control ventilation, displacement ventilation, high-performance filtration, and learning thermostats. These are advancements that are over and above the technologies typically used in California schools, and can greatly improve the energy efficiency of providing heating, cooling, and ventilation in classrooms.	4/13/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-032 ** Bay Area Regional Energy Innovation Cluster	No	Demand-side Management	$2,980,000	$2,980,000	$327,928	N/A
EPC-15-033 Ventilation Solutions for Energy Efficient California Schools: Improving Indoor Air Quality through Advanced, High Performance HVAC	No	Distribution	$1,500,000	$1,500,000	$1,495,245	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-032 ** Bay Area Regional Energy Innovation Cluster	$327,928	$0	$0	Autodesk, Inc.; Lawrence Berkeley National Laboratory; Activate Global, Inc; DLA Piper LLP	$0	0.0%
EPC-15-033 Ventilation Solutions for Energy Efficient California Schools: Improving Indoor Air Quality through Advanced, High Performance HVAC	$1,495,245	$439,287	$0	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-032 ** Bay Area Regional Energy Innovation Cluster	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-032 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	6 out of 12 bidders	Activate Global, Inc
EPC-15-033 Ventilation Solutions for Energy Efficient California Schools: Improving Indoor Air Quality through Advanced, High Performance HVAC	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-033 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45 out of 45 bidders	Regents of the University of California, Davis

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-032 ** Bay Area Regional Energy Innovation Cluster	Group 4: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-15-033 Ventilation Solutions for Energy Efficient California Schools: Improving Indoor Air Quality through Advanced, High Performance HVAC	Group 1: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-032 ** Bay Area Regional Energy Innovation Cluster	This project will help advance the goals of Senate Bill 350 (De Leon, 2015) by accelerating the commercialization of clean energy technologies, including energy efficiency, demand response, renewable generation, energy storage, and smart-grid integration. This project will increase the probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. Intangible benefits to California ratepayers will result from broader, indirect, and multiplicative economic effects that occur from the successful establishment of California-based technology companies.	2a, 3b, 3e	In 2020, Cyclotron Road accepted its sixth cohort of fellows into its program. This latest round of entrepreneurs is developing innovations in areas such as high-efficiency wireless charging, predictive platforms to improve exploration of geothermal resources, and additive manufacturing for high-efficiency electric motors. The fellows will spend the next two years working on bringing their technologies closer to market. Fellows supported by CEC funding have attracted over $33 million in public and private follow-on funding since being accepted into the Cyclotron Road Program. The project team also transferred previously developed in-person curriculum and programing for the fellows into a completely remote experience in response to COVID-19. In 2021, Cyclotron Road will continue to accept a new cohort of fellows.
EPC-15-033 Ventilation Solutions for Energy Efficient California Schools: Improving Indoor Air Quality through Advanced, High Performance HVAC	The project provides information on indoor air quality and energy usage in classrooms with current HVAC systems throughout different parts of California. It demonstrated the next generation HVAC system retrofits with regards to energy efficiency and indoor air quality performance. The results enable energy savings without impacting indoor air quality in classrooms. The study is the first large field study to examine the energy efficiency and indoor air quality impacts after recent energy retrofits.	4b, 5d	The project is completed. In phase 1, the researchers collected indoor air quality (IAQ) monitoring, ventilation, and energy usage data from 104 classrooms in 11 schools using current HVAC systems. Researchers discovered high CO2 levels in some classrooms, suggesting poor ventilation, and worked with the CEC to provide schools tools and information to install, commission, and maintain systems appropriately. In phase 2, researchers installed and commissioned 2 next-generation HVAC systems on 2 schools. In phase 3, the team conducted simulation for schools built in 1998 and 2008. Results show energy savings and IAQ improvements from new HVAC systems. Use of high efficiency air filters significantly decreased PM2.5 levels without significant increase in ventilation energy. Researchers worked with manufacturers to fix issues with the new systems such as additional standby power consumption.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-034 Emerging Energy Public Health Research Roadmap	Applied Research and Development	This research develops a research needs assessment that focuses on the known and potential public health impacts of emerging energy systems. The needs assessment is based on consultation with experts in emerging energy systems and occupational and environmental health (OEH) and with stakeholder representatives from labor, business, government, and community-based organizations.	4/13/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-035 Clarifying and Quantifying Current and Near-Term Groundwater Pumping Energy Use and Costs in California to Improve Energy and Water Systems Reliability	Applied Research and Development	The project is quantifying current statewide energy use and costs attributable to groundwater pumping and is developing near-term projections of energy use and statewide costs. The projections will factor in groundwater demand, groundwater levels, climate change scenarios, energy prices, and obstacles to implementing energy-efficient pumping and groundwater conservation measures. By expanding knowledge of the relationship between groundwater pumping and energy use, the project will enhance the ability of the State of California and irrigation and drinking water districts to coordinate water and energy resources planning. In addition, the project is providing key insights on how to improve groundwater use and pumping efficiency.	4/13/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-034 Emerging Energy Public Health Research Roadmap	No	Generation	$151,000	$151,000	$150,998	N/A
EPC-15-035 Clarifying and Quantifying Current and Near-Term Groundwater Pumping Energy Use and Costs in California to Improve Energy and Water Systems Reliability	No	Demand-side Management	$625,000	$625,000	$619,704	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-034 Emerging Energy Public Health Research Roadmap	$150,998	$0	$0	None	$0	0.0%
EPC-15-035 Clarifying and Quantifying Current and Near-Term Groundwater Pumping Energy Use and Costs in California to Improve Energy and Water Systems Reliability	$619,704	$260,000	$0	Michael Hanneman	$22,550	3.5%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-034 Emerging Energy Public Health Research Roadmap	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-034 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45 out of 45 bidders	Public Health Institute
EPC-15-035 Clarifying and Quantifying Current and Near-Term Groundwater Pumping Energy Use and Costs in California to Improve Energy and Water Systems Reliability	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-035 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45 out of 45 bidders	Lawrence Berkeley National Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-034 Emerging Energy Public Health Research Roadmap	Group 3: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-15-035 Clarifying and Quantifying Current and Near-Term Groundwater Pumping Energy Use and Costs in California to Improve Energy and Water Systems Reliability	Group 7: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-034 Emerging Energy Public Health Research Roadmap	This report establishes a public health research roadmap aimed at anticipating and preventing potential unintended health impacts of emerging electricity generating, storing, and distributing systems (EES). Research recommendations were prioritized and presented in this roadmap.	4b, 5d	In 2017, the research team held 22 meetings with 34 experts throughout the energy, life cycle assessment, health, labor, and environmental justice field for total for over 30 hours. The team also created a growing database of peer-reviewed and grey literature. As of December 2017, the database houses 165 documents on Emerging Electricity-Generating Systems and related health and equity topics. Workshops were conducted in spring and summer of 2017 to obtain inputs. The research roadmap was published in fall 2017.
EPC-15-035 Clarifying and Quantifying Current and Near-Term Groundwater Pumping Energy Use and Costs in California to Improve Energy and Water Systems Reliability	This study is quantifying current and near-term statewide energy use and costs due to groundwater pumping. Previous estimates of energy use for groundwater pumping likely underestimated the amount of energy used because of a lack of information on actual groundwater use. Due to recent regulatory changes, the availability of information on groundwater use has increased significantly. This information, combined with high resolution modeling of hydrologic and climate change effects, will allow the researchers to produce more accurate estimates of current and future energy used for groundwater pumping. Benefits from this study will enable entities, such as investor owned utilities, water agencies, and others, to increase the efficiency of the energy used in the water sector, inform demand side management strategies, and decrease greenhouse gas emissions.	1f, 2a, 4c	This project was completed in 2019. The researchers found that, due to a warming climate, after 2050 there would be a significant increase in groundwater pumping and associated electricity use; some regions will experience a significant increase in groundwater use, such as a 42 percent increase in the Sacramento area by 2050, while other areas will have smaller increases. The researchers also conducted a survey of municipal and agricultural groundwater users to identify barriers to reducing energy used for groundwater pumping. The identified barriers include high initial capital investment, the availability of other more cost-effective operational measures, and the administrative and time intensity burden of incentive programs. The final report for this project is in preparation.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-036 Probabilistic Seasonal and Decadal Forecasts for the Electricity System Using Linear Inverse Modeling	Applied Research and Development	This project made three primary climate data advancements: (1) developed a curated, quality-controlled repository of hourly weather observations at 39 locations across California for the period 1973-2019, (2) provided recommendations for how to best use the data and supporting documentation, and (3) offered guidance on hosting a periodically updated database of quality-controlled, hourly temperature observations on Cal-Adapt. Data products utilized in this work supported development of a statewide data repository, providing energy sector stakeholders with regular ultra-high resolution data products that are needed to help California meet its renewable energy and climate goals. Additionally, the project assessed and quantified the extent to which the state of the Pacific Ocean can be used as a basis for generating predictions of temperature in California. The project then outlined an approach for making such predictions operational. The data and analyses produced and performed in this project meet the stated needs of investor-owned utilities, publicly-owned utilities, and state agencies to provide insight into the effects of sub-daily weather on the electrical system.	4/13/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-036 Probabilistic Seasonal and Decadal Forecasts for the Electricity System Using Linear Inverse Modeling	No	Grid Operations/Market Design	$400,000	$400,000	$399,999	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-036 Probabilistic Seasonal and Decadal Forecasts for the Electricity System Using Linear Inverse Modeling	$399,999	$26,898	$0	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-036 Probabilistic Seasonal and Decadal Forecasts for the Electricity System Using Linear Inverse Modeling	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-036 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45 out of 45 bidders	Eagle Rock Analytics

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-036 Probabilistic Seasonal and Decadal Forecasts for the Electricity System Using Linear Inverse Modeling	Group 10: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-036 Probabilistic Seasonal and Decadal Forecasts for the Electricity System Using Linear Inverse Modeling	Investor-owned utilities and the CEC's demand forecasting group have historically utilized daily climate information to assess and plan for use response to weather. As the share of power provided by intermittent renewable generation increases, and in tandem with the increasing availability of per-user sub-daily user consumption data, sub-daily weather information is increasingly necessary. This work provides a stable quality-controlled record curated for California's energy sector. Providing this information to energy system stakeholders through Cal-Adapt will facilitate a more stable energy system for California ratepayers, by (1) allowing utilities to better understand how diurnal weather variability and electricity use are related and (2) by providing for a centralized, publicly-available, regularly-updated database of quality-controlled data to be hosted on the Cal-Adapt platform.	5c	In 2019, the research team improved and optimized forecasting algorithms; processed and analyzed hourly weather data for trends and relevant quantities; reviewed peer-reviewed atmospheric science literature to identify additional determinants of predictability in seasonal temperature; produced and uploaded datasets for use by the CEC's Demand Analysis Office, the Cal-Adapt development team, and other energy sector stakeholders; and participated in a final meeting in which technical results were shared with the Demand Forecast Office. Finally, the research team submitted a final report for publication, began work on a peer-reviewed publication, and participated in knowledge transfer to support a workshop where hourly data will be discussed by IOUs, CEC, CPUC, and other energy sector stakeholders to illuminate how best to provide access to the data on Cal-Adapt.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-037 Smart Ventilation for Advanced California Homes	Applied Research and Development	This study explored how real-time monitoring and automatic controls can be used in home ventilation systems to improve energy efficiency and/or optimize consumption for time-of-day load balancing. Specifically, the study considered optimization of ventilation for indoor air quality for zones (i.e., air quality in different rooms within buildings). The study used computational simulations leveraging multiple well-established platforms to develop and evaluate control schemes for home ventilation systems. Key evaluation criteria were the modeled ventilation-related energy used over a year of operation, and the indoor air quality relative to a minimally code-compliant continuously operating ventilation system.	4/13/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-038 ** BlueTechValley Innovation Cluster	Applied Research and Development	This project expands access for clean energy entrepreneurs to a region-wide energy-water-food nexus incubator and commercialization services in California's Central Valley and North State regions. The Central Valley Energy Innovation Cluster (a.k.a. BlueTechValley Energy Cluster) provides entrepreneurs with a variety of services, including technology evaluation, proof-of-concept validation and advisory support as well as opportunities to connect with investors, industry leaders and potential customers.	4/13/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-037 Smart Ventilation for Advanced California Homes	No	Distribution	$1,500,000	$1,500,000	$1,500,000	N/A
EPC-15-038 ** BlueTechValley Innovation Cluster	No	Demand-side Management	$3,000,000	$3,000,000	$3,000,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-037 Smart Ventilation for Advanced California Homes	$1,500,000	$649,037	$1,000,000	Lawrence Berkeley National Laboratory; United States Department of Energy; Aereco S.A.	$1,300,000	46.4%
EPC-15-038 ** BlueTechValley Innovation Cluster	$3,000,000	$718,347	$850,000	Schatz Energy Research Center; California State University, Fresno Foundation; Los Angeles Cleantech Incubator; Kern Economic Development Corporation; Child Family Institute for Innovation and Entrepreneurship - UC Davis	$2,655,684	34.7%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-037 Smart Ventilation for Advanced California Homes	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-037 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45 out of 45 bidders	Lawrence Berkeley National Laboratory
EPC-15-038 ** BlueTechValley Innovation Cluster	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-038 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	6 out of 12 bidders	California State University, Fresno Foundation

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-037 Smart Ventilation for Advanced California Homes	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-15-038 ** BlueTechValley Innovation Cluster	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-037 Smart Ventilation for Advanced California Homes	This work built on efforts of the past decade that have facilitated dynamic ventilation approaches. The project used simulation approaches to determine how energy, indoor air quality (IAQ), peak period demand, and comfort can be optimized using smart ventilation. The results from the project will help smart home automation service providers and their consumers identify effective smart ventilation strategies and provide important, as well as provide information that the Energy Commission could potentially use in the development of future ventilation standards.	4b, 5d	The team completed development of an integrated energy simulation model that enables quantitative evaluation of the energy demand, energy cost (based on time-of-use pricing), and air quality implications of various smart ventilation strategies. The team also developed a range of optimized control algorithms for various home ventilation scenarios. The final report was published in July 2020. Prior to publication of the final report, the team completed several journal publications based on literature review and development of guidelines for indoor air quality (IAQ) metrics. Metrics have been used in a U.S. Department of Energy project to support development of a home IAQ scoring system.
EPC-15-038 ** BlueTechValley Innovation Cluster	This project will help lead to technology advancements by providing and coordinating key services, assistance, resources, and infrastructure needed by entrepreneurs and researchers to create and develop advanced energy technologies that will help the state meet the targets set by Senate Bill 350 to increase both renewable electricity generation and energy efficiency to 50 percent by 2030.	2a, 3e	BlueTechValley (BTV) has accepted and supported 231 companies (52 companies in 2020) which received $4.6 million in follow-on private capital and $4.87 million in follow-on public funding in 2020. To date, BTV companies have received $69.3 million in follow-on private capital and $43.8 million in follow-on public funding. In 2020, BTV hosted or supported 135+ events. BTV provided support to entrepreneurs, which included switching quickly from in-person to virtual events (due to COVID-19 challenges) that covered subjects such as grant writing, funding, and legal topics. In 2021, BTV will focus on four key areas: 1) bolster support to cleantech ventures, especially those affected by COVID-19; 2) create innovative ways to provide virtual programs, events, and support; 3) work closely with Hubs to continue programming and support through sustainable funding; 4) engage with government and private industry to promote connectivity and engagement.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-15-038 ** BlueTechValley Innovation Cluster	Market Facilitation	This project expands access for clean energy entrepreneurs to a region-wide energy-water-food nexus incubator and commercialization services in California's Central Valley and North State regions. The Central Valley Energy Innovation Cluster (a.k.a. BlueTechValley Energy Cluster) provides entrepreneurs with a variety of services, including technology evaluation, proof-of-concept validation and advisory support as well as opportunities to connect with investors, industry leaders and potential customers.	4/13/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-039 Carbon Balance with Renewable Energy: Effects of Solar Installations on Desert Soil Carbon Cycle	Applied Research and Development	This project installed soil and meteorological sensors at sites with solar installations and in adjacent undisturbed areas to make direct comparisons on the gains or losses of carbon, changes in microclimate and hydrology, and changes in dust generation or capture, and is aiming to predict long term soil and GHG emissions changes based on geochemical modeling. The project addressed the question of whether land alteration and modification during the construction and use of solar installations has a measurable impact on the soil carbon balance, and ultimately on the net carbon savings that solar installations provide during their lifetime	4/13/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-038 ** BlueTechValley Innovation Cluster	No	Demand-side Management	$2,000,000	$2,000,000	$513,890	N/A
EPC-15-039 Carbon Balance with Renewable Energy: Effects of Solar Installations on Desert Soil Carbon Cycle	No	Generation	$499,181	$499,181	$445,659	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-038 ** BlueTechValley Innovation Cluster	$513,890	$0	$0	Schatz Energy Research Center; California State University, Fresno Foundation; Los Angeles Cleantech Incubator; Kern Economic Development Corporation; Child Family Institute for Innovation and Entrepreneurship - UC Davis	$0	0.0%
EPC-15-039 Carbon Balance with Renewable Energy: Effects of Solar Installations on Desert Soil Carbon Cycle	$445,659	$80,312	$0	The Regents of the University of California, Berkeley Campus	$72,000	12.6%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-038 ** BlueTechValley Innovation Cluster	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-038 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	6 out of 12 bidders	California State University, Fresno Foundation
EPC-15-039 Carbon Balance with Renewable Energy: Effects of Solar Installations on Desert Soil Carbon Cycle	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-039 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45 out of 45 bidders	The Regents of the University of California, Berkeley Campus

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-038 ** BlueTechValley Innovation Cluster	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-15-039 Carbon Balance with Renewable Energy: Effects of Solar Installations on Desert Soil Carbon Cycle	Group 4: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-038 ** BlueTechValley Innovation Cluster	This project will help lead to technology advancements by providing and coordinating key services, assistance, resources, and infrastructure needed by entrepreneurs and researchers to create and develop advanced energy technologies that will help the state meet the targets set by Senate Bill 350 to increase both renewable electricity generation and energy efficiency to 50 percent by 2030.	2a, 3e	BlueTechValley (BTV) has accepted and supported 231 companies (52 companies in 2020) which received $4.6 million in follow-on private capital and $4.87 million in follow-on public funding in 2020. To date, BTV companies have received $69.3 million in follow-on private capital and $43.8 million in follow-on public funding. In 2020, BTV hosted or supported 135+ events. BTV provided support to entrepreneurs, which included switching quickly from in-person to virtual events (due to COVID-19 challenges) that covered subjects such as grant writing, funding, and legal topics. In 2021, BTV will focus on four key areas: 1) bolster support to cleantech ventures, especially those affected by COVID-19; 2) create innovative ways to provide virtual programs, events, and support; 3) work closely with Hubs to continue programming and support through sustainable funding; 4) engage with government and private industry to promote connectivity and engagement.
EPC-15-039 Carbon Balance with Renewable Energy: Effects of Solar Installations on Desert Soil Carbon Cycle	The research project -- the first of its kind -- determined the impact of large solar arrays on the carbon storage of desert soil ecosystems. Findings can provide insights into the most effective ways to design and manage solar production facilities for maximum net carbon benefits.	2a, 4f	The research team continuously collected tropospheric climate and physical and biological soil data at six undisturbed sites within the Mojave National Preserve. Chemical, physical, and organic and inorganic carbon measurements were completed on all soil samples collected from the six sites. Data from the sites has been used to parameterize the DayCent ecosystem process model. Installation and sampling of two in-situ monitoring stations located at a utility-scale solar facility was completed in 2018. Data collection of temperature, water content, and corresponding CO2 concentrations continued through 2019. The final report was published 2020.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-040 Assessing California's Mitigation Guidelines for Burrowing Owls Impacted by Renewable Energy	Applied Research and Development	The project analyzed the consequences of both passive and active relocation methods for burrowing owls (a California Species of Special Concern), and filled an existing need for robust scientific data on the relative effectiveness of relocation as a conservation method. Secondary goals were to provide data on owl movements and habitat use that could inform collision risk models and site selection decisions for renewable energy-generating facilities. The project team fit more than 50 owls with GPS tracking devices and divided them into three study groups--active translocation, passive relocation, and a control group. Frequent site visits provided information on mortality rates and reproductive output.	5/17/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-041 MarketZero: Taking an existing grocery store to scalable near-ZNE	Technology Demonstration and Deployment	The project implements a cost-effective energy efficiency upgrade package for a grocery store that uses both mature and innovative energy efficiency technologies with the objective of converting all major gas using equipment to electric.. The project includes LED lighting and refrigeration system improvements to increase energy efficiency, changing refrigeration units to use a lower global warming potential refrigerant (R448A), and installing high-efficiency variable frequency drive compressors. Other improvements include thermal ice packs in the walk-in freezers to reduce compressor run time during the day and help shift electrical load on hot days, variable speed reluctance motors for the supply fans for new efficient heat pumps, and self-contained refrigeration cases to improve the efficiency.	4/13/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-040 Assessing California's Mitigation Guidelines for Burrowing Owls Impacted by Renewable Energy	No	Generation	$598,671	$598,671	$598,671	N/A
EPC-15-041 MarketZero: Taking an existing grocery store to scalable near-ZNE	No	Demand-side Management	$2,999,591	$2,999,591	$2,962,771	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-040 Assessing California's Mitigation Guidelines for Burrowing Owls Impacted by Renewable Energy	$598,671	$54,425	$0	United States Department Fish and Wildlife Service; Zoological Society of San Diego dba San Diego Zoo Global; Western Riverside County Regional Conservation Authority; Coachella Valley Conservation Commission	$602,936	50.2%
EPC-15-041 MarketZero: Taking an existing grocery store to scalable near-ZNE	$2,962,771	$846,723	$0	Whole Foods Market	$650,000	17.8%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-040 Assessing California's Mitigation Guidelines for Burrowing Owls Impacted by Renewable Energy	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-040 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45 out of 45 bidders	Zoological Society of San Diego dba San Diego Zoo Global
EPC-15-041 MarketZero: Taking an existing grocery store to scalable near-ZNE	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-041 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39 out of 39 bidders	Prospect Silicon Valley

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-040 Assessing California's Mitigation Guidelines for Burrowing Owls Impacted by Renewable Energy	Group 6: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-15-041 MarketZero: Taking an existing grocery store to scalable near-ZNE	Group 5: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-040 Assessing California's Mitigation Guidelines for Burrowing Owls Impacted by Renewable Energy	This project will increase the effectiveness of conservation actions designed to mitigate renewable energy impacts on burrowing owls. This was achieved by evaluating the relative effectiveness of primary translocation methods in an experimental framework. Improvements to the effectiveness of existing translocation methods were tested experimentally. Long-term GPS tracking of individuals in the active and passive relocation groups and a control group provided the critical, previously missing, information to judge the effectiveness of each method. The management recommendations and proposed translocation protocols from this study should improve the success of mitigation and facilitate new permitting of renewable energy.	2a, 4f, 4g	The project was completed in 2019, and the final report was received. The researchers captured the targeted number of burrowing owls at development sites for three treatment groups. They released the active translocation group of owls at conservation areas and monitored their mortality and reproductive success. Short-term survival after translocation was relatively high, with no apparent reduction in reproduction. In collaboration with the Technical Advisory Committee, the project team refined the study design and research protocols and made recommendations to wildlife regulatory agencies about translocation protocols. In addition, they tested GPS units and modified their design for use with burrowing owls. The team shared sample material from captured owls with researchers in EPC-14-061 and EPC-15-043 to extend the data used for isotopic and genetic analyses in those projects.
EPC-15-041 MarketZero: Taking an existing grocery store to scalable near-ZNE	As grocery store owners are risk averse especially with new emerging innovative technologies, successful demonstration showing the benefits and performance of an all electric grocery store, could advance these technologies for use in other grocery stores. As profit margins for grocery stores are between 1 and 3 percent, increases in energy efficiency using these advanced technologies will be beneficial to a store's bottom line. Also, these types of improvements pose challenges to grocery stores due to limited space and existing configurations. However, documenting cost, savings and benefits could influence the grocery market to make similar future upgrades. These solutions and design approaches hope to reduce greenhouse gas emissions and decarbonize grocery stores.	1e, 1f, 1h, 4a	All projects have been installed and the project is complete. Project results indicate that the demonstration site, Whole Foods in San Francisco, is saving about 40 percent of its original energy use. The store has also installed a sound barrier to address sound levels from the new heat pump system. Whole Food's approach has been to: a) transfer information to others through social media, leverage the Whole Foods Market community and outreach with other stores, 2) leverage project experts and professionals on design considerations, construction operability issues, and methods for integrating emerging technologies gleaned by the team.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-042 Zero Energy Residential Optimization - Community Achievement (ZERO-CA)	Technology Demonstration and Deployment	The project serves as proof of concept for large-scale deployment of Zero Net Energy (ZNE) single-family homes in California. The objective is to assess how to construct ZNE homes without creating undue cost burdens on builders, businesses or consumers, and while assuring that changes to home design do not pose health, safety or other risks to occupants. This assessment will be done with a focus on cost control for ZNE construction by developing cost-effective packages of measures that include both commercially available and emerging technologies that meet the requirements of the Building Energy Efficiency Standards (Title 24, Part 6) as well as unregulated measures. In addition to builder cost savings passed to consumers in sales price, the project will assess and optimize actual consumer utility cost savings from ownership of ZNE homes.	5/17/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-043 Development of a Genoscape Framework for Assessing Population-Level Impacts of Renewable Energy Development on Migratory Bird Species in California	Applied Research and Development	This project developed a low-cost method to create high-resolution spatial maps of bird populations and migration routes that capitalizes on genomic data. This technology was extended to identify migration routes for additional vulnerable and endangered species, assess population-level impacts of fatalities at renewable energy facilities, and map migration hotspots. This information can help with siting decisions of new facilities as well as operational decisions, such as when to turn off wind turbines to avoid vulnerable population fatalities, reducing the overall number of bird losses at renewable energy facilities. Accurate understanding of the distributions of vulnerable populations in space and time will lead to more effective siting, monitoring, and operation, ultimately lowering costs to California ratepayers.	4/13/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-042 Zero Energy Residential Optimization - Community Achievement (ZERO-CA)	No	Demand-side Management	$4,819,805	$4,819,805	$4,462,509	N/A
EPC-15-043 Development of a Genoscape Framework for Assessing Population-Level Impacts of Renewable Energy Development on Migratory Bird Species in California	No	Generation	$599,236	$599,236	$597,672	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-042 Zero Energy Residential Optimization - Community Achievement (ZERO-CA)	$4,462,509	$1,488,701	$0	California Homebuilding Foundation (CHF)	$2,611,014	35.1%
EPC-15-043 Development of a Genoscape Framework for Assessing Population-Level Impacts of Renewable Energy Development on Migratory Bird Species in California	$597,672	$114,848	$299,316	Regents of the University of California, Los Angeles	$888,250	59.7%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-042 Zero Energy Residential Optimization - Community Achievement (ZERO-CA)	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-042 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39 out of 39 bidders	California Homebuilding Foundation (CHF)
EPC-15-043 Development of a Genoscape Framework for Assessing Population-Level Impacts of Renewable Energy Development on Migratory Bird Species in California	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-043 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45 out of 45 bidders	Regents of the University of California, Los Angeles

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-042 Zero Energy Residential Optimization - Community Achievement (ZERO-CA)	Group 6: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-15-043 Development of a Genoscape Framework for Assessing Population-Level Impacts of Renewable Energy Development on Migratory Bird Species in California	Group 6: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-042 Zero Energy Residential Optimization - Community Achievement (ZERO-CA)	Working closely with the builder and subcontractors, technology costs were evaluated and along with a real-world perspective on actual time and labor spent to install and commission each of the new technologies versus only the technology cost. By providing this data and analysis, this project serves as a roadmap on the most effective ways to implement ZNE homes. The information gathered was disseminated through various project participants such as California Building Industry Association (CBIA) events and member newsletters in efforts to promote the potential for cost-effective ZNE to the builder community.	1f, 1h, 3b, 4a	A draft final report is in progress and will include data through 2020. Study results indicate that only 7% of homebuyers can define what is a ZNE home, but 72% believe that energy efficiency is very important. Analysis revealed that the most cost-effective single energy efficiency measure varied by climate zone, and the only measure that consistently performed in the top 10 of being most cost-effective was the heat pump water heater. The study also revealed that all-electric appliances for a home cost $200-$500 less than natural gas appliances when natural gas infrastructure savings are included, such as plumbing and flue vents. These findings, while consistent with other electrification analyses, are not consistent with feedback from builders who report that all-electric appliances are $2,200-$3,500 more expensive due to the need for equipment oversizing to meet heating loads and avoid use of supplemental electric resistance heating. Results to be shared with the industry.
EPC-15-043 Development of a Genoscape Framework for Assessing Population-Level Impacts of Renewable Energy Development on Migratory Bird Species in California	This project harnessed the power of genomic data to develop genetic assays for quick, low-cost screening of thousands of individual birds. Researchers created high-resolution maps of population structure and migration routes and applied this information to assess population-level impacts by screening carcasses collected from renewable energy facilities. Genoscape maps were merged with existing spatial data of energy potential to make recommendations for siting new facilities in areas with minimal impact on wildlife.	2a, 4g	The project was completed in 2019, and the final report was received. The researchers developed maps and schedules of the migration routes (genoscape maps) of distinct populations of four birds (Common Yellowthroats, Wilson's Warbler, Burrowing Owls, and American Kestrel) relative to renewable energy sites. Samples from bird carcasses killed at solar and wind facilities were assessed by the genetic methods to estimate the population-level effects. The results support the idea that the majority of individuals exposed to renewable energy development were from the largest genetically distinct populations within each species, whereas carcasses from rare and declining populations made up a smaller percentage of the total number of birds sampled. Prioritization of renewable energy siting varied by the taxonomic groups. Multiple journal articles are being written.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-044 Certified Open-Source Software to Support the Interconnection Compliance of Distributed Energy Resources	Applied Research and Development	This project developed two key open-source software technologies: 1) implementation of a complete, certified IEEE 2030.5 communication protocol that manufacturers can freely incorporate into their products. This reduces the cost and complexity of bringing systems to market, streamlines the certification process, and helps ensure that products can successfully connect and participate in grid programs; and 2) a certification procedure and associated test software by which any system or device can be checked for compliance to the standard. Independent evaluation provides manufacturers with an unbiased assessment of their products and provides both business and individual consumers with assurance that their purchases will work as expected. The project also validated the completeness and quality of these technologies by implementing the open-source client in a commercial DER system and performing field testing.	5/17/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-045 Transactive Incentive Signals to Manage Electricity Consumption for Demand Response	Applied Research and Development	This project develops Transactive Load Management (TLM) signals, expressed in the form of proxy prices reflective of current and future grid conditions, and develops and implements software to calculate such signals. These signals are being designed to provide customers sufficient information to optimize their energy costs by managing their demand in response to system needs. The signals are transported via proven and available protocols and networks for use by projects that will test the efficacy of the TLM signals using the demand response projects awarded under GFO-15-311, Advancing Solutions that allow Customers to Manage Their Energy Demand.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-044 Certified Open-Source Software to Support the Interconnection Compliance of Distributed Energy Resources	No	Distribution	$816,539	$816,539	$806,503	N/A
EPC-15-045 Transactive Incentive Signals to Manage Electricity Consumption for Demand Response	No	Grid Operations/Market Design	$498,054	$498,054	$498,053	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-044 Certified Open-Source Software to Support the Interconnection Compliance of Distributed Energy Resources	$806,503	$203,973	$0	Electric Power Research Institute, Inc.; Xanthus Consulting International; SunSpec Alliance; Enphase Energy; QualityLogic	$243,722	23.0%
EPC-15-045 Transactive Incentive Signals to Manage Electricity Consumption for Demand Response	$498,053	$190,201	$0	Greenlots	$110,450	18.2%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-044 Certified Open-Source Software to Support the Interconnection Compliance of Distributed Energy Resources	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-044 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	23 out of 29 bidders	Electric Power Research Institute, Inc.
EPC-15-045 Transactive Incentive Signals to Manage Electricity Consumption for Demand Response	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-045 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 21 bidders	Electric Power Research Institute, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-044 Certified Open-Source Software to Support the Interconnection Compliance of Distributed Energy Resources	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-15-045 Transactive Incentive Signals to Manage Electricity Consumption for Demand Response	Group 3: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-044 Certified Open-Source Software to Support the Interconnection Compliance of Distributed Energy Resources	This project helps accelerate availability and connection of DER products and systems in California that meet Rule 21 requirements. This also helps more rapidly increase grid-tied solar generation to meet California's aggressive solar mandates.	1a, 1h, 1i, 2a, 3a, 5a	The project completed in March 2019. The final report Certified Open Source Software to Support the Interconnection Compliance of Distributed Energy Resources was received. Four different product vendors have implemented the open sourced IEEE 2030.5 client. The software integrates with their commercial gateways, or facility energy management systems to provide a Rule 21 compliant interface to utility operations. Several others are currently testing the viability of incorporating the open source software in their products.
EPC-15-045 Transactive Incentive Signals to Manage Electricity Consumption for Demand Response	This project has developed a day-ahead hourly proxy price signal that incorporates system conditions as reflected by wholesale energy markets. The hourly prices are being made available on a publicly-accessible server and are being incorporated as one of the experimental pricing structures being evaluated in EPIC demand response projects funded under GFO-15-311. The experimental pricing structures assessed the potential for a variety of different loads and customer types to respond automatically to a real-time proxy pricing signal, and by extension, the potential of DR being a demand side or a supply side resource for the State. Utilities have realized the potential benefits of TLM that PG&E has recently proposed its own day-ahead hourly rate.	1c, 1d, 1e, 1f, 1g, 1h, 3c, 3e, 3f, 3h, 4a, 5a, 5b	This project was completed on March 31, 2020. The final report has been delivered, returned to the contractor for revision, and resubmitted. It is now going through the publications process. This project successfully developed and demonstrated a TLM price signal system to automate load management strategies. The TLM provided a standard approach to enable supply- and demand-side market DR participation. The TLM price signal delivered hourly and sub-hourly energy prices to reflect real-time grid and market conditions. The price signal enabled grid operators to offer price-based DR programs and allowed customers to participate in those programs when it best fit their cost and operational needs.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-046 Developing a Distribution Substation Management System	Applied Research and Development	This project developed a software which can display the current state of the distribution system, detect problems, and automatically suggest potential solutions to reduce outage times. The software also helps automate routine and non-routine engineering and maintenance tasks that are performed on substation equipment, such as monitoring voltage violation.	5/17/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-047 Powernet - A Cloud Based Method for Managing Distribution Resources	Applied Research and Development	This project was designed to further develop Powernet, a cloud-based platform for managing energy resources in homes and businesses. Powernet was developed to control and coordinate energy resources both behind the meter and at the distribution system level for residential and commercial ratepayers to: (i) minimize costs, (ii) increase consumer quality of service, (iii) preserve grid stability and (iv) offer services to the grid.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-046 Developing a Distribution Substation Management System	No	Distribution	$500,000	$500,000	$499,999	N/A
EPC-15-047 Powernet - A Cloud Based Method for Managing Distribution Resources	No	Distribution	$2,210,720	$2,210,720	$2,210,720	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-046 Developing a Distribution Substation Management System	$499,999	$171,526	$0	Siemens Corporation, Corporate Technology	$455,000	47.6%
EPC-15-047 Powernet - A Cloud Based Method for Managing Distribution Resources	$2,210,720	$865,939	$3,500,000	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-046 Developing a Distribution Substation Management System	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-046 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	23 out of 29 bidders	Siemens Corporation, Corporate Technology
EPC-15-047 Powernet - A Cloud Based Method for Managing Distribution Resources	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-047 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	23 out of 29 bidders	SLAC National Accelerator Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-046 Developing a Distribution Substation Management System	Group 2: Ranked # 3	N/A	N/A	Yes; Calif Based Entity
EPC-15-047 Powernet - A Cloud Based Method for Managing Distribution Resources	Group 2: Ranked # 4	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-046 Developing a Distribution Substation Management System	Highly automated and efficient grid operation is required to achieve California's energy goals, in particular with respect to the Clean Energy and Pollution Reduction Act of 2015 (Senate Bill 350) that strives to reach 50 percent renewable energy resources. This project can lead to technological advancement and breakthroughs to overcome barriers in electrical grid automation by demonstrating the potential of semantic technologies for categorizing and processing data, as well as for discovering relationships within a varied data set. This system allows operators to control and further automate routine and non-routine engineering and maintenance tasks that are performed on substations. By making the complex smart grid more accessible for operators, it permits faster resolution of outages, thereby making the grid more maintainable and resilient.	3a, 3d, 5f, 5h	The project completed in March 2019. The final report, A Semantically Integrated Operational Dashboard for the Management of Smart Grid was received. The Siemens Corporate Technology team is actively looking for partners within Siemens and the utilities in California to run a pilot project to conduct user studies of the developed dashboards with grid operators.
EPC-15-047 Powernet - A Cloud Based Method for Managing Distribution Resources	Several significant Powernet system innovations were developed under this agreement: (i) the integration of control, optimization and power electronics enables novel functionality that includes stable connect/disconnect from the grid, local and global power sharing, and grid services including demand response; (ii) the development of a layered system structure that enables the operator to utilize Powernet for a variety of different grid purposes or service offerings; (iii) the design of the system to secure; and (iv) the adoption of open source standards and protocols for the platform to enable scalable engagement of devices in the future.	1g, 2a, 3a, 3d, 3f, 5f, 5h	The project wrapped up this year. The project team completed large-scale simulations (up to 10,000 buildings), modeling different DER deployment scenarios, markets and levels of penetration of renewables. Researchers quantified the stability and performance limits of the algorithms to guide real-world deployment. The team then deployed Powernet in 11 houses in Fremont, CA to test communication between different devices and the cloud and to validate the algorithms developed in simulations. This demonstration validated the modeling, bringing the system closer to commercialization. The recipient has received follow-on funding from ARPA-E to develop a home hub to coordinate DER technologies and smart appliances and integrate the hub with Powernet.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-048 Residential Intelligent Energy Management Solution: Advanced Intelligence to Enable Integration of Distributed Energy Resources	Applied Research and Development	This project tests and validates an intelligent residential energy management system that is capable of communicating with a variety of distributed energy resources (DER) including solar PV and energy storage in 100 residences in San Diego. The project integrates the use of pilot time-of-use utility rates in conjunction with simulated dynamic pricing signals to optimize grid impact and cost savings.	5/17/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-049 Electricity Pumped Storage Systems Using Underground Reservoirs: A Feasibility Study for the Antelope Valley Water Storage System	Applied Research and Development	The project conducts a feasibility study that determines the value of energy storage and associated grid support benefits provided by Peak Hour Pumped Storage and Aquifer Pumped Hydro applications at an existing water bank. The feasibility study also identifies critical parameters for success for both technologies and identifies other water banking sites in the state where these technologies are likely to be successful.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-048 Residential Intelligent Energy Management Solution: Advanced Intelligence to Enable Integration of Distributed Energy Resources	No	Demand-side Management	$3,996,560	$3,996,560	$3,985,174	N/A
EPC-15-049 Electricity Pumped Storage Systems Using Underground Reservoirs: A Feasibility Study for the Antelope Valley Water Storage System	No	Generation	$197,300	$197,300	$136,796	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-048 Residential Intelligent Energy Management Solution: Advanced Intelligence to Enable Integration of Distributed Energy Resources	$3,985,174	$637,870	$0	None	$0	0.0%
EPC-15-049 Electricity Pumped Storage Systems Using Underground Reservoirs: A Feasibility Study for the Antelope Valley Water Storage System	$136,796	$15,276	$0	CIM Group	$199,353	50.3%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-048 Residential Intelligent Energy Management Solution: Advanced Intelligence to Enable Integration of Distributed Energy Resources	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-048 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 21 bidders	Alternative Energy Systems Consulting, Inc.
EPC-15-049 Electricity Pumped Storage Systems Using Underground Reservoirs: A Feasibility Study for the Antelope Valley Water Storage System	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-049 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45 out of 45 bidders	Antelope Valley Water Storage, LLC

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-048 Residential Intelligent Energy Management Solution: Advanced Intelligence to Enable Integration of Distributed Energy Resources	Group 2: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-15-049 Electricity Pumped Storage Systems Using Underground Reservoirs: A Feasibility Study for the Antelope Valley Water Storage System	Group 11: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-048 Residential Intelligent Energy Management Solution: Advanced Intelligence to Enable Integration of Distributed Energy Resources	The key advancements in this project are operational integration strategies developed and tested in the field. These strategies have the potential of achieving widespread deployment throughout the state which could significantly reduce peak demand, reduce annual energy costs, and improve grid operations.	1e, 1h, 2a, 4a	The project has been completed and the final report has been published. Across the 100 homes included in the study, there was an average reduction in consumption during peak hours (4-9 p.m.) of 23% (average hourly load reduced from 0.84 to 0.65 kW). Project results show this technology's potential to dynamically adjust the electric grid by functioning as a missing link between rapid load fluctuations and the grid. This dynamic technology has the potential to dramatically flatten the duck curve and balance variable renewable resources. After the project ended, the energy management system was deactivated for study participants. Now that there's real world data of Itron's technology in 100 homes, there's a better understanding of the systems potential which should make it easier for Itron or others to make the case for additional deployments.
EPC-15-049 Electricity Pumped Storage Systems Using Underground Reservoirs: A Feasibility Study for the Antelope Valley Water Storage System	This project conducts feasibility analyses of Aquifer Pumped Hydro and Peak Hour Pumped Storage for energy storage purposes, hydropower generation, and demand response potential if implemented at a groundwater bank. Potential barriers are identified and economic analysis conducted to identify types of implementation with the highest value. The project is developing a set of tools other water banks can use to conduct similar assessments. Based on preliminary review, these tools could be very useful for all water banks in California.	1e, 3f	The research team conducted technical feasibility analysis and preliminary field testing of two pumped storage systems: Peak Hour Pumped Storage (PHPS) and Aquifer Pumped Hydro (APH) storage at Willow Spring Water Bank. Hydropower generation and demand response potential of groundwater banking projects were assessed. The results show low efficiency and revealed water quality issues as a potential barrier for implementation for the APH system. The demand response during a dry hydrologic year has the highest value based on analysis. The project also created tools for other groundwater banks in California to conduct similar analysis. The project was completed as planned in September 2017 and the final report is published.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-050 Winery Water and Energy Savings	Technology Demonstration and Deployment	This project demonstrated two energy and water saving technologies at a winery facility in northern California. The first technology is a water treatment and reuse system to recycle wastewater for indoor barrel washing. The second is a wine-to-wine heat exchanger for the cold-stabilization process -- a process through which white wine is cooled to a low 28 degrees Fahrenheit and then heated back up to 55 degrees Fahrenheit. Both technologies were installed and underwent monitoring and verification testing at the Jackson Family Wines botting facility in Sonoma County.	5/17/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-051 The Value Proposition for Cost-Effective, DR-Enabling, Nonresidential Lighting System Retrofits in California Buildings	Applied Research and Development	This project identifies, quantifies and evaluates the incremental costs and benefits of demand responsive (DR) lighting controls system requirements in the California Energy Code across existing, non-residential building stock. The project focuses on the incremental costs and benefits associated with adding the DR functionality to enhance general lighting upgrades in existing, non-residential buildings to enable them to act as DR resources.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-050 Winery Water and Energy Savings	No	Demand-side Management	$1,989,201	$1,989,201	$1,986,710	N/A
EPC-15-051 The Value Proposition for Cost-Effective, DR-Enabling, Nonresidential Lighting System Retrofits in California Buildings	No	Demand-side Management	$500,000	$500,000	$500,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-050 Winery Water and Energy Savings	$1,986,710	$157,088	$0	Jackson Family Wines	$404,625	16.9%
EPC-15-051 The Value Proposition for Cost-Effective, DR-Enabling, Nonresidential Lighting System Retrofits in California Buildings	$500,000	$130,529	$0	Energy Solutions International	$138,648	21.7%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-050 Winery Water and Energy Savings	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-050 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 35 bidders	Regents of the University of California, Davis
EPC-15-051 The Value Proposition for Cost-Effective, DR-Enabling, Nonresidential Lighting System Retrofits in California Buildings	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-051 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 21 bidders	Lawrence Berkeley National Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-050 Winery Water and Energy Savings	Group 2: Ranked # 5	N/A	N/A	Yes; Calif Based Entity
EPC-15-051 The Value Proposition for Cost-Effective, DR-Enabling, Nonresidential Lighting System Retrofits in California Buildings	Group 4: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-050 Winery Water and Energy Savings	The demonstrations showed the potential savings and benefits for the wine industry. The water treatment and reuse system uses reverse osmosis to treat water to potable standards. This technology is used in alternative markets, but not at wineries. This project demonstrated that the technology can be used in the winery industry with the treated water used for barrel washing and resulting in average water savings of 75% annually and 84% recovery when optimized. The second technology is an innovative wine-to-wine heat exchanger for the cold-stabilization of the white wine that recovers the thermal potential of existing cooling and heating streams and reduces the amount of energy used for processing white wine. Cold stabilization is one of the most energy intensive processes in the wine industry and can significantly benefit from the simple wine-to-wine heat exchanger technology.	1f, 1h, 2a, 4a, 4c	The agreement completed in March 2020. This project laid the groundwork for further commercial development. Each technology presented unique opportunities for energy and water savings. The water treatment and reuse system (VSEP) yielded an average of 75% water recovery from the raw influent and formal optimization procedures showed even higher potential percent recovery of water achieving up to 84% recovery. The second technology, the wine-to-wine heat exchanger system, was able to reduce energy costs by up to 88% and has shown that it can operate within the required performance specifications. The demonstration site, Jackson Family Wines is interested in expanding the use of these technologies in its operations and the VSEP technology vendor continues to expand its presence in the wine industry. Information on this project was shared with IOU representatives who expressed interest in the wine-to-wine heat exchanger and could consider the technology for future IOU incentive programs.
EPC-15-051 The Value Proposition for Cost-Effective, DR-Enabling, Nonresidential Lighting System Retrofits in California Buildings	This project will advance intelligent, network controls to become dynamically controlled, dispatchable grid resources. The advanced controls developed will ease building participation in Auto-Demand Response (DR) programs and improve grid reliability and resiliency, improve user interfaces for lighting systems to reduce energy waste and cost, and enable IOUs and others to geographically target DR deployments as a cost effective means to transmission and distribution infrastructure upgrades.	1e, 1f, 1h, 5b	The project is complete. Research results indicate that networked lighting control systems will become an important distributed energy resource (DER) because it increases lighting system efficiency, flexible control and rapid-response capabilities, and eases load aggregation. As more facilities recognize the non-energy benefits of net worked lighting control systems, these systems are expected to see increased market adoption along with decreased prices. Additionally, as the electricity market becomes more volatile, these systems could help with grid balancing and stabilization. The final report will be published in January 2019.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-053 Customer-Centric Approach to Scaling IDSM Retrofits	Technology Demonstration and Deployment	This project develops and demonstrates an approach to scale residential retrofits for disadvantaged communities that will focus on customer-centric solutions. This project develops and demonstrates an innovative approach, focusing on energy efficient integrated demand side management (IDSM) retrofit packages that are non-intrusive or do not displace occupants for long periods of time. The measures have the potential of reducing energy use by 30 to 40 percent.	5/17/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-054 Complete and Low Cost Retail Automated Transactive Energy System (RATES)	Applied Research and Development	This project will develop and pilot-test a standards-based Retail Automated Transactive Energy System (RATES), and behind the meter energy management solution. The purpose is to minimize the cost and complexity of customer participation in energy efficiency programs, maximize the potential of small loads to improve system load factor, shave peaks, integrate renewable generation, and provide low opportunity-cost resources to the grid. This project will work with Southern California Edison to facilitate customer participation and expand Demand Response Participation in the area served the Moorpark substation.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-053 Customer-Centric Approach to Scaling IDSM Retrofits	No	Demand-side Management	$3,894,721	$3,894,721	$3,883,487	N/A
EPC-15-054 Complete and Low Cost Retail Automated Transactive Energy System (RATES)	No	Demand-side Management	$3,187,370	$3,187,370	$3,185,294	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-053 Customer-Centric Approach to Scaling IDSM Retrofits	$3,883,487	$1,382,796	$0	Southern California Edison; BIRA Energy; LINC Housing Corporation	$799,559	17.0%
EPC-15-054 Complete and Low Cost Retail Automated Transactive Energy System (RATES)	$3,185,294	$0	$0	Universal Devices, Inc.; TBD - Controls; TBD Electrical Contractor; TeMix, Inc	$1,087,710	25.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-053 Customer-Centric Approach to Scaling IDSM Retrofits	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-053 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39 out of 39 bidders	Electric Power Research Institute, Inc.
EPC-15-054 Complete and Low Cost Retail Automated Transactive Energy System (RATES)	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-054 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 21 bidders	Universal Devices, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-053 Customer-Centric Approach to Scaling IDSM Retrofits	Group 5: Ranked # 3	N/A	N/A	None
EPC-15-054 Complete and Low Cost Retail Automated Transactive Energy System (RATES)	Group 2: Ranked # 4	N/A	N/A	Yes; Small Business, Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-053 Customer-Centric Approach to Scaling IDSM Retrofits	The project provides new data, analysis, and designs for cost-effective integrated demand side management retrofits that addresses some of the infrastructure challenges with existing multifamily buildings. The recipient has identified advanced technologies associated with HVAC and water heating that hope to overcome the infrastructure challenges, along with other innovations including smart thermostats, plug load controls, and LED lighting. The project results and monitoring and verification data will determine whether these portfolio of projects can achieve the goal of 30-40% reduction in energy use while minimizing tenant disruptions.	1f, 1h, 4a, 5b	In Ontario: The research team has completed obtained 12+ months of post-retrofit data. The measures that were installed were cool roof, heat pump HVAC , programmable thermostat, thankless Natural Gas WH, Low-E double pane windows, LED interior lighting, low-flow fixtures, variable speed pool pump, and upgraded appliances. The results showed energy savings of 43%-49% on site and tenant survey was overall positive. In Fresno: Site installation was completed in 2020. The demonstration site installed all 110V PTAC HVAC (heat pump) in all the units. Heat pump water heaters were installed at each building with a large tank that would feed into multiple units. In addition, other measures installed included LED lighting, attic insulation, wall insulation, and upgraded appliances. The project is expected to be completed in early 2021.
EPC-15-054 Complete and Low Cost Retail Automated Transactive Energy System (RATES)	This project developed an energy management automation platform that allows customers to participate in Demand Response (DR) markets by providing them the means to pre-program their preferred operational settings for end-use devices such as thermostats, pool pumps, and battery storage under variable pricing conditions. The technology applied those preferences to automating real-time response to energy market and rate variations using off-the-shelf equipment and a two-way subscription tariff design that allows customers to consume when prices are low and conserve when prices are high, without the need for complicated measurement, verification, and baselines. SCE staff believes that the approach has value and has provided additional funding to continue technology development and pilot testing after the EPIC project term ended.	1c, 1e, 1f, 1g, 1h, 3f, 4a	The project has been completed. The level of engagement by utilities and other partners is expanding the project impacts beyond what was initially anticipated in the agreement. SCE provided additional funding to support expansion of the research in the Moorpark substation area (a disadvantaged community also at risk for reliability issues). In addition, Google has been working with the team to evaluate its Alexa technology as a platform for hosting the transactive client. Post-EPIC project demonstrations are underway and SCE has provided funding to expand the number of test sites and include battery storage in the pilot, as well as facilitating expanded participation in CAISO markets.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-055 The Charge Bliss Advanced Renewable Energy Community for a Disadvantaged Southern California Community	Market Facilitation	This project demonstrated how the City of Carson's disadvantaged downtown community could plan and design an advanced energy community that included an extensive electric vehicle charging network, high penetrations of photovoltaic (PV) generation, and stationary battery storage in their municipal parks and city-owned facilities. The project team used transportation and utility data to develop a plan for where to place EV charging stations within areas with high electric grid congestion and how the associated increased energy demand could be balanced with solar and storage to minimize grid impacts. The team conducted planning, permitting, financial modeling, and engineering design for over three megawatts of PVs and 40+ charging stations for a disadvantaged public sector and commercial area in the City of Carson. Charge Bliss collaborated with two local government entities, South Bay Cities Council of Governments, and Southern California Association of Governments, as well as a collection of universities and private companies on this effort.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-055 The Charge Bliss Advanced Renewable Energy Community for a Disadvantaged Southern California Community	No	Demand-side Management	$1,500,000	$1,500,000	$1,469,125	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-055 The Charge Bliss Advanced Renewable Energy Community for a Disadvantaged Southern California Community	$1,469,125	$197,815	$0	Efacec; Edward Kjaer; Ji Min; Tanner Engineering	$96,937	6.1%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-055 The Charge Bliss Advanced Renewable Energy Community for a Disadvantaged Southern California Community	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-055 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 28 bidders	Charge Bliss, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-055 The Charge Bliss Advanced Renewable Energy Community for a Disadvantaged Southern California Community	Group 4: Ranked # 3	N/A	N/A	Yes; Micro Business, Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-055 The Charge Bliss Advanced Renewable Energy Community for a Disadvantaged Southern California Community	SB 350 (2015) sets a 50 percent renewable energy standard by 2030 and a doubling of energy efficiency savings in buildings by 2030. Local governments can play a critical role in achieving that goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project piloted innovative planning, permitting financing, and engineering approaches and tools to help improve the business case for IDER adoption at the community-scale.	3b, 3e	The project team worked with community, technical, and civic stakeholders to develop a plan that selected the best public buildings and parks to install energy storage, an extensive electric vehicle charging network, photovoltaic, and smart control technology-keeping in mind impacts to the grid, ZNE status, and cost. After completing the engineering design documents, the complete package was submitted to Carson. However, as of the end of 2018 the city chose not to further peruse the proposed development. This project demonstrated that early and frequent engagement with the community and civic leadership is an important aspect for advanced energy community efforts to avoid delays and re-designs that may arise from issues such as the need to compensate for pre-existing community priorities a

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-056 Peninsula Advanced Energy Community (PAEC)	Market Facilitation	Clean Coalition planned and designed a Solar Emergency Microgrid (SEM) for the southern portion of San Mateo County. The team developed several case studies to guide SEM site selection based on which services would be included and their implicit or minimum loads, facility type, interconnection options, resources available, proximity of the site to local hazards, and available financing options. The project team used the case studies to inform their work with the local planning and building departments to streamline zoning and engineering permitting for optimal SEM sites. To help incentivize microgrid investments, including for the project's SEM, the project team worked to establish a backup power valuation methodology to use in commercial applications.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-056 Peninsula Advanced Energy Community (PAEC)	No	Demand-side Management	$1,318,997	$1,318,997	$1,256,872	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-056 Peninsula Advanced Energy Community (PAEC)	$1,256,872	$312,711	$0	Natural Capitalism Solutions, dba Clean Coalition	$330,000	20.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-056 Peninsula Advanced Energy Community (PAEC)	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-056 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 28 bidders	Natural Capitalism Solutions, dba Clean Coalition

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-056 Peninsula Advanced Energy Community (PAEC)	Group 1: Ranked # 3	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-056 Peninsula Advanced Energy Community (PAEC)	Senate Bill 350 (2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Local governments are playing a critical role in achieving this goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project is piloting innovative planning, permitting, and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.	2a, 3b, 3e	This project concluded in June 2018 and Clean Coalition submitted a finalized master community design and case study, including four SEM models for different sites located in a disadvantaged community. These models integrate solar PV, energy storage, and electric vehicle charging infrastructure (EVCI), to increase resiliency from power outages. The project team is still pursuing a plan to connect all four sites, and is working with PG&E on the design. Additionally, several tools were developed to overcome economic, policy, and technical barriers that hinder AEC development, which include a streamlined permitting tool, a solar siting survey, and an EVCI master plan. The recipient has updated the project-specific page on their website at: http://www.clean-coalition.org/our-work/peninsula-advanced-energy-community; http://www.clean-coalition.org/our-work/peninsula-advanced-energy-community/.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-057 Customer-controlled, Price-mediated, Automated Demand Response for Commercial Buildings	Applied Research and Development	The purpose of this project is to improve small and large commercial customer participation in demand response programs by providing a cost-effective energy management system that allows a wide range of service offerings as well as effective and automated price-based management. The project will develop automated control systems capable of responding to dynamic pricing and program designs. Design improvements include: 1) receive price signals and evaluate energy demand; 2) enable heterogeneous customers to adapt to DR with individual preferences; 3) track, evaluate and control multiple devices; 4) interoperate with various building systems; 5) retain the electrical usage history of connected devices; 6) provide pricing based load management algorithms; 7) coordinate to maintain load diversity; 8) provide security; and 9) provide value by allowing customers to minimize the opportunity costs of participating by selecting the least-impactful load management strategy.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-057 Customer-controlled, Price-mediated, Automated Demand Response for Commercial Buildings	No	Demand-side Management	$4,000,000	$4,000,000	$3,993,312	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-057 Customer-controlled, Price-mediated, Automated Demand Response for Commercial Buildings	$3,993,312	$1,373,762	$0	Quantum Energy Services and Technologies, Inc. (DBA: QuEST); Siemens Corporation, Corporate Technology	$424,000	9.6%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-057 Customer-controlled, Price-mediated, Automated Demand Response for Commercial Buildings	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-057 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 21 bidders	The Regents of the University of California (CIEE)

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-057 Customer-controlled, Price-mediated, Automated Demand Response for Commercial Buildings	Group 2: Ranked # 3	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-057 Customer-controlled, Price-mediated, Automated Demand Response for Commercial Buildings	This project developed an open source software solution that is combined with an open architecture enabling platform. The eXtensible Building Operating System (XBOS/DR) can interface with multiple hardware devices from different vendors as well as include software applications from various vendors. With its ability to create a virtual building management system for small commercial buildings by networking thermostats and other controllers, XBOS/DR can provide large and small commercial customers with a variety of choices for DR capability. The open architecture can foster technical innovation by third-party vendors and other manufacturers in providing energy services.	1c, 1e, 1g, 1h, 4a	The project is complete. The researchers successfully developed a cost-effective energy management system that allowed a wide range of service offerings as well as effective and automated price-based management. This is achieved by developing automated control systems capable of responding to dynamic pricing and program designs. Most buildings that installed networked thermostats showed modest savings of 7-9%. DR event testing across 13 buildings resulted in an average of daily savings of $5.53, and 21 kWh in energy savings, with as high as $31.68 and122.01 kWh. The near-term target market is research groups who need data for analytics. The mid-term target market are utility program designers and startup companies who need building and system data. The platform will continue to be used in additional research projects funded by NYSERDA and DOE.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-058 The Oakland EcoBlock - A Zero Net Energy, Low Water Use Retrofit Neighborhood Demonstration Project	Market Facilitation	This project developed a model for a residential block-scale retrofit development of an integrated energy system combining energy efficiency, renewable generation, and water conservation technologies, called the EcoBlock. The development of the energy and water system components of the model served as a case study to analyze different owner-operator, and financing structures that may be applicable to a residential community. This case study can help transform the EcoBlock model from a one-off demonstration to a sustainable and replicable model for the entire state. The City of Oakland will also use the EcoBlock model to develop new planning and permitting processes that can lower the time and cost of similar block-scale developments throughout the city.	5/17/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-059 UniGen Smart System for Renewable Integration	Applied Research and Development	This project developed the UniGen Smart Software System, a control software capable of reducing the volatility of energy output from a combination of variable energy resources (VER). VER generation often deviates from forecasts and schedules because of variations in weather. This can be alleviated by a fast-acting control system that automatically compensates for deviations from projected generation using a dedicated mix of energy resources (e.g., a photovoltaic system and an energy storage system). Onset's UniGen control system couples these resources with a primary power plant using proprietary algorithms in a software application in real time so that the combined output corresponds to the committed output. Any deviation is solved at the project or distributed level, making it easier for the California Independent System Operator (CAISO) to manage grid performance	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-058 The Oakland EcoBlock - A Zero Net Energy, Low Water Use Retrofit Neighborhood Demonstration Project	No	Demand-side Management	$1,500,000	$1,500,000	$1,446,730	N/A
EPC-15-059 UniGen Smart System for Renewable Integration	No	Grid Operations/Market Design	$638,993	$638,993	$630,853	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-058 The Oakland EcoBlock - A Zero Net Energy, Low Water Use Retrofit Neighborhood Demonstration Project	$1,446,730	$117,432	$0	The Regents of the University of California on behalf of the Berkeley campus; Rexel Foundation; Morgan, Lewis and Bockius LLP; Arnold and Porter LLP; Perkins Coie	$769,846	33.9%
EPC-15-059 UniGen Smart System for Renewable Integration	$630,853	$0	$0	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-058 The Oakland EcoBlock - A Zero Net Energy, Low Water Use Retrofit Neighborhood Demonstration Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-058 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 28 bidders	The Regents of the University of California, Berkeley Campus
EPC-15-059 UniGen Smart System for Renewable Integration	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-059 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	23 out of 29 bidders	Onset, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-058 The Oakland EcoBlock - A Zero Net Energy, Low Water Use Retrofit Neighborhood Demonstration Project	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-15-059 UniGen Smart System for Renewable Integration	Group 1: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-058 The Oakland EcoBlock - A Zero Net Energy, Low Water Use Retrofit Neighborhood Demonstration Project	SB 350 (De Leon, 2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Deploying customer-side of the meter technologies at scale will help meet this goal, but will require new innovations to how local jurisdictions design, plan, finance, and manage energy upgrades at the community level. This project is developing sustainable financing structures, clear owner-operator responsibilities, and streamlined planning and permitting processes, which are critical to successfully deploying community-scale energy retrofits throughout the state.	2a, 3b, 3e	The project team completed a Community-Scale Zero Net Energy Retrofit Master Plan that includes 27 houses and 2 multi-family buildings in Oakland. The plan features a DC solar, storage, EV microgrid; energy efficiency retrofits; hybrid AC/DC homes; and a house scale water efficiency systems. The planned systems are estimated to reduce block-wide CO2 emissions by about 65 percent, with near zero net energy reduction at the house scale. The project also identified Community Facilities Districts (CFD) as a viable mechanism for residents to collectively finance communal energy and water installations-both upfront capital and ongoing O&M costs-via assessments on property tax bills. The City of Oakland is using the results of this project to examine any needed changes to its planning or permitting policies to accommodate block-scale DER developments such as the EcoBlock.
EPC-15-059 UniGen Smart System for Renewable Integration	This project developed a software control system that can help integrate large amounts of VERs envisioned by California's energy policy (i.e., 33 percent by 2020 and 60 percent by 2030) along with current generation to create a more stable system. This software control system simplifies the CAISO's energy balancing efforts.	1a, 1h, 2a, 3a, 5a	This project was completed in March 2019. The final report is in the publication process. This project conducted a feasibility study for the UniGen Renewable Integration platform, which allows VERs to be scheduled in the Day Ahead Market (DAM). Using the DAM, in conjunction with UniGen and VERs, allows for greater penetration of renewables and a pathway for California to meet the 60% RPS. Onset, now known as Unigen Resources, entered into a partnership with Marin Clean Energy to undertake a pilot project. This project represents the first step toward commercialization of the Unigen Smart System.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-060 Optimizing Solar Facility Configuration Effects on Habitat, Managed Plants, and Essential Species Interactions	Applied Research and Development	This research implemented field-based experiments to quantify how microhabitat conditions vary across solar energy facilities. It then examined how those variations in microhabitat affect rare plants, invasive plants, and sensitive insects. Researchers determined how habitat variation affects target plant species and their essential species interactions, including herbivory, predation, and pathogens. The results lead to a series of management recommendations for siting new renewable energy facilities and their operation.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-060 Optimizing Solar Facility Configuration Effects on Habitat, Managed Plants, and Essential Species Interactions	No	Generation	$597,865	$597,865	$586,208	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-060 Optimizing Solar Facility Configuration Effects on Habitat, Managed Plants, and Essential Species Interactions	$586,208	$99,801	$150,000	Regents of University of California, Davis; The Regents of the University of California, Santa Cruz	$103,297	14.7%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-060 Optimizing Solar Facility Configuration Effects on Habitat, Managed Plants, and Essential Species Interactions	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-060 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45 out of 45 bidders	Regents of the University of California, Davis

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-060 Optimizing Solar Facility Configuration Effects on Habitat, Managed Plants, and Essential Species Interactions	Group 6: Ranked # 3	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-060 Optimizing Solar Facility Configuration Effects on Habitat, Managed Plants, and Essential Species Interactions	This project provided methods to improve understanding of the environmental impacts of solar energy facilities caused by direct changes in microhabitat or by site preparation treatment. It also enhanced the ability to predict and overcome costly invasions of non-native plants. It is one of the few studies that has considered the effects on species interactions throughout the food web, rather than just the effects on a single species.	2a, 3a, 4f	The project was completed in 2019. The photovoltaic-annual plant experiment studied the effects of solar panels on microhabitat from the effects of shade and enhanced runoff and how those changes affect the growth, survival, and reproductive success of native and invasive species. The results indicate that solar energy development in the Mojave Desert may have adverse impacts on some desert plants and that the level of impact may be regulated, to some extent, by informed site preparation and management practices. The concentrating solar-milkweed experiment found that plant-conservation islands, known as halos, are effective for Mojave milkweed conservation and maintenance of Mojave milkweed-queen butterfly trophic interactions, whereas blading sites was not. Several journal papers are in preparation or review.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-061 Using Data-Driven Approaches to Design Advanced Energy Communities for Existing Buildings	Market Facilitation	This project funded the planning, permitting, and preliminary engineering needed for the integration of advanced energy technologies in a disadvantaged community. The final design provides locally generated, GHG-free electricity from community solar and storage to offset electricity consumption of participants who opt in to the program. The design also enables participants to benefit from savings resulting from various onsite retrofits that enable better energy efficiency, energy management, and demand response. Participants will pay back retrofit costs and cost of capital for solar and storage assets through an on-bill financing mechanism, including a first-of-its-kind virtual net metering tariff across multiple county-owned sites and residential buildings piloted by Los Angeles Community Choice Energy. The project team developed robust data evaluation methods using the LA County Energy Atlas to efficiently and effectively identify high-need customers and site locations and to optimize project design and financing features. More information can be found at the project website: https://www.advancedenergycommunity.org/	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-061 Using Data-Driven Approaches to Design Advanced Energy Communities for Existing Buildings	No	Demand-side Management	$1,497,996	$1,497,996	$1,213,016	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-061 Using Data-Driven Approaches to Design Advanced Energy Communities for Existing Buildings	$1,213,016	$449,666	$0	Regents of the University of California, Los Angeles; Los Angeles County Office of Sustainability	$381,074	20.3%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-061 Using Data-Driven Approaches to Design Advanced Energy Communities for Existing Buildings	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-061 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 28 bidders	Regents of the University of California, Los Angeles

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-061 Using Data-Driven Approaches to Design Advanced Energy Communities for Existing Buildings	Group 4: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-061 Using Data-Driven Approaches to Design Advanced Energy Communities for Existing Buildings	Local governments can play a critical role in achieving the state's SB 350 (2015) building energy efficiency goals by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) for energy efficiency. This project is piloting innovative planning, permitting, and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.	2a, 3b, 3e	This project concluded in March 2018. The project has resulted in a shovel-ready AEC design in preparation for Phase II and has made several findings towards lowering barriers to access to energy efficiency and solar in local DACs. The implementation of a VNEM tariff was critical in showing financial viability of the design since it allows community members to share the benefits of local renewable power even if they cannot or prefer not to install solar panels and/or an energy storage system on their own property. The project team found that the existence of a Community Choice Aggregator (CCA) allows for streamlined deployment of a VNEM tariff, which may not be the case in areas without a CCA.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-062 Robust, Low-Cost, Real-Time, NOx Sensor for Optimization of Dispatchable Distributed Generation Systems	Applied Research and Development	The project tested several recently developed sensors with the capability to detect low NOx levels generated by dispatchable generation systems, such as internal combustion engines and microturbines. The proposed solution offers a cost effective means to monitor the real time emissions of the system and information that can be used to optimize system performance and maintain low emissions.	5/17/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-064 Innovative Net Zero: ZNE Demonstration in Existing Low-Income Mixed-Use Housing	Technology Demonstration and Deployment	This project was to demonstrate the installation of innovative energy efficiency technologies in a retrofit of an existing, low-income, mixed-use multi-unit building in a dense urban setting to become zero net energy (ZNE). The recipient was unable to identify cost effective retrofits that met the requirements of the grant. As a result, the agreement was mutually terminated.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-062 Robust, Low-Cost, Real-Time, NOx Sensor for Optimization of Dispatchable Distributed Generation Systems	No	Generation	$200,000	$200,000	$199,270	N/A
EPC-15-064 Innovative Net Zero: ZNE Demonstration in Existing Low-Income Mixed-Use Housing	No	Demand-side Management	$2,995,653	$2,995,653	$290,859	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-062 Robust, Low-Cost, Real-Time, NOx Sensor for Optimization of Dispatchable Distributed Generation Systems	$199,270	$53,531	$0	None	$0	0.0%
EPC-15-064 Innovative Net Zero: ZNE Demonstration in Existing Low-Income Mixed-Use Housing	$290,859	$408,130	$0	Chinatown Community Development Center	$800,000	21.1%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-062 Robust, Low-Cost, Real-Time, NOx Sensor for Optimization of Dispatchable Distributed Generation Systems	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-062 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45 out of 45 bidders	The Regents of the University of California, Irvine
EPC-15-064 Innovative Net Zero: ZNE Demonstration in Existing Low-Income Mixed-Use Housing	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-064 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39 out of 39 bidders	Prospect Silicon Valley

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-062 Robust, Low-Cost, Real-Time, NOx Sensor for Optimization of Dispatchable Distributed Generation Systems	Group 11: Ranked # 8	N/A	N/A	Yes; Calif Based Entity
EPC-15-064 Innovative Net Zero: ZNE Demonstration in Existing Low-Income Mixed-Use Housing	Group 5: Ranked # 4	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-062 Robust, Low-Cost, Real-Time, NOx Sensor for Optimization of Dispatchable Distributed Generation Systems	The NOx sensor is based on ceramic solid-state electrochemical sensor technology, similar to an automotive oxygen sensor. Solid state NOx sensors have been developed for direct in-situ measurement of exhaust to meet stringent on-board diagnostic requirements for self-diagnosis and reporting, including required sensitivities down to parts-per-million. The NOx sensor combines existing commercial NOx sensors with newly developed electronics for use in applications such as dispatchable distributed generation (e.g., microturbines). Unlike other NOx sensors, the sensor is a simple solid state device, with a single cell and no internal diffusion chambers (electrodes directly in the flow). This gives it faster responsiveness, and makes it both more robust and easier to manufacture.	2a, 3f, 4b	The project is completed. The results show that the two automotive solid state NOx sensors selected proved durable enough to perform reliably for the 6-month evaluation. The research team developed an engine control system integrated with information from the solid state NOx sensor and successfully demonstrated the ability to actively reduce NOx emissions at part load by 10%. The results show that solid state sensors represent an inexpensive and viable approach for monitoring emissions from distributed gas generation systems. This technology could potentially be implemented in California Air Resource Board's certification process for small distributed gas generators as an alternative to the existing Continuous Emission Monitoring System.
EPC-15-064 Innovative Net Zero: ZNE Demonstration in Existing Low-Income Mixed-Use Housing	The project site represented a test case for many of the complex challenges facing zero net energy retrofits of multi-unit, mixed-use buildings. If successful, the project approach could have been packaged for broad dissemination to the design community.	1f, 1h, 4a	On July 13, 2017, PSV informed Energy Commission staff that the project would require an unanticipated $1 million electrical upgrade in order to install the selected retrofit measures and the PV system. PSV attempted to identify alternative financing to fund the electrical service upgrade and identify new measures that could be installed using the existing electrical service. It also explored options for doing the project at a different site. However, it was unable to identify a suite of acceptable retrofit measures and a site that met the solicitation requirements and could be completed within the term of the agreement. PSV agreed to a mutual termination of the project. The termination was approved at the September 21, 2018 Business Meeting.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-065 Berkeley Energy Assurance Transformation (BEAT) Project	Market Facilitation	The BEAT project focused on designing a clean energy microgrid for the public good that could be integrated into the existing fabric of a dense urban city. The project analyzed the feasibility of designing a multi-building, urban microgrid that uses solar and energy storage to share power between existing buildings to better regulate day-to-day energy supply. Additionally, in the case of a power outage, the microgrid would be able to "island" itself from the grid and provide clean back-up power for critical buildings. The BEAT team conducted a series of coordinated regulatory, technical and financial analyses to determine site feasibility, optimal configurations, operation criteria, financing strategies, and lessons learned. The financing and regulatory models provide pathways and recommendations for dense urban communities looking to develop microgrids that cross the public right-of-way. Using this analysis, other microgrid projects will be able to evaluate the benefits and challenges of urban microgrids and accelerate the non-technical planning, modeling, and financing options for microgrid and/or solar + storage projects.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-065 Berkeley Energy Assurance Transformation (BEAT) Project	No	Demand-side Management	$1,499,214	$1,499,214	$1,403,559	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-065 Berkeley Energy Assurance Transformation (BEAT) Project	$1,403,559	$500,070	$248,009	URS Corporation; Center for Sustainable Energy; Office of Energy and Sustainable Development, City of Berkeley; West Coast Code Consultants Inc.; NHA Advisors, LLC; Bay Area Regional Energy Network	$250,121	14.3%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-065 Berkeley Energy Assurance Transformation (BEAT) Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-065 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 28 bidders	Office of Energy and Sustainable Development, City of Berkeley

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-065 Berkeley Energy Assurance Transformation (BEAT) Project	Group 1: Ranked # 4	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-065 Berkeley Energy Assurance Transformation (BEAT) Project	Senate Bill 350 (2015) set a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Local governments are playing a critical role in achieving that goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project is piloting innovative planning, permitting and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.	2a, 3b, 3e	This project concluded in June 2018. The recipient aimed to create a shovel-ready design for an islandable, clean energy microgrid community by integrating buildings located throughout downtown Berkeley. However, challenges with crossing the public right-of-way on existing distribution lines between these non-adjacent buildings, as well as the high-cost for new distribution lines and a lack of incentives through PG&E's current tariff structure made the original design cost-prohibitive. The project team changed directions and opted to create designs for separate solar + storage systems, coupled with energy efficiency measures and smart building operation at three locations. The design allows the city to meet its resiliency goals, reduce utility energy consumption by 36-43 percent, and reduce its existing reliance on backup diesel generators during power outages, by up to 40 percent.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-066 Developing an Advanced Energy Master Plan for the Encanto Neighborhood in San Diego	Market Facilitation	This project developed a prototype plan, called the Encanto Social-Economic Education Development (EnSEED) that attempts to overcome the social, financial and physical barriers to deploying emerging clean energy technology solutions in disadvantaged communities. As part of this project, the project team piloted several digital and in-person outreach strategies to the community, designed to transform an existing disadvantaged community in Southeastern San Diego into a community of near-zero net energy (ZNE) buildings. This project sought close engagement with the local community, and developed a final system design of a community-scale DER deployment as well as an accompanying financing plan. The project also developed a permitting plan that documented the necessary permit processes and required government review and approvals for deploying community-scale DER developments.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-066 Developing an Advanced Energy Master Plan for the Encanto Neighborhood in San Diego	No	Demand-side Management	$1,500,000	$1,500,000	$1,421,437	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-066 Developing an Advanced Energy Master Plan for the Encanto Neighborhood in San Diego	$1,421,437	$129,898	$0	Blue Flame Energy Finance	$520,000	25.7%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-066 Developing an Advanced Energy Master Plan for the Encanto Neighborhood in San Diego	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-066 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 28 bidders	Groundwork San Diego-Chollas Creek

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-066 Developing an Advanced Energy Master Plan for the Encanto Neighborhood in San Diego	Group 4: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-066 Developing an Advanced Energy Master Plan for the Encanto Neighborhood in San Diego	Senate Bill 350 (2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Local governments can play a critical role in achieving the goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project will pilot innovative planning, permitting, and financing approaches and tools to help improve the business case for IDER adoption at the community scale.	2a, 3b, 3e	This project completed in 2018. As part of the project, the project team conducted a case study to document the various challenges and lessons learned in pursuing a community-scale clean energy system in a disadvantaged community. One of the challenges encountered during the project was that it took nearly eight months to receive community energy-usage data, which prevented the project team from being able to model the system design. As a result, the case study recommended that future teams submit their data requests early in the process. The case study also found that public schools could potentially serve as the location of onsite solar generation for the community since most residences may not have the ability to support rooftop PV.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-067 Integrated Community Resource Marketplace	Market Facilitation	This project developed a platform, called the Integrated Community Resource Market (ICRM), that utilizes the City of Fresno's existing policy and development plans, stakeholder input, and additional research, to compile a comprehensive list of development projects that are financially viable, align with current policy goals and timelines, and, upon implementation, produce verifiable savings of energy, greenhouse gas, and water. With a portfolio of projects identified, the project team used the platform to analyze each project to identify options for funding and financing the project, and carried out a financial analysis of each project to examine energy cost savings, incremental measure cost, return-on-investment in the form of payback with and without funding incentives, and property value improvement. This analysis was combined to develop a Master Community Design, which describes a suite of projects and specific processes for Fresno to consider adopting. Additional information is available at the project website: https://www.lgc.org/energize-fresno/	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-067 Integrated Community Resource Marketplace	No	Demand-side Management	$1,500,000	$1,500,000	$1,298,452	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-067 Integrated Community Resource Marketplace	$1,298,452	$432,890	$0	Local Government Commission	$12,445	0.8%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-067 Integrated Community Resource Marketplace	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-067 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 28 bidders	Local Government Commission

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-067 Integrated Community Resource Marketplace	Group 3: Ranked # 3	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-067 Integrated Community Resource Marketplace	SB 350 (2015) sets a 50 percent renewable energy standard by 2030. Local governments can play a critical role in achieving that goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and energy storage. This project piloted innovative planning, permitting and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.	3b, 3e	This project concluded in March 2018. The project team developed and implemented the ICRM platform on Fresno's Blackstone Avenue Corridor. The platform identified a portfolio of projects and programs that contribute to grid reliability and resiliency, increase energy efficiency and renewable energy, and deploy smart grid and zero net energy technologies. In all, 13 development sites, two activity centers, two program enhancements, and two electric vehicle charging proposals were identified as having the highest potential to provide benefits to Fresno. This portfolio is estimated to cost $30.8 million in capital expenditure and save participants $4.6 million annually net of financing costs, and generate approximately $1 million annually in positive cash flow. The final project report is available at: https://www.energy.ca.gov/2018publications/CEC-500-2018-02.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-068 Understanding and Mitigating Barriers to Wind Energy Expansion in California	Applied Research and Development	The research used a combination of global re-analysis datasets, a unique set of observations, and high-resolution global climate model simulations to help identify and characterize the extent to which regions in California may exhibit vulnerability or new opportunity in terms of changes to wind resource magnitude, spatial and temporal variability, and/or operating conditions of sufficient magnitude to alter their viability for wind energy development. The unique strength of this research lies in the use of a next generation variable resolution global climate model that has the ability to simulate climate change over a limited area region, i.e., California, in a computationally cost effective manner.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-068 Understanding and Mitigating Barriers to Wind Energy Expansion in California	No	Generation	$200,000	$200,000	$200,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-068 Understanding and Mitigating Barriers to Wind Energy Expansion in California	$200,000	$74,830	$0	UC Davis; DNV GL USA, Inc. Maritime	$70,000	25.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-068 Understanding and Mitigating Barriers to Wind Energy Expansion in California	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-068 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45 out of 45 bidders	Lawrence Berkeley National Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-068 Understanding and Mitigating Barriers to Wind Energy Expansion in California	Group 11: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-068 Understanding and Mitigating Barriers to Wind Energy Expansion in California	This project will help overcome a key barrier to long-term wind energy investment that can help California meet its renewable energy and climate change mitigation goals. Improving the understanding of wind resource magnitude and variability over many time scales and in the context of climate change can improve the precision with which wind resources can be forecast. Technological advancement was realized through use of a next-generation variable-resolution coupled atmosphere-ocean global climate model that is capable of simulating climate and climate change at relatively high spatial resolution (7km to 14km) over California. This was the first time that a variable-resolution climate modeling system has been used for a specific energy application.	2a, 5c	The project was completed in 2018. The final report is online at: https://www.energy.ca.gov/2018publications/CEC-500-2018-035/CEC-500-2018-035.pdf. The study discovered that observable large-scale patterns such as El Nino can help improve near-term predictions of wind generation. Based on future wind projections from one climate model, the team predicts that with climate change, wind power would increase during summer in most of the state and decrease during fall and winter. This study improves the characterization of uncertainty around the magnitude and variability in space and time of California's wind resources in the near future, which can reduce risk to investors and lead to greater investment in wind energy. The team communicated through three journal articles in 2018, wind investors on TAC, and an industry consultant as a project partner.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-069 Lancaster Advanced Energy Community (AEC) Project	Market Facilitation	In collaboration with the City of Lancaster and Lancaster Choice Energy (LCE), this project planned a ZNE microgrid connected to an affordable housing project that enables the cost-effective deployment of advanced technologies. The microgrid design minimizes the impact of increasing renewables on the grid, increases DER design flexibility, enables local control of energy management, and exploits the plummeting cost of islanding capability to provide valuable resiliency benefits to the community. The project team also developed a community DER valuation framework that assesses the value of DERs on an aggregated and integrated network basis from multiple stakeholder perspectives by combining various value streams and evaluating evolving revenue and market participation opportunities. This framework was used to inform the shared services model behind a "Green District" program that integrates storage, solar, and smart building technology as a service for large commercial and industrial customers to reduce their demand charges while allowing LCE to save on procurement costs. More information can be found at the project website: http://www.znealliance.org/projects/lancaster/	5/17/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-070 Intra-urban Enhancements to Probabilistic Climate Forecasting for the Electric System	Applied Research and Development	This project developed a methodology for creating probabilistic fine-scale temperature zones in California focusing, initially, on summer conditions in the Los Angeles region and the greater San Francisco Bay Area. This was done for both current and future climates and land-use conditions. The project also reduced forecasting errors and uncertainties by improving the performance of the urban Weather Research and Forecasting model (uWRF). Observational weather data from a dense network of mesonet stations were used in model performance evaluation and validation.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-069 Lancaster Advanced Energy Community (AEC) Project	No	Demand-side Management	$1,469,779	$1,469,779	$1,350,689	N/A
EPC-15-070 Intra-urban Enhancements to Probabilistic Climate Forecasting for the Electric System	No	Grid Operations/Market Design	$193,326	$193,326	$193,075	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-069 Lancaster Advanced Energy Community (AEC) Project	$1,350,689	$507,982	$0	City of Lancaster	$1,500,000	50.5%
EPC-15-070 Intra-urban Enhancements to Probabilistic Climate Forecasting for the Electric System	$193,075	$14,035	$0	Altostratus, Inc.	$5,000	2.5%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-069 Lancaster Advanced Energy Community (AEC) Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-069 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 28 bidders	Zero Net Energy (ZNE) Alliance
EPC-15-070 Intra-urban Enhancements to Probabilistic Climate Forecasting for the Electric System	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-070 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45 out of 45 bidders	Altostratus, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-069 Lancaster Advanced Energy Community (AEC) Project	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-15-070 Intra-urban Enhancements to Probabilistic Climate Forecasting for the Electric System	Group 11: Ranked # 6	N/A	N/A	Yes; Small Business, Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-069 Lancaster Advanced Energy Community (AEC) Project	Local governments can play a role in achieving California demand reduction goals by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project will pilot innovative planning, permitting, and financing approaches and tools to help improve the business case for IDER adoption at the community scale.	2a, 3b, 3e	This project concluded in March 2018. The project has resulted in a shovel-ready advanced energy community design in preparation for Phase II that includes a microgrid connecting a zero-net-energy community of 75 single-family homes for low-income residents. The project team also developed a number of resources for local governments to overcome barriers to building ZNE communities and widespread deployment of distributed energy resources. For example, they developed a financial model and policy framework for municipalities to consider land-secured financing as an option for building new residential ZNE communities. They also developed a DER valuation framework to help municipalities identify and analyze the potential value streams from community-scale deployments of solar PV, electric vehicles, battery storage, and demand response programs.
EPC-15-070 Intra-urban Enhancements to Probabilistic Climate Forecasting for the Electric System	This project added fine-resolution, intra-urban climate detail to coarse-scale, regional-level probabilistic or deterministic forecasting, thus allowing for more accurate, area-specific characterizations and forecasts for the electricity system and better apportionment of electricity generation.	1e	The project has been completed. The results show mean urban temperature forecasting error was reduced by up to 1.8 degrees C in the San Francisco Bay Area and up to 0.8 degrees C in the Los Angeles region. The magnitudes of intra-urban temperature variations, including effects of heat islands, are similar to or larger than those of the predicted localized impacts of climate change. Intra-urban variability in temperature (within each Energy Commission building climate zone) was found to be larger than the inter-zone differences, sometimes by several times. Therefore, intra-urban variability is important to account for in planning for electric demand and in building energy modeling.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-071 Zero Net Energy Farms	Market Facilitation	This project developed and piloted a Project Management Application tool for farm and agricultural communities. Included in this tool is information gathered from a trade study of available equipment vendors that will compare cost effectiveness and reliability of technologies for solar, wind, anaerobic digestion, and gasification. A unique feature about this project is that it integrated Net Energy Metering Aggregation (NEMA), a program through the California Public Utilities Commission (CPUC) that enables agricultural communities to aggregate meters in a continuous property, with various other strategies to maximize the effectiveness of the Project Management Application. Development and testing was done in collaboration with four local jurisdictions in the Central Valley, the San Joaquin Valley Air Pollution Control District, and the US Navy.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-071 Zero Net Energy Farms	No	Demand-side Management	$1,175,919	$1,175,919	$887,327	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-071 Zero Net Energy Farms	$887,327	$122,540	$0	West Hills Community College District; San Joaquin Valley Air Pollution Control District; Biodico, Inc.; Office of Community and Economic Development - CSU Fresno; City of San Joaquin; Fresno Council of Governments; PondelWilkinson; Red Rock Ranch, Inc.; San Joaquin Valley Clean Energy Organization ; 18Thirty Entertainment, LLC; City of Huron; Larry Alberg; Dr. Stephen Kaffka; Chelsea Teall, PE; Leon Woods III	$1,140,419	49.2%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-071 Zero Net Energy Farms	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-071 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 28 bidders	Biodico, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-071 Zero Net Energy Farms	Group 3: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-071 Zero Net Energy Farms	SB 350 (2015) sets a 50 percent renewable energy standard and a doubling of energy efficiency savings by 2030. Local governments can play a critical role in achieving that goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, and demand response. This project piloted innovative planning, permitting and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.	2a, 3b, 3e	This project concluded in March 2018. The project developed an interactive tool designed for farm owners called the Zero Net Energy Farm (ZNEF) GeoPlanner, which enables users to assess the renewable energy potential of their property in meeting their specific energy needs. The ZNEF GeoPlanner enables users to estimate the cost and energy generation of various advanced energy technologies (such as solar, wind or biomass technology) geared specifically towards farms in California. An introduction to the ZNEF GeoPlanner is available at: http://www.zeronetenergyfarms.com; http://www.zeronetenergyfarms.com/. Biodico used the ZNEF GeoPlanner to develop a Master Community Design at the Red Rocks Ranch in Five Points, California.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-072 New Chemical Compounds for Cost-Effective Carbon Capture	Applied Research and Development	This project uses computational chemistry to support the identification and characterization of new chemical compounds that can safely and economically capture carbon dioxide (CO2) from the stacks of power plants and other large point source emitters. Specifically, the project screens bioinspired compounds derived from chemicals used by about 25% of all plants to capture carbon dioxide from the atmosphere at night and store it for photosynthesis during daylight hours.	5/17/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-073 Identifying Effective Demand Response Program Designs to Increase Residential Customer Participation	Applied Research and Development	This project tested the effectiveness of innovative designs for demand response programs for residential customers using a behind-the-meter customer engagement platform developed by OhmConnect. This innovative demand response strategy integrates a recent approach that energy researchers have shown to be effective in reducing customer consumption. This strategy includes providing households with a) tailored energy-analytic feedback, b) aggregated versus single-period incentive information, c) non-financial environmental health benefit frames and d) social comparisons. An additional strategy included exploring the effects of timing of the delivered demand response information on the magnitude of household participation and response.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-072 New Chemical Compounds for Cost-Effective Carbon Capture	No	Generation	$200,000	$200,000	$199,998	N/A
EPC-15-073 Identifying Effective Demand Response Program Designs to Increase Residential Customer Participation	No	Demand-side Management	$2,007,875	$2,007,875	$1,824,544	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-072 New Chemical Compounds for Cost-Effective Carbon Capture	$199,998	$40,000	$0	None	$0	0.0%
EPC-15-073 Identifying Effective Demand Response Program Designs to Increase Residential Customer Participation	$1,824,544	$203,115	$0	University of California Los Angeles; Chai Energy	$562,633	21.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-072 New Chemical Compounds for Cost-Effective Carbon Capture	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-072 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45 out of 45 bidders	The Regents of the University of California, Davis Campus
EPC-15-073 Identifying Effective Demand Response Program Designs to Increase Residential Customer Participation	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-073 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 21 bidders	Regents of the University of California, Los Angeles

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-072 New Chemical Compounds for Cost-Effective Carbon Capture	Group 11: Ranked # 9	N/A	N/A	Yes; Calif Based Entity
EPC-15-073 Identifying Effective Demand Response Program Designs to Increase Residential Customer Participation	Group 2: Ranked # 5	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-072 New Chemical Compounds for Cost-Effective Carbon Capture	This project uses innovative ab initio quantum mechanical and molecular dynamics simulations to design and characterize carbon capturing compounds, mimicking processes previously discovered in plants in arid areas. The organic phosphoenolpyruvate (PEP) compounds in these plants store and release CO2 in a similar manner as the currently used inorganic amines. Organic molecules can be modified in a way that adjusts their reaction enthalpy, solubility, viscosity, and reaction rate to be an inexpensive, non-toxic substitute for amines in carbon capture.	2a, 4a	The research team completed simulation and optimization of candidate carbon capturing molecules using a number of complementary molecular dynamics simulations that enable characterization of properties germane to regeneration energy and thus have potential to offer cost-effective approaches to post-combustion capture of carbon dioxide. In 2020, the research team modeled a carbon capture process in a typical electricity producing power plant for chemical compounds identified as promising candidates for improving cost-effectiveness of carbon capture and sequestration. This modeling exercise suggested a high cyclic efficiency (approximately 98%) of candidate compounds and suggest promise for further exploration in laboratory settings. A draft final report was submitted in summer of 2020 and is expected to be published by early 2021.
EPC-15-073 Identifying Effective Demand Response Program Designs to Increase Residential Customer Participation	This project tested the effectiveness of innovative design strategies for residential demand response providers and analyzed different segments of the residential population including various socioeconomic groups and residential customers with photovoltaics and electric vehicles to see what incentives, messages and energy use information motivated reliable participation in utility demand response programs. This information expanded knowledge in this area so that utility companies and regulators can build new and modify existing demand response programs to increase effectiveness. Accurate and reliable forecasts of participation in these programs will enable better utilization of existing generation resources and deferral of system capacity upgrades thereby lowering consumer electricity costs.	1c, 1d, 1e, 1h	The project is complete. The project evaluated the effectiveness of two innovative designs for residential demand response. One provided feedback information on energy use and advanced dynamic thermostat automation, the other engaged customer using social media to reduce loads when asked. Both evaluations confirmed that customers will manage their energy consumption by conserving or shifting loads if they are convinced there is a need and if their ability to participate is simplified. While the information/thermostat experiment has now ended; the participants in the social media-based program continue participating through the third-party aggregator, who continues to expand their client base and provide DR services through ISO markets.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-074 Meeting Customer and Supply-side Market Needs with Electrical and Thermal Storage, Solar, Energy Efficiency and Integrated Load Management Systems	Applied Research and Development	This project developed co-optimization strategies for distributed energy resources (DERs). The purpose was to maximize customer and system value under existing CPUC-approved retail and California ISO wholesale tariff structures, future market structures and pricing, and the transactive energy pricing signals developed under agreement EPC-15-045. The project tested and configured two DER portfolios: a) one was composed of K-12 schools using battery energy storage, solar photovoltaics, and integrated load management, and b) the other was composed of hotels using passive thermal energy storage, load management, and energy efficiency. The control systems for both portfolios were designed to be part of an integrated load management strategy capable of responding to price and reliability signals. The project team also developed operational strategies for wholesale integration subject to the identified retail and wholesale tariffs and other operational constraints.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-074 Meeting Customer and Supply-side Market Needs with Electrical and Thermal Storage, Solar, Energy Efficiency and Integrated Load Management Systems	No	Grid Operations/Market Design	$3,960,805	$3,960,805	$3,603,645	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-074 Meeting Customer and Supply-side Market Needs with Electrical and Thermal Storage, Solar, Energy Efficiency and Integrated Load Management Systems	$3,603,645	$746,794	$0	Solar City Corporation; DNV GL USA, Inc. Maritime; Conectric Networks, LLC	$1,981,262	33.3%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-074 Meeting Customer and Supply-side Market Needs with Electrical and Thermal Storage, Solar, Energy Efficiency and Integrated Load Management Systems	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-074 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 21 bidders	Center for Sustainable Energy

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-074 Meeting Customer and Supply-side Market Needs with Electrical and Thermal Storage, Solar, Energy Efficiency and Integrated Load Management Systems	Group 1: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-074 Meeting Customer and Supply-side Market Needs with Electrical and Thermal Storage, Solar, Energy Efficiency and Integrated Load Management Systems	The project developed and tested strategies that customers, demand response (DR) aggregators, scheduling coordinators, and policy makers can implement to provide demand response that both meets grid needs and is acceptable to customers. The project provided comprehensive recommendations on how to overcome technical, institutional and regulatory barriers to facilitating DER participation in supply-side markets.	1c, 1d, 1e, 1f, 1g, 1h, 3e, 3f	The project demonstrated use cases of two different types of DER resources that participated in the CAISO wholesale electricity market: one consisted of battery energy storage/solar PV systems at five different school sites; the other was a system of smart electricity load sensors and controls in two hotel facilities. While the hotel ownership has changed and they are no longer interested in participating in demand response programs, the school district facilities continue to participate in the CAISO wholesale energy markets. Findings and best practices developed during this study have been and continue to be communicated to CAISO through the ESDER stakeholder process, and to the IOUs and CPUC through the SGIP and Energy Storage proceedings. The project found that behind the meter DERs can reliably perform DR and ancillary services in wholesale electricity markets and that allowing grid export compensation from behind the meter DERs will likely yield additional GHG reductions.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-075 Customer-centric Demand Management using Load Aggregation and Data Analytics	Applied Research and Development	This project demonstrated how a large number of small loads, each impacted by and tuned to individual customer preferences can provide load management for both utilities and the ISO in California. The Recipient worked with an extensive spectrum of leading product providers covering all major distributed energy resources, such as Nest (thermostats), ThinkEco (plug loads), Honda, BMW (auto), EGuana (smart Inverter) and Ice Energy (Thermal Storage). A variety of price signals were tested, including the transactive signal developed by EPRI, Time-of-use, Critical Peak Pricing and Demand response rates.	5/17/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-076 Richmond Advanced Energy Community Project	Market Facilitation	This project provided technical assistance to the City of Richmond in the design and adoption of a comprehensive integrated policy and planning program, and a financing framework to facilitate adoption of advanced energy technologies needed to transform the City of Richmond into a ZNE Community. As part of this project, the project team identified unique challenges to disadvantaged communities and worked with local stakeholders, including the City of Richmond, to identify and implement specific strategies to overcome those challenges. These strategies will be piloted at the conclusion of this agreement as part of a redevelopment effort to convert 20 abandoned homes into affordable ZNE homes available for working families via the First-time Home Buyers' Program.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-075 Customer-centric Demand Management using Load Aggregation and Data Analytics	No	Demand-side Management	$3,998,587	$3,998,587	$3,889,234	N/A
EPC-15-076 Richmond Advanced Energy Community Project	No	Demand-side Management	$1,480,111	$1,480,111	$1,246,861	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-075 Customer-centric Demand Management using Load Aggregation and Data Analytics	$3,889,234	$1,163,894	$0	Electric Power Research Institute, Inc.; InTech Energy, Inc.; Pedagogy World, Inc.	$1,270,312	24.1%
EPC-15-076 Richmond Advanced Energy Community Project	$1,246,861	$370,990	$0	Energy Solutions International; City of Richmond; Olivine, Inc.; Richmond Community Foundation	$2,590,134	63.6%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-075 Customer-centric Demand Management using Load Aggregation and Data Analytics	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-075 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 21 bidders	Electric Power Research Institute, Inc.
EPC-15-076 Richmond Advanced Energy Community Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-076 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 28 bidders	Zero Net Energy (ZNE) Alliance

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-075 Customer-centric Demand Management using Load Aggregation and Data Analytics	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-15-076 Richmond Advanced Energy Community Project	Group 3: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-075 Customer-centric Demand Management using Load Aggregation and Data Analytics	This project is using low cost off-the-shelf technologies to develop a platform that can manage customer end-use devices according to their preferences, minimize their energy costs, and adapt to evolving tariff structures. By making the task of automating multiple end-use devices easier, less costly, and less of an imposition on customers, the project has the potential to increase demand response participation, with consequent benefits to the electric grid.	1c, 1d, 1e, 1f, 1g, 1h, 5c	The project showed the current state of control for behind the meter (BTM) DERs from a practitioner's standpoint and technology opportunities. The work also laid out implementation challenges of integrating BTM DERs, both emerging and currently available, to dynamic rate signals. Community-level (aggregation of the homes in the study) results identified that a "Duck Curve" induced by solar production is evident during the weekdays. This indicates users had not fully adopted the smart technologies into their lifestyles or were not responding well to the indicators of high-price events. Newly-instituted TOU high price periods in the evening coincide with significant increases in customer consumption. In general, the community's load shapes show a distribution of different consumption patterns compared to the code-based energy simulation for the climate zone. The community peaks are large coincident in the 5pm to 9pm timeframe.
EPC-15-076 Richmond Advanced Energy Community Project	Senate Bill 350 (2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Local governments can play a critical role in achieving the goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project will pilot innovative planning, permitting, and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.	2a, 3b, 3e	This project completed in 2018. The project team developed and updated several tools to help the City of Richmond roll out strategies to deploy new clean energy technologies. This included developing a rating system to streamline the City's process for evaluating projects to finance. In addition, this included enhancing the capabilities in the Green Revolving Investment Tracking System to streamline the City's administration of Green Revolving Fund and the Social Impact Bond that will be used to finance the advanced energy projects being proposed.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-077 Huntington Beach Advanced Energy Community Blueprint	Market Facilitation	This project designed an integrated energy system to transform the disadvantaged Huntington Beach community of Oak View, into an advanced energy community (AEC). The team worked closely with ComUNIDAD, a community organization, to ensure the community needs were factored into modeling scenarios. The project team developed new design tools to simulate an integrated energy infrastructure on a community-scale, expanding the capability from the existing single-building design tools. The team evaluated multiple scenarios to determine the most optimal set of clean energy technologies and business and financial models to align the community's energy needs within the constraints of the existing electricity infrastructure.	5/17/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-078 Risk Modeling and Cognitive Science Characterization of Barriers to Climate Change Adaptation in California Electricity Sector	Applied Research and Development	Researchers developed a framework for assessing climate change risk and adaptation practices in the electricity sector, identifying perceived barriers to execution of resilience strategies, and delineating practices that are currently being implemented in the electricity sector. These activities form a basis for developing a dynamic model for long-term resilience planning that can identify optimal strategies to manage climate risks. The analysis also considers how independently initiated adaptation efforts perform relative to a system-wide strategy, with a focus on electricity sector vulnerabilities.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-077 Huntington Beach Advanced Energy Community Blueprint	No	Demand-side Management	$1,500,000	$1,500,000	$1,402,875	N/A
EPC-15-078 Risk Modeling and Cognitive Science Characterization of Barriers to Climate Change Adaptation in California Electricity Sector	No	Grid Operations/Market Design	$350,000	$350,000	$177,177	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-077 Huntington Beach Advanced Energy Community Blueprint	$1,402,875	$508,226	$0	Southern California Gas Company (SoCalGas); Southern California Edison; County of Orange/City of Huntington Beach; The Regents of the University of California, Irvine ; National Renewable Energy Laboratory (NREL); Altura Associates, Inc.	$810,998	35.1%
EPC-15-078 Risk Modeling and Cognitive Science Characterization of Barriers to Climate Change Adaptation in California Electricity Sector	$177,177	$48,887	$0	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-077 Huntington Beach Advanced Energy Community Blueprint	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-077 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 28 bidders	The Regents of the University of California, Irvine
EPC-15-078 Risk Modeling and Cognitive Science Characterization of Barriers to Climate Change Adaptation in California Electricity Sector	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-078 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45 out of 45 bidders	The Regents of the University of California, Berkeley Campus

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-077 Huntington Beach Advanced Energy Community Blueprint	Group 4: Ranked # 4	N/A	N/A	Yes; Calif Based Entity
EPC-15-078 Risk Modeling and Cognitive Science Characterization of Barriers to Climate Change Adaptation in California Electricity Sector	Group 8: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-077 Huntington Beach Advanced Energy Community Blueprint	Senate Bill 350 (2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Local governments can play a critical role in achieving this goal by helping facilitate community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project piloted innovative planning, permitting, and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.	2a, 3b, 3e	The project ended in July 2018. Using the UrbanOpt and DEROpt tools to determine the most optimal technical and economical suite of clean energy technologies, the team developed a master community design for the Oak View AEC. Because of the mild climate and limitations with aging building stock, the plan consists of the most impactful energy efficiency upgrades (lighting and plug-loads), as well as community-scale solar PV systems mounted on carports and rooftops, and energy storage. These systems were sized to reduce the overall electrical use by the maximum of nearly 94 percent. Finally, to encourage community acceptance, the team offered a ten-week STEM course to the elementary school's after-school program, and held a series of workshops to introduce residents to green energy concepts providing materials in Spanish and playing games familiar to the predominantly Hispanic community.
EPC-15-078 Risk Modeling and Cognitive Science Characterization of Barriers to Climate Change Adaptation in California Electricity Sector	Researchers developed methods to account for risks, plan for resulting adaptation, and account for the barriers to adaptation. The results of research are intended to improve on the framing of climate-related policies under uncertainty and to examine all aspects of the adaptation planning process: key decision-makers, the stages of decision processes, and the institutional contexts where the decision-makers develop the decision processes. The results can inform technology choice investment and deployment to the extent that those choices are made with consideration of climate risks.	1e, 2a, 3e, 3h	This project concluded in March 2019 and an initial project report was completed. A final report has not yet been provided despite multiple attempts to contact UC Berkeley's project manager. CEC is exploring options to resolve this issue.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-079 Advanced Renewable Energy Storage and Recycled Water Project	Technology Demonstration and Deployment	The Victor Valley Wastewater Reclamation Authority (VVWRA), in partnership with Primus Power, University of California Riverside (UCR), and Anaergia, aimed to demonstrate an advanced, pre-commercial flow battery storage and control system at VVWRA's existing Regional Wastewater Treatment Plant, located in a disadvantaged community outside of Victorville. The project planned to deploy Primus Power's ENERGYPOD flow battery system in a 240 kW/1,200 kWh configuration, managed by a UCR-designed controller system that is optimized specifically for management, generation and storage of renewable energy power. The project hoped to alleviate rapid fluctuations in the wastewater treatment plant's power demand that causes disruption of the disinfection system used to treat recycled water to California standards, resulting in the disposal of approximately 2.5 million gallons of water annually.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-079 Advanced Renewable Energy Storage and Recycled Water Project	No	Demand-side Management	$1,734,059	$1,734,059	$1,416,893	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-079 Advanced Renewable Energy Storage and Recycled Water Project	$1,416,893	$220,423	$0	Primus Power Corporation; Victor Valley Wastewater Reclamation Authority (VVWRA)	$902,215	34.2%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-079 Advanced Renewable Energy Storage and Recycled Water Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-079 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 35 bidders	Victor Valley Wastewater Reclamation Authority (VVWRA)

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-079 Advanced Renewable Energy Storage and Recycled Water Project	Group 2: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-079 Advanced Renewable Energy Storage and Recycled Water Project	The project hoped to demonstrate an advanced battery storage and control system coupled with on-site renewable energy generation and its ability to control rapid changes in on site power demands. If successful, such an approach could reduce grid power demand and reduce energy costs to wastewater treatment plants and alleviate disruptions in recycled water production due to high variability of on-site power loads which can cause partial treatment shutdowns. The approach could be applicable to other wastewater treatment and industrial plants in California. The project was not completed due to the flow battery manufacturer inability to deliver all planned batteries.	1h, 3c, 4c	December 23, 2020, Primus will still not be delivering the 6 outstanding batteries. Only data on 2 installed batteries was received. An abbreviated draft final report has been received, preliminarily reviewed and has been submitted to publications 11/22/2020. The project was given an extension due to covid19 until 3/31/2021. This extension was signed by VVWRA on 5/4/20.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-080 Interdependencies of Electric Grid and Critical Lifelines: Identifying Climate Exposure and Adaptation Strategies	Applied Research and Development	This pilot study for electricity sector climate adaptation involves vigorous stakeholder engagement and systems analysis to identify and systematically account for cascading impacts internal to and outside of the electricity sector as well as resilience options. These cascading impacts include climate impacts to supply chains for electricity generation and distribution, disruption to telecommunications that the electricity sector relies on in emergencies, and other impacts that may be initially felt far away but have consequences for California's electricity system. One example of supply chain interruption is that manufacturing facilities in East Asia that produce 500kV transformers, which the California distribution system relies on, are susceptible to flooding and other extreme events linked to climate change. This study pilots a systematic framework for assessing such long-distance linkages that can disrupt electricity services and cause ripple or cascading effects on critical infrastructure in the Greater Los Angeles region. Findings from this project, which includes many diverse stakeholders, could be used to inform planning in other areas of the state.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-080 Interdependencies of Electric Grid and Critical Lifelines: Identifying Climate Exposure and Adaptation Strategies	No	Generation	$128,188	$128,188	$128,163	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-080 Interdependencies of Electric Grid and Critical Lifelines: Identifying Climate Exposure and Adaptation Strategies	$128,163	$0	$0	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-080 Interdependencies of Electric Grid and Critical Lifelines: Identifying Climate Exposure and Adaptation Strategies	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-080 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45 out of 45 bidders	Thalassa Research & Consulting, LLC

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-080 Interdependencies of Electric Grid and Critical Lifelines: Identifying Climate Exposure and Adaptation Strategies	Group 11: Ranked # 3	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-080 Interdependencies of Electric Grid and Critical Lifelines: Identifying Climate Exposure and Adaptation Strategies	The research will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by addressing challenges in the state's largest metropolitan area -- the study of societal teleconnections. Societal teleconnections are human-created linkages that connect activities, trends, and disruptions across large distances such that locations can experience negative impacts from faraway places. This study is producing new tools and techniques to assist communities to incorporate climate impacts that are non-local in origin into their traditional climate adaptation and hazard planning. This is the first time that a systematic approach to exogenous risks is being taken for an urban area.	2a, 3a, 3e, 3g, 4a	Drawing on extensive stakeholder engagement in 2016 and 2017 as well as interactive system modeling, researchers published a final, peer reviewed report as part of California's Fourth Climate Change Assessment. Cross-cutting findings include that energy and telecommunication are critically connected to each other and to other lifelines; emergency management and public health services depend on inputs from all lifelines to be effective; workforce availability is crucial to the ability to respond effectively, but it is already limited and dependent on many different upstream lifelines; and maintaining a state of good repair on all equipment is essential to smooth functioning of all lifelines. Opportunities to advance resilience of interdependent lifeline systems include open data policies, adaptation planning mandates, and engagement at regional levels to consider extreme scenarios.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-081 Historical Insights for Electricity Transition Scenarios in California and Flexible Energy Demand Modeling for Residential Air Conditioning with Improved Behavioral Specificity	Applied Research and Development	Analysis of quantitative and qualitative data sheds light on past energy technology transitions, planned and unplanned. The research team's analysis of these transition histories provided examples, principles and insights that can be used in future planning. Leveraging insights from historical technology transitions, the research team designed and tested a flexible, agent-based modeling platform ("SIMSAND") that enables researchers, utilities, and CEC demand modeling and forecasting staff to draw upon a wealth of empirical data as well as projected climate data to simulate dynamic residential demands for air conditioning. This model served as a proof of concept that might later be broadened to other energy uses and demand sectors. The model also illustrated the power of providing a platform that can draw on a variety of data streams available to illuminate energy consumption and potential transition trajectories, rather than representing key parameters as simple averages.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-081 Historical Insights for Electricity Transition Scenarios in California and Flexible Energy Demand Modeling for Residential Air Conditioning with Improved Behavioral Specificity	No	Grid Operations/Market Design	$400,000	$400,000	$393,999	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-081 Historical Insights for Electricity Transition Scenarios in California and Flexible Energy Demand Modeling for Residential Air Conditioning with Improved Behavioral Specificity	$393,999	$0	$0	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-081 Historical Insights for Electricity Transition Scenarios in California and Flexible Energy Demand Modeling for Residential Air Conditioning with Improved Behavioral Specificity	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-081 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45 out of 45 bidders	Ghoulem Research

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-081 Historical Insights for Electricity Transition Scenarios in California and Flexible Energy Demand Modeling for Residential Air Conditioning with Improved Behavioral Specificity	Group 11: Ranked # 4	N/A	N/A	Yes; Calif Based Entity, Woman Own

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-081 Historical Insights for Electricity Transition Scenarios in California and Flexible Energy Demand Modeling for Residential Air Conditioning with Improved Behavioral Specificity	Results improve the state's ability to estimate timing of technology penetration and accrual of benefits, and costs of desirable residential sector technologies. These results are key to improving the performance of efficiency measures outlined in AB 758 and the California Energy Code. They also support goals of CPUC's Energy Efficiency Strategic Plan, and inform updated estimates of timing and benefits as appropriate. Results portraying penetration and performance of key technologies (e.g., air conditioning) are expected to be of direct use in the scenario development and demand forecasts used in the Integrated Energy Policy Report.	5c	The research team convened in-depth discussions with members from the CEC's Demand Analysis Office, Supply Analysis Office, Building Standards Office, and Research Division as they worked to refine their flexible residential air conditioning demand forecast model ("SIMSAND"). SIMSAND, a prototype model to enable exploration of impacts of a number of human factors on residential air conditioning demand, was enhanced to have the flexibility to explore scenarios related to technology policy, adoption, and projected climate change. Through an agreement with Canadian smart thermostat manufacturer EcoBee, researchers obtained a very large data set of thermostat settings from "Donate Your Data" volunteer households. Researchers submitted a final report for publication and presented their work at the 2019 Behavior, Energy, and Climate Change Conference (BECC).

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-082 Low-Temperature Microplasma-Assisted Hydrogen Production from Biogas for Electricity Generation	Applied Research and Development	The purpose of this project is to demonstrate operation of a low-temperature microplasma reactor that will lead to an efficient, electricity-based technique to convert a mixture of carbon dioxide and methane into hydrogen for use in electricity generation. If successful, this technology could be adapted to use other gas inputs in the creation of hydrogen, such as products from the gasification of biomass.	5/17/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-083 Empowering Proactive Consumers to Participate in Demand Response Programs	Applied Research and Development	This project contains three elements to provide data for policymakers and businesses to explore this new market. First, this project determines prosumer (producer/consumer) interest in a third-party demand response market by testing user acquisition via direct and non-direct engagement strategies. Second, experimentation with behavioral and automated users allows analysis of user yield under a variety of conditions and extract a set of shadow curves that can inform how much energy load shifting can be expected under various price incentives. Finally, this project creates a novel solution for using residential telemetry to connect prosumers and their Internet of Things (IoT) devices to the market operators.	5/17/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-082 Low-Temperature Microplasma-Assisted Hydrogen Production from Biogas for Electricity Generation	No	Generation	$200,000	$200,000	$146,653	N/A
EPC-15-083 Empowering Proactive Consumers to Participate in Demand Response Programs	No	Demand-side Management	$3,995,028	$3,995,028	$3,908,849	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-082 Low-Temperature Microplasma-Assisted Hydrogen Production from Biogas for Electricity Generation	$146,653	$35,171	$0	The Regents of the University of California, Merced	$47,199	19.1%
EPC-15-083 Empowering Proactive Consumers to Participate in Demand Response Programs	$3,908,849	$245,265	$0	Honeywell, Inc.; Schneider Electric USA Inc.; OhmConnect, Inc.	$1,877,378	32.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-082 Low-Temperature Microplasma-Assisted Hydrogen Production from Biogas for Electricity Generation	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-082 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	45 out of 45 bidders	The Regents of the University of California, Merced
EPC-15-083 Empowering Proactive Consumers to Participate in Demand Response Programs	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-083 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 21 bidders	OhmConnect, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-082 Low-Temperature Microplasma-Assisted Hydrogen Production from Biogas for Electricity Generation	Group 11: Ranked # 5	N/A	N/A	Yes; Calif Based Entity
EPC-15-083 Empowering Proactive Consumers to Participate in Demand Response Programs	Group 1: Ranked # 3	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-082 Low-Temperature Microplasma-Assisted Hydrogen Production from Biogas for Electricity Generation	Determination of optimal operating parameters for microplasma array reactors to achieve maximum efficiency is an important step in overcoming barriers for advancement of technology converting biogas to syngas. Successful lab-scale demonstration can serve as the proof of concept and lead to farther development of this technology, which has the potential to generate emissions-free hydrogen for use in hydrogen-fueled ZEVs.	2a, 4a	This project was completed in 2019. The project team designed and built a plasma reactor and tested its performance for a range of operating conditions. The following are the key findings: 1) The highest registered conversion rate of CH4 and CO2 to syngas (mixture of H2 and CO) was about 30% for the conditions tested in this project (30% of injected gas was converted to hydrogen). 2) The model developed specifically for this projects predicts that an array of subsequently connected microplasma reactors working in tandem would improve the performance (conversion rate). 3) Compared to hydrogen production using electrolysis (splitting of water molecules into H2 and O2 by the means of electricity), the plasma reactor consumes twice as much power (125 W vs. 56 W to produce about 200 ml of H2 in a minute)
EPC-15-083 Empowering Proactive Consumers to Participate in Demand Response Programs	This project provides critical evidence that residential customers are willing to manage their electric loads for the purpose of meeting grid needs when presented with meaningful, actionable information and salient incentives. The approach makes use of multiple social media platforms for communication and has developed multiple virtual customer "experience" opportunities using those platforms that enhance participation and keep customers interested and involved. The project provides conclusive evidence that with the appropriate approach, residential customers can and will adapt their energy use to a grid that depends heavily on variable renewable generation. This evidence can be used to help policymakers and regulators develop more effective direction for utility tariff and program design and program parameters for third party aggregator participation in demand response.	1c, 1d, 1e, 1f, 1g, 1h, 3e	This project has been completed. Over 450,000 utility customers have signed up with OhmConnect, and about 35,000 of those participated in the experimental treatments conducted under the EPIC grant. About 15% of the enrolled customers live in Disadvantaged Communities. The recipient tested a number of different incentive structures--including a proxy-price "transactive" signal, including those provided by the customer's utility, the CAISO, and EPRI. Over the course of the project, the experimental subgroup saved 27.8 MWH over 1.3M #OhmHours (1-hr long participant events) for which they were paid a total of $668,000. CO2e emissions reductions were estimated at about 9 Metric Tonnes.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-084 Total Charge Management: Advanced Charge Management for Renewable Integration	Applied Research and Development	This project explores the benefits and opportunities of Total Charge Management (TCM), where electric vehicle charging is managed across multiple charging events to maximize vehicle load flexibility. The project tests how flexible electric vehicle load can be if managed across a driver's daily or weekly charge events. This flexibility utilizes several pricing mechanisms to estimate the benefits of the Total Charge Management approach. The research develops and evaluates advanced vehicle telematics for utilities and grid operators to align vehicle battery status, driver mobility needs, and grid conditions. Collaboration between the grid and the driver can yield a charging load profile that minimizes energy costs by aligning daily and weekly charging events to best meet grid needs.	5/17/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-085 San Diego Libraries Zero Net Energy and Integrated Demand Side Management Demonstration Project	Technology Demonstration and Deployment	Through a partnership with the Center for Sustainable Energy (CSE) and the City of San Diego, the project demonstrates a BertBrain pre-commercial plug load technology integrated into the building management systems to serve as a blueprint to local governments. The project also improves energy efficiency by installing LED lighting, enhanced building automation, and controls at three City libraries. The research created community outreach by creating energy kiosk displays that allow the public to visualize each library's energy consumption, solar generation, and energy savings.	6/14/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-084 Total Charge Management: Advanced Charge Management for Renewable Integration	No	Demand-side Management	$3,999,900	$3,999,900	$3,771,576	N/A
EPC-15-085 San Diego Libraries Zero Net Energy and Integrated Demand Side Management Demonstration Project	No	Demand-side Management	$2,715,516	$2,715,516	$2,702,963	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-084 Total Charge Management: Advanced Charge Management for Renewable Integration	$3,771,576	$330,779	$0	BMW of North America, LLC; Kevala, Inc.; Bertrandt Consulting; Sulzer US, LLC	$444,931	10.0%
EPC-15-085 San Diego Libraries Zero Net Energy and Integrated Demand Side Management Demonstration Project	$2,702,963	$725,052	$0	San Diego Gas and Electric Company; City of San Diego; US Green Building Council - Los Angeles Chapter; ABM Electrical and Lighting Solutions Inc	$544,312	16.7%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-084 Total Charge Management: Advanced Charge Management for Renewable Integration	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-084 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 21 bidders	BMW of North America, LLC
EPC-15-085 San Diego Libraries Zero Net Energy and Integrated Demand Side Management Demonstration Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-085 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39 out of 39 bidders	Center for Sustainable Energy

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-084 Total Charge Management: Advanced Charge Management for Renewable Integration	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-15-085 San Diego Libraries Zero Net Energy and Integrated Demand Side Management Demonstration Project	Group 5: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-084 Total Charge Management: Advanced Charge Management for Renewable Integration	This project helps the state advance the flexibility of electric vehicle charging as a flexible grid resource and vehicle charging cost savings to the driver. Optimal charging load patterns will be identified that can capture ratepayer and grid benefits using a variety of grid price signals. The project pioneers demand response and smart charging technology advancement of not only the temporal benefits of controlled charging, but also the possible benefits that can be derived from being able to influence the location of charging.	1g	This project was completed in March 2020. This project demonstrated an average $46 annual charging cost savings per vehicle at a single charging point from shifting charging to the lowest practical time period while still maintaining driver mobility needs. The average annual savings increases to $56 per vehicle when charging is allowed at multiple locations. Shifting charging across multiple locations and time also resulted in a 300 metric tons of GHG annual savings per vehicle and integration of an additional 1,200 kilowatt-hours annually per vehicle. BMW is currently developing a larger pilot with another California IOU to expand the TCM project, and also applying for additional grants through the CEC and U.S. DOE that advance innovative vehicle charging solutions for the local built environment and specific use cases.
EPC-15-085 San Diego Libraries Zero Net Energy and Integrated Demand Side Management Demonstration Project	The commercial sector, and local governments in particular, tend to be risk averse. This project demonstrated an integrated approach by testing and installing a precommerical plug load technology, and other energy efficiency measures without disrupting municipal operations, which is key to encouraging greater adoption of the technologies. The successful implementation of technology can encourage local governments and the commercial building industry to budget, plan and prioritize these types of projects for existing building ZNE upgrades leading up to the state's 2030 requirements.	1e, 1f, 1h	The team continues to replace defective light fixtures that are under warranty. he energy dashboard for the kiosk displays located at each site to educate the community about the benefits of reducing energy consumption in ZNE buildings. The updated final report and final meeting will be scheduled for March 2021. This project aims to serve as a blueprint for the City to consider incorporating emerging technology measures, maximizing energy efficiency and reducing the carbon footprint of municipal and small commercial buildings to achieve ZNE goals. Project updates are posted at their website at: https://sites.energycenter.org/sdzn3.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-086 Substation Automation and Optimization of Distribution Circuit Operations	Applied Research and Development	This project developed a Generic Microgrid Controller (GMC) to allow electrical substation control over grid assets, including generation resources, energy storage, and controllable loads. The GMC improved grid management at the distribution level. The team assessed different tariffs and interconnection agreements for a portfolio of scenarios to address the participation of DERs in the market. In addition, a fictitious retail/distribution market was developed and assessed.	6/14/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-087 Cooling Tower Water Treatment using Vortex Process Technology for Energy and Water Savings	Technology Demonstration and Deployment	This agreement is funding the full-scale deployment demonstration of the Vortex Process Technology in cooling towers of commercial buildings. This technology has been used successfully in Europe and will be testing in California to address state specific goals for water and energy savings.	6/14/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-086 Substation Automation and Optimization of Distribution Circuit Operations	No	Distribution	$932,718	$932,718	$915,543	N/A
EPC-15-087 Cooling Tower Water Treatment using Vortex Process Technology for Energy and Water Savings	No	Demand-side Management	$1,999,995	$1,999,995	$1,974,185	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-086 Substation Automation and Optimization of Distribution Circuit Operations	$915,543	$124,021	$0	The Regents of the University of California, Irvine ; OPAL-RT Corporation	$112,281	10.7%
EPC-15-087 Cooling Tower Water Treatment using Vortex Process Technology for Energy and Water Savings	$1,974,185	$485,121	$0	Electric Power Research Institute, Inc.; Cypress LTD	$449,990	18.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-086 Substation Automation and Optimization of Distribution Circuit Operations	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-086 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	23 out of 29 bidders	Advanced Power and Energy Program (APEP) - University of California, Irvine
EPC-15-087 Cooling Tower Water Treatment using Vortex Process Technology for Energy and Water Savings	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-087 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 35 bidders	Electric Power Research Institute, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-086 Substation Automation and Optimization of Distribution Circuit Operations	Group 2: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-15-087 Cooling Tower Water Treatment using Vortex Process Technology for Energy and Water Savings	Group 2: Ranked # 6	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-086 Substation Automation and Optimization of Distribution Circuit Operations	This project led to technological advancement and breakthroughs by developing a control strategy to manage high penetrations of distributed energy assets (including generating resources, energy storage and controllable loads) as a single unit at a substation. The GMC managed dispatchable loads and generation, reducing stress on the grid by shedding unnecessary loads and dispatching generation as required. The GMC also includes an economic dispatch feature that determined the least expensive solution to serve all the loads.	1g, 3a, 3f, 5f	This project was completed in March 2019. The final report is in process for publication. UCI completed the development and simulation, in partnership with SCE, of the GMC for enhanced substation control. The GMC showed optimal control of DERs on the distribution feeder while using the IEEE 2030.7 microgrid controller standard. UCI will create a hardware-in-loop test for the configuration using industry standard substation equipment. Although the hardware test was not funded through the grant, UCI is committed to validating the research results for purpose of grid modernization and informing stakeholders. The research results from this project informed the top power technology vendors, such as GE, Siemens, and Schneider Electric. A retail market was simulated and various tariffs were evaluated to determine benefits to developers, utilities, and grid stability.
EPC-15-087 Cooling Tower Water Treatment using Vortex Process Technology for Energy and Water Savings	Non-chemical water treatment has the potential to reduce water use, improve quality of water discharged to wastewater stream, reduce scaling in condenser water piping, and increase energy efficiency of chilled water plants. The Vortex technology removes calcium carbonate from recycled cooling water and improves viscosity. By removing calcium carbonate physically it reduces the amount of chemicals used in calcium removal methods.	1f, 1h, 4c, 4d, 4e	As of December 23, 2020 the final report has been received has been being revised into ADA compliant version and submitted to publications 11/22/2020 The final meeting has been completed. Report has not been published as of this date. The PI on the project passed away unexpectedly in mid-February. Though a draft final report was submitted in January, more time is needed to complete the final report. The report was submitted mid summer and submitted to publications 11/22/2020.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-088 Biofiltration as an Advanced Primary Treatment Method to Achieve Substantial Energy Savings	Technology Demonstration and Deployment	Conventional wastewater primary treatment uses clarification for solids removal and activated sludge treatment for secondary treatment to remove organics. Biofiltration is an emerging advanced primary-treatment technology that more efficiently and economically removes particulate and soluble material than the conventional primary method of clarification that removes only particulate material. In a biofiltration system, particulate material is removed mainly through filtering, and soluble organic material is removed by using microorganisms to capture and biologically degrade the pollutants. This project demonstrated that biofiltration is a technically viable and commercially attractive approach to achieve significant electrical energy savings at wastewater treatment plants with a full scale demonstration at Linda County Water District plant.	6/14/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-089 Expanding Standards and Developing Tools to Enable DNP3 Support of Energy Storage Use Cases	Applied Research and Development	The recipient developed tools to make adoption of DNP3 for communication and control of energy storage systems simple and seamless. The project evaluated the current state of communications to DERs, worked with the DNP3 Users Group to update the existing energy storage and solar specifications to support the most advanced energy storage use cases, created an open-source DNP3 client to simplify product development of smart inverters, and developed the appropriate conformance testing tools to ensure interoperability.	6/14/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-088 Biofiltration as an Advanced Primary Treatment Method to Achieve Substantial Energy Savings	No	Demand-side Management	$1,306,185	$1,306,185	$1,287,122	N/A
EPC-15-089 Expanding Standards and Developing Tools to Enable DNP3 Support of Energy Storage Use Cases	No	Distribution	$873,516	$873,516	$871,676	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-088 Biofiltration as an Advanced Primary Treatment Method to Achieve Substantial Energy Savings	$1,287,122	$442,698	$0	Kennedy/Jenks Consultants; Linda County Water District; WesTech, Inc.; Professor George Tchobanoglous, Ph.D., P.E.	$271,750	17.2%
EPC-15-089 Expanding Standards and Developing Tools to Enable DNP3 Support of Energy Storage Use Cases	$871,676	$187,517	$0	Electric Power Research Institute, Inc.; Xanthus Consulting International; SunSpec Alliance; MESA Standards Alliance	$360,828	29.2%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-088 Biofiltration as an Advanced Primary Treatment Method to Achieve Substantial Energy Savings	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-088 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 35 bidders	Kennedy/Jenks Consultants
EPC-15-089 Expanding Standards and Developing Tools to Enable DNP3 Support of Energy Storage Use Cases	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-089 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	23 out of 29 bidders	Electric Power Research Institute, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-088 Biofiltration as an Advanced Primary Treatment Method to Achieve Substantial Energy Savings	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-15-089 Expanding Standards and Developing Tools to Enable DNP3 Support of Energy Storage Use Cases	Group 1: Ranked # 3	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-088 Biofiltration as an Advanced Primary Treatment Method to Achieve Substantial Energy Savings	Biofiltration as an advanced primary treatment method could reduce the aeration electrical energy needed for secondary treatment, increase energy production in the anaerobic digester from the removed organic material and increase existing secondary treatment capacity and forestall the need for future treatment plants. Based on pilot studies outside of California, biofiltration has the potential to decrease aeration power by 45 to 60 percent, increase gas production from 25 to 40 percent and increase treatment capacity by 50 percent.	1f, 1h, 4c	Biofiltration generates energy savings by removing more organic load, which in turn reduces aeration electricity consumption in the downstream biological treatment and increases digester gas energy production from the diverted organic material. This project quantified a electrical energy reduction between 15 to 20 percent achieved by biofiltration based on demonstration results at the Linda County Water District plant. The biofiltration demonstration proved the technology to be a feasible alternative to conventional primary wastewater treatment processes.
EPC-15-089 Expanding Standards and Developing Tools to Enable DNP3 Support of Energy Storage Use Cases	This project advanced the DNP3 protocol (communication standards for smart inverters) by making it simple and seamless while also improving communications with stand-alone energy storage systems and control of other inverter-based devices. This allows California to utilize more energy storage systems; thus, increasing the use of renewables and other DERs to support a more flexible grid.	1a, 1h, 1i, 2a, 3a, 5a	This project was completed in 2019 and the final report is in the process of being published. The team solicited inputs from a 150+ person international advisory group representing utilities, manufacturers, and researchers to identify gaps in the protocol for energy storage. The team concluded the project by performing conformance testing with other standards and streamlined the adoption through tech transfer, open source tools, and compliance testing. The standards for DER are relatively new, and this project created a framework for DNP3, which will allow organizations to be able to refine the technical and business aspects of testing. The DNP3 application note is used by both utilities and DER owners/manufacturers. IEEE 1547-2018 lists this DNP3 application note as one of three allowed protocols for managing DER.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-090 Integrated Distributed Energy Resources Management System (iDERMS)	Applied Research and Development	This project developed an Integrated Distributed Energy Resource Management System (iDERMS) to coordinate the operation of a large number of DERs. In normal grid operations, the system would aggregate multiple DERs consisting of flexible loads, renewable resources, and energy storage systems. The DERs would be coordinated to optimize power flow and respond to a distribution system operator electricity market. In an emergency situation, the system would provide any needed reactive power support to the distribution grid with smart inverters. Additionally, the system would coordinate DERs on the distribution system to help restore the grid in the event of an outage.	6/14/16
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-091 Energy Efficiency and Water Savings in Agriculture by Innovative Plant-Aware Irrigation System	Technology Demonstration and Deployment	This project addresses the specific problem of fixed watering schedules for agricultural crops by demonstrating a new irrigation system that saves both water and energy. This system performs on the principle that crops are watered only when needed, not just on a set time-interval. The additional benefits of this system are the improved quality and yield of the crop. The goals of this project are to demonstrate the Plant Aware Irrigation (PAI) system on perennial crops, quantify the energy and water savings, and engage customers' feedback of perceived benefits while acknowledging their concerns. The technology was demonstrated in three vineyards; Yountville, Napa and Livermore. Each site produced different type of grapes (cabernet sauvignon, pinot noir, and chardonnay) which enabled better insight into water/energy nexus related to each grape type.	6/14/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-090 Integrated Distributed Energy Resources Management System (iDERMS)	No	Distribution	$1,119,437	$1,119,437	$1,083,420	N/A
EPC-15-091 Energy Efficiency and Water Savings in Agriculture by Innovative Plant-Aware Irrigation System	No	Demand-side Management	$1,097,990	$1,097,990	$1,089,129	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-090 Integrated Distributed Energy Resources Management System (iDERMS)	$1,083,420	$97,356	$0	University of California, Riverside; PetaPower, Inc.	$530,392	32.1%
EPC-15-091 Energy Efficiency and Water Savings in Agriculture by Innovative Plant-Aware Irrigation System	$1,089,129	$220,794	$0	Fruition Sciences	$331,000	23.2%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-090 Integrated Distributed Energy Resources Management System (iDERMS)	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-090 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	23 out of 29 bidders	The Regents of the University of California (UC Riverside)
EPC-15-091 Energy Efficiency and Water Savings in Agriculture by Innovative Plant-Aware Irrigation System	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-091 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 35 bidders	Electric Power Research Institute, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-090 Integrated Distributed Energy Resources Management System (iDERMS)	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-15-091 Energy Efficiency and Water Savings in Agriculture by Innovative Plant-Aware Irrigation System	Group 2: Ranked # 4	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-090 Integrated Distributed Energy Resources Management System (iDERMS)	The project will develop controls to create virtual generators by aggregating DERs. The aggregated virtual generators would be capable of providing energy shifting, frequency regulation, and flexible ramping services to mitigate the uncertainties brought by renewable generation. The iDERMS has the potential to increase renewable penetration, reduce GHG emissions and make virtual generators cost competitive with centralized power plants.	1g, 3a, 3f, 5a	This project concluded successfully on January 31, 2020. The project team completed the iDERMS platform and all the associated software modules. The Recipient met with several technology vendors, utilities, and research institutions to disseminate the knowledge gained with possibility for technology vendors to adopt iDERMS in advanced distribution management system platforms. Interested parties include SCE, SMUD, LLNL, PNNL, CAISO, GE, Siemens, and Opus One Solutions. The project team will continue to disseminate the knowledge learned and technology developed in this project by engaging industry vendors and publishing technical papers.
EPC-15-091 Energy Efficiency and Water Savings in Agriculture by Innovative Plant-Aware Irrigation System	The technology being demonstrated precisely detects when crops need water, triggering irrigation only when needed. Delivering less water reduces pumping and the associate energy use, lowering GHG emissions. Expanded deployment to other California perennial fruit crops has the potential to save significant amounts of energy and water, moving the state closer to its energy goals.	1f, 1h, 3g, 4a, 4c	The agreement has completed and the management has completed edits to the final report. Fruition Sciences has been invited as a speaker for the breakout session "The Role of Technology in Drought-Proofing California's Food and Agriculture Sector". The results estimated a 61% combined water and energy savings annually, compared to traditional irrigation. EPRI held a Pollinator Workshop and the project team presented to local farmers at Fresno State University (FSU) 2019 Innovations in Ag Irrigation Technology Showcase to highlight the emerging irrigation and water management technology. The FSU presentation will be featured in West Coast Industrial Solutions magazine. Future market transfer activities will be focused toward wine grape growers and water intense agriculture sectors. These opportunities will concentrate on the objectives and practical aspects to understand the requirements.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-092 Low Energy Biofiltration System with Low Backwash Rate for Groundwater Contaminant Removal	Technology Demonstration and Deployment	The project demonstrated a biofiltration system that uses 70 percent less energy when compared to conventional technology used to treat contaminated water to meet drinking water standards or for use in industrial and/or agricultural applications. The technology was demonstrated in the City of Barstow with the focus on removal of nitrate, perchlorate and turbidity from the wastewater. The project included water testing to attempt to secure Conditional Acceptance as a Title 22 drinking water treatment technology from the State Water Resources Control Board.	6/14/16
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-15-093 Accelerating Drought Resilience Through Innovative Technologies	Market Facilitation	This project compiled data from county utilities to find what industries had the highest energy impact during the drought. Then, the project provided input on what water-energy technologies would lessen the impact during future droughts. Finally, the team assisted local jurisdictions in implementing strategies and measures that reduce development times and costs, as well as recommended innovative financing mechanisms and cutting edge water-energy technologies. The recipient piloted the model for Tulare County in an effort to develop a roadmap for implementation of the model in other similar rural agricultural communities.	6/14/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-092 Low Energy Biofiltration System with Low Backwash Rate for Groundwater Contaminant Removal	No	Demand-side Management	$1,722,072	$1,722,072	$1,722,067	N/A
EPC-15-093 Accelerating Drought Resilience Through Innovative Technologies	No	Demand-side Management	$1,000,000	$1,000,000	$999,376	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-092 Low Energy Biofiltration System with Low Backwash Rate for Groundwater Contaminant Removal	$1,722,067	$0	$0	MWH; City of Barstow; Tomorrow Water dba BKT United; Kana Engineering Group, Inc; Khalil Kairouz Consulting; Eurofins Eaton Analytical	$417,497	19.5%
EPC-15-093 Accelerating Drought Resilience Through Innovative Technologies	$999,376	$178,824	$0	Syzergy, Inc.	$5,000	0.5%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-092 Low Energy Biofiltration System with Low Backwash Rate for Groundwater Contaminant Removal	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-092 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 35 bidders	Tomorrow Water dba BKT United
EPC-15-093 Accelerating Drought Resilience Through Innovative Technologies	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-093 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 35 bidders	Water Energy Innovations, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-092 Low Energy Biofiltration System with Low Backwash Rate for Groundwater Contaminant Removal	Group 2: Ranked # 3	N/A	N/A	Yes; Calif Based Entity, Minority Owned
EPC-15-093 Accelerating Drought Resilience Through Innovative Technologies	Group 3: Ranked # 1	N/A	N/A	Yes; Small Business, Calif Based Entity, Minority Owned, Woman Own

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-092 Low Energy Biofiltration System with Low Backwash Rate for Groundwater Contaminant Removal	The project technology offers a lower energy alternative for treatment of the most common contaminants preventing use of ground water resources in California and could enable the development of new water supplies in many of the drought challenged regions of the state. Local treatment of impaired groundwater provides additional energy benefits by eliminating the cost associated with transporting clean water from distant sources. The biofiltration treatment technology has the potential of efficiently treating contaminated water in an energy efficient manner while generating no waste brine.	1f, 4a, 4d	The Tomorrow Water Biofiltration system simultaneously removed nitrate, perchlorate, and turbidity from groundwater to below state-mandated maximum contaminate levels. and reduced energy consumption by 70% when compared with a conventional fluidized bed reactor. Both contaminants were treated until each MCL (maximum contamination level) reached the project goals of 10 mg/L for nitrate and 6 ug/L for perchlorate based on California's Title 22 drinking water standard. However, the Title 22 testing phase the project was forced to stop due to a change in regulation regarding the handling of potentially percolate contaminated effluent streams. While the project did not achieve a Title 22 certification due to the lack of an acceptable real-time perchlorate measurement, the recipient continues to seek approval with the Regional Water Board regarding real-time perchlorate data.
EPC-15-093 Accelerating Drought Resilience Through Innovative Technologies	This project will develop a comprehensive regional drought resilience plan that will match high potential energy and water efficiency technologies with potential adopters. This will lead to greater reliability and drought resiliency while reducing agricultural energy demand.	3e, 4c	This project completed in October 2018. The project identified specific technology solutions and strategies that Tulare County and similar communities can use to build drought resilience while also supporting electric reliability and reducing greenhouse gas emissions. A model Drought Resilient Technologies Program, developed by the project, is embodied in the Drought Resilient Toolkit at: http://droughtresilience.com/http://droughtresilience.com/. This project found that most drought resilient opportunities involve actions and investments by water users, and that significant draught resilient in Tulare County could be achieved by implementing just the following solutions: convert flood to drip irrigation, recycle/reuse food processing water, and accelerate change outs to water efficient fixtures.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-094 ** Demonstration of Affordable, Comfortable, Grid Integrated Zero Net Energy Communities	Technology Demonstration and Deployment	This project is demonstrating cost-competitive ZNE design strategies that combine occupant needs with technology solutions to create new pathways for residential ZNE communities. The strategies will be demonstrated in single and multifamily buildings. The project's goals are cost effectiveness for the customer, affordability, overcoming customer apprehension, establishing a track record of new technology for builders, enabling distribution grid integration, creating a planning process for ZNE communities, evaluating community solar and evaluating the impact of future changes to ZNE cost effectiveness. This project also aims to understand the operation and energy use of the unregulated loads.	6/14/16
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-15-094 ** Demonstration of Affordable, Comfortable, Grid Integrated Zero Net Energy Communities	Technology Demonstration and Deployment	This project is demonstrating cost-competitive ZNE design strategies that combine occupant needs with technology solutions to create new pathways for residential ZNE communities. The strategies will be demonstrated in single and multifamily buildings. The project's goals are cost effectiveness for the customer, affordability, overcoming customer apprehension, establishing a track record of new technology for builders, enabling distribution grid integration, creating a planning process for ZNE communities, evaluating community solar and evaluating the impact of future changes to ZNE cost effectiveness. This project also aims to understand the operation and energy use of the unregulated loads.	6/14/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-094 ** Demonstration of Affordable, Comfortable, Grid Integrated Zero Net Energy Communities	No	Demand-side Management	$3,207,432	$3,207,432	$2,800,444	N/A
EPC-15-094 ** Demonstration of Affordable, Comfortable, Grid Integrated Zero Net Energy Communities	No	Demand-side Management	$1,735,377	$1,735,377	$0	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-094 ** Demonstration of Affordable, Comfortable, Grid Integrated Zero Net Energy Communities	$2,800,444	$1,460,838	$0	Electric Power Research Institute, Inc.; LINC Housing Corporation; Fresno Housing Authority	$1,109,482	18.3%
EPC-15-094 ** Demonstration of Affordable, Comfortable, Grid Integrated Zero Net Energy Communities	$0	$0	$0	Electric Power Research Institute, Inc.; LINC Housing Corporation; Frenso Housing Authority	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-094 ** Demonstration of Affordable, Comfortable, Grid Integrated Zero Net Energy Communities	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-094 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39 out of 39 bidders	Electric Power Research Institute, Inc.
EPC-15-094 ** Demonstration of Affordable, Comfortable, Grid Integrated Zero Net Energy Communities	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-094 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39 out of 39 bidders	Electric Power Research Institute, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-094 ** Demonstration of Affordable, Comfortable, Grid Integrated Zero Net Energy Communities	Group 6: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-15-094 ** Demonstration of Affordable, Comfortable, Grid Integrated Zero Net Energy Communities	Group 6: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-094 ** Demonstration of Affordable, Comfortable, Grid Integrated Zero Net Energy Communities	This research provides new methodologies for integrating occupant and technology needs into a cost effective and scalable zero net energy (ZNE) strategy. The project analyzes and defines the savings and market barriers in residential communities and provides new, valuable performance data and models from the demonstrations. The products from this research will identify the successes and barriers to meeting the ZNE goals for residential communities.	1f, 1h, 2a	The project is emerging from COVID-19 restrictions, and making progress on all four construction sites. 1) Belmont: construction is complete and PV and storage expected to be operational early 2021. 2) Compton: the installation of all sensing devices are complete and data is being collected and analyzed. Resident surveys are underway. Recipient will submit a draft M&V plans in early 2021. 3) Fresno: construction on the four story housing project broke ground September 2020. 4) Pomona: Site access was denied due to COVID-19 shutdown and now resolved. The project team have installed all monitoring systems and now validating accuracy of incoming data such as hot water heating energy use, water consumption. The PV and storage system is now interconnected and operating. Due to COVID-19 restrictions, all projects were delayed and the recipient is requesting a one year time extension.
EPC-15-094 ** Demonstration of Affordable, Comfortable, Grid Integrated Zero Net Energy Communities	This research provides new methodologies for integrating occupant and technology needs into a cost effective and scalable zero net energy (ZNE) strategy. The project analyzes and defines the savings and market barriers in residential communities and provides new, valuable performance data and models from the demonstrations. The products from this research will identify the successes and barriers to meeting the ZNE goals for residential communities.	1f, 1h, 2a	The project is emerging from COVID-19 restrictions, and making progress on all four construction sites. 1) Belmont: construction is complete and PV and storage expected to be operational early 2021. 2) Compton: the installation of all sensing devices are complete and data is being collected and analyzed. Resident surveys are underway. Recipient will submit a draft M&V plans in early 2021. 3) Fresno: construction on the four story housing project broke ground September 2020. 4) Pomona: Site access was denied due to COVID-19 shutdown and now resolved. The project team have installed all monitoring systems and now validating accuracy of incoming data such as hot water heating energy use, water consumption. The PV and storage system is now interconnected and operating. Due to COVID-19 restrictions, all projects were delayed and the recipient is requesting a one year time extension.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-096 Demonstrating Innovative Leakage Reduction Strategies: Correlating Continuous Acoustic Monitoring, Satellite Imagery and Flow Sensitive Pressure Reducing Valve System	Technology Demonstration and Deployment	This project demonstrated three leak detection technologies to reduce the amount of water lost from pipeline leaks along with the amount of embedded energy wasted due to these leaks. The technologies include satellite imagery leak detection (SILD), correlating continuous acoustic monitoring (CCAM), and flow sensitive pressure reducing valves (FSPRV), which were tested at site demonstrations in four Southern California cities.	6/14/16
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-15-097 Achieving Zero Net Energy in Multi-family Buildings	Applied Research and Development	This project demonstrates the potential of breakthrough electric water heating and space conditioning technologies as a pathway to zero net energy. The project explores the complex, interdependent systems in multifamily buildings and how they work together to achieve zero net energy status for the buildings in a cost-effective manner. Four multifamily buildings, designed to be affordable, are to be evaluated in various stages of design and development. These buildings share a goal of all electric zero net energy construction with 100 percent renewable energy generation, and utilize innovative new heat pump technologies to serve the buildings water heating and/or space conditioning needs.	6/14/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-15-096 Demonstrating Innovative Leakage Reduction Strategies: Correlating Continuous Acoustic Monitoring, Satellite Imagery and Flow Sensitive Pressure Reducing Valve System	No	Demand-side Management	$1,517,780	$1,517,780	$1,382,316	N/A
EPC-15-097 Achieving Zero Net Energy in Multi-family Buildings	No	Demand-side Management	$1,955,811	$1,955,811	$1,797,407	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-15-096 Demonstrating Innovative Leakage Reduction Strategies: Correlating Continuous Acoustic Monitoring, Satellite Imagery and Flow Sensitive Pressure Reducing Valve System	$1,382,316	$222,664	$0	Hazen and Sawyer; American Water Works Company, Inc.; Echologics	$391,461	20.5%
EPC-15-097 Achieving Zero Net Energy in Multi-family Buildings	$1,797,407	$180,555	$350,498	Corporation for Better Housing; MidPen Housing Corp.	$290,090	12.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-15-096 Demonstrating Innovative Leakage Reduction Strategies: Correlating Continuous Acoustic Monitoring, Satellite Imagery and Flow Sensitive Pressure Reducing Valve System	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-096 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 35 bidders	American Water Works Company, Inc.
EPC-15-097 Achieving Zero Net Energy in Multi-family Buildings	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-15-097 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39 out of 39 bidders	Franklin Energy Services, LLC

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-15-096 Demonstrating Innovative Leakage Reduction Strategies: Correlating Continuous Acoustic Monitoring, Satellite Imagery and Flow Sensitive Pressure Reducing Valve System	Group 2: Ranked # 7	N/A	N/A	None
EPC-15-097 Achieving Zero Net Energy in Multi-family Buildings	Group 2: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-096 Demonstrating Innovative Leakage Reduction Strategies: Correlating Continuous Acoustic Monitoring, Satellite Imagery and Flow Sensitive Pressure Reducing Valve System	This project advanced the technical knowledge of detecting underground water leaks and estimated the energy savings associated with the water leak detection/prevention strategies. Identifying and demonstrating tools to help water agencies monitor, assess, and manage their water distribution systems conserves water resources, increases water system reliability, lower emergency and repair costs and reduces water and electricity costs for ratepayers. These benefits were quantified through the volume of water saved and the embedded energy in the saved water.	4c	The correlating continuous acoustic monitoring and satellite imagery leak detection were estimated to save approximately 149,000 to 419,000 kWh of embedded energy and reduce around 3 to 9 percent of the total system's energy use if leaks were discovered and fixed. However, results will vary depending on the number of fixable leaks found per year. The flow sensitive pressure reduction valves proved effective in preventing catastrophic leaks and was deployed in three cities. The correlating acoustic monitoring devices are ready for broad adoption on metal piped systems, but need to adapt to plastic. The satellite imagery leak detection service needs improvement in narrowing down the areas of interest and education for the utilities to increase awareness of this method of leak detection. The flow sensitive pressure reduction valves are a work in progress and barriers associated with software advancement and increased data transmission reliability need to be resolved.
EPC-15-097 Achieving Zero Net Energy in Multi-family Buildings	The project demonstrates the technical and economic feasibility of zero net energy design for large multifamily projects and establishes design and installation best practices that minimize risks for developers. This includes documentation of best practices to ensure that energy and cost benefits of zero net energy are fully realized and identified, including the trade-offs between technology solutions, capital costs, operating and maintenance costs, environmental benefits and grid impacts.	1f, 1h	The project is in its final phase. After delays due to the pandemic, there was difficulty accessing the buildings to retrieve the monitoring equipment. In October 2020, the project team was able to retrieve all monitoring equipment and SD cards from the sites. Data is now being analyzed. The recipient is working on the final report.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-001 Measure Results from Affordable Zero Net Energy Homes	Applied Research and Development	The project implements lessons learned from previous high performance housing research and measures the results in two new homes being built in partnership with Habitat for Humanity. Both houses include advanced architectural design features, high performance enclosures, advanced heating, ventilating and air conditioning systems, and low-cost water heating systems. One all-electric home and one mixed fuel (combined electric and natural gas) home will demonstrate the respective cost-effectiveness of each set of features. In addition to measuring results from actual occupancy, the project is developing a guide to affordable residential zero net energy design and construction, a training curriculum, and offers training opportunities based on project efforts. The houses are in a disadvantaged community in Stockton.	7/13/16
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-002 Pathways to More Cost-Effective ZNE Homes	Applied Research and Development	This study provides detailed cost-effectiveness modeling of all electric, Zero Net Energy (ZNE) homes compared to mixed-fuel ZNE homes with gas-based heating. Evaluation includes costs of building integration, energy efficiency packages, installed equipment, and lifetime investment costs. The project provides spatial and temporal analyses to enable an assessment of cost-effectiveness in four California climate zones. This information will help policy makers better understand the cost and benefit tradeoffs of ZNE policy - and allow for more informed planning to reach ZNE targets in 2020 and 2030. It will also provide the information on the climate trade-offs of all electric homes compared to those with electric and gas service.	7/13/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-001 Measure Results from Affordable Zero Net Energy Homes	No	Demand-side Management	$1,000,000	$1,000,000	$649,081	N/A
EPC-16-002 Pathways to More Cost-Effective ZNE Homes	No	Demand-side Management	$1,000,000	$1,000,000	$1,000,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-001 Measure Results from Affordable Zero Net Energy Homes	$649,081	$325,815	$0	Pacific Gas and Electric Company; Southern California Gas Company	$168,500	14.4%
EPC-16-002 Pathways to More Cost-Effective ZNE Homes	$1,000,000	$436,541	$0	Lawrence Berkeley National Laboratory	$50,000	4.8%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-001 Measure Results from Affordable Zero Net Energy Homes	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-001 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39 out of 39 bidders	Institute of Gas Technology dba Gas Technology Institute
EPC-16-002 Pathways to More Cost-Effective ZNE Homes	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-002 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39 out of 39 bidders	Lawrence Berkeley National Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-001 Measure Results from Affordable Zero Net Energy Homes	Group 2: Ranked # 1	N/A	N/A	None
EPC-16-002 Pathways to More Cost-Effective ZNE Homes	Group 3: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-001 Measure Results from Affordable Zero Net Energy Homes	This project uses innovative construction approaches that couple advanced energy efficiency measures with integrated project design and delivery (IPD) in a cost-effective manner. These approaches reduce structural framing to minimize heat paths through the walls, improve wall and attic insulation, increase equipment efficiency, reduce air infiltration levels, and improve water heater and HVAC performance. The approaches emphasize minimum energy use, high indoor air quality, robust and appealing architectural design, solid structural integrity, and practical, low cost construction. If successful, these innovative approaches could become standard construction practice leading to widespread deployment of affordable ZNE homes.	1e, 1f, 1h, 2a	Progress has been slow in 2020 due to COVID-19 which delayed construction of the two ZNE homes. Progress in 2020 includes finishing installation of HVAC, water heating, and drywall at both homes. The team is aiming to complete construction and collect performance data in 2021.The project team also finalized an eBook which details the innovative energy efficient construction practices being utilized in the ZNE homes and conducted builder training seminars. The recipient offered a series of training webinars on building affordable zero net energy homes in November and December 2020. These webinars were a direct result of the research project.
EPC-16-002 Pathways to More Cost-Effective ZNE Homes	The project identifies key cost-reduction opportunities to inform future policy decisions and includes development of cost data on photovoltaic cost reduction potential, building shell measures, and future end-use appliance costs and performance and estimates of cost sensitivities of various ZNE related issues. The latter includes offsite renewable energy procurement, climate impacts, and policy levers, such as mortgage tax credits and incentives.	1f, 1h, 4a	This project is complete. A final report is in the publication process. A few key takeaways from the project: New all-electric homes have comparable 30-year lifecycle costs to mixed-fuel homes when cost optimized for 2019 Title 24 compliance while offering significantly lower CO2 emissions (average of 38% lower). All-electric home costs can benefit from reduced infrastructure costs for gas lines. All-electric single-family homes with cost-optimized designs have an average of 1kW larger solar PV system sizes compared to mixed-fuel homes to offset increased electricity consumption. Full ZNE home can be achieved by oversizing solar PV systems to offset the TDV of building's total annual site energy usage

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-003 Pilot-Scale Evaluation of an Integrated Building Control Retrofit Package	Applied Research and Development	This project tests an integrated building control package that maximizes energy efficiency for existing commercial buildings. The project refines novel control algorithms that utilize shared device state and environmental data for lighting, fenestration and heating, ventilating and air conditioning (HVAC) systems. Sharing data from multiple device types will further improve overall, sustained, system performance and operation. Control algorithms prioritize lighting or heating/cooling savings based on climate and building design. HVAC system management leverages passive ventilation through windows and skylights and dynamic adjustment of HVAC set point dead bands. The goal of this project is to reduce electricity use by 20-30%. The project team's mission is to partner with manufacturers throughout the critical development and demonstration phases to give products the best chance for market success. The research team will leverage multiple advocacy tools to make the knowledge gained, experimental results, and lessons learned from this effort available to the public and key decision makers.	7/13/16
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-004 Integrated Whole-Building Zero Net Energy Retrofits for Small Commercial Offices	Applied Research and Development	This project develops and evaluates cost-effective packages of pre-commercial integrated energy efficiency measures and controls to achieve zero net energy (ZNE) performance for small commercial offices in California. The project team is utilizing Lawrence Berkeley National Laboratory's FLEXLAB to test whole-building integrated systems under varied climate and use conditions, with additional testing to be conducted at a retrofitted office building in Berkeley, CA. The team is aiming to achieve a minimum of 50 percent energy savings over baseline conditions at the retrofit site to achieve ZNE. Data on energy, occupant comfort, and occupant behavior are being analyzed to identify best practices that can be replicated elsewhere in the State.	7/13/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-003 Pilot-Scale Evaluation of an Integrated Building Control Retrofit Package	No	Demand-side Management	$1,999,089	$1,999,089	$1,673,585	N/A
EPC-16-004 Integrated Whole-Building Zero Net Energy Retrofits for Small Commercial Offices	No	Demand-side Management	$2,000,000	$2,000,000	$1,760,556	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-003 Pilot-Scale Evaluation of an Integrated Building Control Retrofit Package	$1,673,585	$349,266	$0	Regents of the University of California, Davis - California Lighting Technology Center	$267,363	11.8%
EPC-16-004 Integrated Whole-Building Zero Net Energy Retrofits for Small Commercial Offices	$1,760,556	$781,092	$0	Northern California test site partner	$2,000,000	50.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-003 Pilot-Scale Evaluation of an Integrated Building Control Retrofit Package	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39 out of 39 bidders	Regents of the University of California, Davis - California Lighting Technology Center
EPC-16-004 Integrated Whole-Building Zero Net Energy Retrofits for Small Commercial Offices	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39 out of 39 bidders	Lawrence Berkeley National Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-003 Pilot-Scale Evaluation of an Integrated Building Control Retrofit Package	Group 1: Ranked # 4	N/A	N/A	Yes; Calif Based Entity
EPC-16-004 Integrated Whole-Building Zero Net Energy Retrofits for Small Commercial Offices	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-003 Pilot-Scale Evaluation of an Integrated Building Control Retrofit Package	This project seeks to improve sensor-controlled lighting and air conditioning systems by integrating and sharing information from multiple sensors, resulting in better quality indoor spaces with reduced energy cost. This research focuses on refinement and testing of an Integrated Building Control Retrofit Package. The includes the refinement of novel control algorithms that utilize shared device state and environmental data among lighting, fenestration and HVAC devices. This is a breakthrough because most lighting and HVAC controls operate independent of each other and this project hopes to integrate both.	1f, 1h, 3e	The recipient is finalizing installation of the smart controls with the windows shades, thermostats, and lighting at the demonstration site at the Barn in UC Davis. Due to COVID-19 and the shelter in place the building has been unoccupied. The research team is coming up with solutions on to simulate occupancy presence in the building to provide theoretical savings. The project is expected to end 3/31/2021.
EPC-16-004 Integrated Whole-Building Zero Net Energy Retrofits for Small Commercial Offices	This project develops and validates integrated whole building retrofit packages using pre-commercial underutilized technologies and controls with the goal of reducing energy use in small commercial offices by at least 50 percent. The project also aims to increase system reliability by reducing peak energy loads and potentially supporting automated demand response implementation. The energy efficiency and demand reduction components of the project provide a path towards meeting the State's energy efficiency and climate goals along with a means to replicate these strategies.	1e, 1f, 1h, 2a, 4a	Progress was slow in 2020 due to COVID-19, which delayed the ZNE retrofit construction effort. The team is now making good progress and anticipates completing ZNE retrofit and begin collecting and analyzing performance data in 2021.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-005 Energy Efficient HVAC Packages for Existing Residential Buildings	Applied Research and Development	This project demonstrates innovative pre-commercial, cost-effective retrofit packages for cooling and ventilation for single family homes. Energy savings, occupant behavior and indoor air quality (IAQ) are to be measured for two specific retrofit packages that each includes three innovative technologies: (1) building envelope sealing, (2) two variants of smart mechanical ventilation that include pre-cooling strategies, and (3) mostly compressor-free evaporative air-conditioning. Furthermore, barriers and opportunities towards adoption of such retrofits are to be identified through stakeholder interviews.	7/13/16
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-006 Low Energy, Zero Liquid Discharge Adsorption Technology to Remove Contaminants and Recover Source Water	Applied Research and Development	The project tested an innovative, low energy, zero liquid discharge water treatment system that uses an adsorption process to remove arsenic and other contaminants from a groundwater reservoir. A demonstration-scale water treatment system was developed and tested to determine operational costs, energy and water savings of the single use adsorption system. The demonstration validated the reduction in spent adsorption media through natural dehydration to further save energy and water associated with residual solid waste handling.	7/13/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-005 Energy Efficient HVAC Packages for Existing Residential Buildings	No	Demand-side Management	$1,200,000	$1,200,000	$611,873	N/A
EPC-16-006 Low Energy, Zero Liquid Discharge Adsorption Technology to Remove Contaminants and Recover Source Water	No	Demand-side Management	$986,262	$986,262	$786,630	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-005 Energy Efficient HVAC Packages for Existing Residential Buildings	$611,873	$366,421	$126,000	None	$0	0.0%
EPC-16-006 Low Energy, Zero Liquid Discharge Adsorption Technology to Remove Contaminants and Recover Source Water	$786,630	$0	$0	ES Engineering Services, LLC; Khalil Kairouz Consulting; Enova Water LLC; AQUAlity Engineering, Inc.; Municipal Management Group, Inc.	$194,904	16.5%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-005 Energy Efficient HVAC Packages for Existing Residential Buildings	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39 out of 39 bidders	Regents of the University of California, Davis
EPC-16-006 Low Energy, Zero Liquid Discharge Adsorption Technology to Remove Contaminants and Recover Source Water	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-006 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 35 bidders	ES Engineering Services, LLC

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-005 Energy Efficient HVAC Packages for Existing Residential Buildings	Group 1: Ranked # 3	N/A	N/A	Yes; Calif Based Entity
EPC-16-006 Low Energy, Zero Liquid Discharge Adsorption Technology to Remove Contaminants and Recover Source Water	Group 1: Ranked # 4	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-005 Energy Efficient HVAC Packages for Existing Residential Buildings	To address the current issues with indoor air quality and energy efficiency in existing homes, this project evaluates two residential retrofit packages that incorporate advanced technologies for achieving both of these goals. Better envelope tightness combined with a dedicated ventilation system and highly efficient evaporative cooler will increase indoor air quality, reduce energy use for air conditioning and reduce overall peak demand. Additionally, the technology could reduce energy costs for building owners/occupants.	1f, 1h, 2a	Field monitoring was completed with the Smart Vent and Night Breeze systems along with the sub wet bulb evaporative cooling and DX coil. Both sites received aerosol envelope sealing, and a sub wet bulb indirect evaporative cooling (IDEC) with a fresh air vent system. A small add-on direct expansion coil was added to each IDEC unit to allow for extra cooling during summer temperatures. Indoor air quality measurements monitored CO2 and PM 2.5. Initial results show that the home with the single cold water coil in the attic from the IDEC met the home's temperature requirements, but the home with the multiple mini-splits system supplied by the IDEC was unable to keep occupants comfortable. Recipient is currently testing the following systems in the laboratory to optimize the performance: attic coil system, the sub wet bulb evaporative cooler (SWEC) mini-split, and the hybrid mini-split (using a small compressor in conjunction with the SWEC).
EPC-16-006 Low Energy, Zero Liquid Discharge Adsorption Technology to Remove Contaminants and Recover Source Water	The hydrogel adsorption process offers benefits of being simple, with its minimal amount of equipment required and can save water that would normally be too difficult to treat. This technology is an innovative approach to treat water with high amounts of metal contaminants using a low energy treatment method to restore impaired drinking water sources. This treatment method is especially suitable for small inland treatment systems, where liquid backwash and brine disposal may be cost prohibitive or infeasible.	1h, 4c, 4d	The demonstration was completed and the technology successfully removed arsenic and some other contaminants from ground water. The technology is most suited for continuous flow applications. Due to inconsistent flow rates, the demonstration site, City of Cerritos, did not continue to use the technology following the end of the project. The recipient is working to adapt their technology to handle other contaminants including selenium.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-007 Optimization of Energy Efficiency to Achieve Zero-Net Energy in Multifamily and Commercial Buildings	Applied Research and Development	This is a modeling study. The recipient uses EnergyPlus, a building energy modeling tool, to analyze the cost-effectiveness of various electricity saving/generation measures for multifamily and commercial buildings in California. Each building type and climate zone will receive a cost-benefit analysis for each measure individually and an optimized package of measures to achieve as close to zero net energy as is cost-effectively possible	7/13/16
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-008 Santa Monica Advanced Energy District	Market Facilitation	The city of Santa Monica designed an advanced energy district with a multiuser microgrid that is anchored at the City Yards, an old landfill site where most of the city's municipal buildings and fleets are housed. The design integrates a suite of local renewable energy sources, energy storage, and controllable loads into a single system that can be scaled to interconnect adjacent, public and private properties inclusive of the Bergamont Art District and Metro Maintenance Facility. The project team explored what role the city can play in delivering and wheeling power between customers, and what special utility tariffs and financing can help incentivize a system that shares the value of distributed energy resources equitably. Next, the project team developed a financial and ownership model for constructing and operating a multiuser microgrid that achieves a net-zero, or near net-zero energy district for the customers. A case study and tool kit of outreach materials was developed to share with stakeholders and other local governments.	8/10/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-007 Optimization of Energy Efficiency to Achieve Zero-Net Energy in Multifamily and Commercial Buildings	No	Demand-side Management	$1,000,000	$1,000,000	$879,180	N/A
EPC-16-008 Santa Monica Advanced Energy District	No	Demand-side Management	$1,487,609	$1,487,609	$1,080,480	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-007 Optimization of Energy Efficiency to Achieve Zero-Net Energy in Multifamily and Commercial Buildings	$879,180	$151,821	$0	Electric Power Research Institute, Inc.; Regents of the University of California, Davis	$105,000	9.5%
EPC-16-008 Santa Monica Advanced Energy District	$1,080,480	$570,347	$0	Arup North America Ltd; City of Santa Monica; Hathaway Dinwiddie Construction Company; Miller Hull Partnership; Buro Happold Engineering	$253,030	14.5%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-007 Optimization of Energy Efficiency to Achieve Zero-Net Energy in Multifamily and Commercial Buildings	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39 out of 39 bidders	Regents of the University of California, Davis
EPC-16-008 Santa Monica Advanced Energy District	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-008 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 28 bidders	City of Santa Monica

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-007 Optimization of Energy Efficiency to Achieve Zero-Net Energy in Multifamily and Commercial Buildings	Group 4: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-16-008 Santa Monica Advanced Energy District	Group 2: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-007 Optimization of Energy Efficiency to Achieve Zero-Net Energy in Multifamily and Commercial Buildings	This project will accelerate the adoption of cost-effective electricity saving and generation technologies, equipment, materials and construction practices in California multifamily and commercial buildings by providing a rapid-assessment tool. This tool will help stakeholders identify and prioritize energy efficiency measures/technologies based on their cost-effectiveness.	1f, 1h, 3e	The recipient has provided the details of their modeling approach and the cost database that will be used in the final cost-effectiveness analysis. They have also built the necessary hardware set-up for running simulations and generating impact data for the final report. The final report is expected to be delayed for about six months due to COVID19-related delays in delivery of a simulation equipment and staff unavailability. A COVID19-related term extension request had been initiated.
EPC-16-008 Santa Monica Advanced Energy District	Senate Bill 350 (2015) sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Local governments must play a role in achieving the goal by operationalizing community-scale deployment of Integrated Distributed Energy Resources (IDER) such as energy efficiency, onsite renewables, demand response, and electric vehicles. This project pilots innovative planning, permitting, and financing approaches and tools to help improve the business case for IDER adoption at the community-scale.	2a, 3b, 3e	This project concluded in December 2018. After evaluating several technical and financial options, the team developed three scenarios to provide a phased approach for a low-carbon energy solution to the City of Santa Monica and surrounding community. The base-case scenario includes 1.2 MW solar PV and 7.2 MWh energy storage to meet the projected energy demand for the redeveloped City Yards, and allows for 2 days of continued operation in a power outage. The two expansion scenarios include increased solar generation and energy storage, as well as fuel cells to meet the significantly higher demands for the adjacent Bergamont Art District, and the Metro's maintenance facilities located across the street. The City will vote on a final microgrid design once the City Yards redevelopment plan is complete and financing becomes available.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-009 Testing a Low-Energy Water Treatment System for Fail-Safe Direct Potable Reuse	Applied Research and Development	The project is testing a low-energy, dual barrier, direct potable reuse system, known as dprShield, with breach-activated barrier technology to demonstrate that this technology can improve public health safeguards and reduce the electrical energy, chemical consumption, maintenance and overall cost for potable reuse of municipal wastewater. While being energy efficient and cost-effective, this system effectively removes trace contaminants through two tight membranes. In the event that one of the membrane barriers is breached, a Breach Activated Barrier is triggered and the contaminants are pushed away from the clean water stream, ensuring safe operation in real time. This direct potable reuse technology could replace more energy intensive processes.	8/10/16
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-010 Improving Water and Energy Efficiency in California's Dairy Industry	Applied Research and Development	This project evaluates the viability and effectiveness of new cooling technologies for dairy cattle. Cow cooling is critical to livestock health and milk production. Conventional livestock cooling methods, such as fans and sprinkling cows with water, require significant amounts of electricity and water. The new technology developed under this project combines conduction and convection cooling methods, and it has the potential to reduce water consumption by up to 86 percent and electricity consumption by up to 38 percent. The novel cattle cooling approach developed during the initial stage of this project is currently being demonstrated at a dairy in Tulare, California.	8/10/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-009 Testing a Low-Energy Water Treatment System for Fail-Safe Direct Potable Reuse	No	Demand-side Management	$999,795	$999,795	$979,250	N/A
EPC-16-010 Improving Water and Energy Efficiency in California's Dairy Industry	No	Demand-side Management	$1,000,000	$1,000,000	$951,141	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-009 Testing a Low-Energy Water Treatment System for Fail-Safe Direct Potable Reuse	$979,250	$248,634	$2,826,591	Orange County Water District; Leland Stanford Junior University; Porifera, Inc.; City of Hayward	$144,784	12.6%
EPC-16-010 Improving Water and Energy Efficiency in California's Dairy Industry	$951,141	$191,936	$0	Regents of University of California, Davis	$164,710	14.1%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-009 Testing a Low-Energy Water Treatment System for Fail-Safe Direct Potable Reuse	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 35 bidders	Porifera, Inc.
EPC-16-010 Improving Water and Energy Efficiency in California's Dairy Industry	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 35 bidders	Regents of University of California, Davis

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-009 Testing a Low-Energy Water Treatment System for Fail-Safe Direct Potable Reuse	Group 1: Ranked # 2	N/A	N/A	Yes; Calif Based Entity, Minority Owned, Woman Own
EPC-16-010 Improving Water and Energy Efficiency in California's Dairy Industry	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-009 Testing a Low-Energy Water Treatment System for Fail-Safe Direct Potable Reuse	This project demonstrates an energy efficient solution for direct potable reuse of municipal wastewater. The dprShield is estimated to use 65 percent less energy than State Water Project transfers, 75 percent less than desalination and more than 50 percent less energy than competing technologies for direct potable reuse of municipal wastewater, removal of contaminants from water and real-time membrane integrity monitoring.	1f, 1h, 4c, 4d	The final report has been submitted. The pilot demonstration results show that the dprShield uses 33% less energy than competing DPR solutions and 70% less energy compared to desalination.
EPC-16-010 Improving Water and Energy Efficiency in California's Dairy Industry	This project advances management strategies for reducing thermal stress in dairy cows while also reducing energy and water use. There are two methods of reducing thermal stress in cows: (i) lowering the cow's heat exposure and (ii) increasing the cow's ability to get rid of excess body heat. Current practice includes use of evaporative cooling with water sprayed on the cows using feed-line soakers, and cooling is enhanced by convective heat transfer via large overhead fans. This project will test and demonstrate an innovative approach that seeks to optimize the cow's ability to remove excess body heat by utilizing more efficient cooling technologies, which have the potential to significantly change the way dairy cows are cooled.	1e, 1f, 1h, 4a, 4c	Installation and testing of the full-scale system has been completed in Pixley, CA. Data collection on the "ducted" strategy has been completed. The second trial of testing and measurement of cow performance during the baseline and optimized baseline cooling methods was finalized during the summer of 2020. In addition to completing the data collection, the recipient has conducted several interviews with the diary managers and provided a Behavioral and Market Analysis Report in October 2020. The team is currently preparing the draft final report.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-011 Novel Membrane Technology to Improve Energy Efficiency and Water Savings in Wastewater Treatment Operations	Applied Research and Development	This project was to demonstrate and assess the potential of an innovative amphiphilic, anti-adhesive membrane technology (developed by membrane manufacturer, inge/BASF) designed to minimize foulants onto membrane surface to improve the performance of membrane filtration systems used by drinking water and water reclamation agencies.	8/10/16
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-012 Power and Water Saving Advanced Hybrid Air/Wet Cooling System	Applied Research and Development	This project uses high performance porous fins to enhance cooling through water vaporization and mass transfer. By retrofitting the heat exchanger with a water spray feature, this project has the potential to reduce energy and water use of HVAC and refrigeration systems in California. The developed Advanced Hybrid Heat Exchanger (AHHEX) only uses water when ambient temperatures rise above 85 degrees F. The ambient air temperatures in California rise above this level only a limited number of hours per year. This means that the AHHEX will have lower energy needs when the air temperature is low and water not used, compared to a conventional systems.	8/10/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-011 Novel Membrane Technology to Improve Energy Efficiency and Water Savings in Wastewater Treatment Operations	No	Demand-side Management	$882,430	$882,430	$736,251	N/A
EPC-16-012 Power and Water Saving Advanced Hybrid Air/Wet Cooling System	No	Demand-side Management	$999,994	$999,994	$998,888	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-011 Novel Membrane Technology to Improve Energy Efficiency and Water Savings in Wastewater Treatment Operations	$736,251	$304,611	$0	Kennedy/Jenks Consultants; BASF; California Water Services	$98,600	10.1%
EPC-16-012 Power and Water Saving Advanced Hybrid Air/Wet Cooling System	$998,888	$529,685	$0	Altex Technologies Corporation	$187,207	15.8%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-011 Novel Membrane Technology to Improve Energy Efficiency and Water Savings in Wastewater Treatment Operations	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-011 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 35 bidders	Kennedy/Jenks Consultants
EPC-16-012 Power and Water Saving Advanced Hybrid Air/Wet Cooling System	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-012 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 35 bidders	Altex Technologies Corporation

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-011 Novel Membrane Technology to Improve Energy Efficiency and Water Savings in Wastewater Treatment Operations	Group 1: Ranked # 3	N/A	N/A	Yes; Calif Based Entity
EPC-16-012 Power and Water Saving Advanced Hybrid Air/Wet Cooling System	Group 1: Ranked # 5	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-011 Novel Membrane Technology to Improve Energy Efficiency and Water Savings in Wastewater Treatment Operations	A survey by the American Membrane Technologies Association (AMTA) indicates that there are approximately 100 microfiltration/ultrafiltration treatment plants with a total design capacity of approximately 400 MGD, eight nanofiltration facilities (30 MGD), and over 100 reverse osmosis (RO) facilities (400 MGD) in California. As membrane treatment is energy intensive due to fouling, this technology could reduce energy demand for membrane treatment processes while decreasing the water need for backwashing.	1f, 1h, 3a, 4a, 4c	The project is complete. The pilot test showed that use of the amphiphilic membrane could be effective in minimizing membrane fouling and promoting energy efficiency, but that differences in water source or quality impact the extent of those performance improvements. Overall process energy usage under all pilot testing conditions was reduced by approximately 6 percent. However, chemical degradation of the membrane surface occurred during testing indicating that further work may be needed on the part of the manufacturer to evaluate special chemical resistance specifications and cleaning protocol. The results suggest that the ultrafiltration membrane module has potential benefit but is not yet market ready.
EPC-16-012 Power and Water Saving Advanced Hybrid Air/Wet Cooling System	When compared to conventional condensers, the hybrid cooling system increases performance and lowers capital costs. This is accomplished by reducing the pressure drop, using water evaporation when ambient air temperatures are high, and reducing the volume weight. All of this translates to 50 percent lower heat exchanger volume, weight, cost, and reduced fan power cost.	1f, 1h, 4a, 4c	Testing for the hybrid heat exchanger and parameter optimization was completed and final report was submitted and is under review. Relative to conventional condensers, the Advanced Hybrid Heat Exchanger (AHHEX) can reduce evaporative cooler yearly water use by up to 98.7 percent for a 170-ton example cooling system operating in Oakland at constant load. The water and electric power reductions is expected to be up to 2.1 million gallons/year and 28,499 kWh/year, respectively. While the test system capacity was smaller than the targeted commercial and industrial markets, the AHHEX is modular and capacity can be added by duplicating and connecting panels in parallel to the larger chiller. Data from this project can be applied to full-scale commercial and industrial condensers and AHHEX can be scaled to range of applications.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-013 Integrating Smart Ceiling Fans and Communicating Thermostats to Provide Energy-Efficient Comfort	Applied Research and Development	This project develops an optimal system configuration for smart comfort controlled ceiling fans integrated with learning thermostats. This system is to be tested and evaluated for energy performance and occupant acceptance in low income multi-family residential and small commercial buildings in disadvantaged communities in California. This research and development advances the solution's technology readiness level and support market adoption acceleration. A design guide and energy code language are to be developed to facilitate widespread adoption.	8/10/16
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-014 A New Solution to California's Energy and Water Challenges: Reducing the Cost of Desalination and Increasing Water Reuse	Applied Research and Development	This project is demonstrating a flow-through electrode capacitive desalination (FTE-CD) technology to reduce the energy used to remove salt from wastewater. This advanced technology removes salt from water by applying an electric field to two porous electrodes. The electrodes act like a magnet for salt while the field is applied and remove the salt from water that flows through the electrodes using less energy and less costly than reverse osmosis (RO). Energy use of an FTD-CD system is projected to be 50% less compared to the energy use for an RO system. The recipient is partnering with two water districts to test the use of FTE-CD devices to desalinate wastewater from industrial and municipal sectors and determine how this small, flexible device can improve the energy and operating efficiency of wastewater treatment solutions for communities. Energy use and performance are being measured, while fouling and other operation issues are being identified.	8/10/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-013 Integrating Smart Ceiling Fans and Communicating Thermostats to Provide Energy-Efficient Comfort	No	Demand-side Management	$1,888,683	$1,888,683	$1,803,208	N/A
EPC-16-014 A New Solution to California's Energy and Water Challenges: Reducing the Cost of Desalination and Increasing Water Reuse	No	Demand-side Management	$999,040	$999,040	$999,040	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-013 Integrating Smart Ceiling Fans and Communicating Thermostats to Provide Energy-Efficient Comfort	$1,803,208	$188,176	$0	Regents of the University of California, Berkeley (Center for the Built Environment); BIG ASS FANS	$315,926	14.3%
EPC-16-014 A New Solution to California's Energy and Water Challenges: Reducing the Cost of Desalination and Increasing Water Reuse	$999,040	$448,176	$0	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-013 Integrating Smart Ceiling Fans and Communicating Thermostats to Provide Energy-Efficient Comfort	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	39 out of 39 bidders	The Regents of the University of California on behalf of the Berkeley campus
EPC-16-014 A New Solution to California's Energy and Water Challenges: Reducing the Cost of Desalination and Increasing Water Reuse	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-014 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	27 out of 35 bidders	Lawrence Livermore National Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-013 Integrating Smart Ceiling Fans and Communicating Thermostats to Provide Energy-Efficient Comfort	Group 1: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-16-014 A New Solution to California's Energy and Water Challenges: Reducing the Cost of Desalination and Increasing Water Reuse	Group 1: Ranked # 6	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-013 Integrating Smart Ceiling Fans and Communicating Thermostats to Provide Energy-Efficient Comfort	Air movement, such as through ceiling fans, can cool a person indoors in a similar manner as lowering the temperature, but uses only a tiny fraction of the energy required by HVAC systems. New smart ceiling fans, using only 1-8 watts (compared to 2000-3500 watts for the typical 1.5-3 ton air conditioning system) and producing 1.5 to 2 mph air movement near building's occupants, can offset a 6ºF increase in indoor air temperature. This improves the occupant's comfort and perceived air quality while substantially decreasing energy consumption. Allowing higher indoor temperatures reduces a building's total HVAC energy by an average of 5% per degree Fahrenheit, and even greater in climate zones where natural ventilation or evaporative cooling systems are used instead of compressor-based cooling, or where there are a large number of airside economizer hours (such as California).	1f, 1h, 3a, 3e, 4a	The project is complete. The research team developed guidelines and online tools to help architects, engineers and builders to properly integrate smart automated ceiling fans into their HVAC system design. In 2020, and as a result of this project, multiple buildings in California and other states are installing automated ceiling fans in their buildings such as the SFO airport new offices, Laguna Honda hospital in San Francisco and others.
EPC-16-014 A New Solution to California's Energy and Water Challenges: Reducing the Cost of Desalination and Increasing Water Reuse	The FTE-CD technology has the potential to reduce the cost and energy associated with desalinating low to moderate salt content water and will represent an advancement over current RO technology. This technology has the potential to increase water recycling and reuse at the community or industrial level, which reducing the need to procure and transport fresh water sources. The advanced FTE-CD technology is small, flexible, and can be customized to the scale needed for each community or industry, thereby increasing a community's water reuse potential and drought resilience for the state.	1f, 1h, 4d	Recipient developed and tested a new operation mode of electrodes (called batch mode) and cell modules before deployment to Delta Diablo. Preliminary testing shows the potential to meet salt removal and productivity targets, while reducing flow efficiency losses caused by undesired mixing of desalted water and feed water. Using the optimized electrodes, the recipient demonstrated the ability to achieve desalination targets of 500 parts per million(ppm) total dissolved solids (tds) removal with more than 70% water recovery on Delta Diablo water samples. The recipient evaluated a novel charging circuitry design that takes advantage of the large inherent capacity of the cells to eliminate the need for AC-DC converters, thus simplifying the design and lowering cost. The pilot testing at demonstration site is delayed due to COVID-19 and agreement is extended to 12/31/2021.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-015 Los Angeles Regional Energy Innovation Cluster	Market Facilitation	This project establishes the Los Angeles Regional Energy Innovation Cluster to act as a regional hub of the clean energy ecosystem and to give promising clean energy entrepreneurs in Los Angeles, Orange, Santa Barbara, and Ventura counties direct access to the region's top technical, business, outreach, and commercialization support services. This project assesses and addresses the region's energy needs by making use of and expanding resources for entrepreneurs and startups, including facilities, coaching, business support, speaking and networking engagements, and information about funding opportunities, all through connections facilitated by the Los Angeles Cleantech Incubator.	8/10/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-015 Los Angeles Regional Energy Innovation Cluster	No	Demand-side Management	$4,999,247	$4,999,247	$2,368,673	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-015 Los Angeles Regional Energy Innovation Cluster	$2,368,673	$541,645	$650,000	California State University, Long Beach Research Foundation; Southern California Edison; Community Environmental Council; California State University, Northridge; Economic Development Corporation of Los Angeles County; California State Polytechnic University Pomona; Los Angeles Cleantech Incubator; Los Angeles Cleantech Incubator; Los Angeles County Office of Sustainability; Sustain Southern California; CSU Dominguez Hills; CSU Los Angeles; CSU Channel Islands; LA Business Technology Center; CSU Water Resources and Policy Initiatives	$3,658,099	42.3%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-015 Los Angeles Regional Energy Innovation Cluster	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-015 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	2 out of 2 bidders	Los Angeles Cleantech Incubator

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-015 Los Angeles Regional Energy Innovation Cluster	Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-015 Los Angeles Regional Energy Innovation Cluster	This project will benefit California IOU electricity ratepayers through the increased probability of commercialization and deployment of a portfolio of technologies that can reduce electricity costs, decrease peak demand, and improve system reliability and safety. This project will also support technologies based on the regional energy market needs and engage a diverse group of clean energy stakeholders to provide the support, network, and resources needed for accelerated clean energy commercialization.	2a, 3e	In 2020, the LA Regional Energy Innovation Cluster accepted its fifth cohort of portfolio companies to receive services, for a total of fifty-eight startups who have engaged with this program to date. The program will continue to provide important technical and business services such as speaking and networking opportunities, access to business development resources, awareness of funding opportunities, and connections to local energy stakeholders. The program also recently off-boarded startups from its first cohort. The program helped these startups meet critical milestones, including advancement in technology readiness, expanded customer base and partnerships, increased staff, and follow-on funding. As of June 2020, startups receiving services from this program have received $32,384,500 in private follow-on funding and $10,227,834 in public follow-on funding.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-016 Commercializing a Disruptively Low Cost Solar Collector	Applied Research and Development	This project has developed a low cost Concentrated Solar Power (CSP) collector to advance the market readiness of this technology. Hyperlight's CSP collector is based on the linear Fresnel reflector (LFR) and is able to make cost reductions through breakthroughs in materials, design, manufacturing, and installation. A major innovation of the system involves use of mirrors attached to UV stabilized and low-cost plastic tubes that are mounted on a sealed water bed foundation. The project has developed: (1) a single 1,000 square foot module used for lifecycle testing and validation of upgraded design elements; (2) a one-half acre system for pilot testing and demonstration; and (3) a front end engineering design study to establish the feasibility and requirements to scale the system up to ten acres and to co-locate with other renewable energy such as a geothermal facility. EPIC funds are being used as cost share funding to Hyperlight's $1.5 million grant from the US DOE.	10/19/16
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-017 Maximizing Energy Efficiency and Reducing Bio-solids Waste from New Anaerobic Wastewater Treatment Technology	Technology Demonstration and Deployment	This project is demonstrating the elimination of aeration and its high energy demands as part of secondary water treatment at the Silicon Valley Clean Water wastewater treatment facility using a novel staged Anaerobic Fluidized Bed Membrane Bioreactor (SAF-MBR). This System is projected to generate 30 percent less bio-solids than conventional systems that require aeration. This project also seeks to demonstrate the potential for development of a new high-quality local water supply through non-potable and advanced potable reuse treatment trains that eliminate process steps that normally precede the use of reverse osmosis.	10/19/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-016 Commercializing a Disruptively Low Cost Solar Collector	No	Generation	$750,000	$750,000	$747,342	N/A
EPC-16-017 Maximizing Energy Efficiency and Reducing Bio-solids Waste from New Anaerobic Wastewater Treatment Technology	No	Demand-side Management	$1,999,962	$1,999,962	$288,685	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-016 Commercializing a Disruptively Low Cost Solar Collector	$747,342	$177,896	$2,252,694	None	$0	0.0%
EPC-16-017 Maximizing Energy Efficiency and Reducing Bio-solids Waste from New Anaerobic Wastewater Treatment Technology	$288,685	$327,386	$0	Leland Stanford Junior University; Santa Clara Valley Water District; Silicon Valley Clean Water; GE Water; LG Water Solutions	$1,219,943	37.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-016 Commercializing a Disruptively Low Cost Solar Collector	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-016 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	43 bidders	Hyperlight Energy
EPC-16-017 Maximizing Energy Efficiency and Reducing Bio-solids Waste from New Anaerobic Wastewater Treatment Technology	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-017 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	8 out of 8 bidders	Silicon Valley Clean Water

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-016 Commercializing a Disruptively Low Cost Solar Collector	N/A ***	N/A ***	N/A	Yes; Calif Based Entity
EPC-16-017 Maximizing Energy Efficiency and Reducing Bio-solids Waste from New Anaerobic Wastewater Treatment Technology	Ranked # 1	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-016 Commercializing a Disruptively Low Cost Solar Collector	The project will support technological development by advancing a low-cost CSP collector to commercial availability. In addition to the value of demonstrating the collector through the physical installation, the front end design study and the availability of this low cost collector could inform geothermal power plant owners on the potential to use this innovative system to boost the output of their plants and provide more renewable energy to the grid. The resulting increase in heat transfer fluid temperature from 200 to 300 C expands the market for this technology from food processing to biofuel process plants and petroleum refining.	2a, 4a	A prototype reflector of 20 feet by 50 feet was tested to 10,000 cycles representing a 30-year lifetime, and results of the testing showed minimal degradation. The project site preparation work was completed and the pilot system has been operating as designed. Total system annual solar-to-thermal efficiency of 1/2 acre module plant was in the range of 60% to 85%. Important milestone achieved in this project include the mass manufacture and installation of the tube structural components required to achieve cost-savings. This project was completed in March, 2019. Hyperlight energy will design and install this technology, at Saputo Cheese plant in Tulare to convert solar energy into supplemental heat for thermal processes required to process milk into cheese. In addition, this technology has a good chance of utilization to boost output of geothermal plants.
EPC-16-017 Maximizing Energy Efficiency and Reducing Bio-solids Waste from New Anaerobic Wastewater Treatment Technology	This project has the potential to lower energy costs of wastewater treatment and water recycling. The advanced technology used in this project is the Staged Anaerobic Fluidized Bed Membrane Reactor (SAFBMR) which eliminates the aeration stage of wastewater treatment. The aeration stage is one of the most energy intensive steps in wastewater treatment. The SAFBMR also has the potential to reduce operation and maintenance costs because bio-solids waste, which typically requires off-site disposal, is reduced, and the effluent does not require the typical microfiltration pre-treatment step prior to the reverse osmosis systems.	1f, 1h, 4a, 4c, 4e	Construction of the Staged Anaerobic Fluidized Bed Membrane Reactor (SAFBMR) system began in January 2020, but it has been delayed as a result of the COVID-19 pandemic. In October 2020 the reactor, biogas holdup tank, and piping were installed and the system is starting the testing phase. In December the team won funding opportunities from USBR and the Water Board to begin investigations on the second phase of the SAF-MBR technology to treat to potable reuse levels. The lead PI for this next phase of work is Professor Bill Mitch and Dr.Criddle. Dr. Tilmans will be there to help operations go smoothly. This section of the project ends around the 2023/2024 timeframe. The project is on schedule. (1/22/2021)

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-018 Biological Double-Efficiency Process as an Advanced Wastewater Treatment Method to Achieve Substantial Energy and Water Savings	Technology Demonstration and Deployment	This project is demonstrating an efficiency technology that targets one of the major energy using steps in wastewater treatment. The Biological Double Efficiency Process (BDP) combines state of the art, easy to maintain aeration technology, airlift circulation/dilution technology, and an integrated all-in-one bioreactor technology to replace the separate anoxic and aerobic tanks associated with secondary clarifiers. The BDP is based on simultaneous nitrification and denitrification principles.	11/9/16
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-019 21st Century Solutions for 20th Century Wind Projects	Applied Research and Development	This project aimed to develop inexpensive, standardized turbine upgrades that will allow aged turbines to behave more similarly to modern turbines by dispatching on/off when it is beneficial. The upgrade was a low-cost, robust, wireless communication and control system. The project included installation of wireless communications and a field demonstration of the turbine upgrades and the forecasting algorithm at an operating wind plant in collaboration with CAISO and wind plant owners. A field test was carried out at an operating wind farm in the Tehachapi region.	3/8/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-018 Biological Double-Efficiency Process as an Advanced Wastewater Treatment Method to Achieve Substantial Energy and Water Savings	No	Demand-side Management	$1,565,400	$1,565,400	$1,429,015	N/A
EPC-16-019 21st Century Solutions for 20th Century Wind Projects	No	Generation	$810,438	$810,438	$672,149	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-018 Biological Double-Efficiency Process as an Advanced Wastewater Treatment Method to Achieve Substantial Energy and Water Savings	$1,429,015	$15,486	$0	BDP Technologies	$330,904	17.4%
EPC-16-019 21st Century Solutions for 20th Century Wind Projects	$672,149	$322,793	$0	Department of Mechanical and Aerospace Engineering - UC Davis	$124,916	13.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-018 Biological Double-Efficiency Process as an Advanced Wastewater Treatment Method to Achieve Substantial Energy and Water Savings	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-018 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	8 out of 8 bidders	BDP Technologies
EPC-16-019 21st Century Solutions for 20th Century Wind Projects	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-019 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29 out of 32 bidders	Regents of University of California, Davis

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-018 Biological Double-Efficiency Process as an Advanced Wastewater Treatment Method to Achieve Substantial Energy and Water Savings	Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-16-019 21st Century Solutions for 20th Century Wind Projects	Group 3: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-018 Biological Double-Efficiency Process as an Advanced Wastewater Treatment Method to Achieve Substantial Energy and Water Savings	The innovative BDP technology has the potential to provide substantial energy savings to wastewater treatment plants, including reducing 50 percent of the aeration required for secondary treatment, thus decreasing electrical energy requirements and greatly improves oxygen transfer efficiency to 48-52 percent compared to 20-30 percent in conventional technologies.	1f, 1h	There was a substantial period of inactivity due to COVID-19, therefore the agreement was extended to 3/31/2022. The recipient supervised equipment delivery and inspection in August. Due to Stay in Place orders, no on- site construction could occur in August. In late October 2020, the recipient did a project site condition checkup. The recipient intends to accomplish the following prior to the end of the year: complete electrical installation, complete leak repair and redo hydrostatic testing, complete equipment installation, complete laboratory setup, and continue leak repairs.
EPC-16-019 21st Century Solutions for 20th Century Wind Projects	The innovative, real-time dispatch system for legacy turbines and implementation of a low-cost, robust form of remote communication and control developed under this agreement addressed the inability to efficiently and quickly on and off dispatch turbines when grid and market conditions demand. The project delivered a low cost standardized communication and control system for aged turbines capable of remote on/off dispatch, and created a grid, market, and weather forecasting system to enable automated dispatching of turbines in response to oversupply and low/no wind conditions.	1c, 3a, 3f, 4a, 5c	Through development of the innovative, real-time dispatch system for legacy turbines and implementation of a low-cost, robust form of remote communication and control, this project addressed a key technical barrier for legacy wind plants to efficiently and quickly dispatch turbines on or off as grid and market conditions demand. The economic analysis found that a properly-sized energy storage system has the potential to reduce peak loads and associated demand charges, with a payback period of three to four years. The remote dispatch system and forecast algorithm demonstrated successful operation during a three-month field test involving nine turbines at a wind plant in Tehachapi, California and the cost of the prototype control system was reduced by 82% compared to the cost of a similar commercial system. Information on the remote dispatch system and forecast algorithm are open-source.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-020 Recovery of Lithium from Geothermal Brines	Applied Research and Development	This project demonstrated a cost-effective integrated process for the recovery of lithium from geothermal brines based on: (1) new high-capacity selective composite sorbents comprised of inorganic lithium-ion sieves and lithium-ion-imprinted polymers; and (2) a new sorbent regeneration process using eco-friendly carbon dioxide/carbonic acid that leads to the direct formation of high-purity lithium carbonate (Li2CO3). Compared to traditional methods of Li recovery from brines, the high-capacity selective sorbents and their regeneration process are expected to lower the cost of Li production by enabling online separation with higher recovery efficiency, using smaller volumes of sorbents, and minimizing processing time. The project demonstrated a laboratory-scale integrated separation process for the production of high-purity Li2CO3 from geothermal brines.	12/14/16
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-021 High-Resolution Imaging of Geothermal Flow Paths Using a Cost Effective Dense Seismic Network	Applied Research and Development	This project advanced the technology for imaging subsurface flow paths, barriers, and heterogeneity in operating geothermal reservoirs through an integrated approach that combines the recent development of low-cost, dense seismic networks together with established state-of-the-art micro-earthquake imaging algorithms and rock physics concepts. The technical advancement of this project is the integration of these components into a system that can be cost-effectively, reliably and routinely deployed in operating geothermal fields to image the movement of fluids in space and time with high-resolution and fast-turnaround time from data collection, to processing, to imaging, to rock physics interpretations.	12/14/16

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-020 Recovery of Lithium from Geothermal Brines	No	Generation	$873,387	$873,387	$873,387	N/A
EPC-16-021 High-Resolution Imaging of Geothermal Flow Paths Using a Cost Effective Dense Seismic Network	No	Generation	$1,672,639	$1,672,639	$1,672,639	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-020 Recovery of Lithium from Geothermal Brines	$873,387	$452,445	$0	None	$0	0.0%
EPC-16-021 High-Resolution Imaging of Geothermal Flow Paths Using a Cost Effective Dense Seismic Network	$1,672,639	$678,255	$0	Jarpe Data Solutions	$50,000	2.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-020 Recovery of Lithium from Geothermal Brines	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-020 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29 out of 32 bidders	SRI International
EPC-16-021 High-Resolution Imaging of Geothermal Flow Paths Using a Cost Effective Dense Seismic Network	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-021 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29 out of 32 bidders	Lawrence Berkeley National Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-020 Recovery of Lithium from Geothermal Brines	Group 2: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-16-021 High-Resolution Imaging of Geothermal Flow Paths Using a Cost Effective Dense Seismic Network	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-020 Recovery of Lithium from Geothermal Brines	This project will lead to technological advancement by enabling co-production of power and high-value metals from geothermal resources. The co-production of metals will improve the economic viability of geothermal power production, therefore increasing the penetration of geothermal renewable energy.	2a, 3g	The project successfully demonstrated the laboratory-scale Integrated Lithium Capture System. The recipient has licensed the technology to ExSorbtion, Inc. who will be pursuing commercialization.
EPC-16-021 High-Resolution Imaging of Geothermal Flow Paths Using a Cost Effective Dense Seismic Network	This project provided tools to help geothermal operations to be more productive. It demonstrated the advantages of a micro-earthquake imaging system that uses a dense network of seismic stations and automated processing to perform fast-turnaround, high-resolution imaging of fluid movement in producing geothermal reservoirs.	1c, 2a, 3a, 3b	Over 17,000 earthquakes were detected and analyzed, yielding high-resolution images of the heterogeneous structure of the reservoir. The images delineated regions with high concentrations of steam and water. Most of the results of the 3D seismic imaging were corroborated by the information contained in Calpine's 3D reservoir model, thereby demonstrating the successful application of the technology in an operational geothermal reservoir. The 91-station network remains in place and continues to collect data.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-022 Comprehensive Physical-Chemical Modeling to Reduce Risks and Costs of Flexible Geothermal Energy Production	Applied Research and Development	This project seeks to address the specific challenges of baseload and flexible-mode geothermal production, including wellbore and reservoir integrity, scaling, and corrosion. An improved model is being developed and applied to better understand these issues. Flexible mode production typically includes daily cycles in production rate that result in extraordinary stress on the wellbore and reservoir system. The modeling and assessment are being conducted to predict short- and long-term impacts of flexible-mode production on liquid-dominant geothermal reservoir systems representative in California as well as on the site-specific vapor-dominated Geysers Geothermal Field.	12/14/16
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-024 San Gabriel Valley Water Company "Plug and Play" In-Conduit Hydropower Development Project (SGVWC Project)	Applied Research and Development	The San Gabriel "Plug and Play" In-Conduit Hydropower Development Project aims to design, develop and demonstrate a modular, cost-effective in-conduit hydroelectric system designed for the sub-100-kW in-conduit hydroelectric market that will reduce civil, mechanical, electrical, and interconnection costs. The San Gabriel Project includes a new 73 kW modular "plug and play" in-conduit hydroelectric station at a space-constrained site in an urban, potable water system that will provide an estimated 381 megawatt-hours (MWh) of renewable generation per year, while also providing a model that can be deployed to many undeveloped, small sub-100 kW in-conduit sites throughout the state.	1/25/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-022 Comprehensive Physical-Chemical Modeling to Reduce Risks and Costs of Flexible Geothermal Energy Production	No	Grid Operations/Market Design	$999,032	$999,032	$810,000	N/A
EPC-16-024 San Gabriel Valley Water Company "Plug and Play" In-Conduit Hydropower Development Project (SGVWC Project)	No	Generation	$500,000	$500,000	$499,988	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-022 Comprehensive Physical-Chemical Modeling to Reduce Risks and Costs of Flexible Geothermal Energy Production	$810,000	$480,995	$0	None	$0	0.0%
EPC-16-024 San Gabriel Valley Water Company "Plug and Play" In-Conduit Hydropower Development Project (SGVWC Project)	$499,988	$13,082	$0	NLine Energy, Inc.; San Gabriel Valley Water Company	$782,000	61.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-022 Comprehensive Physical-Chemical Modeling to Reduce Risks and Costs of Flexible Geothermal Energy Production	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-022 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29 out of 32 bidders	Lawrence Berkeley National Laboratory
EPC-16-024 San Gabriel Valley Water Company "Plug and Play" In-Conduit Hydropower Development Project (SGVWC Project)	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-024 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29 out of 32 bidders	San Gabriel Valley Water Company

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-022 Comprehensive Physical-Chemical Modeling to Reduce Risks and Costs of Flexible Geothermal Energy Production	Group 2: Ranked # 3	N/A	N/A	Yes; Calif Based Entity
EPC-16-024 San Gabriel Valley Water Company "Plug and Play" In-Conduit Hydropower Development Project (SGVWC Project)	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-022 Comprehensive Physical-Chemical Modeling to Reduce Risks and Costs of Flexible Geothermal Energy Production	This project will lead to technological advancement by providing modeling tools that can be used by geothermal operators to better understand the impacts of flexible-mode production on the reservoir-wellbore system. This knowledge will allow the development of power plant and control technologies to enable geothermal power plants to operate in different variable modes, and to be both a baseload and flexible renewable resource.	2a, 3a, 5a, 5f	The modeling tools have been completed. The project team completed modeling simulations for baseload and flexible production for liquid dominant geothermal systems. The project team also modeled site specific conditions of the vapor dominated resource at The Geysers and validated the model using pilot test data. The project team will conduct further sensitivity studies to develop recommendations regarding well designs, cement properties, and production schedules to allow geothermal power plants to operate in different variable modes.
EPC-16-024 San Gabriel Valley Water Company "Plug and Play" In-Conduit Hydropower Development Project (SGVWC Project)	The project will recover wasted energy from an existing pressure-reducing station. The recipient estimates there to be about 120 similar-sized pressure reducing opportunities within California, representing 9,000 kilowatts that will become economically viable if the project is able to meet its cost reduction goals.	1a, 1b, 2a	The overall design of the project has been delayed due to a late start of the project as well as the need for completion of a water balancing study. With a turbine lead time of 6 months, a decision was made to push the project construction to fall 2018 to ensure that San Gabriel Valley Water Company can meet peak water demand in the summer time. Construction did begin in the fall of 2018 and the system was commissioned in the summer of 2019. Testing and operation are ongoing pending final reporting. The project ends on December 31, 2019.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-025 Comprehensive Assessment, Tools and Resources for Advancing In-Conduit Hydropower in California	Applied Research and Development	This project conducted a comprehensive assessment of in-conduit hydropower generation potential in California and developed a guidebook and a business case assessment tool that assist municipal, agricultural, and industrial water purveyors with the cost effective implementation of in-conduit hydropower generation projects. The proposed guidebook and the business case assessment tool will provide invaluable knowledge base for municipal (water and wastewater), agricultural and industrial agencies that are considering capturing hydrokinetic/hydrostatic energy and integrating in-conduit hydropower into the existing energy mix. The Business Case Assessment Tool will assist users with building a business case for implementation of an in-conduit hydropower project, providing qualitative and quantitative guidance on the system configuration and site characteristics for fit-for-purpose applications, and estimating preliminary life cycle cost, LCOE, and GHG emissions.	1/25/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-026 Develop and Pilot Test Flexible Demand Response Control Strategies for Water Pumping Stations and Industrial Refrigeration Plants	Applied Research and Development	The project develops technologies with the potential to achieve at least 20% demand reduction or adjustment for fast and flexible demand response (DR). The pilot demonstrations are at 2 different end use sectors: 1) a water pumping station and 2) commercial refrigerated food warehouse. The control strategies demonstrated can be replicated to show plant managers a way to integrate control strategies to reduce and adjust demand, to achieve new levels of operational reliability and efficiency.	5/10/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-025 Comprehensive Assessment, Tools and Resources for Advancing In-Conduit Hydropower in California	No	Generation	$400,000	$400,000	$399,998	N/A
EPC-16-026 Develop and Pilot Test Flexible Demand Response Control Strategies for Water Pumping Stations and Industrial Refrigeration Plants	No	Demand-side Management	$3,000,000	$3,000,000	$1,299,268	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-025 Comprehensive Assessment, Tools and Resources for Advancing In-Conduit Hydropower in California	$399,998	$121,338	$0	Leland Stanford Junior University; NLine Energy, Inc.; Stantec Consulting Services Inc.	$83,018	17.2%
EPC-16-026 Develop and Pilot Test Flexible Demand Response Control Strategies for Water Pumping Stations and Industrial Refrigeration Plants	$1,299,268	$888,920	$0	Electric Power Research Institute, Inc.; San Diego Gas and Electric Company; Southern California Edison	$465,000	13.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-025 Comprehensive Assessment, Tools and Resources for Advancing In-Conduit Hydropower in California	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-025 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29 out of 32 bidders	Stantec Consulting Services Inc.
EPC-16-026 Develop and Pilot Test Flexible Demand Response Control Strategies for Water Pumping Stations and Industrial Refrigeration Plants	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-026 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 27 out of 28 bidders	Electric Power Research Institute, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-025 Comprehensive Assessment, Tools and Resources for Advancing In-Conduit Hydropower in California	Group 1: Ranked # 4	N/A	N/A	Yes; Calif Based Entity
EPC-16-026 Develop and Pilot Test Flexible Demand Response Control Strategies for Water Pumping Stations and Industrial Refrigeration Plants	Phase 1 Group 2: Ranked # 5	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-025 Comprehensive Assessment, Tools and Resources for Advancing In-Conduit Hydropower in California	Newer in-conduit hydroelectric turbine technology research and development has not been adequately covered in any published guidebook. Available guidebooks do not include many novel technologies and lack technical information related to performance, equipment, siting criteria, engineering design considerations, and costs that will assist California's stakeholders in determining which in-conduit hydroelectric technologies are best suited for a particular site.	1a, 3a, 3b	The project team estimated the in-conduit hydropower potential in California by analyzing data collected by NLine Energy, results from a questionnaire prepared by the team and distributed to various water agencies, as well as crossing data from USGS, DWR and SWRCB database. The estimate concluded that while there is at-least 343 MW of installed in-conduit hydropower facilities in California as of 2017, there is 414 MW of remaining potential. The team also conducted eight case studies, which identified that small in-conduit hydropower projects should consider multiple scenarios at the feasibility stage to investigate different hydrologic conditions, and interconnection costs can vary considerably. The final report and assessment tool were presented in a webinar attended by more than 200 people.
EPC-16-026 Develop and Pilot Test Flexible Demand Response Control Strategies for Water Pumping Stations and Industrial Refrigeration Plants	This project develops technology that will enable industrial customers to provide automated DR service to the grid including fast ramping, operating reserves, frequency regulation, and peak load reduction in support of California's goals for DR and energy efficiency as well as renewable integration and greenhouse gas emissions reduction. For refrigerated warehouses, the ability to shed load during periods of grid stress will be important, especially during summer heat waves like those experienced in 2020.	1g	The refrigeration site team has nearly completed the data analytics. The team is making sure the data are all correct and analyzing energy consumption from miscellaneous (non-refrigeration) loads. The water site team has resolved the issue of tank cycling constraints and is adding corresponding software requirements and the user interface to include new information. The water team is now testing the software prior to a demonstration of the demand response tool for California Water Service.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-027 Facilitating On-farm Participation in Energy Demand Management Programs	Applied Research and Development	This project is developing a management tool for optimizing irrigation at ten farms in California. The sites have varied water requirements, growing a mix of almonds and alfalfa. The project is validating a pre-commercial water management system that allows irrigators to have more flexibility over when they irrigate and use energy. Instead of adding water whenever the soil is dry, this system will manage plant stress so that water can be delivered when needed by the plant and when electricity costs are low. The irrigation management technology enables irrigators to participate in utility demand response, time-of-use, and automated demand response incentive programs offering cost savings benefits to customers who can shift their energy demand.	3/8/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-028 Irvine Ranch Water District Load Shifting and Demand Response Pilot Project	Applied Research and Development	This project develops, tests, and validates a load-shifting optimization platform to reduce energy use and demand charges in the water sector. The platform advances pre-commercial demand response technologies to reduce: peak demand, energy use, and operational costs. The platform integrates advanced real-time monitoring, automated load shifting control, energy storage, and a pre-commercial cost optimization platform. Data generated by the project will validate the approach and identify best practices for increasing water sector participation in demand response programs.	3/8/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-027 Facilitating On-farm Participation in Energy Demand Management Programs	No	Demand-side Management	$1,588,872	$1,588,872	$914,640	N/A
EPC-16-028 Irvine Ranch Water District Load Shifting and Demand Response Pilot Project	No	Demand-side Management	$1,403,465	$1,403,465	$560,886	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-027 Facilitating On-farm Participation in Energy Demand Management Programs	$914,640	$153,035	$0	Irrigation for the Future, Inc.	$126,663	7.4%
EPC-16-028 Irvine Ranch Water District Load Shifting and Demand Response Pilot Project	$560,886	$832,615	$0	Advanced Microgrid Solutions, Inc.	$760,427	35.1%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-027 Facilitating On-farm Participation in Energy Demand Management Programs	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-027 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 27 out of 28 bidders	Irrigation for the Future, Inc.
EPC-16-028 Irvine Ranch Water District Load Shifting and Demand Response Pilot Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-028 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 27 out of 28 bidders	Advanced Microgrid Solutions, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-027 Facilitating On-farm Participation in Energy Demand Management Programs	Phase 1 Group 2: Ranked # 4	N/A	N/A	None
EPC-16-028 Irvine Ranch Water District Load Shifting and Demand Response Pilot Project	Phase 1 Group 2: Ranked # 3	N/A	N/A	Yes; Calif Based Entity, Woman Own

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-027 Facilitating On-farm Participation in Energy Demand Management Programs	The project results in testing an irrigation management system to facilitate use of partial irrigation strategies, enabling flexible energy load control. This will allow irrigators to participate in utility demand response and time of use programs, providing grid flexibility.	1b, 1e, 1f, 1g, 2a, 4c	The research team continues to collect in-season measurement and observations at the cooperating farms in preparation for the third season field trial of the automated irrigation management system, Irrigation Management Online (IMO). This system employs automated data integration that can generate updated irrigation schedules which is sent to the grower on-demand via the updated IMO interface. The IMO system informs the growers of the water use and yield reduction consequences of participating in any demand response (DR) or Auto DR event.
EPC-16-028 Irvine Ranch Water District Load Shifting and Demand Response Pilot Project	The project integrates several pre-commercial and commercial technologies into a platform that enables operational equipment and energy storage resources to respond automatically to energy price signals. The integrated approach promotes greater participation in demand reduction events, including the ability to participate without prior-day notice.	1e, 1f, 1g, 1h, 4a	Battery energy storage systems (BESS) were installed at six sites and enrolled in the Local Capacity Requirements (LCR) program with a total capacity of 6.5 MW/35 MWh. The systems were controlled by the Platform which optimized the BESS operation to maximize value of demand charge management (DCM) and demand response (DR) programs. Performance data was used to evaluate project performance according to six key performance indicators, peak demand and peak usage reduction; DR performance; bill reduction; GHG reduction; and tariff impact. The BESS effectively reduced on-peak energy use and curtailed consumption during LCR events. However, this did not translate into lower operating costs. Bills increased by 1-2%. GHG emissions and electricity consumption were also higher post-BESS, likely due to battery round-trip inefficiencies. Varied performance with regard to on-peak demand and global peak demand reduction reflects the complexity of co-optimizing BESS for DCM and DR participation.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-029 Water/Energy Bank Proof-of-Concept	Applied Research and Development	This proof of concept study evaluated the feasibility of using groundwater storage and cycling surface reservoirs to shift the State Water Project's Southern California water deliveries to non-summer months to reduce summer electric grid peak demand. Shifting the timing of water deliveries could reduce solar and wind power over-generation risk during non-summer months when renewable energy is in surplus. This project investigated the technical, institutional, legal and economic feasibility of implementing a guaranteed water delivery shift and develop demand response and load shifting tools and strategies to manage peak load and demand and thereby reduce energy costs in the water sector.	3/8/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-030 Enabling Energy Efficient Data Centers in Smart Power Distribution Systems	Applied Research and Development	This project is researching and testing technologies that improve data center energy efficiency at three different levels in a smart power distribution system. The technologies include increasing server energy efficiency, through coordinated deep sleep and dynamic voltage-frequency scaling (DVFS); data center workload balancing through phase and load balancing across multiple servers in a data center; and geographical workload balancing through phase/load balancing in a single or multiple power distribution network or feeder.	3/8/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-029 Water/Energy Bank Proof-of-Concept	No	Demand-side Management	$1,000,000	$1,000,000	$824,854	N/A
EPC-16-030 Enabling Energy Efficient Data Centers in Smart Power Distribution Systems	No	Demand-side Management	$1,783,118	$1,783,118	$1,277,942	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-029 Water/Energy Bank Proof-of-Concept	$824,854	$150,000	$0	Antelope Valley Water Storage, LLC	$225,000	18.4%
EPC-16-030 Enabling Energy Efficient Data Centers in Smart Power Distribution Systems	$1,277,942	$306,631	$0	San Jose State Research Foundation; The Regents of the University of California (UC Riverside)	$297,064	14.3%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-029 Water/Energy Bank Proof-of-Concept	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-029 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 27 out of 28 bidders	Antelope Valley Water Storage, LLC
EPC-16-030 Enabling Energy Efficient Data Centers in Smart Power Distribution Systems	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-030 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 27 out of 28 bidders	Regents of the University of California, Riverside Campus

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-029 Water/Energy Bank Proof-of-Concept	Phase 1 Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-16-030 Enabling Energy Efficient Data Centers in Smart Power Distribution Systems	Phase 1 Group 1: Ranked # 3	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-029 Water/Energy Bank Proof-of-Concept	The project could lower peak demand on the electric grid during Summer months when power demand is at its highest levels. This will increase the reliability of the electric grid system, reduce the use of peaker plants that operate on fossil fuels to meet system demand and operating margins, and lower Department of Water Resource's water transport costs by shifting electric demand to non-summer months when demand and energy rates are lower.	1e, 1f, 4a, 5b	This project was completed in July 2019. The technical and final reports are complete. Using the Edmonston pumping plant for the analysis, implementation of the Recipient's recommendations would lead to an average peak load reduction of 60 MW from July to September based on a normal water year. A notable finding is the possibility of converting the Water-Energy Bank into an energy neutral operation through the use of 40 MW of solar arrays and 5 MW of hydropower. The Recipient presented the Water-Energy Bank concept at the Demand Response and Distributed Energy Resources World Forum on October 16, 2018 and American Water Works Association CA-NV spring conference The Recipient also plans to publish results in journals and disseminate results at future conferences after the end of the grant period.
EPC-16-030 Enabling Energy Efficient Data Centers in Smart Power Distribution Systems	Data centers are a major consumer of electricity. In the PG&E service territory, peak demand of data centers is around 500 MW, representing 2.5% of peak load consumption. The energy use from data centers is expected to increase by 4% annually in the next 5-10 years. The development of agile energy efficiency solutions for data centers is needed. This project provides unique software-based solutions, rather than hardware solutions, to reduce electricity consumption by data centers through deep sleep and dynamic voltage frequency scaling, peak efficiency scheduling and spatial workload scheduling. If successful, potential electricity savings of up to 35% could result to data centers in California.	1f, 1g, 2a	The project team has completed the modeling of the Peak Efficiency Scheduling Algorithm and have preliminary average results of approximately 15% overall energy usage reduction. The project team is now working on the development of load migration and demand response algorithms. Early examples show nearly perfect compliance. The servers can effectively move their demand within milliseconds. Due to COVID-19, project progress has slowed since students are not allowed on campus. The project was granted a 9-month no cost time extension. The final report is in progress.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-031 VOLTTRON Testing Tool Kit	Applied Research and Development	This federal cost share project demonstrates the benefits of the VOLTTRON platform for DER management through the testing of the VOLTTRON Testing Tool Kit. VOLTTRON is a US Department of Energy funded open source platform intended to provide a software base for integrating management of energy demand in buildings, distributed energy resources, and the electrical grid. The tool kit includes simulation test suites, a platform monitoring and debugging tool, and more extensive database support to promote wider adoption of VOLTTRON platform beyond its original set of developers. By lowering implementation costs and adding easy adoption features, the tool kit encourages adoption by other users, including organizations and private entities seeking to develop DER integration projects.	3/8/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-032 Leading in Los Angeles: Demonstrating Scalable Emerging Energy Efficient Technologies for Integrated Facade, Lighting and Plug Loads	Technology Demonstration and Deployment	The recipient is demonstrating and validating new retrofit package solutions from laboratory pre-testing through field demonstrations in existing government-owned commercial buildings. The solution sets, dubbed "INTER", are comprised of shading products from Rollease Acmeda and lighting and plug load systems and integrated controls, including HVAC systems, from Enlighted. The technologies can be combined and customized to suit a variety of building types and spaces, resulting in an estimated whole building energy reduction of 20 to 32 percent. Beginning in the Los Angeles basin, the team is leveraging existing market connections to increase and accelerate market adoption of these retrofit solution sets to maximize the potential energy and carbon savings, first in the region and ultimately, throughout California.	3/8/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-031 VOLTTRON Testing Tool Kit	No	Demand-side Management	$70,000	$70,000	$70,000	N/A
EPC-16-032 Leading in Los Angeles: Demonstrating Scalable Emerging Energy Efficient Technologies for Integrated Facade, Lighting and Plug Loads	No	Demand-side Management	$4,981,000	$4,981,000	$4,562,177	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-031 VOLTTRON Testing Tool Kit	$70,000	$28,501	$805,000	None	$0	0.0%
EPC-16-032 Leading in Los Angeles: Demonstrating Scalable Emerging Energy Efficient Technologies for Integrated Facade, Lighting and Plug Loads	$4,562,177	$1,767,847	$0	Southern California Edison; CSU Dominguez Hills; Lawrence Berkeley National Laboratory; Rollease Acmeda, Inc.; Delos; BeMO USA Corp; City of Santa Ana; Daintree	$1,725,500	25.7%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-031 VOLTTRON Testing Tool Kit	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-031 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	43 bidders	SLAC National Accelerator Laboratory
EPC-16-032 Leading in Los Angeles: Demonstrating Scalable Emerging Energy Efficient Technologies for Integrated Facade, Lighting and Plug Loads	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-032 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 8 out of 10 bidders	New Buildings Institute, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-031 VOLTTRON Testing Tool Kit	N/A ***	N/A ***	N/A	Yes; Calif Based Entity
EPC-16-032 Leading in Los Angeles: Demonstrating Scalable Emerging Energy Efficient Technologies for Integrated Facade, Lighting and Plug Loads	Phase 1 Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-031 VOLTTRON Testing Tool Kit	Communication of DERs with grid operators is critical for successful utilization of distributed energy resources. DOE developed the VOLTTRON platform to facilitate such communication. However, the platform is in its early stages and requires additional support and an expanded user base to become widely adopted. The VOLTTRON Testing Tool Kit provides new tools to confidently run a high qualify open source project. All knowledge gained and software written will be pushed to GitHub for open source use. With the testing tool kit, VOLTTRON becomes a more effective platform for DER management. This will enable higher utilization of DERs in support of the state's renewable energy and GHG reduction goals.	1d, 1e, 1f, 1g, 1h, 4a, 5b	The project objective was to facilitate adoption and demonstrate the benefits of the VOLTTON platform for DER management systems. The project team set out to increase the VOLTTRON user community and increase its diversity in order to move VOLTTRON closer to reaching a critical mass needed for widespread market adoption. The project team created awareness among the DER industry and utilities through the project and added several new companies that engaged with the VOLTTON. The project team found that the DER industry is further along in their integration effort and switching to VOLTTON could cost them significant effort and time. However, the new capabilities added with this project should help speed up the newcomers' development efforts should they chose to utilize VOLTRTRON. All tools developed contributed back to the VOLTTRON open source repository on GitHub.
EPC-16-032 Leading in Los Angeles: Demonstrating Scalable Emerging Energy Efficient Technologies for Integrated Facade, Lighting and Plug Loads	This project creates a holistic, low-barrier integrated retrofit solution for significant energy savings. The scalable energy retrofit solution will be demonstrated in municipal government buildings but is also applicable to other commercial and residential buildings and to new construction and existing buildings. Installation does not require specialized training. The integration of technologies can produce higher savings than individual technologies operated in isolation. Creating building retrofit solutions that are least disruptive to building occupants while solving energy, occupant and owner issues are key to providing solutions that will support California's statewide zero net energy and existing building goals.	1f, 1h	Installation of automated shades, HVAC controls and all lighting retrofits were completed in both the City of Santa Ana and CSU Dominquez Hills buildings. Preliminary findings from the integrated retrofit indicate energy savings of 62% in the winter and 76% in the summer, relative to the existing building baseline. In 2020, the recipient received a no cost time extension due to COVID-19. The added time is needed to revise the M&V plans based on reduced occupancy, and to update the Technology Transfer strategy in light of the changes due to the pandemic.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-033 Internet of Things and Ubiquitous Sensing in University Building Energy Management: Design Optimization and Technology Demonstration	Technology Demonstration and Deployment	This project is demonstrating and assessing a pre-commercial integrated energy management system based on internet of things (Iot) to achieve control of lighting HVAC and plug loads in a building on the CSU Long Beach campus.	3/8/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-033 Internet of Things and Ubiquitous Sensing in University Building Energy Management: Design Optimization and Technology Demonstration	No	Demand-side Management	$2,509,946	$2,509,946	$1,847,337	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-033 Internet of Things and Ubiquitous Sensing in University Building Energy Management: Design Optimization and Technology Demonstration	$1,847,337	$78,271	$0	Regents of the University of California, Riverside Campus; CSU Long Beach Research Foundation; Enlighted Inc.; ControlWorks, Inc.; Wayne State University	$1,072,958	29.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-033 Internet of Things and Ubiquitous Sensing in University Building Energy Management: Design Optimization and Technology Demonstration	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-033 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 8 out of 10 bidders	CSU Long Beach Research Foundation

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-033 Internet of Things and Ubiquitous Sensing in University Building Energy Management: Design Optimization and Technology Demonstration	Phase 1 Group 2: Ranked # 2	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-033 Internet of Things and Ubiquitous Sensing in University Building Energy Management: Design Optimization and Technology Demonstration	The project aims to remove barriers to achieve widespread deployment of state-of-the-art energy management technologies. The project provides California IOUs, academic institutions (universities, including 22 CSU campuses), energy management technology developers, and other stakeholders with an IOT-based energy management platform. Additionally, the project provides a comprehensive example of the potential for large scale deployment, including technical considerations, building performance, energy savings, and non-energy benefits.	1f, 1g, 1h	The recipient chose not to extend the agreement to 2022, A shorter term extension date of May 31, 2021 is being developed for approval. The team expects to be able to complete the deliverables by the revised end date. They continues to evaluate the building's ability to participate in Demand Response (DR) . The campus has been closed since March 2020 due to pandemic. The team has completed more than 5 months of data from the normal operation of the HVAC system. They also have HVAC system data after March, 2020 and until December 2020, which satisfied the 9 months of data, but with a different occupancy than baseline. The team analyzed the overall building energy consumptions from September 2019 until December 2020. The results show that the new technologies consistently reduce the building energy consumptions by more than 20%.CSU system suggests there are plans to repopulate the campuses at greater percentages will be in the fall of 2021.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-034 Automated Cloud-Based Continuously Optimizing Building Energy Management System	Technology Demonstration and Deployment	This project develops a software platform that helps building energy management systems run more effectively. The Automated Cloud-based Continuously Optimizing Building Energy Management System (ACCO-BEMS) automates and optimizes control of building systems and devices. It is being implemented at Pomona College in 10 buildings on campus, half of which will have ACCO-BEMS as a new building energy management system, the other half will have ACCO-BEMS integrated with the existing system.	3/8/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-035 High-Performance Cu-Plating for Heterojunction Silicon Cells, Based on Ultra-Low-Cost Printed Circuit Board (PCB) Technology (Stage II)	Applied Research and Development	This project develops a next generation manufacturing tool for low-cost, high-performance copper patterning on solar photovoltaic cells using technologies from printed circuit board manufacturing, reducing costs by up to 35%, and increasing cell efficiency by 15%.	4/12/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-034 Automated Cloud-Based Continuously Optimizing Building Energy Management System	No	Demand-side Management	$2,500,000	$2,500,000	$2,295,000	N/A
EPC-16-035 High-Performance Cu-Plating for Heterojunction Silicon Cells, Based on Ultra-Low-Cost Printed Circuit Board (PCB) Technology (Stage II)	No	Generation	$2,430,000	$2,430,000	$1,711,084	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-034 Automated Cloud-Based Continuously Optimizing Building Energy Management System	$2,295,000	$552,488	$0	Zero Net Energy (ZNE) Alliance; MelRok, LLC	$1,184,891	32.2%
EPC-16-035 High-Performance Cu-Plating for Heterojunction Silicon Cells, Based on Ultra-Low-Cost Printed Circuit Board (PCB) Technology (Stage II)	$1,711,084	$730,620	$9,540,309	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-034 Automated Cloud-Based Continuously Optimizing Building Energy Management System	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-034 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 8 out of 10 bidders	Zero Net Energy (ZNE) Alliance
EPC-16-035 High-Performance Cu-Plating for Heterojunction Silicon Cells, Based on Ultra-Low-Cost Printed Circuit Board (PCB) Technology (Stage II)	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-035 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	43 bidders	Sunpreme, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-034 Automated Cloud-Based Continuously Optimizing Building Energy Management System	Phase 1 Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-16-035 High-Performance Cu-Plating for Heterojunction Silicon Cells, Based on Ultra-Low-Cost Printed Circuit Board (PCB) Technology (Stage II)	N/A ***	N/A ***	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-034 Automated Cloud-Based Continuously Optimizing Building Energy Management System	Energy performance monitoring and fault detection diagnostics software is a key technology that must be further enhanced and deployed to overcome barriers to achieving ZNE buildings. A principal barrier to real-time management of energy systems is the many, often incompatible, protocols and interfaces used by energy devices and sensors. These have long represented a barrier to the integration of discrete systems, sensors and actuators necessary to automatically assess and control energy use. This project uses an internet-of-things gateway to communicate with the various energy using devices in the building using their native protocol and interface. The platform uses machine learning to assess real-time building performance and automatically adjust individual devices. The technology eliminates building drift and negates the need for expensive reprogramming or optimization measures.	1f, 1h, 4a	The ACCO-BEMS platform has been installed at 10 campus buildings, HVAC systems commissioned, and additional sensors and actuators installed. The platform successfully identified a number of problems and retrofitting opportunities that would have required costly manual recommissioning to uncover. The fault detection engines use physics-based rules and artificial intelligence based pattern recognition to detect failures. The project team continues to develop applications to modify HVAC scheduling based on real-time occupancy data. In March, 2020, the campus was closed in response to the COVID-19 pandemic. Uncertainty around when the campus might reopen delayed start of the M&V period. When it became clear the campus would not reopen in Fall 2020, the project team updated their M&V approach in order to proceed with calculating the estimated project savings. A 12-month time extension was approved allowing additional time to complete M&V and final reporting.
EPC-16-035 High-Performance Cu-Plating for Heterojunction Silicon Cells, Based on Ultra-Low-Cost Printed Circuit Board (PCB) Technology (Stage II)	The project is developing a next generation manufacturing tool for low-cost, high-performance copper patterning on solar photovoltaic cells using technologies from printed circuit board manufacturing. This new process will lower electricity-related greenhouse gas (GHG) emissions and improve solar cell efficiency.	1b, 1c, 2a, 3b, 4a	This project was completed in 2019. The research team developed and tested next generation manufacturing at a pilot scale for copper patterning on silicon photovoltaic cells. This includes the following steps: dual-sided exposure for high-throughput wafer patterning, cell development, cell stripping, cell etching and lamination. The project team manufactured solar photovoltaic cells with 24.03% efficiency, performed in-house reliability testing, and received certification from an independent laboratory. Completion of the final project task of integrating the process into a large-scale PV cell factory was inhibited by a lack of additional investment.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-036 Thermoelectric Generator Application and Pilot Test in a Geothermal Field	Applied Research and Development	Thermoelectric Generator (TEG) technologies have the potential to produce geothermal electricity without as much infrastructure (turbines, steam piping, etc.), thus making small-scale production and geothermal-powered microgrids both practicable and affordable. Small (below 5 MW) geothermal projects could provide consumers with the same distributed power flexibility provided by solar and wind production with the additional benefit of being a more reliable baseload source of electricity. TEG technologies can also allow geothermal heat to provide balancing and grid support. This project is scaling up a TEG from the watt-level in the lab to a 20-kW unit for demonstration in a geothermal reservoir.	4/12/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-037 The Amador Water Agency In-Conduit Hydropower Development Project (AWA Project)	Applied Research and Development	The goal of this project is to design, test, and demonstrate a 417 kW in-conduit Pelton turbine runner at an existing Pressure Reducing Station (PSR) site located in Ione, California. The project will demonstrate the ability to maximize the wasted energy captured at the station using an improved design of a higher-efficiency Pelton turbine runner specifically designed for small, in-conduit hydroelectric applications to contribute in the integration of in-conduit small hydropower into the existing state energy mix.	4/12/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-036 Thermoelectric Generator Application and Pilot Test in a Geothermal Field	No	Generation	$1,280,000	$1,280,000	$723,631	N/A
EPC-16-037 The Amador Water Agency In-Conduit Hydropower Development Project (AWA Project)	No	Generation	$750,000	$750,000	$596,652	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-036 Thermoelectric Generator Application and Pilot Test in a Geothermal Field	$723,631	$310,473	$0	Leland Stanford Junior University; AltaRock Energy, Inc.	$118,095	8.4%
EPC-16-037 The Amador Water Agency In-Conduit Hydropower Development Project (AWA Project)	$596,652	$0	$0	NLine Energy, Inc.; Amador Water Agency	$1,115,000	59.8%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-036 Thermoelectric Generator Application and Pilot Test in a Geothermal Field	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-036 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 20 out of 20 bidders; phase 2: 9 out of 9 bidders	AltaRock Energy, Inc.
EPC-16-037 The Amador Water Agency In-Conduit Hydropower Development Project (AWA Project)	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-037 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29 out of 32 bidders	Amador Water Agency

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-036 Thermoelectric Generator Application and Pilot Test in a Geothermal Field	Group 1: Ranked # 3	N/A	N/A	None
EPC-16-037 The Amador Water Agency In-Conduit Hydropower Development Project (AWA Project)	Group 1: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-036 Thermoelectric Generator Application and Pilot Test in a Geothermal Field	This project will develop a means to expand use of low temperature and stranded geothermal resources by making small scale production both practicable and affordable.	1a, 1b, 1c, 2a, 3b	The project team deployed two small test units (about 100 and 500 watts each) at the geothermal site as a test run. The lessons learned helped the team make improvements to the design and process. The final phase of this project involves building and deploying the scaled up 20-kW system at the same geothermal site. Demonstrating the technology at this scale will help improve efficiency and cost and bring the technology closer to commercialization.
EPC-16-037 The Amador Water Agency In-Conduit Hydropower Development Project (AWA Project)	The system developed under this project will recover and maximize the capture of wasted energy in a Pressure Reducing Station (PRS); improve the efficiency, performance, and cost of the Pelton turbine technology to capture wasted energy; provide a viable retrofit solution; and help expand small hydropower deployment.	1a, 1b, 1c, 3a, 3b, 4a	The project completed the design phase and contracted with Gilkes to manufacture the turbine, which was delivered in the spring of 2019. AWA also procured a general contractor, Central Sierra Electric, to construct the project. Construction began in fall of 2018. Installation of the turbine and balancing of the plant began in late spring of 2019 continued through the fall. Due to the covid-19 pandemic, Gilkes had not been able to travel to the United States for the commissioning and startup. AWA has hired a local firm to assist in the project startup, testing, and commissioning. The battery test report is approved by PG&E and the project team is planning the PG&E PPI (Pre-Parallel Inspection) to test the switchgear. Once the PPI is complete, AWA will be looking for a PTO (permission to operate) letter from PG&E. The project is expected to conclude by March 2022.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-038 Use of Indoor Rearing for Head-Starting Desert Tortoises	Applied Research and Development	The project has conducted experimental releases of juvenile desert tortoises raised since 2011-2013 and new hatchlings in 2016-2017 to evaluate the trade-offs of head-start duration on post-release survival of desert tortoises. The project team divided new hatchlings into two cohorts, raising half of them exclusively outdoors and the other half under a combination of indoor/outdoor rearing, releasing them as 2 year olds, and comparing their post-release survival. Data on the growth and survival of animals in this study will provide guidance on the minimum duration of outdoor head-starting and whether indoor head-starting should be pursued in future head-starting programs for desert tortoises. Ultimately, the results of the study can inform the extent to which head-starting both indoors and outdoors is a viable solution for mitigating localized impacts to tortoise populations affected by development for solar energy production facilities.	4/12/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-039 A Life Cycle Assessment of the Environmental and Human Health Impacts of Emerging Energy Storage Technology Deployment	Applied Research and Development	This project investigated whether flow batteries are a viable option for providing grid energy storage at the large scale, either in place of or alongside lithium-ion battery technology. The researchers are examining a life cycle-based characterization of the environmental impacts and resource usage associated with three chemistries of flow batteries (Vanadium Redox (V2O5), Zinc-Bromide (ZnBr), and Iron-Sodium (FeNa)). The research focused on materials use, energy use, and toxic waste outputs of the life cycle phases of each flow battery type, including materials extraction, manufacturing, use, and disposal or recycling as applicable.	4/12/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-038 Use of Indoor Rearing for Head-Starting Desert Tortoises	No	Generation	$493,089	$493,089	$384,676	N/A
EPC-16-039 A Life Cycle Assessment of the Environmental and Human Health Impacts of Emerging Energy Storage Technology Deployment	No	Distribution	$600,000	$600,000	$598,901	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-038 Use of Indoor Rearing for Head-Starting Desert Tortoises	$384,676	$106,461	$400,000	The Regents of the University of California, Davis Campus	$61,119	11.0%
EPC-16-039 A Life Cycle Assessment of the Environmental and Human Health Impacts of Emerging Energy Storage Technology Deployment	$598,901	$98,142	$0	The Regents of the University of California, Irvine	$186,219	23.7%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-038 Use of Indoor Rearing for Head-Starting Desert Tortoises	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-038 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	14 out of 14 bidders	Regents of University of California, Davis
EPC-16-039 A Life Cycle Assessment of the Environmental and Human Health Impacts of Emerging Energy Storage Technology Deployment	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-039 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	14 out of 14 bidders	The Regents of the University of California, Irvine

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-038 Use of Indoor Rearing for Head-Starting Desert Tortoises	Group 2: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-16-039 A Life Cycle Assessment of the Environmental and Human Health Impacts of Emerging Energy Storage Technology Deployment	Group 5: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-038 Use of Indoor Rearing for Head-Starting Desert Tortoises	The research will be the first to evaluate the trade-offs in duration of head-starting on post-release survival in the eastern Mojave Desert where numerous solar production facilities have been recently constructed. Because longer head-start periods cost more, finding the optimal head-starting duration will help develop more cost-effective head-starting programs. The research will also evaluate indoor-head-starting. If the increase in size also results in an increase in post-release survival compared to outdoor-reared animals, indoor head-starting could dramatically reduce the costs of rearing animals to releasable size and also increase production of head-starting facilities.	2a, 3a, 3b, 4f, 4g	The research team produced tortoise hatchlings in 2016 and 2017 and assigned them either to the indoor or outdoor experimental groups. The indoor group was raised indoors in their first year and then transitioned to outdoor pens for the second year of their head-starting. All captive tortoises were measured to track their growth rates in different treatments. In September 2018, the team released 78 juvenile tortoises and began post-release monitoring using radio telemetry; the remainder were released in Fall 2019. Data collection has been completed and data analysis of all captive and released animals is underway. The project team is collaborating closely with a complementary project (EPC-16-053), as well as with U.S. Fish and Wildlife Service and California Department of Fish and Wildlife to develop guidelines and recommendations about the mitigation and recovery strategy.
EPC-16-039 A Life Cycle Assessment of the Environmental and Human Health Impacts of Emerging Energy Storage Technology Deployment	This project provides guidance for California policymakers and planning agencies for selecting emerging energy storage technologies that can facilitate the increased uptake of renewable resources and decarbonization of California's energy system, helping safeguard the environment and public health. This study is a first of its kind for flow battery technology and provides the knowledge base needed for flow batteries to be deployed in a safe and environmentally sensitive manner.	2a, 3e, 4b, 4c, 4d, 4e, 4f, 5d, 5e	Results from the life cycle assessment suggest that Vanadium-Redox flow battery exhibited the highest environmental impacts and potential human health hazards, and the highest material cost -- $491/kWh across its life cycle. These impacts are attributable to the carbon emission intensity and high market prices for materials used to produce the vanadium pentoxide electrolyte. Production of the All-Iron flow battery exhibited the lowest impacts according to 6 of the 8 environmental indicators as well as the lowest potential human health hazards, and material costs of $196/kWh. Production of the Zinc-Bromide flow battery exhibited environmental and human health impacts at a level between the other two battery chemistries, and the lowest materials costs of $153/kWh. These results are very sensitive to assumptions about the life cycle inventories and the materials chosen for these specific systems.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-040 Assessing Cooling Tower PM2.5 and PM10 Emissions using Advanced Instrumentation, Plume Transects, and Plume Modeling	Applied Research and Development	Current methods estimating PM emissions from cooling towers are rough approximations at best and most likely overestimate those emissions. This leads to power plant operators pursuing more expensive PM reduction than may actually be required. This project measured PM2.5 and PM10 across the spray drift plume from two power plant cooling towers that use fresh water and brackish water. These measurements are being used to develop and validate a model of power plant PM2.5 and PM10 emissions that will provide power plant operators and air quality agencies a methodology to accurately estimate PM2.5 and PM10 emissions of brackish water use in cooling towers.	4/12/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-041 Benefits and Challenges in Deployment of Low GWP A3 Refrigerants in Residential and Commercial Cooling Equipment	Applied Research and Development	This project develops test procedures and conducts testing for alternative refrigerants to assess flammability and to characterize energy savings. The recipient will also develop a favorability index of end-use market segments and equipment types based on potential GHG savings and commercial adoption feasibility. Results will be shared with the industry through public seminars, technical reports and journals, and conferences. The TAC includes manufacturing, codes and standards, and policy entities to help guide the research.	4/12/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-040 Assessing Cooling Tower PM2.5 and PM10 Emissions using Advanced Instrumentation, Plume Transects, and Plume Modeling	No	Generation	$700,000	$700,000	$598,457	N/A
EPC-16-041 Benefits and Challenges in Deployment of Low GWP A3 Refrigerants in Residential and Commercial Cooling Equipment	No	Demand-side Management	$500,000	$500,000	$460,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-040 Assessing Cooling Tower PM2.5 and PM10 Emissions using Advanced Instrumentation, Plume Transects, and Plume Modeling	$598,457	$108,004	$0	None	$0	0.0%
EPC-16-041 Benefits and Challenges in Deployment of Low GWP A3 Refrigerants in Residential and Commercial Cooling Equipment	$460,000	$221,625	$0	Institute for Governance and Sustainable Development	$500,000	50.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-040 Assessing Cooling Tower PM2.5 and PM10 Emissions using Advanced Instrumentation, Plume Transects, and Plume Modeling	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-040 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	14 out of 14 bidders	The Regents of the University of California, Davis Campus
EPC-16-041 Benefits and Challenges in Deployment of Low GWP A3 Refrigerants in Residential and Commercial Cooling Equipment	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-041 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	14 out of 14 bidders	Lawrence Berkeley National Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-040 Assessing Cooling Tower PM2.5 and PM10 Emissions using Advanced Instrumentation, Plume Transects, and Plume Modeling	Group 4: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-16-041 Benefits and Challenges in Deployment of Low GWP A3 Refrigerants in Residential and Commercial Cooling Equipment	Group 7: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-040 Assessing Cooling Tower PM2.5 and PM10 Emissions using Advanced Instrumentation, Plume Transects, and Plume Modeling	The research team is using plume measurements from fresh and brackish water-cooling towers to develop a model of the droplet and particle size distribution changes in cooling tower plumes as a function of cooling water composition, meteorological conditions, and cooling tower operating parameters. The model is based on first principles of chemistry and physics and is being validated using the measurement data. The model supports the use of brackish water instead of expensive fresh water, leading to decreased costs for electric utilities and ratepayers and freeing up more fresh water for use in homes, industry, and agriculture in California.	1c, 2a, 3a, 4b, 4c	The research team has completed measuring PM in the cooling tower plume at three operating power plants. A third power plant was added to allow for sampling at a cooling tower with brackish water. The team is currently analyzing the data collected from the plume measurements and is working on developing the model to allow power plant operators and regulatory agencies to accurately estimate PM emissions from cooling towers. The project is on schedule to be completed by March 2021.
EPC-16-041 Benefits and Challenges in Deployment of Low GWP A3 Refrigerants in Residential and Commercial Cooling Equipment	This project is evaluating alternative, low global warming potential (GWP) refrigerants that will also result in increased energy efficiency of cooling equipment. This project will identify current barriers and technical issues, and assess the potential for an expanded set of products which could use low GWP A3 refrigerants. The recipient will (1) develop test procedures for alternative refrigerants for flammability and energy savings characterization and (2) develop a favorability index of end-use market segments and equipment types based on potential GHG savings impact and commercial feasibility and adoption. This can help equipment manufacturers with product development and adopt equipment with much lower lifetime GHG emissions. By transitioning to refrigerants with lower GWP, the state will see fewer GHG emissions from commercial and residential buildings over the next 10-30 years.	1f, 1h, 4a	The recipient has started testing room air conditioning units as well as mini-split and packaged terminal air conditioning units. The team is also performing soft-optimization tests of room air conditioning units to determine unit-level efficiency and capacity. The team completed a differential lifecycle cost analysis of low GWP room air conditioner costs with A3 R-290 refrigerant versus R-22. The cost is about 10% higher for R-290 due to the need for additional safety equipment and are confident that this is the upper bound on the manufacturing cost difference. The team will next develop scenarios for room AC adoption and energy, GHG, and cost impacts for California based on their cost analysis and test results for energy efficiency and cooling capacity. Project end date has been extended to August 30, 2021 due to COVID-19-related delays.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-042 Low-Cost High-Reliability Thermoelectrics for Waste Heat Conversion	Applied Research and Development	This project is developing a cost-effective mid- to high-temperature range (400-800 C) thermoelectric material for waste heat recovery using silicon nanowire arrays. The intent is to surpass technologies implementing an organic Rankine cycle or similar processes by having low parasitic losses, compact structure, and ability to be modularized for a broad scale of distributed applications. To achieve the goal, the project will advance the state of the art in nanowire characterization; demonstrate an optimized process for the production of Si nanowire arrays and a process to produce a freestanding array of aligned nanowires; characterize the thermoelectric and mechanical properties of these arrays and single Si nanowire; optimize the fabrication of the Si nanowire arrays; and integrate these arrays into devices capable of heat-to-power conversion. The results of device performance will be used to evaluate the techno-economic impacts of this technology. Taken together, the project will move silicon nanowire technology's Technology Readiness Level (TRL) from 2 to a prototype technology demonstration in a relevant environment (TRL of 5).	4/12/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-043 Cost-Effective and Climate Resilient In-Conduit Hydropower and Civil Works Innovation	Applied Research and Development	This aim of this project was to scale in-canal hydropower retrofits by lowering project footprint and civil works costs. As most drop structures in irrigation canals have a consistent design, the goal was to design and implement a modular powerhouse and standard plant design that can be replicated across irrigation drops in California. Using a simple and more easily scalable design will support the installation of the system across the low-head sites identified across California with in-canal potential. However, this project termed out incomplete.	4/12/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-042 Low-Cost High-Reliability Thermoelectrics for Waste Heat Conversion	No	Generation	$2,000,000	$2,000,000	$1,375,000	N/A
EPC-16-043 Cost-Effective and Climate Resilient In-Conduit Hydropower and Civil Works Innovation	No	Generation	$954,715	$954,715	$97,010	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-042 Low-Cost High-Reliability Thermoelectrics for Waste Heat Conversion	$1,375,000	$440,167	$0	The Board of Trustees of the Leland Stanford Junior University	$516,502	20.5%
EPC-16-043 Cost-Effective and Climate Resilient In-Conduit Hydropower and Civil Works Innovation	$97,010	$0	$3,430,000	Natel Energy	$954,715	50.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-042 Low-Cost High-Reliability Thermoelectrics for Waste Heat Conversion	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-042 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 20 out of 20 bidders; phase 2: 9 out of 9 bidders	Lawrence Berkeley National Laboratory
EPC-16-043 Cost-Effective and Climate Resilient In-Conduit Hydropower and Civil Works Innovation	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-043 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29 out of 32 bidders	Natel Energy

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-042 Low-Cost High-Reliability Thermoelectrics for Waste Heat Conversion	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-16-043 Cost-Effective and Climate Resilient In-Conduit Hydropower and Civil Works Innovation	Group 1: Ranked # 3	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-042 Low-Cost High-Reliability Thermoelectrics for Waste Heat Conversion	This project will address principal barriers to the widespread application of current thermoelectric materials by providing a low-cost, reliable, affordable, and mass-producible technology that can be broadly applied to convert high-temperature heat that is currently wasted at the production and retail levels in California.	1h, 3h, 4a	Stanford University is manufacturing the thermoelectric nanofibers as a new subcontractor to LBNL. To date, individual Si nanowires have been produced and the thermal properties have been measured. Due to the covid-19 pandemic, DOE and California guidance has restricted or severely limited onsite access to both Stanford and Berkeley Lab facilities. The restrictions to site access have significantly delayed Si nanowire testing and development, and the corresponding and subsequent deliverables. Therefore, a no cost-extension to March 31, 2022 has been requested. To date, Si nanowires have been produced and thermal properties have been measured. Si nanowire fabrication is also being optimized to improve performance.
EPC-16-043 Cost-Effective and Climate Resilient In-Conduit Hydropower and Civil Works Innovation	Greater reliability could be achieved by enabling greater penetration at significant total megawatts of new, distributed baseload renewable energy with predictable generation profiles. The project was designed to significantly reduce the capital cost of installing small hydropower in existing irrigation drop structures by reducing the cost of construction and civil works by an estimated 50 percent when compared with installing custom designed works and equipment for each site.	1a, 1b	Since its kickoff in July 2017, the project team conducted site surveys, design and agreement development with site hosts and partners. The project team selected two sites for demonstration: Alder Drop in Yolo County, and Murphys Afterbay in Calaveras County. Interconnection applications for both projects were filed with PG&E. CEC staff was informed in July 2019 that the economics of the project as structured was not viable, hence Natel would not be able to move forward with the demonstration. Upon discussion with the RD&D Lead Commissioner and Legal staff, and in consideration of the pros and cons of alternatives, a decision was made to keep a Stop Work Order in place until the agreement term expired.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-044 Hyper Efficient Pump Motor Unit with Fully Integrated Permanent Magnet Motor and Motor Controls with Combined Liquid Cooling	Applied Research and Development	During this project, Terzo Power Systems developed an economical and efficient configuration for a novel hydraulic power system with large scale integration and adoption of highly efficient liquid cooled permanent magnet motors, and fully integrated, liquid cooled motor controls. Terzo Power Systems used these technologies to develop a smart hydraulic pump motor unit that can quickly be commercialized and adopted statewide by industrial facilities.	4/12/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-045 Development of New Technologies for Agricultural Loads to Participate in Renewables Integration, RTP Programs, and/or New Time of Use Rates	Applied Research and Development	This project develops a smart irrigation control system that improves and expands on current remote irrigation pump switching technology. The technologies developed will provide growers with the ability to automate their preferred load control strategies in response to new time-of-use electricity rates. Beyond that basic capability, the systems facilitate automated response to utility and system operator demand response signals, enabling participation in current and future demand response and reliability programs. The system is being deployed and tested on multiple farms and multiple crop types in PG&E service territory in the Fresno area.	4/12/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-044 Hyper Efficient Pump Motor Unit with Fully Integrated Permanent Magnet Motor and Motor Controls with Combined Liquid Cooling	No	Demand-side Management	$2,311,050	$2,311,050	$2,311,031	N/A
EPC-16-045 Development of New Technologies for Agricultural Loads to Participate in Renewables Integration, RTP Programs, and/or New Time of Use Rates	No	Grid Operations/Market Design	$2,884,912	$2,884,912	$2,819,060	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-044 Hyper Efficient Pump Motor Unit with Fully Integrated Permanent Magnet Motor and Motor Controls with Combined Liquid Cooling	$2,311,031	$99,350	$0	Terzo Power Systems, LLC.; Ansync Labs, Inc.	$145,689	5.9%
EPC-16-045 Development of New Technologies for Agricultural Loads to Participate in Renewables Integration, RTP Programs, and/or New Time of Use Rates	$2,819,060	$415,408	$0	Polaris Energy Services Inc.	$649,485	18.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-044 Hyper Efficient Pump Motor Unit with Fully Integrated Permanent Magnet Motor and Motor Controls with Combined Liquid Cooling	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-044 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 27 out of 28 bidders	Terzo Power Systems, LLC.
EPC-16-045 Development of New Technologies for Agricultural Loads to Participate in Renewables Integration, RTP Programs, and/or New Time of Use Rates	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-045 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 27 out of 28 bidders	Polaris Energy Services Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-044 Hyper Efficient Pump Motor Unit with Fully Integrated Permanent Magnet Motor and Motor Controls with Combined Liquid Cooling	Phase 1 Group 1: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-16-045 Development of New Technologies for Agricultural Loads to Participate in Renewables Integration, RTP Programs, and/or New Time of Use Rates	Phase 1 Group 2: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-044 Hyper Efficient Pump Motor Unit with Fully Integrated Permanent Magnet Motor and Motor Controls with Combined Liquid Cooling	The recipient's novel Hyper Efficient Pump Motor Unit developed and demonstrated during this project reduced the energy use and operating cost for hydraulic power systems by integrating an efficient permanent magnet motor, efficient motor controller, and a combined liquid cooling loop. Hydraulic power systems are found in nearly all industrial facilities.	1f, 1h	The project is complete and the final meeting was held in April 2020. The recipient demonstrated that its novel Hyper Efficient Pump Motor Unit can achieve an energy reduction of up to 80%, depending on the specific industry application. The integration of an efficient permanent magnet motor, efficient motor controller, and integrated liquid cooling loop along with embedded intelligence enabled the significant energy reduction, while also leading to a more compact and lighter weight system compared to traditional hydraulic systems. Final report submitted to publications 11/2020. Terzo is marketing to and seeking funding from venture capital funds.
EPC-16-045 Development of New Technologies for Agricultural Loads to Participate in Renewables Integration, RTP Programs, and/or New Time of Use Rates	For many electrical utilities, agriculture is a significant component of their peak load. Collectively there are between 160,000 and 170,000 irrigation pumps in the Central Valley. This project addresses the direct electricity cost of irrigation for agricultural customers and the indirect cost to all electricity ratepayers of procuring sufficient resources to meet marginal peak demand, integrating variable renewable energy generation, and building sufficient infrastructure to support agricultural pumping load peaks. The project developed a control system and operational strategies that can adapt to different rate designs--including dynamic and DR-program tariffs--by optimizing pumping loads across large numbers of irrigation pumps.	1c, 1d, 1e, 1g, 1h, 3f	Progress this year includes completing testing, completing the final report, and presenting at the 2020 EPIC Symposium. This research project demonstrated the ability of agricultural pumping load to respond to energy market price signals which can be used to incentivize consumption patterns that help meet California's energy policy goals. The project demonstrated the use of Polaris' platform to schedule irrigation in response to price signals and operate pumping systems through either the Polaris Pump Automation Controller or generic irrigation management systems. Results show that agricultural energy users will respond to clear price signals if they have sufficient automation and financial incentives through rates and/or programs that share the system benefits with customers. In the pilot, participants shifted two thirds of their load from the 4-9 p.m. ramp hours to other times of the day.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-046 Pilot Testing of Isothermal Compression	Applied Research and Development	Gas Technology Institute (GTI) and Carnot Compression LLC (Carnot) are developing and field testing a novel, near isothermal air compressor which will enable improved efficiency, maintenance and reliability. The unit will be tested at an industrial facility in southern California. This project hopes to reduce the energy consumption in industrial, water, agricultural, and commercial applications that require compression of air and other gases. This project demonstrates a more efficient compressor that will use less electricity to meet the same performance metrics of existing air and gas compressors. If successful, this project could improve the energy efficiency of compressed air/gas systems which are prevalent in all industrial processing facilities.	4/12/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-047 California Biopower Impact Project	Applied Research and Development	This project develops an attributional life cycle assessment framework for various biomass-to-electricity supply chain and end-use scenarios that are specific to California. The research quantifies on a fine geospatial scale the amount of technically recoverable forest and agricultural biomass residue material in California, and it considers future impact projections from different climate change scenarios and fire risk probabilities under various harvest and land management scenarios. Based on the estimates, researchers are developing a detailed life cycle inventory - disaggregated by parcel, supply chain, and end-use characteristics. Results are supporting development of the California Residual Biomass-to-energy Carbon Accounting Tool (C-BREC) that will be made available to the public and could inform policy decisions on the role of biomass residues in California's energy portfolio.	4/12/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-046 Pilot Testing of Isothermal Compression	No	Demand-side Management	$2,570,946	$2,570,946	$2,192,957	N/A
EPC-16-047 California Biopower Impact Project	No	Generation	$1,000,000	$1,000,000	$853,741	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-046 Pilot Testing of Isothermal Compression	$2,192,957	$628,022	$0	Carnot Compression Inc.	$238,700	8.5%
EPC-16-047 California Biopower Impact Project	$853,741	$247,784	$0	Humboldt State University Sponsored Programs Foundation; Sierra Institute for Community and Environment	$131,575	11.6%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-046 Pilot Testing of Isothermal Compression	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-046 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 27 out of 28 bidders	Institute of Gas Technology dba Gas Technology Institute
EPC-16-047 California Biopower Impact Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-047 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	14 out of 14 bidders	Humboldt State University Sponsored Programs Foundation

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-046 Pilot Testing of Isothermal Compression	Phase 1 Group 1: Ranked # 4	N/A	N/A	None
EPC-16-047 California Biopower Impact Project	Group 3: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-046 Pilot Testing of Isothermal Compression	This near isothermal compressor, or Carnot Compressor, solves the heat of compression problem by using a working liquid to compress a gas, while actively removing the heat of compression throughout the compression process. By removing the heat throughout the compression step, the energy required to compress air from near atmospheric pressure to ~100 psig can be reduced by up to 50% compared to commercial air compressors, such as piston, screw, and scroll designs. These energy savings are expected to significantly improve the efficiency of industrial air applications.	1f, 1h	The COVID-19 shelter-in-place restrictions have significantly delayed system operations. The project team is working on the installation of new control system to correct airflow meter readings and provide better control of the cooling water balance tank. Project has been granted a one year no-cost time extension for a new project end date of 3/31/2022.
EPC-16-047 California Biopower Impact Project	This research project develops a rigorous California-specific lifecycle emissions accounting framework for evaluation of various forest biomass residue mobilization scenarios, quantification of key potential environmental and climate impacts associated with biomass residue mobilization and conversion to electricity, and identification of potential pathways for offsetting biomass residue mobilization costs. The framework and Carbon Accounting Tool (C-BREC) will provide California policymakers with an evidence-based, spatially-disaggregated, and probabilistic analysis to aid in creating policies aimed at managing the environmental performance of bioenergy systems. Ultimately, the results from this project will provide information on the topic of carbon neutrality of residual biomass-to-energy production.	2a, 3a, 3g, 4a, 4b	The research team has conducted a net potential recoverable forest and agricultural residue assessment and compiled a spatially explicit database of these materials. The team has also developed a residual biomass-to-energy life cycle emissions accounting framework that considers various supply-chain and end-use scenarios for California and published a beta version of an interactive accounting tool for GHG and criteria pollutants emissions accounting from woody biomass converted to electricity. Additionally, the research team completed the wildfire risk impact assessment, nearly completed characterization of secondary environmental and climate impacts from woody biomass, and started development of a document with policy recommendations. Because of covid-19 delays, the recipient has requested a no-cost time extension through July 2021.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-048 Development and Testing of an Energy Efficient Ultra-low Charge Ammonia Refrigeration System in a Food Processing Plant	Applied Research and Development	This project is pilot testing and demonstrating an air-cooled, low-charge ammonia refrigerant-based, integrated package closed cooling system for an industrial food processing application. The project is demonstrating the effectiveness of a water-saving innovation with the use of a micro-channel, air-cooled condenser. The project is demonstrating the expected energy savings of 20% compared to a chiller using hydrofluorocarbon (HFC) refrigerant for similar end use at the same site. This system eliminates the need for water for cooling. The entire system can be prepackaged, factory charged, and brought to site as an integrated package which simplifies field installation and makes it cost effective.	4/12/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-048 Development and Testing of an Energy Efficient Ultra-low Charge Ammonia Refrigeration System in a Food Processing Plant	No	Demand-side Management	$2,406,054	$2,406,054	$1,194,069	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-048 Development and Testing of an Energy Efficient Ultra-low Charge Ammonia Refrigeration System in a Food Processing Plant	$1,194,069	$804,238	$0	Electric Power Research Institute, Inc.; TAKARA SAKE USA	$605,000	20.1%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-048 Development and Testing of an Energy Efficient Ultra-low Charge Ammonia Refrigeration System in a Food Processing Plant	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-048 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 27 out of 28 bidders	Electric Power Research Institute, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-048 Development and Testing of an Energy Efficient Ultra-low Charge Ammonia Refrigeration System in a Food Processing Plant	Phase 1 Group 1: Ranked # 5	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-048 Development and Testing of an Energy Efficient Ultra-low Charge Ammonia Refrigeration System in a Food Processing Plant	An air cooled, low-charge, ammonia refrigerant based integrated closed-packaged system with semi-hermetic motor/compressor seal that eliminates the mechanical seal between the compressor and the motor is not available in the U.S market today. As this is a packaged product, the M&V data from this project will help verify the energy savings and benefits and make it easier for industries to understand and implement this new technology and the energy and water savings benefits.	1e, 1f, 1h, 2a	The recipient has completed the low-charge, packaged ammonia chiller installation and is operating normally as confirmed by monitoring and verification (M&V) data. Preliminary M&V results show that the ammonia chiller is 38 % more efficient than the R-507A chiller. Further testing at demonstration site is delayed due to COVID-19. The agreement was extended to 12/31/2021 to collect more real-world data at the demonstration site. The project team is now receiving monthly water treatment reports to track the change in the cycles of concentration for the R507A cooling tower. This allows the project team to compile the amount of water consumed each month (gallons/month) and then determine the number of gallons used per kWh of cooling provided.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-049 Ultra-High Power Density Roadway Piezoelectric Energy Harvesting System	Applied Research and Development	This project leverages a multidisciplinary system approach to investigate the energy recovery potential of dual-mode piezoelectric generators to create roadway piezoelectric energy harvesting systems with ultra-high power density and efficiency. The goal is to design and test a piezoelectric roadway energy harvesting system, consisting of multi-layer stack generators and power electronics, to capture over 50% of the compression mechanical energy as electricity from passing vehicles. This project will demonstrate electric power generation, in the laboratory and on a 95 feet x 12 feet section of a road at the UC Merced campus, and will determine feasibility for future large-scale demonstrations on highways and streets with piezoelectric under-pavement.	4/12/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-049 Ultra-High Power Density Roadway Piezoelectric Energy Harvesting System	No	Generation	$1,270,000	$1,270,000	$125,133	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-049 Ultra-High Power Density Roadway Piezoelectric Energy Harvesting System	$125,133	$310,100	$0	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-049 Ultra-High Power Density Roadway Piezoelectric Energy Harvesting System	Grant	NEW IP TYPE(S): System Patent NEW IP DESCRIPTION: International Patent Application WO2020028592. High-Power-Density Piezoelectric Energy Harvesting System. The disclosed subject matter has resulted from the research work carried out on campus of the University of California, Merced, sponsored by a grant from the California Energy Commission (Agreement Number: EPC- 16-049). TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-049 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 20 out of 20 bidders; phase 2: 9 out of 9 bidders	University of California - Merced

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-049 Ultra-High Power Density Roadway Piezoelectric Energy Harvesting System	Group 2: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-049 Ultra-High Power Density Roadway Piezoelectric Energy Harvesting System	This project advances a piezoelectric energy harvesting system with ultra-high density and efficiency. Using an award-winning piezoelectric technology with unique dual-mode and multi-layer generator design and under-pavement installation strategy for smooth drive of passing vehicles and pedestrians, this project will help the ratepayers in California by reducing cost of electricity and reducing emissions related to power generation.	1e, 3h, 4a	The project has completed design and fabrication of a batch of multi-layer piezoelectric generators, and has conducted laboratory evaluation of the prototype. The prototype design was revised and improved, resulting in a promising relationship between the loading and displacement of the piezoelectric unit. An order to purchase 200 piezoelectric generator towers was issued and the project team has fabricated mechanical parts for 100 piezoelectric generators. A patent has been filed for the mechanical amplification design. The project has started collecting field data.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-050 Scaling Reliable, Next-Generation Perovskite Solar Cell Modules	Applied Research and Development	Recent advances have pushed the solar conversion efficiency, making perovskites one of the most efficient solar technologies in existence. This project will use a scalable large-area manufacturing approach for fabrication of the perovskite solar absorber, the solar cell's transport and contact layers, and the encapsulation of the solar cell modules. The project will also include bifacial module design, where light enters from both front and back.	5/16/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-051 Increased Energy Efficiency via Programmable Irrigation and Fertigation	Applied Research and Development	PowWow Energy, in collaboration with WiseConn Engineering, West Hills College Coalinga (WHCC) and UC Santa Barbara (UCSB), is developing an automated, programmable irrigation management system that integrates cutting-edge technologies to increase the energy efficiency of irrigation (defined as using less energy to achieve the same level of crop production). Pilot-scale tests of the integrated technology platform are being conducted at two sites on commercial farms located in disadvantaged communities: an almond orchard near Delano (AgWise Enterprises, SCE territory) and a field with a rotation of row crops (tomato, garlic, etc.) near Huron (Woolf Farming and Processing, PG&E territory).	4/12/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-050 Scaling Reliable, Next-Generation Perovskite Solar Cell Modules	No	Generation	$1,450,000	$1,450,000	$896,217	N/A
EPC-16-051 Increased Energy Efficiency via Programmable Irrigation and Fertigation	No	Demand-side Management	$2,992,660	$2,992,660	$2,547,051	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-050 Scaling Reliable, Next-Generation Perovskite Solar Cell Modules	$896,217	$184,540	$550,000	The Regents of the University of California, San Diego	$146,050	9.2%
EPC-16-051 Increased Energy Efficiency via Programmable Irrigation and Fertigation	$2,547,051	$341,285	$0	Environmental Studies Program and Bren School of Environmental Science and Management - UC Santa Barbara; PowWow Energy, Inc.; Aduro Accounting and Consulting, LLC; Naico ITS, Inc; WiseConn Engineering; West Hills College Coalinga; Mamala Research, LLC	$350,547	10.5%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-050 Scaling Reliable, Next-Generation Perovskite Solar Cell Modules	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-050 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 20 out of 20 bidders; phase 2: 9 out of 9 bidders	The Regents of the University of California, San Diego
EPC-16-051 Increased Energy Efficiency via Programmable Irrigation and Fertigation	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-051 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 27 out of 28 bidders	PowWow Energy, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-050 Scaling Reliable, Next-Generation Perovskite Solar Cell Modules	Group 1: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-16-051 Increased Energy Efficiency via Programmable Irrigation and Fertigation	Phase 1 Group 1: Ranked # 1	N/A	N/A	Yes; Small Business, Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-050 Scaling Reliable, Next-Generation Perovskite Solar Cell Modules	Currently, encapsulated perovskite cells degrade in several hundred hours even in controlled low-oxygen and low-humidity conditions. This project integrates materials innovations developed to date at UC San Diego in the perovskite absorber layer, the solar cell's contact layers, and the encapsulation of the module to make breakthrough advances in perovskite solar cell reliability and scaling. Combining these materials together in a module assembly with glass on top and bottom slows degradation by a factor of 1,000. In addition, the bifacial design of the module boosts its efficiency.	2a, 4a	The project team successfully transferred graphene atop perovskite layers, developed new electron transport layers, and improved cell process by characterization and new absorber layer chemistry. The project team has compared the unencapsulated perovskite against the graphene barrier layer encapsulated perovskite cells. The project is growing crystals by using an electro-deposition approach. The project has established an 80% yield on perovskite solar cells of 5 mm2 in size of at least 16% power conversion efficiency under one sun.
EPC-16-051 Increased Energy Efficiency via Programmable Irrigation and Fertigation	PowWow's technology integrates three new strategies for water and energy efficiency on farms (continuous pump testing with automated remote pump control, programmable irrigation for specific soil types and plant varieties, and management of water and fertility) with their cloud-based software. PowWow's data analytics software platform monitors irrigation pumps, energy rates, and other parameters and sends alerts to growers on how and when to irrigate to save energy, water, and cost without affecting crop yield or quality.	1h, 4a, 4c	The project is complete. Growers using PowWow's service cut water and electricity use by an average of 9% and 13%, respectively, without impacting crop yields. The recipient's software now monitors over 100,000 acres in California and continues to expand. PowWow changed their name to AgMonitor and completed another round of funding, raising an additional $1.5M from private sources, which was made possible by this project which helped AgMonitor increase their TRL from 5 to 7.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-052 Force Multiplier Actuated Piezoelectric Energy Harvester for Roadway Energy Recovery	Applied Research and Development	The project develops, designs, and installs a multitude of pavement-embedded devices to demonstrate energy harvesting from overpassing motor vehicles on the road in smart pavement covering 36 feet x 6 feet. The system consists of materials that exhibit the piezoelectric effect, generating an electric charge.	4/12/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-053 Habitat Influences on Desert Tortoise Translocation Success	Applied Research and Development	The project team is determining if habitat characteristics of the release sites can improve survival rates of smaller juveniles to the point that they are equivalent to the rates of the animals that were released only after reaching the desired size target. Careful measurement of resources that may help tortoises avoid predation or meet nutritional requirements will allow investigators to differentiate excellent habitat from merely adequate habitat. They are also studying the effects of outdoor rearing on juvenile desert tortoise behavior and health, and size-age relationships to survival in the wild upon their release. The project will generate quantitative scientific information about the most cost-effective husbandry and release methods during and following a head-start program for this threatened species.	4/27/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-052 Force Multiplier Actuated Piezoelectric Energy Harvester for Roadway Energy Recovery	No	Generation	$1,000,000	$1,000,000	$808,944	N/A
EPC-16-053 Habitat Influences on Desert Tortoise Translocation Success	No	Generation	$499,605	$499,605	$415,011	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-052 Force Multiplier Actuated Piezoelectric Energy Harvester for Roadway Energy Recovery	$808,944	$234,596	$0	Pyro-E, LLC	$100,007	9.1%
EPC-16-053 Habitat Influences on Desert Tortoise Translocation Success	$415,011	$32,237	$0	Zoological Society of San Diego dba San Diego Zoo Global	$390,528	43.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-052 Force Multiplier Actuated Piezoelectric Energy Harvester for Roadway Energy Recovery	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-052 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 20 out of 20 bidders; phase 2: 9 out of 9 bidders	Pyro-E, LLC
EPC-16-053 Habitat Influences on Desert Tortoise Translocation Success	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-053 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	14 out of 14 bidders	Zoological Society of San Diego dba San Diego Zoo Global

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-052 Force Multiplier Actuated Piezoelectric Energy Harvester for Roadway Energy Recovery	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-16-053 Habitat Influences on Desert Tortoise Translocation Success	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-052 Force Multiplier Actuated Piezoelectric Energy Harvester for Roadway Energy Recovery	The project demonstrates and assesses the potential of regenerative pavement technology, a roadway-embedded energy harvester that uses the untapped energy of car movements. The hardware devices developed using smart materials harvest energy from pavement deflections and vibrations under normal driving conditions. Energy performance data is collected to determine the technology's potential for widescale adoption in roadways and other surfaces.	1e, 2a	The project team completed basic design for the vibrational energy harvester, with a goal to maximize life under repeated impact and compression cycles from a vehicle. A batch of flexors, for converting vertical compression into horizontal extension, was fabricated and calibrated with force transducers and strain instruments to ensure proper specifications. A uniform subscale piezo-ceramic stack prototype was fabricated and assembled to prevent stress concentrations under buckling loads. Preliminary field testing at subscale was performed to collect data for power and energy. Work has started for permitting with the City of San Jose.
EPC-16-053 Habitat Influences on Desert Tortoise Translocation Success	This project will increase the effectiveness of conservation actions designed to mitigate renewable energy impacts on Mojave Desert tortoises. This will be achieved by evaluating the relative effectiveness of head-start and release methods in an experimental framework. Improvements to the effectiveness of habitat management to encourage natural recruitment of juveniles will also be tested experimentally where possible.	2a, 3a, 3b, 4f	The project hatched the first cohort of 63 hatchling tortoises at Edwards Air Force Base (EAFB). This number is sufficient for the 18-month old group to be released in 2020. Unfortunately, there was complete nest failure at the Cadiz site. Researchers tried to overcome this setback by attempting to collect a larger number of eggs in 2019 so that half could be reared indoors to reach the size the 18-month cohort would have achieved, but this was unsuccessful. Investigating the cause of the nest failure should lead to improved guidance for head-starting. The team is collaborating with a complementary project (EPC-16-038). The covid-19 pandemic also prevented access to EAFB, blocking the research team from releasing tortoises there in spring 2020. A no-cost time extension is being processed to allow adequate time to track this set of tortoises.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-054 Open Vehicle to Building/Microgrid Integration Enabling ZNE and Improved Distribution Grid Services	Applied Research and Development	This project develops a "3-in-1" smart inverter, charging station, and building energy management system. The project focuses on defining and developing control algorithms to implement V2G and V2B with minimal impact to the PEV battery life, which is verified through accelerated battery testing. This project develops and demonstrates the Smart Power Integrated Node (SPIN) prototype -- an off-vehicle V2G power conversion and control device targeted at residential and small commercial customers. The bidirectional direct-current (DC) PEV charger allows customers to island from the electric grid during outages and support critical loads in their homes with energy stored in their PEV batteries. The integrated system simplifies installation and reduces expensive redundant equipment for customers with rooftop solar and a PEV.	4/27/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-054 Open Vehicle to Building/Microgrid Integration Enabling ZNE and Improved Distribution Grid Services	No	Demand-side Management	$1,500,000	$1,500,000	$1,350,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-054 Open Vehicle to Building/Microgrid Integration Enabling ZNE and Improved Distribution Grid Services	$1,350,000	$540,024	$0	Electric Power Research Institute, Inc.; Oak Ridge National Laboratory; National Renewable Energy Laboratory (NREL); Flex Power Control, Inc.	$2,341,001	60.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-054 Open Vehicle to Building/Microgrid Integration Enabling ZNE and Improved Distribution Grid Services	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-054 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29 out of 31 bidders	Electric Power Research Institute, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-054 Open Vehicle to Building/Microgrid Integration Enabling ZNE and Improved Distribution Grid Services	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-054 Open Vehicle to Building/Microgrid Integration Enabling ZNE and Improved Distribution Grid Services	This project is developing technologies that allow PEVs to become a controllable distributed energy resource (DER) by enabling V2G capabilities that provide resilience to residential and commercial customers. The SPIN prototype can also optimize charging to coincide with high renewable generation and low system demand, helping to reduce greenhouse gas emissions and integrate more PEV charging load without upgrading electricity infrastructure. Results inform investor-owned utilities on how V2G and V2B can be a viable resource to meet the Assembly Bill 2514 Storage Mandate and the CAISO energy storage and DER initiative. The project is validating and informing valuation of several V2G use cases as well as informing automotive manufacturers considering inclusion of bi-directional capabilities in vehicles.	1c, 1e, 2a, 3f, 4a, 5b	In early 2020, the project team completed development and virtual testing of the optimization algorithms and control pathways to manage electric vehicle bi-directional charging, building loads, energy storage, and solar generation. Testing of the complete Solar Power Integration Node (SPIN) prototype began in November 2020 with modified bi-directional capable vehicles provided by Fiat Chrysler America. The team will verify the core functionality and safety of the SPIN prototype and collect performance data through the end of 2020. Accelerated aging tests on vehicle battery packs to evaluate the impacts to battery degradation of V2G applications re-commenced at NREL in August 2020. Delays associated with COVID-19 and restrictions on laboratory access resulted in a no-cost time extension. The project team will continue prototype testing and demonstration through early 2021, with further commercialization activities supported by an award from the U.S. Department of Energy.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-055 Improving Commercial Viability of Fast Charging by Providing Renewable Integration and Grid Services with Integrated Multiple DC Fast Chargers	Applied Research and Development	The project enables day-ahead and real-time pricing for DC fast charging by developing an integrated hardware and software platform to engage drivers and customers, manage DC fast chargers, and control an on-site second life PEV battery storage device to limit peak demand. The site controller and network-based platform advances smart and efficient charging by managing four multi-port fast charging stations to minimize grid impact and lower operating costs, evaluates the suitability of DC fast charging to participate in demand response programs, and develops and evaluates control strategies to integrate more renewable generation on the California grid. The project produces real and simulated data from the demonstration site in Monterey Park, Ca, that supports DC fast charging service provider planning regarding use of managed charging and distributed energy resources. The technologies developed are being commercialized at other sites in California and nationally.	4/27/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-055 Improving Commercial Viability of Fast Charging by Providing Renewable Integration and Grid Services with Integrated Multiple DC Fast Chargers	No	Demand-side Management	$826,250	$826,250	$742,861	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-055 Improving Commercial Viability of Fast Charging by Providing Renewable Integration and Grid Services with Integrated Multiple DC Fast Chargers	$742,861	$0	$0	Zeco Systems dba Greenlots	$302,008	26.8%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-055 Improving Commercial Viability of Fast Charging by Providing Renewable Integration and Grid Services with Integrated Multiple DC Fast Chargers	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-055 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29 out of 31 bidders	Zeco Systems dba Greenlots

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-055 Improving Commercial Viability of Fast Charging by Providing Renewable Integration and Grid Services with Integrated Multiple DC Fast Chargers	Group 1: Ranked # 1	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-055 Improving Commercial Viability of Fast Charging by Providing Renewable Integration and Grid Services with Integrated Multiple DC Fast Chargers	This project advances technologies for aggregation and control of DC fast chargers and on-site stationary storage to reduce grid congestion, integrate more renewable generation, and manage peak demands. This will lower the cost of EV charging--helping to accelerate transportation electrification--and support efficient use of existing distribution infrastructure with savings passed on to ratepayers.	1e, 1h, 2a, 4a	Greenlots completed building and testing of its network and control algorithms for managed charging in early 2020. All installation and permitting activities for the project demonstration site were completed in March 2020. The demonstration site consists of four direct current fast chargers and a second life battery installed in Monterey Park, CA. Usage is low due in part to COVID-19 impacts on travel behavior. The team advertised the location, installed credit card readers, and reduced the set point at which the battery discharges in August 2020 to improve data collection. The project team also leveraged data collected at other sites to simulate use cases that include demand charge reduction, demand response participation, and renewable integration. CEC staff reviewed preliminary results in November 2020, and simulation will continue through early 2021. Greenlots leveraged project findings at other sites and participated in multiple CEC workshops in 2020 to share project learnings.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-056 Performance Evolution, Specification and Verification of Building Control Sequences	Applied Research and Development	Many existing building predate current energy codes and standards . Few commercial buildings have optimized control systems and new construction projects that are designed to implement control strategies frequently struggle with complicated processes that can result in inefficient and often uncomfortable buildings that waste energy. The current software tools available for design controls is tedious and error prone. This agreement's goal is to build software tools to addresses the gap between expected building control's design and its actual performance operations. The tools will improve the design process, cost-effective implementation, and validation of the control sequences used in commercial buildings. These tools will have the potential to substantially reduce energy use in both new commercial and existing buildings with controls retrofits. The agreement is co-funded by the California Energy Commission and the United States Department of Energy (DOE).	5/10/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-056 Performance Evolution, Specification and Verification of Building Control Sequences	No	Demand-side Management	$1,000,000	$1,000,000	$1,000,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-056 Performance Evolution, Specification and Verification of Building Control Sequences	$1,000,000	$473,633	$3,065,000	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-056 Performance Evolution, Specification and Verification of Building Control Sequences	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-056 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	43 bidders	Lawrence Berkeley National Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-056 Performance Evolution, Specification and Verification of Building Control Sequences	N/A ***	N/A ***	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-056 Performance Evolution, Specification and Verification of Building Control Sequences	A major barrier to achieving the state's statutory energy goals is the failure of most commercial buildings to perform close to the technical design potential of its equipment. This can account for significant wasted energy. The team has shown that Innovations in commercial building control sequences can transform existing buildings to achieve energy savings. The team worked with the ASHRAE Standards Committee to use a standardized programming language, pioneered and developed in this project.The ASHRAE Guideline 36, software language will have an impact on improving the California Energy Code, Title 24, which requires specific algorithms, documented in ASHRAE Guideline 36. This can result in a large impact to industry to enable accountability for controls performance between design and operation.	1f, 3a, 3b, 3f, 4a	The final report is under review and the Final meeting is schedule for Jan 21,2021. The team has documented the potential for the control sequences to reduce heating, ventilation, and air-conditioning system energy use by 30% through the use of advanced controls. This agreement site is located at: https://obc.lbl.gov.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-057 Development of Smart Charging Infrastructure Planning Tool (SCRIPT)	Applied Research and Development	This project developed a tool that enables predictive smart charging of PEVs and performs cost-benefit analysis for investment in charging infrastructure from the point of view of different stakeholders. The tool will allow stakeholders to generate multiple future PEV adoption scenarios, evaluate the potential of smart charging in changing the overall load profile to reduce grid congestion and maximize solar utilization, understand the effects that investments in different charging segments has in the PEV load, and perform an assessment of the cost and benefits to the region, PEV owners and ratepayers. The goals of the project included: developing a predictive smart charging framework for PEVs that considers future travel plans of drivers and various power system conditions; performing a cost-benefit analysis for investment in charging infrastructure; and integrating the above elements to allow stakeholders to make decisions pertaining to new investments in charging infrastructure.	5/10/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-058 Advanced Transit Bus VGI Project	Technology Demonstration and Deployment	Led by Prospect Silicon Valley, the project leverages VTA's plans to purchase up to 15 all-electric buses towards electrification of its near 500-bus fleet in order to build on the strategies, technologies and partnerships from numerous existing VGI efforts. The Project Team successfully integrated the Energy Management Platform (EMP) with a telematics system installed on the buses, and fleet management software, so that VTA's bus operations team can use it to optimize the charging schedule and minimize the cost of charging, creating savings in charging costs for the agency.	5/10/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-057 Development of Smart Charging Infrastructure Planning Tool (SCRIPT)	No	Demand-side Management	$1,500,000	$1,500,000	$1,500,000	N/A
EPC-16-058 Advanced Transit Bus VGI Project	No	Demand-side Management	$1,675,417	$1,675,417	$1,388,442	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-057 Development of Smart Charging Infrastructure Planning Tool (SCRIPT)	$1,500,000	$328,945	$0	UC Santa Barbara; ChargePoint, Inc.	$94,153	5.9%
EPC-16-058 Advanced Transit Bus VGI Project	$1,388,442	$412,909	$0	Santa Clara Valley Transit Authority; Proterra Inc.	$1,064,569	38.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-057 Development of Smart Charging Infrastructure Planning Tool (SCRIPT)	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-057 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29 out of 31 bidders	Board of Trustees of the Leland Stanford Junior University (SLAC National Accelerator Laboratory)
EPC-16-058 Advanced Transit Bus VGI Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-058 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29 out of 31 bidders	Prospect Silicon Valley

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-057 Development of Smart Charging Infrastructure Planning Tool (SCRIPT)	Group 1: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-16-058 Advanced Transit Bus VGI Project	Group 4: Ranked # 4	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-057 Development of Smart Charging Infrastructure Planning Tool (SCRIPT)	There are significant benefits from workplace smart charging that may be shared with the vehicle owners. By exercising the flexibility of the vehicle charging in the workplace, commercial customers can save from energy and demand charge costs. Smart charging can decrease energy charges by up to 1.5% of the overall utility bill and decrease demand charges by up to 24.7%. Further benefits can be achieved from adding PV as a distributed energy resource at a site, but even without that addition there are significant benefits to both the EV owner and workplace where the EV is being charged. The project team is conducting a cost-benefit analysis that will inform the final report.	1e, 1f, 3a, 3f, 4a, 5b	The project team completed development of the SCRIPT and achieved the tool's goals of providing predictive smart-charging, flexible load forecasts and interoperability that allows stakeholders the ability to perform analysis on efficient and effective PEV charging infrastructure planning. The project team used multiple scenarios for analysis that targeted a forecasted PEV adoption volume for 2025 and 2030, percentage of charging infrastructure across multiple segments (i.e. residential, workplace, and public), and the distribution projected across the state. The project team completed cost-benefit analysis from a societal, ratepayer, and PEV owner perspective. The flexible PEV load forecast will help utilities anticipate and plan for infrastructure investments to ensure high reliability while minimizing electricity costs. The forecasts will also provide load information at the state and county level identifying locations to install renewable generation with the appropriate capacity.
EPC-16-058 Advanced Transit Bus VGI Project	The project's goals were to implement a world-class electric transit fleet to significantly advance California's energy goals. The project applied integrated systems to reduce charging costs through demand management using unidirectional charging control. These features were integrated with commercial fleet management tools for the first fully integrated energy management in a heavy-duty fleet.	2a, 4a, 4b	The project team, in a coordinated effort with many subcontractors, has developed an Energy Management Platform (EMP) and telemetry systems to manage the E-bus charging sessions and fleet operations at VTA. Bus state of charge range, efficiency, odometer readings, and MAC ID settings between the actual busses and the EMP were successfully tested for full integration at VTA. Demonstrations of the EMP in real-world scenarios, using up to 5 E-buses, have been conducted through July-October 2020. The team is now conducting measurement and verification of the value of managed charging and summarizing the findings in the final report.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-058 Advanced Transit Bus VGI Project	Technology Demonstration and Deployment	Led by Prospect Silicon Valley, the project leverages VTA's plans to purchase up to 15 all-electric buses towards electrification of its near 500-bus fleet in order to build on the strategies, technologies and partnerships from numerous existing VGI efforts. The Project Team successfully integrated the Energy Management Platform (EMP) with a telematics system installed on the buses, and fleet management software, so that VTA's bus operations team can use it to optimize the charging schedule and minimize the cost of charging, creating savings in charging costs for the agency.	5/10/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-059 Advanced VGI Control to Maximize Battery Life and Use of Second-Life Batteries to Increase Grid Service and Renewable Power Penetration	Applied Research and Development	This project demonstrates an automated control system for a fleet of PEVs and repurposed second-life batteries that reduces the overall cost of ownership by maximizing battery lifetime, shifting load to minimize electricity and demand charges, and providing V2G and V2B services, including those supporting the use of onsite solar generation. The demonstration adds a stationary second-life battery installation to the existing PEV fleet site at the Los Angeles Air Force Base.	5/10/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-058 Advanced Transit Bus VGI Project	No	Demand-side Management	$0	$0	$0	N/A
EPC-16-059 Advanced VGI Control to Maximize Battery Life and Use of Second-Life Batteries to Increase Grid Service and Renewable Power Penetration	No	Demand-side Management	$1,500,000	$1,500,000	$1,135,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-058 Advanced Transit Bus VGI Project	$0	$0	$0	Santa Clara Valley Transit Authority; Proterra Inc.	$0	0.0%
EPC-16-059 Advanced VGI Control to Maximize Battery Life and Use of Second-Life Batteries to Increase Grid Service and Renewable Power Penetration	$1,135,000	$407,071	$0	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-058 Advanced Transit Bus VGI Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-058 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29 out of 31 bidders	Prospect Silicon Valley
EPC-16-059 Advanced VGI Control to Maximize Battery Life and Use of Second-Life Batteries to Increase Grid Service and Renewable Power Penetration	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-059 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29 out of 31 bidders	Lawrence Berkeley National Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-058 Advanced Transit Bus VGI Project	Group 4: Ranked # 4	N/A	N/A	Yes; Calif Based Entity
EPC-16-059 Advanced VGI Control to Maximize Battery Life and Use of Second-Life Batteries to Increase Grid Service and Renewable Power Penetration	Group 2: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-058 Advanced Transit Bus VGI Project	The project's goals were to implement a world-class electric transit fleet to significantly advance California's energy goals. The project applied integrated systems to reduce charging costs through demand management using unidirectional charging control. These features were integrated with commercial fleet management tools for the first fully integrated energy management in a heavy-duty fleet.	2a, 4a, 4b	The project team, in a coordinated effort with many subcontractors, has developed an Energy Management Platform (EMP) and telemetry systems to manage the E-bus charging sessions and fleet operations at VTA. Bus state of charge range, efficiency, odometer readings, and MAC ID settings between the actual busses and the EMP were successfully tested for full integration at VTA. Demonstrations of the EMP in real-world scenarios, using up to 5 E-buses, have been conducted through July-October 2020. The team is now conducting measurement and verification of the value of managed charging and summarizing the findings in the final report.
EPC-16-059 Advanced VGI Control to Maximize Battery Life and Use of Second-Life Batteries to Increase Grid Service and Renewable Power Penetration	This project is developing and implementing an optimization and control algorithm for a fleet of PEVs and stationary battery packs that includes impacts on battery health expressed as an economic cost, using models and parameters derived from actual battery measurements. These activities will help demonstrate PEV ownership lifecycle cost reductions and will advance scientific knowledge of the impacts of V2G and V2B services on mobile and second-life PEV batteries.	1h, 3f, 4b	The August 2019 bankruptcy of Princeton Power Systems (PPS) left the project without any support for the continually problematic PPS charging stations. Without functional charging stations, the project EVs are not useful to the US Air Force project site partner eliminating the source of second-life batteries for the project. The project team has worked with the CEC CAM to amend the project scope to create the control systems as intended, demonstrate the controller in simulation, and address a related EV charging challenge for military bases. This change has been reviewed and approved by the base staff.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-061 Intelligent Electric Vehicle Integration (INVENT)	Technology Demonstration and Deployment	This project is deploying vehicle-grid integration (VGI) technology with unidirectional and bidirectional power flow capabilities using light fleet and consumer vehicles. These vehicles will provide local grid support by controlling the charge rate based on locally available energy and power capacity, controlling the voltage, and providing grid-wide support by participating in frequency regulation or adjusting the reactive power. The mix of services provided will be optimized within a campus laboratory setting with the goal of expanding this technology into a real-world setting.	6/14/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-061 Intelligent Electric Vehicle Integration (INVENT)	Technology Demonstration and Deployment	This project is deploying vehicle-grid integration (VGI) technology with unidirectional and bidirectional power flow capabilities using light fleet and consumer vehicles. These vehicles will provide local grid support by controlling the charge rate based on locally available energy and power capacity, controlling the voltage, and providing grid-wide support by participating in frequency regulation or adjusting the reactive power. The mix of services provided will be optimized within a campus laboratory setting with the goal of expanding this technology into a real-world setting.	6/14/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-061 Intelligent Electric Vehicle Integration (INVENT)	No	Distribution	$3,967,165	$3,967,165	$3,256,181	N/A
EPC-16-061 Intelligent Electric Vehicle Integration (INVENT)	No	Distribution	$0	$0	$0	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-061 Intelligent Electric Vehicle Integration (INVENT)	$3,256,181	$212,026	$0	The Regents of the University of California, San Diego; Strategen; Nuvve Corporation; FleetCarma	$3,697,744	48.2%
EPC-16-061 Intelligent Electric Vehicle Integration (INVENT)	$0	$0	$0	The Regents of the University of California, San Diego; Strategen; Nuvve Corporation; FleetCarma	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-061 Intelligent Electric Vehicle Integration (INVENT)	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-061 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29 out of 31 bidders	Nuvve Corporation
EPC-16-061 Intelligent Electric Vehicle Integration (INVENT)	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-061 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29 out of 31 bidders	Nuvve Corporation

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-061 Intelligent Electric Vehicle Integration (INVENT)	Group 4: Ranked # 5	N/A	N/A	None
EPC-16-061 Intelligent Electric Vehicle Integration (INVENT)	Group 4: Ranked # 5	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-061 Intelligent Electric Vehicle Integration (INVENT)	This project is developing an advanced VGI technology to optimize the blend of unidirectional charging, bidirectional operation, and vehicle-to-building functions, for different real-world grid applications such as frequency regulation, power quality, voltage control, and grid support. The project will show the value of EVs as distributed energy resources, with the ability to defer or eliminate the need for grid upgrades, and enable greater renewable energy penetrations.	1h, 3f, 4b	In 2019, Nuvve successfully demonstrated and operated nine uni-directional and nine bi-directional charging stations on the UCSD campus. These charging stations have demonstrated frequency regulation, demand response, and demand charge management as part of Nuvve's use cases. In June 2020, Nuvve began participation in California's wholesale energy markets through an agreement with SDG&E. Nuvve is now working to expand its market participation capabilities by incorporating more vehicles in its EV charging infrastructure.
EPC-16-061 Intelligent Electric Vehicle Integration (INVENT)	This project is developing an advanced VGI technology to optimize the blend of unidirectional charging, bidirectional operation, and vehicle-to-building functions, for different real-world grid applications such as frequency regulation, power quality, voltage control, and grid support. The project will show the value of EVs as distributed energy resources, with the ability to defer or eliminate the need for grid upgrades, and enable greater renewable energy penetrations.	1h, 3f, 4b	In 2019, Nuvve successfully demonstrated and operated nine uni-directional and nine bi-directional charging stations on the UCSD campus. These charging stations have demonstrated frequency regulation, demand response, and demand charge management as part of Nuvve's use cases. In June 2020, Nuvve began participation in California's wholesale energy markets through an agreement with SDG&E. Nuvve is now working to expand its market participation capabilities by incorporating more vehicles in its EV charging infrastructure.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-062 Advancing Demand Response in the Water Sector	Applied Research and Development	This project is developing a demand management system to optimize energy use and operations using the Moulton Niguel Water District as a pilot site. Through better system optimization, the water utility will be able to reduce its energy bill by participating in demand response and load shifting incentive programs. The demand management system will optimize load for the potable and recycled water systems at Moulton Niguel and be easily adopted by other water districts and utilities.	5/10/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-063 Advanced Statistical-Dynamical Downscaling Methods and Products for California Electricity System Climate Planning	Applied Research and Development	This project develops new and better ways of merging two modeling approaches, using both weather forecast models (more generally called dynamical models) and inferences from past history (statistical models). The combined method is called a hybrid dynamical-statistical approach for inferring fine-resolution climate information from the coarse-resolution global climate models. Ideally, the hybrid approach will be able to capture many of the physical processes simulated by the costly weather forecast models, but with the reduced expense of statistical models. The hybrid approach will be applied to three key areas of California's climate that have important implications for the state's ratepayers: wind, clouds, and hydrology.	4/27/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-062 Advancing Demand Response in the Water Sector	No	Demand-side Management	$2,984,983	$2,984,983	$1,490,340	N/A
EPC-16-063 Advanced Statistical-Dynamical Downscaling Methods and Products for California Electricity System Climate Planning	No	Demand-side Management	$1,399,888	$1,399,888	$823,384	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-062 Advancing Demand Response in the Water Sector	$1,490,340	$282,171	$0	Moulton Niguel Water District; Helio Energy Solutions	$105,765	3.4%
EPC-16-063 Advanced Statistical-Dynamical Downscaling Methods and Products for California Electricity System Climate Planning	$823,384	$192,928	$0	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-062 Advancing Demand Response in the Water Sector	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-062 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 2: 6 out of 7 bidders	Regents of the University of California, Davis
EPC-16-063 Advanced Statistical-Dynamical Downscaling Methods and Products for California Electricity System Climate Planning	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-063 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	14 out of 14 bidders	University of California, San Diego Scripps Institution of Oceanography 0955

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-062 Advancing Demand Response in the Water Sector	Ranked # 3	N/A	N/A	Yes; Calif Based Entity
EPC-16-063 Advanced Statistical-Dynamical Downscaling Methods and Products for California Electricity System Climate Planning	Group 6: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-062 Advancing Demand Response in the Water Sector	The demand management system uses real-time energy analytics to: (1) reduce and/or shift peak energy loads, (2) account for different energy tariff structures, and (3) balance the grid's intermittent renewable load generation. This demand management tool enables water utility participation in demand response and load shifting utility programs. The project efforts will market and communicate the technology, informing other water utilities, which could result in increased use and acceptance. Given the impact of energy consumption by the water industry in California, widespread use of the demand management system could help achieve energy demand reduction needed to support the state's energy goals.	1e, 1g, 1h, 2a, 3h, 4a	The team has developed an energy grid model and continues to add features to the demand management system (DMS) to optimize energy demands of water systems. The team continues to refine data and inputs to the energy demand management system software, including gathering tariff and grid operation characteristics information from the utilities and the California Independent System Operator.. A working prototype of the DMS has been developed and is currently being tested at the water utility for final refinements before a full-scale demonstration.
EPC-16-063 Advanced Statistical-Dynamical Downscaling Methods and Products for California Electricity System Climate Planning	The project includes an extensive quantification (model validation) effort based on data from observed meteorological stations, satellite records of cloudiness compiled by project members, and USGS stream-flow and groundwater observations (for the hydrologic modeling). The method under development could be used for the California's Fifth Climate Change Assessment and future energy planning.	5c	The research team is running dynamic regional climate models and exploring the use of statistical models for hourly simulations. In the past, climate scenarios for CA only included projections with daily resolution. The research team has made significant progress on key areas such as: development of dataset variables that focus on low clouds, fire weather, and wind generation, with input from other CEC project(s); comprehensive verification of downscaled clouds, wind, and near-surface temperature; integrated hydrologic modeling using machine learning for building statistical models of hydrologic quantities through watersheds; and, merging multiple precipitation products to improve simulated hydrologic fluxes. The project has been extended to August 30, 2021 to complete model simulations to replicate historical conditions such as coastal clouds, wind, and humidity.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-064 Investigating Avian Attraction to Solar Energy Facilities Through a Lake Effect	Applied Research and Development	Researchers are exploring the behavior of attraction by birds to solar facilities, particularly in relation to the "lake effect" hypothesis. Specifically, they are studying 1) the ability of birds to detect potentially attractive visual cues associated with solar facilities (e.g., polarized light, irradiance); 2) the corresponding change in flight behavior characteristic of movement toward solar facilities; and 3) the mortality and natural history of birds that actually occupy solar facilities. First, the recipient is examining the sensory basis of attraction through field and lab experiments. Second, radar and thermal imaging are used to measure the degree to which birds alter their flight paths to settle at solar facilities. Data on behavior and mortality from multiple solar facilities are gathered to inform a statistical model to determine what characteristics of solar facilities and species' natural history together explain variations in mortality exhibited across sites.	5/10/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-065 California E-Bus to Grid Integration Project	Technology Demonstration and Deployment	This project focused on improving the economics of incorporating e-buses in a transit agency fleet. The project team worked with the Antelope Valley Transit Authority (AVTA) to evaluate multiple scenarios, including smart charging, improving vehicular energy efficiency through best driving practices, and using the vehicle batteries for grid services when the E-buses are not being used for their routes. More effective smart charging reduces the frequency and duration of in-route charging, and the fuel economy improvements that come from smart driving result in operational cost savings. By reducing the likelihood that several/all E-buses will be charging at once, smart charging can achieve greater flexibility and decrease demand charges.	5/10/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-064 Investigating Avian Attraction to Solar Energy Facilities Through a Lake Effect	No	Generation	$499,785	$499,785	$375,042	N/A
EPC-16-065 California E-Bus to Grid Integration Project	No	Grid Operations/Market Design	$2,633,670	$2,633,670	$2,150,996	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-064 Investigating Avian Attraction to Solar Energy Facilities Through a Lake Effect	$375,042	$200,240	$50,000	United States Geological Survey; Western EcoSystems Technology, Inc.; Humboldt State University Sponsored Programs Foundation; NRG Energy, Inc.; NextEra Energy; Bard College; 8minuteenergy Renewables, LLC; First Solar; Recurrent Energy	$740,251	59.7%
EPC-16-065 California E-Bus to Grid Integration Project	$2,150,996	$658,112	$0	Antelope Valley Transit Authority	$2,900,097	52.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-064 Investigating Avian Attraction to Solar Energy Facilities Through a Lake Effect	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-064 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	14 out of 14 bidders	US Geological Survey
EPC-16-065 California E-Bus to Grid Integration Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-065 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29 out of 31 bidders	Zero Net Energy (ZNE) Alliance

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-064 Investigating Avian Attraction to Solar Energy Facilities Through a Lake Effect	Group 1: Ranked # 1	N/A	N/A	None
EPC-16-065 California E-Bus to Grid Integration Project	Group 4: Ranked # 1	N/A	N/A	Yes; Micro Business, Minority Owned

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-064 Investigating Avian Attraction to Solar Energy Facilities Through a Lake Effect	This project is the first systematic study to determine whether birds are attracted to solar energy facilities and if so, to develop an understanding of the sensory basis and proximal response of birds to solar facilities in relation to the "lake effect" attraction phenomenon. Following from that new understanding, the project will identify potentially viable methods for deterring birds from approaching solar facilities and informing future siting decisions in ways that reduce the likelihood of birds fatally interacting with solar facilities.	2a, 3a, 4f, 4g	The first and second field seasons (fall 2018 and 2019) of data collection were successfully completed for both radars, as well as a bird carcass search and bird use surveys at several additional solar photovoltaic facilities across southern and central California. These data are in the process of being analyzed. The experimental tasks to study bird attraction to polarized surfaces are underway. The study is revealing important information about differences in polarization between polycrystalline vs. thin-film solar panels, times of day, and direction of flight relative to the sun that can be related to the radar and mortality survey field results. The covid-19 pandemic prevented on-schedule completion of experimental work on bird attraction. The team has requested a no-cost time extension to be able to complete this task.
EPC-16-065 California E-Bus to Grid Integration Project	Exposure to on-road diesel emissions is a factor in the symptoms of lung disease and asthma. E-Buses have the technical and economic potential to rapidly displace diesel transit buses. AVTA's E-buses have been deployed with onboard telematics to understand the vehicle's operating health and parameters. High-power wireless inductive charging has been shown to be a viable solution for in-route charging. Together, these technologies help overcome range limitations and uncertainty. However, while these technologies alone provide great value and overcome key adoption barriers, integrating them with analytics and distributed energy resource (DER) management platforms can unlock even greater value.	2a, 3f, 4a	The team developed an E-Fleet Energy Model that accounts for the effects of weather, geography, drivers' skill and other factors on the kWh/mi. efficiency of the E-Buses. Fleet operators are seeing the benefits of driver training in reducing the fleet's overall energy usage. The team also determined the greatest energy cost savings can be achieved through managed charging to reduce peak loads and charge during lower time-of-use rates. The project team worked with transit industry leaders in knowledge transfer activities to disseminate transit fleet electrification best practices.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-065 California E-Bus to Grid Integration Project	Technology Demonstration and Deployment	This project focused on improving the economics of incorporating e-buses in a transit agency fleet. The project team worked with the Antelope Valley Transit Authority (AVTA) to evaluate multiple scenarios, including smart charging, improving vehicular energy efficiency through best driving practices, and using the vehicle batteries for grid services when the E-buses are not being used for their routes. More effective smart charging reduces the frequency and duration of in-route charging, and the fuel economy improvements that come from smart driving result in operational cost savings. By reducing the likelihood that several/all E-buses will be charging at once, smart charging can achieve greater flexibility and decrease demand charges.	5/10/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-067 Robust Super Insulation at a Competitive Price	Applied Research and Development	Heating and cooling represents the greatest energy consumption in buildings. This project is developing thermal building insulation material with high R-value at low cost. The product is expected to provide a significant increase in energy savings for existing buildings.	6/14/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-065 California E-Bus to Grid Integration Project	No	Grid Operations/Market Design	$0	$0	$0	N/A
EPC-16-067 Robust Super Insulation at a Competitive Price	No	Demand-side Management	$100,000	$100,000	$100,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-065 California E-Bus to Grid Integration Project	$0	$0	$0	Antelope Valley Transit Authority	$0	0.0%
EPC-16-067 Robust Super Insulation at a Competitive Price	$100,000	$42,679	$1,600,000	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-065 California E-Bus to Grid Integration Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-065 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29 out of 31 bidders	Zero Net Energy (ZNE) Alliance
EPC-16-067 Robust Super Insulation at a Competitive Price	Grant	NEW IP TYPE(S): Technology Patent NEW IP DESCRIPTION: LBNL filed two provisional patent applications. One in 2019 and one in 2020. The 2020 application is the only active case. TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-067 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	43 bidders	Lawrence Berkeley National Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-065 California E-Bus to Grid Integration Project	Group 4: Ranked # 1	N/A	N/A	Yes; Micro Business, Minority Owned
EPC-16-067 Robust Super Insulation at a Competitive Price	N/A ***	N/A ***	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-065 California E-Bus to Grid Integration Project	Exposure to on-road diesel emissions is a factor in the symptoms of lung disease and asthma. E-Buses have the technical and economic potential to rapidly displace diesel transit buses. AVTA's E-buses have been deployed with onboard telematics to understand the vehicle's operating health and parameters. High-power wireless inductive charging has been shown to be a viable solution for in-route charging. Together, these technologies help overcome range limitations and uncertainty. However, while these technologies alone provide great value and overcome key adoption barriers, integrating them with analytics and distributed energy resource (DER) management platforms can unlock even greater value.	2a, 3f, 4a	The team developed an E-Fleet Energy Model that accounts for the effects of weather, geography, drivers' skill and other factors on the kWh/mi. efficiency of the E-Buses. Fleet operators are seeing the benefits of driver training in reducing the fleet's overall energy usage. The team also determined the greatest energy cost savings can be achieved through managed charging to reduce peak loads and charge during lower time-of-use rates. The project team worked with transit industry leaders in knowledge transfer activities to disseminate transit fleet electrification best practices.
EPC-16-067 Robust Super Insulation at a Competitive Price	Currently, there is no thermal building insulation material that can cost-effectively be assembled with high R-values. This Department of Energy cost share agreement is developing a manufacturing process to achieve a high R-value and decrease the installed thickness of the insulation, at a competitive price. This will make retrofits easier because much less space will be needed to accommodate existing building wall assemblies.	1h	This federal cost share grant has completed and the Final report is in review. This research set the ground work to develop a high R value material for building envelope insulation. The team achieved an R/inch of 9 for the one-inch insulation sample. In order to scale up, further RD&D is needed to create a larger sample size. LBNL filed a provisional patent application #62/001,818 was filed in 2020. At the end of March, LBNL expects to decide whether they will convert the provisional applications to have a publicly available patent application.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-068 Integrated Community-Level Solutions for Resource Management for a Grid and Customer Benefits	Applied Research and Development	This project demonstrates the feasibility of using an integrated community-scale solar plus storage system, sited at a low-income multi-family disadvantaged community in Willowbrook, CA. The technology solution balances a combination of grid-connected distributed energy resources (DERs), including advanced solar PV, energy storage, smart inverter, and load management. The project team is working with Southern California Edison to study the distribution grid impacts that the DERs can mitigate, realizing cost savings and enabling increased PV penetration. It is also investigating innovative business strategies to maximize the value of DERs to both end-users and the utility. Another objective of the project is to demonstrate a cost-effective solution to achieving Zero Net Energy (ZNE) within an affordable housing community to realize California's 2020 goal for new sustainable and scalable ZNE communities.	6/14/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-070 Integrating Front-of-the-Meter Energy Storage with Smart PV Inverters and Solar Forecasting	Technology Demonstration and Deployment	The purpose of this agreement is to design and install in front-of-meter energy storage with smart PV inverters and solar forecasting. The research will demonstrate a cost-effective and scalable solution that integrates distributed energy resources to address grid needs and identify cost reductions and revenue-generating opportunities for developers and commercial customers. The project will also identify barriers to integration of front-of-the meter resources and strategies to overcome these barriers.	6/14/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-068 Integrated Community-Level Solutions for Resource Management for a Grid and Customer Benefits	No	Demand-side Management	$2,976,991	$2,976,991	$1,205,790	N/A
EPC-16-070 Integrating Front-of-the-Meter Energy Storage with Smart PV Inverters and Solar Forecasting	No	Demand-side Management	$1,832,770	$1,832,770	$537,245	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-068 Integrated Community-Level Solutions for Resource Management for a Grid and Customer Benefits	$1,205,790	$864,761	$0	Electric Power Research Institute, Inc.; LINC Housing Corporation; Gridscape Solutions, Inc.; OhmConnect, Inc.; Staten Solar Corporation	$1,002,900	25.2%
EPC-16-070 Integrating Front-of-the-Meter Energy Storage with Smart PV Inverters and Solar Forecasting	$537,245	$644,129	$0	Electric Power Research Institute, Inc.; Sonoma Valley Unified School District	$591,438	24.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-068 Integrated Community-Level Solutions for Resource Management for a Grid and Customer Benefits	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-068 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31 out of 35 bidders	Electric Power Research Institute, Inc.
EPC-16-070 Integrating Front-of-the-Meter Energy Storage with Smart PV Inverters and Solar Forecasting	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-070 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31 out of 35 bidders	Electric Power Research Institute, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-068 Integrated Community-Level Solutions for Resource Management for a Grid and Customer Benefits	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-16-070 Integrating Front-of-the-Meter Energy Storage with Smart PV Inverters and Solar Forecasting	Group 6: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-068 Integrated Community-Level Solutions for Resource Management for a Grid and Customer Benefits	The project includes high efficiency bifacial 355 W solar modules manufactured by Canadian Solar that can substantially assist commercial and multifamily buildings with roof area constraints, as well as the integration of solar and storage with smart inverters that include segmentation of storage for meeting multiple needs. The project also demonstrates a platform that can manage both loads and storage while integrating DC mini grids to eliminate conversion losses for solar PV.	1a, 1b, 1c, 1e, 1f, 1h, 1i, 2a, 3f, 4a, 4b	The Energy Commission issued a Stop Work Order (SWO) on December 11, 2019, since EPRI's subcontractor and site host LINC Housing failed to execute a subcontract agreement with lender Los Angeles County Development Authority (LACDA), which needed to authorize LINC Housing to proceed with the start of construction. This impacted several aspects of the project, including the schedule for the start of construction; commissioning the system; and gathering, analyzing, and evaluating the data. EPRI addressed all requirements and was released from the SWO in August 2020. The construction-related activities, interconnection by SCE, and permit to operate were completed in Q4 2020, with data collection anticipated to start in Q1 2021.
EPC-16-070 Integrating Front-of-the-Meter Energy Storage with Smart PV Inverters and Solar Forecasting	The project will demonstrate an interoperable solution that integrates in front-of-the-meter energy storage with smart PV inverters and satellite-based solar forecasting to address grid limitations. The results will provide strategies for aggregating larger amounts of distributed energy resources on the grid with front-of-the-meter energy storage to support the state's goal for achieving zero carbon electricity by 2045.	1a, 1e, 3a, 4a	In 2020, the project focused on the interconnection process, which took more time than initially envisioned. Also, PG&E required that an existing transformer be transferred to the customer, and PG&E filed an ownership transfer approval request with the CPUC under Section 851 and General Order 173 in October, which was approved by CPUC on December 10. Separately, the storage system initially proposed for this project was no longer available due to the vendor closing its energy storage division in June and no California based vendors sell the same size battery within budget. The team identified a system at a different power rating that met the project scope. PG&E required the recipient to submit a revised interconnection application for the new energy storage system. The new application was submitted in September and the Small Generator Interconnection Agreement (SGIA) between PG&E and Sonoma Valley Unified School District was fully executed on December 14.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-073 Valencia Gardens Energy Storage	Technology Demonstration and Deployment	The project will deploy 750kWh of energy storage at a public housing complex in San Francisco's Mission District with existing PV of 580kW on a circuit with a peak load of 570kW. Valencia Gardens has 218 family flats and 42 senior apartments among 16 buildings on a five-acre site. This Energy Storage System (ESS) will provide multiple integrated services: increasing the PV hosting capacity of the circuit, optimizing and balancing circuit load and generation, providing ancillary services to the California Independent System Operator (CAISO), and providing local grid resilience.	6/14/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-077 Solar+ Storage Integrated Energy Management Demonstration in a Supportive Housing Facility	Applied Research and Development	The project deploys a 100 kW high-performing solar PV system, a 150 kW/150 kWh li-ion battery energy storage system, a smart inverter, and an advanced energy management platform to demonstrate different use cases and showcase the advanced functions of smart inverters. These components will be integrated to optimize flexibility in demand side energy management through load shifting, solar PV self-consumption, emergency back-up, demand response, and ancillary grid services. The proposed system will be able to autonomously meet demand response and energy management requests while critical loads at the building are maintained, minimizing operational impacts. It will also realize energy and demand charge cost savings to the building owner and tenants.	6/14/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-073 Valencia Gardens Energy Storage	No	Demand-side Management	$1,994,687	$1,994,687	$953,117	N/A
EPC-16-077 Solar+ Storage Integrated Energy Management Demonstration in a Supportive Housing Facility	No	Demand-side Management	$2,110,657	$2,110,657	$681,966	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-073 Valencia Gardens Energy Storage	$953,117	$251,310	$0	PATHION, INC	$620,470	23.7%
EPC-16-077 Solar+ Storage Integrated Energy Management Demonstration in a Supportive Housing Facility	$681,966	$332,995	$0	LINC Housing Corporation; Regents of the University of California, Riverside Campus; EnSync Energy Systems; EnerBlü	$411,509	16.3%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-073 Valencia Gardens Energy Storage	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-073 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31 out of 35 bidders	Natural Capitalism Solutions, dba Clean Coalition
EPC-16-077 Solar+ Storage Integrated Energy Management Demonstration in a Supportive Housing Facility	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-077 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31 out of 35 bidders	Regents of the University of California, Riverside Campus

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-073 Valencia Gardens Energy Storage	Group 6: Ranked # 2	N/A	N/A	None
EPC-16-077 Solar+ Storage Integrated Energy Management Demonstration in a Supportive Housing Facility	Group 1: Ranked # 3	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-073 Valencia Gardens Energy Storage	This project will lead to technological advancement and breakthroughs to overcome barriers to the achievement of California's statutory energy goals by utilizing energy storage as a local balancing and optimization solution on a circuit on the distribution grid. The project will demonstrate a combination of advancements and breakthroughs including, but not limited to, an advanced local energy system that utilizes energy storage on a circuit to optimize local circuit balancing, increases PV hosting capacity and provides the California Independent System Operator with ancillary services.	1e, 1h, 4a, 5b	The recipient worked through interconnection planning with PG&E and also received permit approval from the San Francisco Planning Commission on October 15, 2020 for the battery energy storage system. The project will now move forward to the construction phase, which is being coordinated with PG&E for interconnection to the grid. The system is expected to be operational in the second quarter of 2021.
EPC-16-077 Solar+ Storage Integrated Energy Management Demonstration in a Supportive Housing Facility	This project integrates BESS and PV technology with advanced control algorithms and smart inverter autonomous functions. The solar+ system uses high efficiency solar panels that are DC coupled with Li-ion BESS and demonstrates various smart inverter functions to provide autonomous grid services and energy management practices under a variety of operational conditions. The team is assessing the impact smart inverter-provided grid services and solar + storage operation have on each other. The project provides BESS and PV technology integrated with an energy management system to support diurnal energy loads. This project implements utility-initiated demand response functions and creates an architecture that allows expansion to future power regulation and potential wholesale market participation.	1c, 1d, 1e, 1g, 1h, 2a, 3d, 3f, 3h, 5a	Construction on the mixed-use supportive housing building was completed in 2020, and it is scheduled for occupancy by early 2021. UC Riverside spent most of 2020 permitting and applying for interconnection of the solar + storage system. The battery and solar equipment were installed onsite as of December 2020. To date, the research team has submitted their Energy Management System Test Plan, System Operation Test Plan, Control Algorithms Report, Smart Inverter Performance Assessment Test Plan, and System Impact Assessment Plan.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-079 Impact Assessment & Secure Implementation of California Rule 21 Phase 3 Smart Inverter Functions to Support High PV Penetration	Applied Research and Development	This project will comprehensively evaluate the smart inverter Phase III functions. The process includes computer modeling of California distribution circuits for economic analysis, implementation of Phase III functions in multiple inverter brands, laboratory testing, and field pilot testing. An economic analysis will build on the technical findings from the computer modeling, identifying the impact to the asset owner, performing an economic valuation of these impacts, and providing guidance regarding potential compensation. A comprehensive cyber security assessment of the communication system will be performed and key public infrastructure will be established to support the cyber security needs in California.	6/14/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-001 Best-in-Class: Demonstrating Scalable Operational Efficiency through Optimized Controls Sequences and Plug-and-Play Solutions	Technology Demonstration and Deployment	This demonstration optimizes and simplifies control upgrades (HVAC and lighting) that achieve energy savings while also improving occupant comfort by using automated fault detection and diagnostics, continuous commissioning, and advanced measurement and verification procedures. The team will use the results to develop recommendations for strategies, tools, and initiatives to address market barriers and promote large scale market adoption.	7/12/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-16-079 Impact Assessment & Secure Implementation of California Rule 21 Phase 3 Smart Inverter Functions to Support High PV Penetration	No	Grid Operations/Market Design	$2,935,822	$2,935,822	$2,642,240	N/A
EPC-17-001 Best-in-Class: Demonstrating Scalable Operational Efficiency through Optimized Controls Sequences and Plug-and-Play Solutions	No	Demand-side Management	$2,966,716	$2,966,716	$2,289,644	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-16-079 Impact Assessment & Secure Implementation of California Rule 21 Phase 3 Smart Inverter Functions to Support High PV Penetration	$2,642,240	$601,394	$0	Electric Power Research Institute, Inc.; SunSpec Alliance; Sunrun	$1,659,077	36.1%
EPC-17-001 Best-in-Class: Demonstrating Scalable Operational Efficiency through Optimized Controls Sequences and Plug-and-Play Solutions	$2,289,644	$934,507	$4,600,000	Trane U.S., Inc.; United States Department of Energy; Automated Logic Corporation; Siemens Corporation, Corporate Technology; Kaiser Permanente Medical Center; Enlighted Inc.; Delos; KGS Buildings; Alerton	$2,773,750	48.3%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-16-079 Impact Assessment & Secure Implementation of California Rule 21 Phase 3 Smart Inverter Functions to Support High PV Penetration	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-16-079 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31 out of 35 bidders	Electric Power Research Institute, Inc.
EPC-17-001 Best-in-Class: Demonstrating Scalable Operational Efficiency through Optimized Controls Sequences and Plug-and-Play Solutions	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-001 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 2: 13 out of 15 bidders	Taylor Engineering

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-16-079 Impact Assessment & Secure Implementation of California Rule 21 Phase 3 Smart Inverter Functions to Support High PV Penetration	Group 4: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-17-001 Best-in-Class: Demonstrating Scalable Operational Efficiency through Optimized Controls Sequences and Plug-and-Play Solutions	Group 1: Ranked # 1	N/A	N/A	Yes; Small Business, Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-079 Impact Assessment & Secure Implementation of California Rule 21 Phase 3 Smart Inverter Functions to Support High PV Penetration	This project will help overcome three major barriers to achieving the state's energy goals by: 1) proving that CA Rule 21 Phase III functions can be deployed feasibly, safely and predictably via standardization; 2) demonstrating that grid penetration levels can be increased by 25% or more via use of the Phase III advanced control functions; and 3) enabling secure, scalable and affordable cyber security infrastructure that can make the grid safer and more reliable.	1a, 1b, 5a, 5b, 5f, 5g	In 2020, the project team continued the evaluation of two commercial smart inverters for Phase III compliance. The lab test at the University of California, San Diego (UCSD) was also leveraged to conduct cyber security testing (penetration testing). The test results were aimed at providing guidelines to California's DER stakeholders about safe and secure deployment of smart inverter communications. A proof of concept for cyber secure communications was established, 50 residential customers were recruited for the field demonstration of Rule 21 Phase III functions, and communication and control systems to update Phase III functions was successfully established. In March 2020 all testing was completed. The project concluded successfully in September 2020 and the final report was published in December 2020.
EPC-17-001 Best-in-Class: Demonstrating Scalable Operational Efficiency through Optimized Controls Sequences and Plug-and-Play Solutions	This project facilitates increased market adoption of control system retrofits that result in significant energy savings in commercial buildings. The successful demonstration of scalable, plug-and-play integrated packages of HVAC and lighting controls will allow commercial building owners and operators to maximize energy savings across large portfolios of buildings while reducing transaction costs.	1f, 1h	Progress this year includes finalizing installations of optimized controls at all demonstration sites, commissioning installed systems, and collecting data. Preliminary results indicate whole building electricity savings of 10-25%.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-002 Scaling Solar+ for Small and Medium Commercial Buildings	Applied Research and Development	This project is developing standardized components for a Solar+ system designed specifically for the SMB sector. The research team is designing, implementing, operating, and evaluating a Solar+ system in a pilot scale application at a convenience store. The project is designed to innovate across three key priority areas necessary for technology scale-up: hardware design guidelines, integration software, and site targeting. Filling these knowledge gaps will help move the deployment of Solar+ technologies forward, thereby bringing substantial benefit to individual building owners, as well as opening opportunities to provide service to the broader distribution and bulk power systems. This project focuses on the convenience store/fueling station SMB sector, but lessons learned and products developed can be transferred to other SMB sectors.	7/12/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-003 Developing a Comprehensive, System-Wide Forecasting to Support High-Penetration Solar	Applied Research and Development	This project developed, tested, and validated a high-accuracy forecast for photovoltaic (PV) generation across California and coordinated with the California Independent System Operator (CAISO) on incorporating the results into its PV forecasting operation. The comprehensive forecast included both behind-the-meter (BTM) and in-front-of-the meter scale PV systems. The project quantified the costs and benefits of these improvements. The researchers used mid-term distributed energy resource (DER) adoption forecasts adapted from the investor-owned utility distribution resource plans to project the distribution of DERs through 2050. The team also provided CAISO with the steps required to incorporate the statistically-adjusted BTM solar PV generation estimates into CAISO's Reconstituted Load forecasting approach.	7/12/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-002 Scaling Solar+ for Small and Medium Commercial Buildings	No	Demand-side Management	$1,500,000	$1,500,000	$1,229,894	N/A
EPC-17-003 Developing a Comprehensive, System-Wide Forecasting to Support High-Penetration Solar	No	Generation	$750,000	$750,000	$744,661	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-002 Scaling Solar+ for Small and Medium Commercial Buildings	$1,229,894	$413,443	$0	Humboldt State University Sponsored Programs Foundation; Tesla Motors, Inc.; Serraga Energy, LLC at Blue Lake Rancheria	$354,959	19.1%
EPC-17-003 Developing a Comprehensive, System-Wide Forecasting to Support High-Penetration Solar	$744,661	$261,080	$0	State University of New York at Albany; Clean Power Research, L.L.C.	$320,000	29.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-002 Scaling Solar+ for Small and Medium Commercial Buildings	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-002 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31 out of 35 bidders	Humboldt State University Sponsored Programs Foundation
EPC-17-003 Developing a Comprehensive, System-Wide Forecasting to Support High-Penetration Solar	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31 out of 35 bidders	Clean Power Research, L.L.C.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-002 Scaling Solar+ for Small and Medium Commercial Buildings	Group 2: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-17-003 Developing a Comprehensive, System-Wide Forecasting to Support High-Penetration Solar	Group 5: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-002 Scaling Solar+ for Small and Medium Commercial Buildings	This project is integrating DERs, including energy storage, and controllable loads to increase the value of Solar+ systems in the SMB sector. Optimized relative sizing of batteries to PV and flexible operations from model-predictive control (MPC)-enabled building automation are demonstrating how investment in an integrated system can save costs and create efficiency compared to standalone PV and storage. The project is developing and demonstrating an open-source MPC algorithm. Improved hardware-software interfaces integrate the solar PV system with localized energy storage and MPC-improved load control systems. This allows SMB owners to optimize the benefits of distributed solar and approach net-zero energy buildings while also supporting the larger grid power system.	1c, 1e, 1f, 1h, 1i, 2a, 3d, 3h, 5a, 5f	The convenience store microgrid at Blue Lake Rancheria successfully demonstrated its load-shedding and islanding capabilities while responding to California's grid needs in the September 2020 fire season. Schatz Energy Research Center at Humboldt State University conducted capability and performance testing of the solar plus storage system from August to September 2020, and as of December 2020, the research team's final report is under review for publication. The final meeting for this agreement is scheduled for January 2021.
EPC-17-003 Developing a Comprehensive, System-Wide Forecasting to Support High-Penetration Solar	This project advanced the state of PV forecasting in California by improving the accuracy of solar irradiance and PV forecasts, particularly rooftop solar, which was not previously well-understood. Participants in the Energy Commission's January 2017 forecasting workshop identified the lack of visibility into DER impacts on net load as a major barrier to generating accurate forecasts. Forecast inaccuracies cost California millions of dollars annually and result in the unnecessary curtailment of renewable generation.	1c, 2a, 3a, 5c	The project developed several forecast improvements by advancing methods for identifying low-level clouds motion and PV forecast uncertainty. The researchers refined the Reconstituted Load Model, developed under a prior EPIC agreement, to account for systematic day-ahead forecast errors due to the misspecification of the solar PV generation impact. The study demonstrated that the accuracy of the existing Reconstituted Load models can be improved by replacing the unadjusted solar PV generation with statistically-adjusted data. The day-ahead forecast of the morning, midday/afternoon, evening, and dawn hours are expected to have accuracy gains of 20%, 3%, 10%, and 8%, respectively. CAISO has incorporated this project's BTM forecast into its short-term load forecast models to improve the forecasts as penetrations of BTM solar increase. The final report was published in September 2020.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-004 Enhanced Modeling Tools to Maximize Solar + Storage Benefits	Applied Research and Development	This project developed a free, publicly available tool that performs a comprehensive cost-effectiveness analysis for energy storage and other distributed energy resources (DER). The Solar + Storage Tool identifies the most effective and economical approach of integrated solar photovoltaic and storage systems and estimates the value delivered to the customers based on their expected operations, location on the grid, electricity market prices, and other factors. The Solar + Storage Tool is equipped with the California Public Utilities Commission's (CPUC) avoided costs for DERs, as well as market-price forecasts and utility rates, to develop cost-benefit analyses from a variety of perspectives.	7/12/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-005 Integrating Building-Scale Solar + Storage Advanced Technologies Maximizing Value to Customer and the Distribution Grid	Applied Research and Development	This project assesses the performance and benefits of integrated solar PV and storage along with advanced energy efficiency, demand response, and distributed energy resource management technologies in a commercial building setting. The goal is to leverage the synergies of integrated and controllable components to improve distribution grid stability and reliability while also enabling the commercial customer to reduce both capital costs and operational and management costs for optimal value.	7/12/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-004 Enhanced Modeling Tools to Maximize Solar + Storage Benefits	No	Demand-side Management	$987,379	$987,379	$987,368	N/A
EPC-17-005 Integrating Building-Scale Solar + Storage Advanced Technologies Maximizing Value to Customer and the Distribution Grid	No	Distribution	$1,491,764	$1,491,764	$1,080,210	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-004 Enhanced Modeling Tools to Maximize Solar + Storage Benefits	$987,368	$457,030	$0	Southern California Edison; Energy and Environmental Economics, Inc. (E3); Starboard Energy Advisors, LLC	$115,463	10.5%
EPC-17-005 Integrating Building-Scale Solar + Storage Advanced Technologies Maximizing Value to Customer and the Distribution Grid	$1,080,210	$360,079	$0	Electric Power Research Institute, Inc.	$271,090	15.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-004 Enhanced Modeling Tools to Maximize Solar + Storage Benefits	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31 out of 35 bidders	Energy and Environmental Economics, Inc. (E3)
EPC-17-005 Integrating Building-Scale Solar + Storage Advanced Technologies Maximizing Value to Customer and the Distribution Grid	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31 out of 35 bidders	Electric Power Research Institute, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-004 Enhanced Modeling Tools to Maximize Solar + Storage Benefits	Group 3: Ranked # 1	N/A	N/A	Yes; Small Business, Calif Based Entity
EPC-17-005 Integrating Building-Scale Solar + Storage Advanced Technologies Maximizing Value to Customer and the Distribution Grid	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-004 Enhanced Modeling Tools to Maximize Solar + Storage Benefits	This project developed a modeling tool, with feedback from Technical Advisory Committee members, that enhanced the existing Local Net Benefits Analysis (LNBA) tool developed by the project team under the CPUC's Distribution Resource Planning (DRP) proceeding. As a successor to the LNBA tool, this tool can perform the same analysis, but with a higher degree of accuracy and additional functionalities. In addition to the DER benefits evaluation provided by the LNBA tool, the Solar + Storage Tool can evaluate a suite of DER technologies and perform pro forma analyses to calculate total project costs. It's capable of simulating the operations of DERs under different tariff and program designs and determining the new designs that align the best uses of DERs for customers and for the grid and can maximize the benefits of DERs for ratepayers.	1a, 1b, 1c, 2a, 3b	The public release of the Solar + Storage Modeling Tool was completed in June 2019, with the link to download the tool available at the Energy Commission's website. E3 held two public workshops to introduce the tool. The first workshop in June 2019 introduced the tool, reviewed the user guide and functionalities, and discussed how the tool can simulate and determine which design will maximize the benefits of DERs to ratepayers. The workshop in August 2019 provided an in-depth training for stakeholders interested in using the tool. E3 guided stakeholders through the process of creating inputs, analyzing the cases, and viewing the final results. This vetted public tool is also available for evaluating DER with local distribution benefits in the CPUC's Integrated Distributed Energy Resources and DRP proceedings. The final report was published in September 2020.
EPC-17-005 Integrating Building-Scale Solar + Storage Advanced Technologies Maximizing Value to Customer and the Distribution Grid	For California to achieve its long-term greenhouse gas reduction goals, there is a greater need for flexibility at all levels of grid operations. This project is demonstrating a suite of DER technologies, including solar + storage, at a commercial building, with the capability for active and reliable control of customer-owned loads and resources to 1) reduce the building owner's energy bill and 2) reduce the need to build new transmission and distribution infrastructure that is often required to compensate for high loads and customer-side generation.	1h	The project team completed the majority of the installation at the demonstration site in early 2020 but had problems getting approved for interconnection through PG&E due to test failures, design issues, and missing documents. Those issues are now resolved, and the project is almost ready for interconnection. As of November 2020, EPRI is in the process getting bollards installed to prevent vehicles from backing into the meter. Once that is done, PG&E will issue permission to operate. The project has been delayed in part because of COVID-19. EPRI has completed the following deliverables: DER-integrated design document, test plan, requirements definition document, site readiness document, measurement and verification plan, software algorithm report, final report outline, energy data warehouse final report, tariff effectiveness document.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-006 Development, Implementation, and Integration of a Holistic Solar Forecasting System for California	Applied Research and Development	The project develops an improved forecasting system for solar irradiance in California, with a particular focus on fog and stratus conditions, through targeted deployment of instrumentation. The improved forecasts will be integrated into operational tools for use by the California Independent System Operator (CAISO) and utilities. This project utilizes a targeted instrumentation network, consisting of existing and new sensors, to improve the models used for forecasting fog and stratus conditions. The Recipient will design and deploy this network with the aim of improving the forecasts that are most important to CAISO and utility operations.	7/12/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-007 Integrated Community Solar and Storage at a Low-Income Mobile Home Park	Applied Research and Development	The Center for Sustainable Energy (CSE) planned to apply high efficiency solar and storage technologies to create an integrated community solar and storage energy system at a low-income mobile home park. If this project had proceeded as planned, it would have illuminated operational strategies for solar and storage to provide clear value propositions to end-use customers with existing tariff structures and demonstrated alternate structures and additional value streams that could have increased the value of solar and storage to the end customer while better achieving distribution system operational goals.	7/12/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-006 Development, Implementation, and Integration of a Holistic Solar Forecasting System for California	No	Grid Operations/Market Design	$749,740	$749,740	$674,642	N/A
EPC-17-007 Integrated Community Solar and Storage at a Low-Income Mobile Home Park	No	Grid Operations/Market Design	$2,005,923	$2,005,923	$28,528	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-006 Development, Implementation, and Integration of a Holistic Solar Forecasting System for California	$674,642	$365,395	$0	Electric Power Research Institute, Inc.; Sonoma Technology, Inc.; AWS Truepower, LLC	$324,830	30.2%
EPC-17-007 Integrated Community Solar and Storage at a Low-Income Mobile Home Park	$28,528	$499,016	$0	Resident Owned Parks, Inc.	$340,905	14.5%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-006 Development, Implementation, and Integration of a Holistic Solar Forecasting System for California	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-006 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31 out of 35 bidders	Electric Power Research Institute, Inc.
EPC-17-007 Integrated Community Solar and Storage at a Low-Income Mobile Home Park	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	31 out of 35 bidders	Center for Sustainable Energy

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-006 Development, Implementation, and Integration of a Holistic Solar Forecasting System for California	Group 5: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-17-007 Integrated Community Solar and Storage at a Low-Income Mobile Home Park	Group 1: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-006 Development, Implementation, and Integration of a Holistic Solar Forecasting System for California	The use of an advanced network of existing and new instrumentation to inform numerical weather and statistical model improvements will significantly improve the current state of solar forecast modeling in California. The holistic forecasts produced will showcase a combination of various aspects of the weather forecast value chain, not previously demonstrated, linking observation systems and advanced physical and statistical modeling for solar forecasting. The project's focus on fog and marine layer forecasts, which are traditionally challenging to predict, will improve solar energy forecasting and contribute to increased PV penetration.	1b, 2a	The project completed a measurement program involving targeted deployment of ground-based atmospheric boundary layer sensors. This successful measurement program can serve as a model for coordinating similar efforts in the future. Given the overlapping benefits of boundary layer sensor data across weather, air quality, and energy forecasting applications. The team performed many months of forecasts to investigate the impact of various physical parameterization choices on the WRF model. The results show an overall improvement in forecast skill and suggested that point measurements at a handful of locations are not likely to substantially improve forecasts above their already fairly high skill. The team also implemented and tested machine learning models for predicting cloudiness and solar irradiance at very short-term forecast horizons using project sensor data. Overall results could be integrated into operational tools of CAISO and utilities.
EPC-17-007 Integrated Community Solar and Storage at a Low-Income Mobile Home Park	This project planned to design, install, and evaluate integrated high-efficiency solar panels with energy storage batteries, along with low-cost control hardware to demonstrate the impact of an integrated community solar and energy storage system in a low-income mobile home community. The project was designed to demonstrate the impact of an integrated community solar and energy storage system in a low-income community mobile home community to reduce net energy consumption and energy bills. A demonstration of a scalable solar and storage solution that provides clear value to residents is necessary to spur adoption of these clean energy technologies in the underserved mobile home residential sector.	3h	Due to many complications in subcontracting and siting, agreement EPC-17-007 is being processed for mutual termination with CSE.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-008 Empowering Energy Efficiency in Existing Big-Box Retail/ Grocery Stores	Technology Demonstration and Deployment	This project demonstrates the impact of an integrated suite of pre-commercial energy efficiency technologies in a large, existing, retail building located near a disadvantaged community. One of the technologies that comprise the installation package includes a novel supervisory controller to provide system-wide optimization, to reduce electricity consumption across numerous building subsystems, including lighting, refrigeration, and heating, ventilation, and air-conditioning. This could enable site electricity savings of greater than 20%.	7/12/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-009 Bundle-Based Energy Efficiency Technology Solutions for California (BEETS for California)	Technology Demonstration and Deployment	This project demonstrates three innovative bundles of pre-commercial technologies. The technology bundles were strategically developed through a systems-level approach to address the most energy-intensive areas in commercial buildings. These include: (1) Chilled Water Plants: Optimized all-variable-speed chilled-water (CHW) plants utilizing alternative refrigerant chillers. (2) Office and Exterior Space LED fixtures with integrated advanced controls, advanced building management system (BMS), and plug load controls controllable for demand response (DR), and off-grid, exterior, LED lighting in the parking lot, and lastly (3) Advanced laboratory ventilation, fume hood exhaust, and direct current (DC) lighting systems.	7/12/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-008 Empowering Energy Efficiency in Existing Big-Box Retail/ Grocery Stores	No	Demand-side Management	$2,824,685	$2,824,685	$1,770,617	N/A
EPC-17-009 Bundle-Based Energy Efficiency Technology Solutions for California (BEETS for California)	No	Demand-side Management	$3,994,256	$3,994,256	$2,586,411	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-008 Empowering Energy Efficiency in Existing Big-Box Retail/ Grocery Stores	$1,770,617	$544,329	$0	Southern California Edison; Center for Sustainable Energy; TRC Engineers, Inc.; Software Motor Corporation; Walmart; LumaStream LLC; i2 Systems California; Rector Law Office	$759,984	21.2%
EPC-17-009 Bundle-Based Energy Efficiency Technology Solutions for California (BEETS for California)	$2,586,411	$875,037	$0	Trane U.S., Inc.; ASWB Engineering; Willdan Energy Solutions; Aris Wind	$2,382,225	37.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-008 Empowering Energy Efficiency in Existing Big-Box Retail/ Grocery Stores	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-008 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 2: 13 out of 15 bidders	Center for Sustainable Energy
EPC-17-009 Bundle-Based Energy Efficiency Technology Solutions for California (BEETS for California)	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 2: 13 out of 15 bidders	Willdan Energy Solutions

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-008 Empowering Energy Efficiency in Existing Big-Box Retail/ Grocery Stores	Phase 2: Ranked # 3	N/A	N/A	Yes; Calif Based Entity
EPC-17-009 Bundle-Based Energy Efficiency Technology Solutions for California (BEETS for California)	Phase 2: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-008 Empowering Energy Efficiency in Existing Big-Box Retail/ Grocery Stores	This project demonstrates how pre-commercial energy efficient technologies can deliver cost-effective, deep electric savings in a big-box retail environment, while also showcasing the demand reduction potential of these strategies. The project team will install a holistic suite of pre-commercial technologies such as a variable speed rooftop unit (RTU), high rotor pole switched reluctance (HRPSR) retrofit motor, direct current (DC) LED technology, direct-evaporative cooling to treat RTU condenser inlet air, and a cloud-based control system that will monitor all systems and detect energy waste, equipment malfunctions, and other operational problems. These technologies have the ability to demonstrate 20% energy savings.	1f, 1h, 2a, 3a, 4c	in 2020, the team identified a new lighting technology with I2 Systems, Inc. The lighting system uses DC drivers to power the LED lights in the store. NREL completed the optimization report which outlined the modeling of the suite of measures to be installed at the store. The modeling predicts that the measures will achieve the overall goal of reducing the site's electricity consumption by 20%. In 2020, construction began with installation of new efficient motors for the RTU and refrigeration systems. In 2021, the project is expected to complete installation and begin their 12 months of post-retrofit data collection.
EPC-17-009 Bundle-Based Energy Efficiency Technology Solutions for California (BEETS for California)	The demonstration project offers an innovative approach applicable to a range of commercial buildings. This strategy will accelerate adoption of energy savings technologies, contributing to reaching the state's energy efficiency and GHG reduction goals. By demonstrating this comprehensive approach in a real-world application this research has the potential to lead to further scale up and adoption of similar technology packages in other government and commercial buildings.	1f, 1h, 3b	The project continues to progress as expected. The Recipient worked with site owners to meet their procurement requirements and the chiller, cooling tower, and lab space retrofits have been completed. Work is ongoing to complete the DC backup infrastructure and plug load controls. Measurement and verification is ongoing and preliminary data shows the project will exceed the expected 20% site savings. Data analysis and lessons learned are ongoing and a draft final report is expected in late 2020.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-010 Integrated Heat and Moisture Calculation Tool for Building Envelopes	Applied Research and Development	This jointly funded project with the US Department of Energy developed a software calculation tool, THERMM, to enable end users to design buildings resistant to moisture accumulation and moisture-related damage. The agreement builds on the widely used existing software program, THERM, and adds moisture characteristics to the simulation tools. This will help account for moisture characteristics to reduce occupants' health and safety issues and improve building envelop design and performance.	8/9/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-011 Demonstration of an Innovative, Community-Scale, Organic Waste-to-Energy Facility	Technology Demonstration and Deployment	The goal of the project was to construct and demonstrate operation of an innovative, state-of-the-art anaerobic digestion facility for converting organic waste into renewable electricity in San Luis Obispo County. The facility is the first of its kind in dry digester technology to be installed in the United States and is expected to process about 36,500 tons of food waste and urban waste into 6.2 million kWh per year of renewable electricity, 13,000 tons of compost, and 1.6 million gallons of liquid fertilizer leading to a host of benefits for the environment (e.g., reduction of 5,300 MT CO2e per year), economy, grid reliability, and safety.	8/9/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-010 Integrated Heat and Moisture Calculation Tool for Building Envelopes	No	Demand-side Management	$125,000	$125,000	$125,000	N/A
EPC-17-011 Demonstration of an Innovative, Community-Scale, Organic Waste-to-Energy Facility	No	Generation	$4,000,000	$4,000,000	$4,000,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-010 Integrated Heat and Moisture Calculation Tool for Building Envelopes	$125,000	$59,209	$1,375,175	None	$0	0.0%
EPC-17-011 Demonstration of an Innovative, Community-Scale, Organic Waste-to-Energy Facility	$4,000,000	$0	$0	HZIU Kompogas SLO Inc.	$5,278,373	56.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-010 Integrated Heat and Moisture Calculation Tool for Building Envelopes	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	43 bidders	Lawrence Berkeley National Laboratory
EPC-17-011 Demonstration of an Innovative, Community-Scale, Organic Waste-to-Energy Facility	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-011 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders	HZIU Kompogas SLO Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-010 Integrated Heat and Moisture Calculation Tool for Building Envelopes	N/A ***	N/A ***	N/A	Yes; Calif Based Entity
EPC-17-011 Demonstration of an Innovative, Community-Scale, Organic Waste-to-Energy Facility	Group 3: Ranked # 1	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-010 Integrated Heat and Moisture Calculation Tool for Building Envelopes	The development of a cost-effective modeling software tool enables improved envelope designs that integrate themal efficience and moisture mitigation, thus increasing building energy efficiency.Shifting the way we design buildings.The target market is architects, engineers, builders and consultants involved in the design and implementation of building envelope components. Building envelopes represent approximately 0.37 quads in California's residential and commercial buildings. The ability to design moisture control with great deal of confidence will improve energy efficiency of building envelopes and can prolong the life of buildings. It is estimated that 5% improvement in building envelope energy performance can be attributed to more confident building envelope design, resulting in 0.02 quads in energy savings in California.	1f, 1h	The existing THERM software already had a large, established user community of professionals, academics, and researchers using the tool for rating windows and buildings. The team continues to use web-based forums to disseminate information and request testing from users. The research team is currently testing and doing verification of THERM-M and continues to work on making the software tool more user friendly and fixing bugs in the software based on user feedback. The draft final report is under review. The team continues to inform potential users at conferences and industry gatherings regarding the project results. The web page with the latest version of THERM-M, as well as documentation, including technical documentation is located on the LBNL Therm 8 / Window 8 web page (https://windows.lbl.gov/therm-8-window-8).
EPC-17-011 Demonstration of an Innovative, Community-Scale, Organic Waste-to-Energy Facility	This project will benefit California ratepayers by demonstrating an innovative, state-of-the-art anaerobic digester facility. Once economical operation is proven, similar facilities can be replicated across California to provide similar benefits to other local communities.	1a, 1b, 1c, 2a, 3a, 3b, 3g, 3h, 4a	The project successfully completed the construction and demonstration of the state-of-the-art anaerobic digester facility in San Luis Obispo. The facility currently converts 700 tons of green waste and food waste per week into 465 kWh of renewable electricity on average. The BioMAT PPA agreement was executed in July 2019 and facility has since been selling power to PG&E at a price 12.7 cents per kWh. In addition, the facility produces compost and has been selling it to wineries.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-012 Biomass-to-Electricity: Pilot-Scale Testing of Baseload Compared to Flexible Power	Applied Research and Development	The project tests and evaluates three different energy pathways for conversion of woody biomass to electricity. The three pathways tested with the pilot-scale gasifier system are: 1) clean fuel gas production for baseload power generation, 2) syngas to Fischer-Tropsch liquid production for storage and flexible power generation, and 3) direct bio-crude production for storage and flexible power generation. Results from the three pathways will be compared and an optimal pathway will be identified for extended testing. After performing extended testing of the optimal pathway, the technical, environmental, and economic performance of a full-scale facility will be evaluated.	7/12/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-013 Small Scale Forest Waste Power System	Applied Research and Development	This project develops a pilot-scale modular biomass power system called Altex Forest Power Technology (FORPOWER) that uses biomass from forest management as fuel to generate renewable electricity. FORPOWER is based on an indirectly-fired gas turbine technology that separates the fuel combustion products from the clean gas turbine working fluid by using a novel heat exchanger. The system uses forest slash as a renewable fuel while meeting criteria pollutant requirements, reducing greenhouse gas emissions, supporting renewable energy goals, and improving forest sustainability. FORPOWER is expected to cost-effectively convert forest slash to electric power and interconnect with the grid at distributed locations within investor-owned utility regions that are close to forest resources.	7/12/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-012 Biomass-to-Electricity: Pilot-Scale Testing of Baseload Compared to Flexible Power	No	Generation	$1,499,000	$1,499,000	$1,279,285	N/A
EPC-17-013 Small Scale Forest Waste Power System	No	Generation	$1,499,994	$1,499,994	$1,335,698	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-012 Biomass-to-Electricity: Pilot-Scale Testing of Baseload Compared to Flexible Power	$1,279,285	$254,980	$0	None	$0	0.0%
EPC-17-013 Small Scale Forest Waste Power System	$1,335,698	$768,611	$0	Altex Technologies Corporation; The Avogadro Group, LLC	$161,728	9.7%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-012 Biomass-to-Electricity: Pilot-Scale Testing of Baseload Compared to Flexible Power	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-012 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders	Taylor Energy
EPC-17-013 Small Scale Forest Waste Power System	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders	Altex Technologies Corporation

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-012 Biomass-to-Electricity: Pilot-Scale Testing of Baseload Compared to Flexible Power	Group 1: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-17-013 Small Scale Forest Waste Power System	Group 1: Ranked # 4	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-012 Biomass-to-Electricity: Pilot-Scale Testing of Baseload Compared to Flexible Power	This project will test and evaluate new biomass-to-energy pathways, which is critical to meeting several of California's energy goals and provides numerous economic, environmental, and safety benefits to California ratepayers.	2a, 3a, 3b, 3e, 4a	The project team has completed initial system modifications and has performed testing of the first pathway - clean fuel gas production for baseload power generation. The project team is performing system modifications required for testing of the other two pathways. The contractor has completed gas clean-up and carbon-char removal systems, while testing biomass gasification.
EPC-17-013 Small Scale Forest Waste Power System	Integrating a low cost feedstock densification approach and innovative heat exchanger with gasifier and externally-fired gas turbine to efficiently generate electricity from forest slash will provide multiple benefits to California investor-owned utility ratepayers, including reduced power cost relative to alternative approaches, improved electric power generation reliability, reduced risk of forest fires and pollutant emissions, and improved economic development opportunities in forested regions.	1a, 2a	FORPOWER densification and bioenergy modules have been built and tested. The work was delayed due to a generator power output problem and a biomass feeding problem. Both problems were corrected, and testing of those components was completed. Technical and economic evaluation are proceeding and data results being collected for the report. The results will determine the potential of the concept to convert forest slash into power.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-014 Advanced Plug Load Controls and Management in the Educational Environment	Technology Demonstration and Deployment	This project deploys APMD technology at approximately 3,500 computer workstations at several community colleges, and focuses on integrating the technology with facility operations to ensure that they meet the needs of the sites and staff. One of the devices is the Embertec Tier 2 Advanced Power Strip which controls an occupant's computer workstation by powering off when it detects no user presence by mouse movement or keyboard hits. The other device is the Ibis Intellisocket which controls large plug load end uses such as water coolers, TV displays, and large printers. Key features of the project include outreach and individual education programs to California Community College Districts, evaluation of sites for participation in the project, purchase and installation of APMDs at approved sites, measurement and verification (M&V) activities both pre- and post-APMD implementation at the selected demonstration sites. The goal is that the plug load controllers are reduce energy use by 20%.	8/9/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-014 Advanced Plug Load Controls and Management in the Educational Environment	No	Demand-side Management	$1,264,296	$1,264,296	$1,149,708	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-014 Advanced Plug Load Controls and Management in the Educational Environment	$1,149,708	$181,505	$0	Ibis Networks; Newcomb Anderson McCormick, Inc.; Embertec	$625,486	33.1%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-014 Advanced Plug Load Controls and Management in the Educational Environment	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-014 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 2: 13 out of 15 bidders	Newcomb Anderson McCormick, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-014 Advanced Plug Load Controls and Management in the Educational Environment	Phase 2: Ranked # 4	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-014 Advanced Plug Load Controls and Management in the Educational Environment	Reductions in electricity consumption and cost could occur with implementation of the APMD technology. Preliminary results show that the plug load controllers are reducing the controlled plug loads by 20%. Following project completion, the APMD systems will continue to provide savings throughout their 8 to 10 year expected useful life. Successful deployment at participating Districts could be leveraged to expand technology adoption to other community colleges.	1f, 1h, 2a	The project team completed installations of nearly more than 3,500 plug load controllers across multiple community colleges. In 2020, the team collected more than one year of post-installation data. Currently, the devices are controlling approximately 700,000 kWh of annual baseline plug loads across all the demonstration sites. Preliminary results show that the plug load controllers are reducing the controlled plug loads by 20% or 142,000 kWh/yr. The team is currently finalizing their draft final report and technology transfer tasks for the project. The technology transfer activities include meeting with community college facility meetings to see if they will further adopt these technologies to other locations based on the savings presented.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-014 Advanced Plug Load Controls and Management in the Educational Environment	Technology Demonstration and Deployment	This project deploys APMD technology at approximately 3,500 computer workstations at several community colleges, and focuses on integrating the technology with facility operations to ensure that they meet the needs of the sites and staff. One of the devices is the Embertec Tier 2 Advanced Power Strip which controls an occupant's computer workstation by powering off when it detects no user presence by mouse movement or keyboard hits. The other device is the Ibis Intellisocket which controls large plug load end uses such as water coolers, TV displays, and large printers. Key features of the project include outreach and individual education programs to California Community College Districts, evaluation of sites for participation in the project, purchase and installation of APMDs at approved sites, measurement and verification (M&V) activities both pre- and post-APMD implementation at the selected demonstration sites. The goal is that the plug load controllers are reduce energy use by 20%.	8/9/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-015 Installation and Soft Cost Reduction for Horizontal Single Axis Trackers (Stage II)	Technology Demonstration and Deployment	This project is demonstrating a novel single axis solar PV tracking system suitable for sloped and rolling terrain. This will help solar developers build projects on lands closer to load centers and interconnection points that typically would not be considered, creating more site options. The construction costs are reduced by eliminating the need for grading soil and environmental mitigation costs can be cut as well. The new tracker was developed through a DOE award and a full-scale system is under testing at a rolling terrain near Davis, CA. The Energy Commission grant is funding improvements and testing of the various tracker components in an effort to find cost-cutting opportunities to update the product design and optimize it for full-scale manufacturing.	8/8/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-014 Advanced Plug Load Controls and Management in the Educational Environment	No	Demand-side Management	$0	$0	$0	N/A
EPC-17-015 Installation and Soft Cost Reduction for Horizontal Single Axis Trackers (Stage II)	No	Generation	$999,822	$999,822	$999,822	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-014 Advanced Plug Load Controls and Management in the Educational Environment	$0	$0	$0	Ibis Networks; Newcomb Anderson McCormick, Inc.; Embertec	$0	0.0%
EPC-17-015 Installation and Soft Cost Reduction for Horizontal Single Axis Trackers (Stage II)	$999,822	$76,846	$2,999,466	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-014 Advanced Plug Load Controls and Management in the Educational Environment	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-014 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 2: 13 out of 15 bidders	Newcomb Anderson McCormick, Inc.
EPC-17-015 Installation and Soft Cost Reduction for Horizontal Single Axis Trackers (Stage II)	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-015 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	43 bidders	Nevados Engineering, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-014 Advanced Plug Load Controls and Management in the Educational Environment	Phase 2: Ranked # 4	N/A	N/A	Yes; Calif Based Entity
EPC-17-015 Installation and Soft Cost Reduction for Horizontal Single Axis Trackers (Stage II)	N/A ***	N/A ***	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-014 Advanced Plug Load Controls and Management in the Educational Environment	Reductions in electricity consumption and cost could occur with implementation of the APMD technology. Preliminary results show that the plug load controllers are reducing the controlled plug loads by 20%. Following project completion, the APMD systems will continue to provide savings throughout their 8 to 10 year expected useful life. Successful deployment at participating Districts could be leveraged to expand technology adoption to other community colleges.	1f, 1h, 2a	The project team completed installations of nearly more than 3,500 plug load controllers across multiple community colleges. In 2020, the team collected more than one year of post-installation data. Currently, the devices are controlling approximately 700,000 kWh of annual baseline plug loads across all the demonstration sites. Preliminary results show that the plug load controllers are reducing the controlled plug loads by 20% or 142,000 kWh/yr. The team is currently finalizing their draft final report and technology transfer tasks for the project. The technology transfer activities include meeting with community college facility meetings to see if they will further adopt these technologies to other locations based on the savings presented.
EPC-17-015 Installation and Soft Cost Reduction for Horizontal Single Axis Trackers (Stage II)	This project focused on creating products to facilitate the move from flat land installation sites to non-flat land sites to accelerate the growth of solar installations leading the state to a 100% clean energy future.	1e, 2a, 3a, 3b, 4a	The project team completed substantial work on the All-Terrain Tracker and the product is now commercially ready. However, further work will continue to bring down the costs, expand the product capability, and expand the products offered. The version of the product that was ready at the end of the project includes a single axis tracker that can fit to flat, sloped, and rolling terrain on slopes of up to 37% grade and with changes in slope along the length of the row of up to 17% grade at each bearing assembly. The team has also developed software products for optimum operation and control and remote monitoring. These products are commercially ready to enable sale, manufacturing, and deployment of the tracker. Nevados has already sold and installed the new tracker system at several customer sites.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-016 An Online Siting Tool Application for Woody Biomass-to-Electricity Facilities in California	Applied Research and Development	This project develops a decision support system that will reduce the soft costs of estimating and planning new bioenergy power plants that consume woody biomass from sustainable forest management activities. The open-source facility-siting tool will be hosted online and will allow users to quickly evaluate economic feasibility and environmental performance potential of locations for developing a wood-based biomass power plant. The project includes case study analysis to understand feasibility and barriers to developing biopower facilities in high-risk hazard zones.	8/9/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-017 The Nexus of Clean Energy, Healthy Forests, and a Stable Climate: Innovative Biomass Gasification for Sustainable Forest Management	Applied Research and Development	This project supports the development of the Powertainer+ (PT+) -- a multi-modal power and products platform designed to generate low-cost renewable energy, process thousands of tons of forestry waste, and sequester carbon. The Powertainer+ will include a combined heat and power module, increase the power capacity (from 150kW to between 210-250kW), and increase the forestry waste processing capacity to up to 2200 bone dry tons per year.	10/11/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-016 An Online Siting Tool Application for Woody Biomass-to-Electricity Facilities in California	No	Generation	$1,222,284	$1,222,284	$638,294	N/A
EPC-17-017 The Nexus of Clean Energy, Healthy Forests, and a Stable Climate: Innovative Biomass Gasification for Sustainable Forest Management	No	Generation	$1,500,000	$1,500,000	$966,113	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-016 An Online Siting Tool Application for Woody Biomass-to-Electricity Facilities in California	$638,294	$203,977	$0	Regents of University of California, Davis	$28,523	2.3%
EPC-17-017 The Nexus of Clean Energy, Healthy Forests, and a Stable Climate: Innovative Biomass Gasification for Sustainable Forest Management	$966,113	$0	$0	Humboldt State University Foundation, Schatz Energy Research Center; All Power Labs, Inc.; Anderson Biomass Complex	$750,000	33.3%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-016 An Online Siting Tool Application for Woody Biomass-to-Electricity Facilities in California	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-016 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders	The Regents University of California, Davis
EPC-17-017 The Nexus of Clean Energy, Healthy Forests, and a Stable Climate: Innovative Biomass Gasification for Sustainable Forest Management	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-017 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders	All Power Labs, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-016 An Online Siting Tool Application for Woody Biomass-to-Electricity Facilities in California	Group 1: Ranked # 3	N/A	N/A	Yes; Calif Based Entity
EPC-17-017 The Nexus of Clean Energy, Healthy Forests, and a Stable Climate: Innovative Biomass Gasification for Sustainable Forest Management	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-016 An Online Siting Tool Application for Woody Biomass-to-Electricity Facilities in California	This project will increase the cost competitiveness of biopower plant projects, resulting in expanded opportunities for using biomass waste streams. The online and open application architecture will ensure that everyone has open, public access to this resource.	1a, 1b, 1c, 3b, 3h, 4a, 5d, 5e	UC Davis received 2016 tree mortality data for the Sierra Nevada region from the U.S. Forest Service's (USFS) F3 modeling team, but the production of the 30-year forward projected data for the Sierra Nevada region, as well as the rest of California, is delayed due to the USFS F3 team's urgent work related to California's wildfires. The UC Davis research team is carrying on with the development of the tool for the Sierra Nevada regional tree mortality data. The siting tool based on the Sierra Nevada area is expected to be completed early 2021 and will be updated as the rest of the F3 data becomes available.
EPC-17-017 The Nexus of Clean Energy, Healthy Forests, and a Stable Climate: Innovative Biomass Gasification for Sustainable Forest Management	Broadly, the goals of this project are to decrease the modular technology platform's levelized cost of electricity, increase its forestry residue processing capacity, add new value streams in the forms of hot water and biochar production, and enhance the system's carbon sequestration capacity.	1a, 1f, 3g, 4a, 4e	The project team conducted activities associated with the manufacturing and integration of the gas making components of the PT+ system, building all subsystems (except for the enclosure and fuel feed subsystems) at APL's facility in Berkeley. These subsystems include the emissions control, pre-combustion biochar off-take, and heat module subsystems, as well as automation assembly, gasifier, flare, and filter subsystems. Before the COVID-19 shutdown, the project made a lot of progress in integrating the bioenergy system, and conducting engineering and validation tests of the gas making module and the production of biochar. Delays and challenges experienced during the temporary shutdown due to COVID-19 made the team to focus on behind-the-meter demonstration activities at the demonstration site in Anderson, Shasta County.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-018 Demonstrating the Potential for On-Site Electricity Generation from Food Waste Using Containerized Anaerobic Digestion Units	Technology Demonstration and Deployment	This project assesses the potential for a highly standardized and rapidly deployable decentralized AD solution as a compelling alternative to large-scale centralized AD facilities. By implementing on-site AD at locations where food waste is generated and electricity demand exists, it is possible to reduce or avoid 1) the consumption of non-renewable electricity, 2) the transmission and distribution (TandD) losses associated with the delivery of electricity across long distances on the regional grid, and 3) the transport costs (inclusive of the monetary, environmental, and public health costs) of hauling food waste long distances to feed larger AD generators.	9/13/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-019 Burney-Hat Creek Bioenergy	Technology Demonstration and Deployment	This project seeks to bring West Biofuels gasification technology, a technology funded by EPIC under an applied research and development program grant (EPC-14-024), to full commercialization. The West Biofuels gasification solution is designed to utilize forest derived biomass and is ready for scale-up demonstration and deployment. To advance its commercial readiness, this project is developing and demonstrating a community-scale forest biomass facility in the Burney-Hat Creek region that is designed to address the need for increased markets for forest biomass resources. The bioenergy facility will be consistent with the requirements of the BioMAT Category 3 and obtain a power purchase agreement at a financially viable price. The plant will consume about 22,000 bone dry tons (BDT) of forest sourced feedstock per year, generate 2.88 MW of renewable energy at full rated capacity, and have a capacity factor that is greater than or equal to 75 percent.	9/13/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-018 Demonstrating the Potential for On-Site Electricity Generation from Food Waste Using Containerized Anaerobic Digestion Units	No	Generation	$2,411,007	$2,411,007	$611,618	N/A
EPC-17-019 Burney-Hat Creek Bioenergy	No	Generation	$5,000,000	$5,000,000	$233,159	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-018 Demonstrating the Potential for On-Site Electricity Generation from Food Waste Using Containerized Anaerobic Digestion Units	$611,618	$171,649	$0	UC Davis; Biodico, Inc.; SeaHold, LLC	$756,133	23.9%
EPC-17-019 Burney-Hat Creek Bioenergy	$233,159	$0	$0	Hat Creek Bioenergy, LLC	$5,000,000	50.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-018 Demonstrating the Potential for On-Site Electricity Generation from Food Waste Using Containerized Anaerobic Digestion Units	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-018 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders	The Regents University of California, Davis
EPC-17-019 Burney-Hat Creek Bioenergy	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-019 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders	Fall River Resource Conservation District

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-018 Demonstrating the Potential for On-Site Electricity Generation from Food Waste Using Containerized Anaerobic Digestion Units	Group 3: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-17-019 Burney-Hat Creek Bioenergy	Group 2: Ranked # 2	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-018 Demonstrating the Potential for On-Site Electricity Generation from Food Waste Using Containerized Anaerobic Digestion Units	This project addresses the knowledge gap regarding the optimal scale for the deployment and use of AD technology to convert food waste into renewable electricity, heat, and fertilizer. To meet this need, researchers will perform techno-economic and environmental assessments of increased deployment of micro-scale AD systems across the state. Researchers will also develop new information about the performance variability of micro-scale AD systems relative to fluctuating and heterogeneous food waste feedstock inputs.	1a, 1b, 2a, 3b, 3g, 4a, 4e	The equipment was delivered to the Oxnard site in September 2020, and the system was installed and integrated in December 2020. Commissioning is scheduled to commence in January 2021. UC Davis has completed an Operation and Maintenance manual for the system. UCD has identified food waste producers that will provide feedstock for the containerized anaerobic digestion system.
EPC-17-019 Burney-Hat Creek Bioenergy	The Burney-Hat Creek Bioenergy facility will be the first commercial deployment of an innovative gasification system that integrates a horizontally positioned rotary gasifier based off a torrefaction reactor, a thermal oxidizer and an Organic Rankine Cycle (ORC) technology in place of an internal combustion engine. The technology is expected to overcome important challenges with the use of forest-sourced wood, including environmental compliance and operating challenges that are hindering large scale bioenergy projects.	1a, 1b, 2a, 3g, 3h, 4a, 4b, 4e	The project team successfully negotiated a PG&E BioMAT contract in 2019. PG&E is reviewing some changes required with the interconnection application and the project team is awaiting new approvals to move forward with the execution of the interconnection agreement. Equity financing has been obtained and operating agreements and land leases are in development. Debt financing and loan guarantees are under review, with the goal of achieving financial close by the end of 2020. Project has made significant progress in pre-construction engineering and other activities while the actual construction will begin in 2021.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-020 Demonstration of Vehicle-Grid Integration under Non-residential Scenarios	Technology Demonstration and Deployment	This agreement will demonstrate vehicle-grid integration in non-residential facilities to show the flexibility of smart charging. The team will build and validate models that incorporate usage patterns, quantify the impacts of EV charging, develop controls to manage the smart charging to minimize grid impacts and utility costs, and calculate the value streams and costs associated with realizing those value streams.	9/13/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-021 Mariposa Biomass Project	Technology Demonstration and Deployment	This project is designing and constructing a thermochemical biomass-to-energy conversion facility for forest wood waste that will have a capacity between 2.0 and 2.4 megawatt (MW) annually and produce between 15,000 to 18,500 MWh annually of renewable, community-scale, grid-connected electricity. The project demonstrates and optimizes this forest waste bioenergy technology and assesses the performance characteristics and best practices when using wood waste from forest management as feedstock. The project is in Mariposa, CA -- often referred to as ground zero for the tree mortality disaster -- and will use forest biomass obtained from a high fire hazard zone.	3/21/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-020 Demonstration of Vehicle-Grid Integration under Non-residential Scenarios	No	Distribution	$2,340,000	$2,340,000	$1,905,217	N/A
EPC-17-021 Mariposa Biomass Project	No	Generation	$5,000,000	$5,000,000	$66,286	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-020 Demonstration of Vehicle-Grid Integration under Non-residential Scenarios	$1,905,217	$728,697	$0	UC Santa Barbara; Google.Inc; Kisensum; ChargePoint, Inc.; Board of Trustees of the Leland Stanford Junior University (SLAC National Accelerator Laboratory)	$597,593	20.3%
EPC-17-021 Mariposa Biomass Project	$66,286	$8,842	$0	Cortus Energy	$11,135,367	69.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-020 Demonstration of Vehicle-Grid Integration under Non-residential Scenarios	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-020 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	29 out of 31 bidders	Board of Trustees of the Leland Stanford Junior University (SLAC National Accelerator Laboratory)
EPC-17-021 Mariposa Biomass Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-021 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders	Mariposa County Resource Conservation District (MCRCD)

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-020 Demonstration of Vehicle-Grid Integration under Non-residential Scenarios	Group 4: Ranked # 3	N/A	N/A	Yes; Calif Based Entity
EPC-17-021 Mariposa Biomass Project	Group 2: Ranked # 3	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-020 Demonstration of Vehicle-Grid Integration under Non-residential Scenarios	The project will develop and demonstrate advanced model-predictive control strategies that are more sophisticated than the current state of the art technology by incorporating usage patterns, quantifying the impacts of EV charging while managing the smart charging, and calculating the value streams/costs. This project will demonstrate how to minimize electric vehicle charging effects on the distribution system while analyzing EV fleet capabilities under non-residential scenarios.	1h, 3f, 4b	The SLAC team is developing and implementing managed charging functionalities at its SLAC and Google campus demonstration sites. With the real-time data obtained from each site, the team was able to develop software interfaces to control and optimize EV charging events. At the Stanford site, SLAC has developed software to optimize the charging strategy of its E-Bus fleet by improving bus schedules and routes. The optimized charging will reduce the peak charging loads and lower demand charges.
EPC-17-021 Mariposa Biomass Project	The Mariposa Biomass Project has partnered with Cortus Energy to demonstrate an innovate gasification system trademarked as WoodRoll technology. The technology uses a 3-stage drying, pyrolysis and gasification process to produce a clean high BTU syngas, thus reducing costly engine maintenance costs and outages; and the gasification facility will integrate automation and remote monitoring to further reduce operating costs. The WoodRoll facility will have 16 standardized factory-tested modules that can be installed quickly and moved if necessary. The combination of high efficiency and availability combined with low operating and maintenance costs will allow the Mariposa Biomass Project to be a financially successful small-scale forest biomass demonstration facility that can be replicated in other rural areas with access to sustainable forest biomass supplies.	1a, 1b, 3g	The project team successfully entered PG&E's BioMAT queue in October 2019. PG&E is reviewing this application and the project team is awaiting the execution of the power purchase agreement. Development of a sister plant by the project's major subcontractor, Cortus Energy, has been completed and fully commissioned. Once the power purchase agreement with PG&E is executed, the components will be shipped to the designated plant site in Mariposa County.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-022 Skid Mounted Mobile Pilot/Education Unit for Source Separated Organics Processing with Cogeneration Capabilities	Technology Demonstration and Deployment	The purpose of this project is to construct and demonstrate an innovative technology to pretreat organic wastes prior to anaerobic digestion at a wastewater treatment facility to enhance operational efficiencies and increase biogas production. The pretreatment technology will be constructed as skid-mounted mobile units for processing source-separated organic wastes and biosolids and will have cogeneration capabilities, thereby further increasing the energy generation from the wastewater treatment system.	11/8/17
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-023 High Performance, Ultra-Tall, Low Cost Concrete Wind Turbine Towers Additively Manufactured On-Site	Applied Research and Development	This project aims to develop and test a reinforced concrete additive manufacturing (RCAM) technology for building low cost ultra-tall wind turbine towers on-site at a wind plant. Taller wind turbine towers capture more wind energy from faster winds aloft, but are constrained by transportation size and weight. The key goal is to develop a RCAM technology that can be used to fabricate a wind turbine tower on-site in one day at half of the cost of conventional steel towers, and reduce the levelized cost of wind generated electricity in a low wind speed site by 11%.	11/8/17

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-022 Skid Mounted Mobile Pilot/Education Unit for Source Separated Organics Processing with Cogeneration Capabilities	No	Generation	$1,589,163	$1,589,163	$1,430,247	N/A
EPC-17-023 High Performance, Ultra-Tall, Low Cost Concrete Wind Turbine Towers Additively Manufactured On-Site	No	Generation	$1,249,982	$1,249,982	$393,275	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-022 Skid Mounted Mobile Pilot/Education Unit for Source Separated Organics Processing with Cogeneration Capabilities	$1,430,247	$19,396	$0	GHD, Inc.; Lystek International Limited; Design2Operate	$493,075	23.7%
EPC-17-023 High Performance, Ultra-Tall, Low Cost Concrete Wind Turbine Towers Additively Manufactured On-Site	$393,275	$164,368	$0	RCAM Technologies	$62,558	4.8%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-022 Skid Mounted Mobile Pilot/Education Unit for Source Separated Organics Processing with Cogeneration Capabilities	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-022 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders	Lystek International Limited
EPC-17-023 High Performance, Ultra-Tall, Low Cost Concrete Wind Turbine Towers Additively Manufactured On-Site	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-023 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	19 out of 19 bidders	RCAM Technologies

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-022 Skid Mounted Mobile Pilot/Education Unit for Source Separated Organics Processing with Cogeneration Capabilities	Group 3: Ranked # 3	N/A	N/A	Yes; Calif Based Entity
EPC-17-023 High Performance, Ultra-Tall, Low Cost Concrete Wind Turbine Towers Additively Manufactured On-Site	Ranked # 1	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-022 Skid Mounted Mobile Pilot/Education Unit for Source Separated Organics Processing with Cogeneration Capabilities	This project will yield greater biogas generation and utilization resulting in higher diversion opportunities of organic wastes while producing more renewable electricity than conventional digester systems. If successful, the combined technologies will provide wastewater treatment operators with greater confidence in working with generators and processors of organic waste for accepting feedstock material suitable for co-digestion.	1a, 2a, 4a, 4e, 5b	The first delivery of food waste came from UC- Santa Barbara (USB) dining hall on August 27, 2019. They have been slowly feeding the test digesters since start-up and reached optimum capacity in December 2019. The project recorded measurable levels of biogas generation from the test digesters early in the project timeline. Due to feedstock supply interruptions in December 2019 and January 2020, the project converted to a hybrid mix (adding treated sludge waste to the feedstock). As a result of the non-uniform waste characteristics as well as COVID-19 closure of USB dining hall, the project experienced a reduction in biogas generation. Starting from May 2020, the project resumed testing with preferred sludge waste streams.
EPC-17-023 High Performance, Ultra-Tall, Low Cost Concrete Wind Turbine Towers Additively Manufactured On-Site	Substantial recent investments and advancements in concrete additive manufacturing technologies for buildings make this an opportune time to use the RCAM technology for constructing tall wind turbine towers in California. Concrete additive manufacturing technologies are being developed by countries around the world; however, most development has been performed on concrete printing manufacturing methods for buildings that have little or no structural reinforcement necessary. The project team will build upon the state-of-the art technology to develop the innovative RCAM method that incorporates reinforcement in concrete printing for ultra-tall turbine towers.	2a	The researchers decided to manufacture its 140-meter tall tower using commercially available large-scale 3D concrete printers with locally available cementitious materials supplied by standard ready-mix concrete trucks and/or by on-site mixing, and selected an innovative two-step assembly and manufacturing process to reduce assembly time and crane costs by manufacturing and assembling the towers in sections. The team is still analyzing alternative forms of reinforcement, such as random fibers and meshes, that have the potential to reduce the cost and material usage for turbine towers, as well as to increase the production rate by further reducing the manual labor needed for reinforcement. Current activities are focused on testing ultra-high-strength 3D printing concrete specimens and performing large-scale printing of tower segments.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-024 Electric Access System Enhancement (EASE)	Technology Demonstration and Deployment	Distributed control capabilities will enable distributed intelligence and control capability to support fast, automated decisions and improve overall resiliency of the system. This project implements a plug and play concept to facilitate service discovery from PV and batteries both under direct control and being controlled via aggregator to streamline all interconnection types and rationalize multiple systems and processes. In addition, the project explores and demonstrates distributing the existing enterprise functions, i.e. state estimation and optimization, out on the distribution system and to the edge, where necessary and desirable to securely operate the system closer to limits. This project is a federal cost share project to SCE's EASE project under U.S. DOE's ENERGISE program.	1/17/18
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-025 TradePro Connect Product and Service Procurement Project	Market Facilitation	This project is creating TradePro Connect - an online platform that provides a marketplace that facilitates tailored connections between customers and service providers. It empowers customers to find qualified contractors serving their area; request, evaluate and select bids; and schedule services. Contractors enrolled in the platform will gain access to new work opportunities, an ability to represent their certifications and training, and membership in an exclusive clean energy Group Purchasing Organization. The project aims to enroll a minimum of 100 contractor organizations on the platform, directing at least 30 jobs to small, disabled veteran, minority, LGBT and/or women business enterprises; as well as implement at least 50 projects during the project period. TradePro Connect is being demonstrated by facilitating projects for the SOMAH and SCE Auto DR programs as well as service-territory-agnostic On-Bill Financing (OBF) functionality.	3/21/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-024 Electric Access System Enhancement (EASE)	No	Distribution	$2,000,000	$2,000,000	$0	N/A
EPC-17-025 TradePro Connect Product and Service Procurement Project	No	Grid Operations/Market Design	$991,110	$991,110	$768,093	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-024 Electric Access System Enhancement (EASE)	$0	$75,160	$8,188,000	None	$0	0.0%
EPC-17-025 TradePro Connect Product and Service Procurement Project	$768,093	$159,260	$0	ASWB Engineering; Cohen Ventures, Inc. dba Energy Solutions; Qmerit; ProQure; Ecometes	$994,084	50.1%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-024 Electric Access System Enhancement (EASE)	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-024 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	43 bidders	Southern California Edison
EPC-17-025 TradePro Connect Product and Service Procurement Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-025 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	15 out of 15 bidders	Cohen Ventures, Inc. dba Energy Solutions

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-024 Electric Access System Enhancement (EASE)	N/A ***	N/A ***	N/A	Yes; Calif Based Entity
EPC-17-025 TradePro Connect Product and Service Procurement Project	Group 4: Ranked # 1	N/A	N/A	Yes; Small Business

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-024 Electric Access System Enhancement (EASE)	This project will form an architecture and cooperative framework enabling a "system of systems" approach that streamlines the integration of DERs from planning to operations and enables cross optimization between different participants (IOU, third-party DER owners, CAISO) to allow exchange of services and improved use of assets.	1d, 1g, 1h, 1i, 3f, 3h, 5b	As of December 2020, SCE and subcontractor KITU Systems have begun efforts to acquire customers for the EASE pilot program. The SCE research team has completed the final use cases for the system, hardware-in-loop testing of the DER provision service, and a cybersecurity report that assesses how to securely integrate third party aggregators with SCE's utility interface.
EPC-17-025 TradePro Connect Product and Service Procurement Project	By streamlining the customer's buying experience, working with the supply-chain to stock and promote best-in-class products, and ensuring proper design, installation, commissioning, operation and maintenance, the project reduces the cost and risk of DER technology procurement which increases adoption. This leads to lower energy use and GHG emissions and also facilitates compliance with SB 350's Responsible Contractor Policy.	1c, 3b	As of October 2020, 73 service providers have been onboarded onto the TradePro Connect platform, primarily servicing the CPUC's Solar on Multifamily Affordable Housing (SOMAH) program. The platform has facilitated 27 projects by working with SCE to offer customers free smart thermostats with optional Auto DR integration for additional savings. To get the offer, customers and service providers would have to use TradePro Connect to execute the project, after connecting to each other in TradePro Connect's online bid process. The Recipient will continue to demonstrate the platform by facilitating additional SOMAH projects and will also look for new opportunities to connect contractors and new utility and State agency clean energy programs to potential customers.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-026 Accelerating the Adoption of EVs as DERs through Fleet Procurement	Market Facilitation	The MyFleetBuy fleet procurement system developed in this project will mitigate uncertainties for fleet managers by providing clarity on cost savings offered by EVs and smart charging, and verifying the range viability of EVs. MyFleetBuy will leverage the sophisticated vehicle physics models underlying the LBNL-developed MyGreenCar technology, analyzing individual fleet vehicle duty cycles and translating the analysis into easy-to-understand graphics. MyFleetBuy will provide fleet managers with a low cost, highly scalable data collection and analytics system with which to compare their options when investing in new vehicles. The platform will accelerate fleet procurement of EVs by raising awareness of options while mitigating the uncertainties that limit their adoption in fleets.	3/21/18
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-027 The Distributional Electricity Impacts of Climate Change on California's Residential Communities	Applied Research and Development	This project studied the impacts of rising temperatures on electricity demand and the related emissions of pollutants from current generation stations. On the demand side, the researchers created an empirically calibrated statistical model using household level data to estimate household response of electricity demand to temperature. On the supply side, the study estimated the implications of the increased intensity and frequency of extreme heat events from climate change on peak demand and concentrations of criteria air pollutants in the absence of policy intervention or technology change. These changes in peak demand and air quality were then compared between disadvantaged and non-disadvantaged communities.	3/21/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-026 Accelerating the Adoption of EVs as DERs through Fleet Procurement	No	Grid Operations/Market Design	$1,000,000	$1,000,000	$1,000,000	N/A
EPC-17-027 The Distributional Electricity Impacts of Climate Change on California's Residential Communities	No	Generation	$200,000	$200,000	$188,940	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-026 Accelerating the Adoption of EVs as DERs through Fleet Procurement	$1,000,000	$115,875	$0	Caltrans; County of Alameda; City of Oakland Bureau of Infrastructure and Operations	$1,779,718	64.0%
EPC-17-027 The Distributional Electricity Impacts of Climate Change on California's Residential Communities	$188,940	$36,240	$0	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-026 Accelerating the Adoption of EVs as DERs through Fleet Procurement	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-026 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	15 out of 15 bidders	Lawrence Berkeley National Laboratory
EPC-17-027 The Distributional Electricity Impacts of Climate Change on California's Residential Communities	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-027 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 29 bidders	The Regents of the University of California, Berkeley Campus

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-026 Accelerating the Adoption of EVs as DERs through Fleet Procurement	Group 4: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-17-027 The Distributional Electricity Impacts of Climate Change on California's Residential Communities	Group 4b: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-026 Accelerating the Adoption of EVs as DERs through Fleet Procurement	MyFleetBuy will raise fleet managers' awareness of EVs while mitigating the risks and uncertainties that inhibit their adoption of EVs. MyFleetBuy will (1) collect high-resolution data on individual fleet vehicles, including driving distances, traffic, terrain, driving style, and more, using low-cost data loggers; (2) analyze these data with sophisticated vehicle physics models; and (3) provide fleet managers with a decision-support tool to compare fuel costs of conventional, hybrid, or EVs; compare overall operating costs for all vehicles; and, calculate the difference in costs of uncontrolled vs. smart charging for EVs.	3a, 4a, 5b	In 2020, the recipient made significant progress on market discovery, customer development, and securing market traction for MyFleetBuy (MFB).The MFB software has been tested with fleet telematics data from pilot fleets from Alameda County and Caltrans. Feedback from the pilot fleets and entities engaged during the sales-outreach process was used to develop an understanding of how MFB caters to customer demands, and how the product must evolve to meet customer demand. The MFB team also concluded a case study where they were contracted to assess municipal fleet electrification for the City of Fremont. Using the MFB software, the team identified a pathway to electrify 159 of the city's current vehicles. These EVs would result in $3,000,000 of reduced operating expenditures and 54% reductions over the life of these vehicles. In 2021 the recipient plans to continue business development to secure contracts and partnerships to scale MFB to government and commercial fleets.
EPC-17-027 The Distributional Electricity Impacts of Climate Change on California's Residential Communities	This project generated new and precise estimates of the forecasted damages to California's residential communities due to climate change. This created a scenario in the absence of additional standards and policies (such as additional emissions abatement requirements) and hence created a baseline for calculating their value. These two approaches provide the most comprehensive analysis of the potential impact of climate change on California's residential communities and particularly on disadvantaged communities.	2a	The project was completed in 2020 and the final report is in the final revision stage. Disadvantaged communities, as defined by SB 535, are projected to see larger percentage increases in electricity consumption and smaller decreases in natural gas consumption than their non-SB 535 counterparts. Disadvantaged communities experience twice the increase in ambient concentrations of NOx, SO2, and particulate matter compared to non-disadvantaged communities. However, increases in ambient concentrations from a 20 percent increase in demand are extremely small.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-028 High Resolution Source Importance Mapping to Minimize Impacts of Waste Biomass Distributed Generation on Ozone Air Quality in Disadvantaged Communities in the San Joaquin Valley	Applied Research and Development	This research includes high-resolution mapping of local and regional sources that influence ozone pollution in disadvantaged communities and non-attainment areas in the San Joaquin Valley across diverse weather conditions. The researchers will use a 3-D chemical transport modeling system in a number of simulations to determine location-dependent emission limits for bioenergy distributed generation deployment needed to protect the public health of disadvantaged communities and meet federal ozone standards. A decision support model will be developed to aid planners in siting distributed bioenergy generation and mitigating associated impacts.	3/21/18
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-029 Lowering Costs of Underwater Biological Surveys to Inform Offshore Renewable Energy	Applied Research and Development	This agreement funded a core team of scientists, students, and staff from computer science and marine biology to develop DeepSeaAnnotations.com, a free and open-source, web-based software. The team performed three main development tasks that will lead to open-source artificial intelligence classification capabilities: 1) "intelligent" video/image annotation tools to streamline annotation/classification workflows; 2) custom convolutional neural network training using an iterative training process to improve the accuracy of the prediction model; and 3) the annotation software, workflow, and tools on the cloud to provide widespread adoption and customization capabilities for the broader scientific and consulting community. Using this tool, undergraduate marine biology students interpreted 50 hours of high-resolution, benthic survey video provided by the Monterey Bay Aquarium Research Institute, resulting in more than 40,000 annotations of more than 100 classifications of deep-sea, benthic species. These data were then used to annotate new videos for five environmentally important species and assess the accuracy.	3/21/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-028 High Resolution Source Importance Mapping to Minimize Impacts of Waste Biomass Distributed Generation on Ozone Air Quality in Disadvantaged Communities in the San Joaquin Valley	No	Generation	$200,000	$200,000	$200,000	N/A
EPC-17-029 Lowering Costs of Underwater Biological Surveys to Inform Offshore Renewable Energy	No	Generation	$199,978	$199,978	$199,478	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-028 High Resolution Source Importance Mapping to Minimize Impacts of Waste Biomass Distributed Generation on Ozone Air Quality in Disadvantaged Communities in the San Joaquin Valley	$200,000	$89,052	$0	None	$0	0.0%
EPC-17-029 Lowering Costs of Underwater Biological Surveys to Inform Offshore Renewable Energy	$199,478	$29,057	$0	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-028 High Resolution Source Importance Mapping to Minimize Impacts of Waste Biomass Distributed Generation on Ozone Air Quality in Disadvantaged Communities in the San Joaquin Valley	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-028 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 29 bidders	Lawrence Berkeley National Laboratory
EPC-17-029 Lowering Costs of Underwater Biological Surveys to Inform Offshore Renewable Energy	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-029 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 29 bidders	Cal Poly Corporation

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-028 High Resolution Source Importance Mapping to Minimize Impacts of Waste Biomass Distributed Generation on Ozone Air Quality in Disadvantaged Communities in the San Joaquin Valley	Group 4a: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-17-029 Lowering Costs of Underwater Biological Surveys to Inform Offshore Renewable Energy	Group 4b: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-028 High Resolution Source Importance Mapping to Minimize Impacts of Waste Biomass Distributed Generation on Ozone Air Quality in Disadvantaged Communities in the San Joaquin Valley	This study maps both local and upwind emission sources that contribute to ozone air pollution in disadvantaged communities (DAC) and uses the source importance mapping to develop site-specific ozone mitigation strategies.	2a, 4b	The researchers have developed the modeling protocol and are conducting modeling simulations and assessing ozone impact metrics. That task has been completed and a report on the modeling simulations was submitted. The researchers are currently identifying impact risks by running simulations based upon populations in disadvantage communities in the San Joaquin Valley, and areas with ozone levels that exceed air quality standards. The research team continues to work on modeling and analysis to understand heterogeneity in the sources based upon meteorology, precursor emissions, and impact metrics. Due to the pandemic, this project is behind schedule and is requesting a one-year no cost time extension until March 2022.
EPC-17-029 Lowering Costs of Underwater Biological Surveys to Inform Offshore Renewable Energy	This project provides advanced tools to scientists to facilitate the efficient collection of higher quality data that will provide regulators, decision makers, and the public with greater scientific certainty regarding the impact of marine renewable energy on California's marine ecological resources. Reducing the regulatory uncertainty of marine renewable energy production will provide decision makers with better information about impacts of offshore renewables as California seeks to achieve its Renewables Portfolio Standard (60% renewable electricity by 2030) and the 100% renewable and zero-carbon electricity goal established in Senate Bill 100.	2a, 4f	The project was completed in 2020 and the final report is available online. The team completed the development of the video annotation software and the machine learning portion of the project to automate the identification of target species in the video. Students annotated underwater video from the Monterey Bay Aquarium Research Institute. The technology developed for this project is a proof of concept and achieved acceptable accuracy for several species. Additional work is needed before this tool can be used for large-scale implementation of automated classification of deep-sea organisms. Computer science students gained real-world experience coding the software, while marine biology students learned to identify species in the underwater video. The approach could be extended in the future for other applications, such as marine or terrestrial birds and bats.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-030 California Opportunities for Procurement to Accelerate Clean Energy (Cal-OP ACE)	Market Facilitation	This project will establish a new incubator program specifically geared towards bridging the gap between California clean energy companies and institutional/commercial customers that rely on formal procurement processes to purchase DER solutions and packages. The project will provide and coordinate key services, assistance, and resources needed to bridge the gap between emerging energy technology solutions and large-scale procurement processes. Cal-OP ACE will provide support to clean energy ventures navigating and competing in institutional energy procurement processes, while providing guidance to customers updating and streamlining their procurement processes for advanced DER technologies. Cal-OP ACE will be responsible for facilitating information sharing so clean energy ventures are aware of market opportunities provided by institutional customers; and institutional customers are aware of new DER technology features that can address their critical needs.	3/21/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-030 California Opportunities for Procurement to Accelerate Clean Energy (Cal-OP ACE)	No	Demand-side Management	$3,998,715	$3,998,715	$2,012,881	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-030 California Opportunities for Procurement to Accelerate Clean Energy (Cal-OP ACE)	$2,012,881	$128,875	$0	Energy Solutions International; Lawrence Berkeley National Laboratory; Prospect Silicon Valley; TerraVerde; Ecomedes; California State University - Office of the Chancellor	$1,244,450	23.7%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-030 California Opportunities for Procurement to Accelerate Clean Energy (Cal-OP ACE)	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-030 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	15 out of 15 bidders	Prospect Silicon Valley

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-030 California Opportunities for Procurement to Accelerate Clean Energy (Cal-OP ACE)	Group 3: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-030 California Opportunities for Procurement to Accelerate Clean Energy (Cal-OP ACE)	The need for connecting DERs to Integrated Demand Side Management (IDSM) strategies has been well-established in the following state policy contexts: 1) California energy code (Title 24) requirements for building controls and demand response (DR) capabilities; 2) AB 802 requirements for utilities to shift to Normalized Metered Energy Consumption (NMEC) to inform more rigorous utility pay for performance efficiency programs; 3) SB 350 doubling energy efficiency targets and rolling out a responsible contractor policy to ensure proper installation and commissioning of DERs; and 4) AB 793 energy management technology requirements.	1c, 1f, 2a, 3e	In 2020, this project has aligned Empower Procurement team members to design and launch 6 Procurement Initiatives (PI) that guide efforts to streamline the adoption of DER technologies: E-Fleet, Benchmarking, Contracts, Practices, Products, and Services. With the use of common tools like custom-designed assessments, a common digital dashboard for project management, and a work plan for each PI, all six initiatives are currently underway with California institutions. In 2021, the project team will focus on enrolling more institutions to participate in the PIs, with the objective of gathering a robust and diverse data set of insights to address the scalability of these PIs.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-031 Port of Long Beach Microgrid - Resilience for Critical Facilities	Technology Demonstration and Deployment	This project will create a microgrid at the Port's critical response facility, the JCCC. Key features include photovoltaic energy production, stationary battery energy storage, mobile battery energy storage, and a microgrid controller. Both batteries will provide grid services, such as demand response and peak shaving, during regular operation of the utility grid. During wide-spread outages or emergencies, the microgrid will support the JCCC, which coordinates response to emergencies. The mobile battery will act to extend the microgrid as a zero-emission generator that can be deployed where needed, such as stormwater pump stations and refrigerated container yards.	3/21/18
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-032 Miramar Microgrid - Flight Line Resilience through Landfill Gas and Energy Storage	Technology Demonstration and Deployment	This project will demonstrate a microgrid at Marine Corps Air Station Miramar. It will incorporate distributed energy resources including: bio gas generators, solar PV, battery energy storage, and electric vehicles. When operational, the microgrid will help maintain critical flight line facilities during grid outages and facilitate higher renewable generation from landfill gas (LFG) generators.	3/21/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-031 Port of Long Beach Microgrid - Resilience for Critical Facilities	No	Distribution	$5,000,000	$5,000,000	$116,951	N/A
EPC-17-032 Miramar Microgrid - Flight Line Resilience through Landfill Gas and Energy Storage	No	Demand-side Management	$5,000,000	$5,000,000	$106,807	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-031 Port of Long Beach Microgrid - Resilience for Critical Facilities	$116,951	$95,909	$0	Electric Power Research Institute, Inc.; National Renewable Energy Laboratory; Advanced Power and Energy Program (APEP) - University of California, Irvine; City of Long Beach, Harbor Department (Port of Long Beach); Schneider Electric Buildings Americas, Inc.; South Orange County Community College District	$2,120,000	29.8%
EPC-17-032 Miramar Microgrid - Flight Line Resilience through Landfill Gas and Energy Storage	$106,807	$425,962	$20,000,000	Marine Corps Air Station Miramar	$6,002,320	54.6%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-031 Port of Long Beach Microgrid - Resilience for Critical Facilities	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-031 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	54 out of 60 bidders	City of Long Beach, Harbor Department (Port of Long Beach)
EPC-17-032 Miramar Microgrid - Flight Line Resilience through Landfill Gas and Energy Storage	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-032 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	54 out of 60 bidders	The Regents of the University of California, San Diego

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-031 Port of Long Beach Microgrid - Resilience for Critical Facilities	Group 1: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-17-032 Miramar Microgrid - Flight Line Resilience through Landfill Gas and Energy Storage	Group 1: Ranked # 4	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-031 Port of Long Beach Microgrid - Resilience for Critical Facilities	The project has several innovations, including the ability to allow for direct DC transfer of energy from the PV system to the battery, significantly improving the efficiency of the stored energy, and testing charge and discharge strategies for the mobile battery to support load reduction during normal operations and providing support power to various distributed critical loads in an emergency.	1b, 1c, 1h, 4a, 5b	The microgrid design is near complete. Final design iterations are addressing grid interconnection requirements and site constraints for installing the solar array. Two of the energy storage battery banks have been assembled. A workforce development study has begun that will identify the workforce needs for supporting a microgrid. The outputs of the study will be used by a community college to develop microgrid training packages. Initial cyber-security development work has explored various system configurations to address operational user needs, real-time system communication requirements, and protective features.
EPC-17-032 Miramar Microgrid - Flight Line Resilience through Landfill Gas and Energy Storage	This project is incorporating a large scale battery storage system, as well as advanced demand response controls, into a very complex microgrid with a heavy penetration of renewables and over 100 buildings worth of load. Energy storage will allow the microgrid to incorporate higher penetrations of renewable landfill power in island mode, while mitigating demand charges in economic mode, saving money for the Base. This project will address critical challenges associated with instantaneous power loss from the bio gas generators by using microgrid controlled distributed energy resources. Furthermore, project findings will be relevant to landfill gas generation facilities, wastewater treatment plants with biogas generation, as well as hospitals, ports, and military bases.	2a, 3h, 4b, 5a	In 2020, the project team brought the battery energy storage system (BESS) design to 90% completion. Seven modes of operation of the BESS were defined and the implementation into the microgrid controller was laid out. The project team also compiled a measurement and verification plan for demand limiting of building energy use and implemented demand limiting functionality into the Miramar's building energy management system. Additionally, during the heat storm events that occurred in August and September 2020 where the overall California Grid was stressed, the Miramar Microgrid was able to island from the local grid and provide a load reductions of approximately three megawatts.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-033 Building on the Cal-Adapt Platform to Deliver Actionable Information in Support of Electricity Sector Resilience	Applied Research and Development	This project builds on the Cal-Adapt platform to provide enhanced tools, data services, and visualizations that leverage existing web infrastructure and features to improve usability to energy sector stakeholders. The research team will collaborate closely with the Energy Commission and energy stakeholders, including IOUs and the California Independent System Operator, to build on Cal-Adapt, developing enhanced targeted visualizations and tools that allow for improved decision support that leverages projections of parameters associated with climate-related risk. Priority tools will address sea level rise and wildfire. These new tools are being designed in close coordination with stakeholders, as the requirements of each organization necessitate tools that are specific to their application needs. Targeted visualization tools depict climate-related risks from a variety of stressors on electricity infrastructure, enabling improved planning for future reliability.	3/21/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-033 Building on the Cal-Adapt Platform to Deliver Actionable Information in Support of Electricity Sector Resilience	No	Grid Operations/Market Design	$900,000	$900,000	$491,038	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-033 Building on the Cal-Adapt Platform to Deliver Actionable Information in Support of Electricity Sector Resilience	$491,038	$172,916	$0	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-033 Building on the Cal-Adapt Platform to Deliver Actionable Information in Support of Electricity Sector Resilience	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-033 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 29 bidders	The Regents of the University of California, Berkeley Campus

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-033 Building on the Cal-Adapt Platform to Deliver Actionable Information in Support of Electricity Sector Resilience	Group 3: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-033 Building on the Cal-Adapt Platform to Deliver Actionable Information in Support of Electricity Sector Resilience	This project is providing needed actionable information to energy sector stakeholders regarding climate change consequences on electricity generation and distribution. California's energy system is facing, and will continue to contend with, a changing climate. Substantial changes in the climate are projected to occur within a timeframe that overlaps with the time horizons of a variety of electricity system planning decisions, such as siting of power generation facilities and transmission lines. Regionally downscaled climate projections with high spatial resolution are valuable resources to better plan electricity and energy infrastructure developments, adaptations, and future siting.	3a, 5c	The project has incorporated new hourly observed station data. This supports demand forecast calculations by enabling users to access a record of 39 stations across the state, each with an observation period of greater than 30 years (1973 to present). The Wildfire Tool has been enhanced to include adding monthly time steps and additional projected wildfire probability. This work was developed with input from Technical Advisory Committee members, from meetings with electricity IOUs, from users via webinars, and support from volunteer beta-testers. The research also took steps to develop an Enhanced Sea Level Rise Tool and updated the Stakeholder Engagement Plan, which allow the team to better track progress related to engagement activities.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-034 California Energy Product Evaluation Hub	Market Facilitation	This project will develop the California Energy Product Evaluation (Cal-EPE) Hub to conduct and disseminate evaluations of advanced DER products relevant to large commercial and institutional customers through a web-based buyer's guide. To accomplish this, the recipient will: (1) determine Cal-EPE Hub user (i.e. large commercial and institutional customers) needs; (2) develop a list of product categories to evaluate based on user needs; (3) develop evaluation guidelines and methodologies; (4) acquire (through purchase or donation) and evaluate products from product categories; and (5) develop a web-based Buyer's Guide, which will contain the results of product evaluations and related information and documentation.	3/21/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-034 California Energy Product Evaluation Hub	No	Demand-side Management	$10,993,646	$10,993,646	$1,883,431	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-034 California Energy Product Evaluation Hub	$1,883,431	$3,915,128	$0	Regents of the University of California, Berkeley (Center for the Built Environment); Western Cooling Efficiency Center - UC Davis; Sheet Metal Workers 104 and Bay Area Industry Training Fund; Collaborative for High Performance Schools; Lawrence Berkeley National Laboratory; Local Government Commission; Cohen Ventures, Inc. dba Energy Solutions	$2,347,629	17.6%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-034 California Energy Product Evaluation Hub	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-034 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	15 out of 15 bidders	Western Cooling Efficiency Center - UC Davis

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-034 California Energy Product Evaluation Hub	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-034 California Energy Product Evaluation Hub	The California Energy Product Evaluation (Cal-EPE) Hub will increase the adoption of advanced DER technology products in the marketplace by disseminating reliable and independent product evaluations to large commercial and institutional customers, through a web-based buyer's guide, which will help these customers more confidently select the DER technology they require with their procurement process.	1c, 1f, 1h, 2a, 3b, 3e, 3h, 4a	To date the recipient has determined the needs of advanced DER users, developed a list of product categories to evaluate, and developed evaluation processes to test selected products. The recipient prioritized the evaluation of products into three testing phases. Phase 1 evaluations include the follow product categories: electric space conditioning, plug load products, and building fenestration and windows. Phase 2 evaluations are expected to include the follow product categories: energy management and information systems, distributed photovoltaics and energy storage, lighting, electric space conditioning, and agricultural irrigation systems. In 2020, Phase 1 testing began where possible, with some delays due to COVID-19. The Buyer's Guide website development continued and included preliminary Phase 1 data to mock-up product category sections. In early 2021, the recipient will focus on completing Phase 2 test protocols and procedures, continue Phase 1, and start Phase 2 evaluations.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-035 Building Healthier and More Energy-Efficient Communities in Fresno and the Central Valley	Applied Research and Development	This project develops a holistic community action plan to achieve climate benefits and air quality improvements through energy efficiency measures, electrification, and distributed energy resources in the residential building and light-duty and medium-duty transportation sectors in the City of Fresno. Field surveys and validation testing provide inputs on appropriate implementation strategies and selection of systems and technologies to overcome barriers associated with site characteristics and user responses. Researchers monitor energy use in typical households within disadvantaged communities to inform analysis of energy programs.	4/11/18
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-038 Camp Parks Army Microgrid - A Blueprint for Nested, Modular Design	Technology Demonstration and Deployment	The Parks Reserve Forces Training Area (PRFTA) microgrid project will produce a permanent, modular, nested design that maximizes renewables and is inherently secure, expandable, economically viable and efficient. The project will deliver a blueprint for incorporating multiple distributed energy resources (DER); a vendor-neutral microgrid control system; and a resilient nodal building block approach that supports grid-within-grid nesting. The project will also develop engineering guidelines and an easy-to-adapt "how-to" case tool for accelerated adoption and commercialization.	3/21/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-035 Building Healthier and More Energy-Efficient Communities in Fresno and the Central Valley	No	Distribution	$1,100,000	$1,100,000	$659,691	N/A
EPC-17-038 Camp Parks Army Microgrid - A Blueprint for Nested, Modular Design	No	Demand-side Management	$5,000,000	$5,000,000	$1,649,032	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-035 Building Healthier and More Energy-Efficient Communities in Fresno and the Central Valley	$659,691	$401,103	$0	None	$0	0.0%
EPC-17-038 Camp Parks Army Microgrid - A Blueprint for Nested, Modular Design	$1,649,032	$817,221	$0	Customized Energy Solutions; Ultrasolar Technology; U.S. Army	$11,410,900	69.5%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-035 Building Healthier and More Energy-Efficient Communities in Fresno and the Central Valley	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-035 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 29 bidders	Lawrence Berkeley National Laboratory
EPC-17-038 Camp Parks Army Microgrid - A Blueprint for Nested, Modular Design	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-038 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	54 out of 60 bidders	Lawrence Berkeley National Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-035 Building Healthier and More Energy-Efficient Communities in Fresno and the Central Valley	Group 2b: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-17-038 Camp Parks Army Microgrid - A Blueprint for Nested, Modular Design	Group 1: Ranked # 3	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-035 Building Healthier and More Energy-Efficient Communities in Fresno and the Central Valley	This project provides state-of-the-art information and analyses on the impacts of prioritized and integrated energy efficiency, electrification, distributed energy resources, and battery electric vehicles in the Fresno area in relation to climate benefits and air quality improvements.	1f, 2a, 4b	Due to the covid-19 pandemic, in-home walk-throughs for collecting baseline equipment data and energy use information from residents in south Fresno has been replaced with remote data collection using phone interviews. In early 2020, the team completed a long-form survey which was approved by the Human Subjects Committee at LBNL. Five pilot interviews were conducted by Rising Sun - a community-based organization - and the long form survey was adjusted based on the responses from the pilot survey. The research team has also compiled building data from publicly available sources, and the neighborhood-scale City-BES modeling tool (CityBES.lbl.gov) has been updated to include building data for south Fresno neighborhoods of interest. Data includes building vintages and floor sizes for all residential buildings.
EPC-17-038 Camp Parks Army Microgrid - A Blueprint for Nested, Modular Design	This project will demonstrate how a nested set of smaller microgrids within an overall base microgrid can be designed and operated to provide resilience on the base, while substantially reducing energy use and the need for multiple backup diesel generators. This approach can be transferrable to other military bases or similar commercial or academic campuses or local communities to improve resilience.	1h, 2a, 3h, 5a	In 2020, the project team completed detailed designs and specifications for ten integrated resilient nodes (IRNs) including IRN #1 that includes a 100 kW PV array and 400 kWh 4-hr battery energy storage system. Vendors have been selected for the CEC-funded IRN #1 and an RFP package has been prepared to acquire a vendor for the other Army-funded IRNs.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-039 Validated, Transparent, and Accessible Microgrid Valuation and Optimization Tool (DER-VET)	Applied Research and Development	The Distributed Energy Resource Value Estimation Tool (DER-VET) is publicly available at www.der-vet.com as a modeling tool that provides a platform for the calculation and understanding of the value of energy storage, other distributed energy resources (DER), and microgrids based on their technical merits and constraints. DER-VET incorporates the full range of DER technologies into the analysis tool including energy storage, solar, wind, controllable load, electric vehicle (EV) charging, internal combustion engines, and combined heat and power in different configurations, including microgrids. DER-VET uses load and other data to determine the optimal size, duration, and technical characteristics for energy storage and/or solar systems to optimize reliability, resilience and economic objectives. DER-VET enables consistent technical and economic analysis to support DER and microgrid opportunity identification and design. This tool has the capability to assess a wide array of different microgrid use cases, technologies, and locations. To support this, it covers different microgrid ownership models, regulatory and market environments, topologies, and DER technologies.	5/9/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-039 Validated, Transparent, and Accessible Microgrid Valuation and Optimization Tool (DER-VET)	No	Distribution	$2,000,000	$2,000,000	$1,460,069	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-039 Validated, Transparent, and Accessible Microgrid Valuation and Optimization Tool (DER-VET)	$1,460,069	$479,496	$0	Electric Power Research Institute, Inc.; XENDEE	$568,110	22.1%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-039 Validated, Transparent, and Accessible Microgrid Valuation and Optimization Tool (DER-VET)	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-039 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 29 bidders	Electric Power Research Institute, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-039 Validated, Transparent, and Accessible Microgrid Valuation and Optimization Tool (DER-VET)	Group 1: Ranked # 1	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-039 Validated, Transparent, and Accessible Microgrid Valuation and Optimization Tool (DER-VET)	The objectives of this project are focused on the development of (1) a powerful and user-friendly microgrid assessment tool, (2) a comprehensive microgrid analysis framework, and (3) a novel approach to microgrid location screening and selection to help streamline the deployment of microgrids across California. The tool will be useful to maximize potential benefits of microgrids to end-customers (including disadvantaged communities), the distribution grid, and the bulk system. At the same time, it will reduce soft-costs of microgrid project development and enhance engineering capabilities by simplifying the techno-economic analysis of prospective microgrid projects.	1b, 1c, 1f, 1h, 5b, 5f	In April 2020, the EPRI team released the beta version of DER-VET to the public for user testing and feedback. EPRI has captured and utilized the feedback received from a wide array of beta users to finalize the tool for the planned full release to the public in March 2021. Additionally throughout 2020, EPRI has actively validated the tool with live project case studies and actual data while presenting the validation results in a transparent and accessible forum through EPRI's Energy Storage Integration Council (ESIC) at: https://www.epri.com/pages/sa/epri-energy-storage-integration-council-esic.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-040 ** Mass Deployment of Energy Efficiency Retrofits in Disadvantaged Communities	Applied Research and Development	This project develops and demonstrates standardized energy efficiency retrofit packages, specifically geared towards the low-income multifamily housing market, and that can be scaled to drive down costs. As part of the agreement, the recipient will develop a business model for these packages to overcome financing challenges.	6/13/18
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-040 ** Mass Deployment of Energy Efficiency Retrofits in Disadvantaged Communities	Technology Demonstration and Deployment	This project develops and demonstrates standardized energy efficiency retrofit packages, specifically geared towards the low-income multifamily housing market, and that can be scaled to drive down costs. As part of the agreement, the recipient will develop a business model for these packages to overcome financing challenges.	6/13/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-040 ** Mass Deployment of Energy Efficiency Retrofits in Disadvantaged Communities	No	Demand-side Management	$2,401,436	$2,401,436	$1,116,475	N/A
EPC-17-040 ** Mass Deployment of Energy Efficiency Retrofits in Disadvantaged Communities	No	Demand-side Management	$4,802,872	$4,802,872	$0	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-040 ** Mass Deployment of Energy Efficiency Retrofits in Disadvantaged Communities	$1,116,475	$1,555,647	$6,200,000	Association for Energy Affordability; Rocky Mountain Institute; Stone Energy Associates; City of San Francisco Department of Environment	$6,705,308	48.2%
EPC-17-040 ** Mass Deployment of Energy Efficiency Retrofits in Disadvantaged Communities	$0	$0	$0	Association for Energy Affordability; Rocky Mountain Institute; Stone Energy Associates; City of San Francisco Department of Environment	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-040 ** Mass Deployment of Energy Efficiency Retrofits in Disadvantaged Communities	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-040 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	18 out of 18 bidders	Rocky Mountain Institute
EPC-17-040 ** Mass Deployment of Energy Efficiency Retrofits in Disadvantaged Communities	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-040 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	18 out of 18 bidders	Rocky Mountain Institute

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-040 ** Mass Deployment of Energy Efficiency Retrofits in Disadvantaged Communities	Group 3: Ranked # 1	N/A	N/A	None
EPC-17-040 ** Mass Deployment of Energy Efficiency Retrofits in Disadvantaged Communities	Group 3: Ranked # 1	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-040 ** Mass Deployment of Energy Efficiency Retrofits in Disadvantaged Communities	Significant improvements in speed and cost reductions of retrofit packages are critical to realizing mass-scale deployment of retrofits. Even when pairing grants from the State's Low-Income Weatherization Program (LIWP) for multifamily buildings, it is rare that those retrofit projects alone can achieve ZNE. The key to bringing costs down and construction speeds up is to simultaneously address the technical and business model barriers that exist in the market. Some of the innovative approaches to be considered include: modularized, pre-fabricated, pre-insulated building enclosures; packaged multi-function heat pumps for heating and cooling; energy recovery ventilation; advanced heat pump water heaters; and behavior modification technologies and strategies. These approaches hope to speed up implementation, bring down retrofit costs, and integrate them into programs, such as LIWP.	1f, 2a, 3a, 3b, 3f	In 2020, the research team identified 3 of the 4 sites that will be the location of the newly installed energy efficient retrofit measures. The team completed a summary of baseline and recommended measures for each site identified. All sites are multifamily housing that are located in a disadvantaged community. The team also completed a Building Characterization report of the different multifamily building types in California in order to target which building typography is best suited for the scalable retrofit approach. The team is finalizing a list of emerging technology selection matrix and retrofit scope of work plan with each site and project partners. In 2021, the goal is to start installing the measures at the sites and developing a market assessment of the technologies.
EPC-17-040 ** Mass Deployment of Energy Efficiency Retrofits in Disadvantaged Communities	Significant improvements in speed and cost reductions of retrofit packages are critical to realizing mass-scale deployment of retrofits. Even when pairing grants from the State's Low-Income Weatherization Program (LIWP) for multifamily buildings, it is rare that those retrofit projects alone can achieve ZNE. The key to bringing costs down and construction speeds up is to simultaneously address the technical and business model barriers that exist in the market. Some of the innovative approaches to be considered include: modularized, pre-fabricated, pre-insulated building enclosures; packaged multi-function heat pumps for heating and cooling; energy recovery ventilation; advanced heat pump water heaters; and behavior modification technologies and strategies. These approaches hope to speed up implementation, bring down retrofit costs, and integrate them into programs, such as LIWP.	1f, 2a, 3a, 3b, 3f	In 2020, the research team identified 3 of the 4 sites that will be the location of the newly installed energy efficient retrofit measures. The team completed a summary of baseline and recommended measures for each site identified. All sites are multifamily housing that are located in a disadvantaged community. The team also completed a Building Characterization report of the different multifamily building types in California in order to target which building typography is best suited for the scalable retrofit approach. The team is finalizing a list of emerging technology selection matrix and retrofit scope of work plan with each site and project partners. In 2021, the goal is to start installing the measures at the sites and developing a market assessment of the technologies.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-041 ** Lead Locally	Applied Research and Development	This project is evaluating and demonstrating strategies to increase retrofits of existing buildings and includes the following elements: 1) identification and pilot testing of promising emerging efficiency technology packages for cost-effectiveness, feasibility, and customer acceptance; 2) development of an "Energy Marketplace" where consumers can directly procure technologies appropriate for their buildings. This will be combined with financing and rebates. The program targets those with little to no upfront capital and are the most difficult to reach. Training will be offered to contractors, realtors, and building officials with the goal of greatly increasing customer knowledge, decreasing code violations, and increasing penetration of energy efficiency measures outside the framework of utility programs.	4/11/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-041 ** Lead Locally	No	Demand-side Management	$3,271,532	$3,271,532	$3,271,532	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-041 ** Lead Locally	$3,271,532	$4,687,705	$0	Sonoma Clean Power Authority	$3,335,500	25.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-041 ** Lead Locally	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-041 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	18 out of 18 bidders	Sonoma Clean Power Authority

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-041 ** Lead Locally	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-041 ** Lead Locally	The project could increase market penetration for existing building retrofits and result in deeper savings per site using the existing program funding that Sonoma Clean Power and the investor-owned utilities will allocate in future years. The project anticipates providing a full range of options for customers--from whole building integrated retrofits to partial retrofits and traditional equipment upgrades, depending on the customer's interest, budget, and need. The high level estimated net present value of the project benefits is over $60M in 2030. Additional benefits could be realized if fuel-switching strategies that are being evaluated as part of the applied research phase of the project meet cost-effectiveness, feasibility, and customer acceptance criteria and can be included in the Energy Marketplace.	1f, 1h	The recipient has completed the installation of following technologies: (1) air-to-water heat pump space heating and cooling systems (10 sites), (2) phase change materials (five sites installed and four more sites underway), (3) advanced daylighting system (one site), (4) residential induction cooking (three sites), (5) aerosol envelope sealing (four sites), and Nightbreeze economizer ventilation (three sites). Additionally, the recipient has chosen 10 sites for demonstrating grid integrated hear pump water heaters. The renovations for the Advanced Energy Center have been delayed and the facility is expected to be ready for consumers by late December 2020. This project was featured at the 2019 ACEEE Hot Water Forum, and the CPUC-CEC Joint Agency Workshop on Building Decarbonization on 4/8/19. The official website of the program can be found at sonomacleanpower.org/lead-locally.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-041 ** Lead Locally	Technology Demonstration and Deployment	This project is evaluating and demonstrating strategies to increase retrofits of existing buildings and includes the following elements: 1) identification and pilot testing of promising emerging efficiency technology packages for cost-effectiveness, feasibility, and customer acceptance; 2) development of an "Energy Marketplace" where consumers can directly procure technologies appropriate for their buildings. This will be combined with financing and rebates. The program targets those with little to no upfront capital and are the most difficult to reach. Training will be offered to contractors, realtors, and building officials with the goal of greatly increasing customer knowledge, decreasing code violations, and increasing penetration of energy efficiency measures outside the framework of utility programs.	4/11/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-041 ** Lead Locally	No	Demand-side Management	$6,543,064	$6,543,064	$2,033,324	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-041 ** Lead Locally	$2,033,324	$0	$0	Sonoma Clean Power Authority	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-041 ** Lead Locally	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-041 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	18 out of 18 bidders	Sonoma Clean Power Authority

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-041 ** Lead Locally	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-041 ** Lead Locally	The project could increase market penetration for existing building retrofits and result in deeper savings per site using the existing program funding that Sonoma Clean Power and the investor-owned utilities will allocate in future years. The project anticipates providing a full range of options for customers--from whole building integrated retrofits to partial retrofits and traditional equipment upgrades, depending on the customer's interest, budget, and need. The high level estimated net present value of the project benefits is over $60M in 2030. Additional benefits could be realized if fuel-switching strategies that are being evaluated as part of the applied research phase of the project meet cost-effectiveness, feasibility, and customer acceptance criteria and can be included in the Energy Marketplace.	1f, 1h	The recipient has completed the installation of following technologies: (1) air-to-water heat pump space heating and cooling systems (10 sites), (2) phase change materials (five sites installed and four more sites underway), (3) advanced daylighting system (one site), (4) residential induction cooking (three sites), (5) aerosol envelope sealing (four sites), and Nightbreeze economizer ventilation (three sites). Additionally, the recipient has chosen 10 sites for demonstrating grid integrated hear pump water heaters. The renovations for the Advanced Energy Center have been delayed and the facility is expected to be ready for consumers by late December 2020. This project was featured at the 2019 ACEEE Hot Water Forum, and the CPUC-CEC Joint Agency Workshop on Building Decarbonizaton on 4/8/19. The official website of the program can be found at sonomacleanpower.org/lead-locally.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-17-042 Camptonville Biomass-to-Energy Project	Technology Demonstration and Deployment	This agreement will fund the demonstration and deployment of a 5 MWnet biomass power plant. The biomass facility will include advanced low-emissions technology to reduce NOx, CO and VOC emissions, and the facility will include a state-of-the art low water consumption condenser.	1/22/20
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-043 GLOW: A User-friendly Interface for GridLAB-D	Applied Research and Development	This project is developing GridLAB-D Open Workspace (GLOW), an intuitive interface for GridLAB-D that will provide a user-friendly environment for researchers, planners, developers, and regulators involved in advanced electric grid technology simulation and scenario analysis. The interface will simplify data input and simulations, enable visualization of complex information, and be scalable for big data simulations. GLOW will be a freely available and widely supported open-source tool based on existing GridLAB-D technology.	5/9/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-042 Camptonville Biomass-to-Energy Project	Yes	Generation	$4,999,830	$4,999,830	$123,894	N/A
EPC-17-043 GLOW: A User-friendly Interface for GridLAB-D	No	Distribution	$2,999,699	$2,999,699	$1,560,863	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-042 Camptonville Biomass-to-Energy Project	$123,894	$110,031	$0	Phoenix Energy	$13,030,225	72.3%
EPC-17-043 GLOW: A User-friendly Interface for GridLAB-D	$1,560,863	$193,906	$0	Hitachi America LTD; National Grid	$1,255,060	29.5%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-042 Camptonville Biomass-to-Energy Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-042 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	phase 1: 56 out of 57 bidders; phase 2: 23 out of 23 bidders	Camptonville Community Partnership, Inc
EPC-17-043 GLOW: A User-friendly Interface for GridLAB-D	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-043 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 29 bidders	Hitachi America LTD

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-042 Camptonville Biomass-to-Energy Project	Ranked # 4	N/A	N/A	Yes; Calif Based Entity
EPC-17-043 GLOW: A User-friendly Interface for GridLAB-D	Group 4: Ranked # 1	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-042 Camptonville Biomass-to-Energy Project	This project will address the goal of reducing wildfire threats by using dead and diseased trees and other forest byproducts removed from forest lands to fuel a 5 MW renewable energy power plant. The project will export 3 MW to the grid under the Bioenergy Market Adjustment Tariff (BioMAT) program with an additional 2 MW exported through other market channels. The power plant will integrate an advanced emissions controls and a state-of-the-art low water use condenser. The technologies that comprise the integrated system have all been successfully used at large scales but have not been demonstrated as an integrated system at a the relatively small scale planned for this project.	1a, 1b, 1c, 2a	The grant recipient Camptonville Community Partnership (CCP) held its second technical advisory committee meeting in September 2020. During the second TAC meeting, CCP and Designer Group USA (DGU) presented the preliminary design and engineering study for the biomass plant, and this study was used to prepare a request for proposals (RFP) to select a contractor. CCP received approval from TAC members to proceed with their technical plans. As of November 202, the project was on schedule, however, having financial challenges, e.g. needed to start investing in equipment to meet the Investment Tax Credit requirements, which could delay the project if not met.
EPC-17-043 GLOW: A User-friendly Interface for GridLAB-D	The technical advancement of the project is the development of an intuitive and widely available user interface for GridLAB-D, a software simulation tool for advanced distribution system simulation and analysis developed by the U.S. Department of Energy.	3b, 3c, 5b	In 2020, the GLOW team held two technical advisory committee (TAC) meetings. They showcased preliminary software and offered alpha testing to TAC members, including regulators, IOUs, and private vendors to help test use cases and request for additional functions as necessary. Alpha testing started in November and will plan to run updates with stakeholders until the end of 2021 when beta testing is released. GLOW is also offering periodic public seminars due to annual in-person workshop being canceled from the global pandemic.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-044 ** Researching, Developing, Demonstrating the Commoditization of Building Energy Efficiency Retrofits in Southern California	Applied Research and Development	The project had hoped to develop a web-based marketplace platform for connecting customers with energy service providers, technologies, and lenders; installing retrofits at a variety of commercial customer sites in southern California, evaluating the pay-for-performance concept. This includes financing components to offset customer costs, insurance markets to reduce perceived risk for lenders, and a sales-as-a-service marketplace where efficiency products and services are connected with sales professionals.	6/13/18
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-044 ** Researching, Developing, Demonstrating the Commoditization of Building Energy Efficiency Retrofits in Southern California	Technology Demonstration and Deployment	The project had hoped to develop a web-based marketplace platform for connecting customers with energy service providers, technologies, and lenders; installing retrofits at a variety of commercial customer sites in southern California, evaluating the pay-for-performance concept. This includes financing components to offset customer costs, insurance markets to reduce perceived risk for lenders, and a sales-as-a-service marketplace where efficiency products and services are connected with sales professionals.	6/13/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-044 ** Researching, Developing, Demonstrating the Commoditization of Building Energy Efficiency Retrofits in Southern California	No	Demand-side Management	$2,399,772	$2,399,772	$829,261	N/A
EPC-17-044 ** Researching, Developing, Demonstrating the Commoditization of Building Energy Efficiency Retrofits in Southern California	No	Demand-side Management	$4,799,543	$4,799,543	$0	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-044 ** Researching, Developing, Demonstrating the Commoditization of Building Energy Efficiency Retrofits in Southern California	$829,261	$2,139,730	$0	InTech Energy, Inc.	$2,600,274	26.5%
EPC-17-044 ** Researching, Developing, Demonstrating the Commoditization of Building Energy Efficiency Retrofits in Southern California	$0	$0	$0	InTech Energy, Inc.	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-044 ** Researching, Developing, Demonstrating the Commoditization of Building Energy Efficiency Retrofits in Southern California	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-044 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	18 out of 18 bidders	InTech Energy, Inc.
EPC-17-044 ** Researching, Developing, Demonstrating the Commoditization of Building Energy Efficiency Retrofits in Southern California	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-044 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	18 out of 18 bidders	InTech Energy, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-044 ** Researching, Developing, Demonstrating the Commoditization of Building Energy Efficiency Retrofits in Southern California	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-17-044 ** Researching, Developing, Demonstrating the Commoditization of Building Energy Efficiency Retrofits in Southern California	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-044 ** Researching, Developing, Demonstrating the Commoditization of Building Energy Efficiency Retrofits in Southern California	This project had hoped to accelerate the adoption of market-driven, pay-for-performance retrofits at commercial customer sites by maximizing market potential using Sales-as-a-Service marketplace where customers, products and supporting services can connect with industry professionals. Through this marketplace, the recipient had hoped that the value of energy efficiency will be standardized and transparent, lowering cost and time to implement these technologies. The combination of these methods, along with new energy efficiency technologies in the demonstration sites, would showcase how cost-effective, energy-efficient solutions can be provided in a timely fashion.	1e, 1f, 1h	This project is being mutually terminated because the project objectives are unlikely to be met.
EPC-17-044 ** Researching, Developing, Demonstrating the Commoditization of Building Energy Efficiency Retrofits in Southern California	This project had hoped to accelerate the adoption of market-driven, pay-for-performance retrofits at commercial customer sites by maximizing market potential using Sales-as-a-Service marketplace where customers, products and supporting services can connect with industry professionals. Through this marketplace, the recipient had hoped that the value of energy efficiency will be standardized and transparent, lowering cost and time to implement these technologies. The combination of these methods, along with new energy efficiency technologies in the demonstration sites, would showcase how cost-effective, energy-efficient solutions can be provided in a timely fashion.	1e, 1f, 1h	This project is being mutually terminated because the project objectives are unlikely to be met.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-045 Oak View Microgrid: Using Microgrid Technologies to Simultaneously Improve Quality of Life and Electric Grid Operations	Applied Research and Development	This project develops multiple urban energy scenarios in which multiple types of energy efficiency, electrification, and microgrid technologies are considered. The design approach uses integrated methods that simultaneously consider various technology and retrofit options, while also verifying that the proposed technology mixes accomplish the goals of improving air quality and grid operations. The work will result in the proposal of a microgrid design ready for implementation in the Oak View community and an extensible and robust design methodology that can be used throughout the state for economic and environmentally sensitive microgrid development.	4/11/18
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-046 HiPAS GridLAB-D: A High-Performance Agent-based Simulation using GridLAB-D	Applied Research and Development	The High Performance Agent-Based Simulation (HiPAS) GridLAB-D project will increase the performance of the open-source version of GridLAB-D and improve the broad accessibility of high-performance power grid simulation capabilities to the community of smart grid and distribution simulation users in California. HiPAS includes methods that parallelize many of the iterative methods used in simulations. HiPAS is intended for both desktop multi-core processors and cloud platforms. It will enable GridLAB-D users to more efficiently analyze multiple scenarios with improved resolution by reducing the computational costs associated with analysis.	5/9/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-045 Oak View Microgrid: Using Microgrid Technologies to Simultaneously Improve Quality of Life and Electric Grid Operations	No	Grid Operations/Market Design	$1,099,760	$1,099,760	$668,209	N/A
EPC-17-046 HiPAS GridLAB-D: A High-Performance Agent-based Simulation using GridLAB-D	No	Grid Operations/Market Design	$3,068,781	$3,068,781	$2,384,292	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-045 Oak View Microgrid: Using Microgrid Technologies to Simultaneously Improve Quality of Life and Electric Grid Operations	$668,209	$157,594	$0	Advanced Power and Energy Program (APEP) - University of California, Irvine; County of Orange/City of Huntington Beach; National Renewable Energy Laboratory (NREL); Altura Associates, Inc.	$367,804	25.1%
EPC-17-046 HiPAS GridLAB-D: A High-Performance Agent-based Simulation using GridLAB-D	$2,384,292	$1,149,270	$6,730,000	National Grid	$300,000	8.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-045 Oak View Microgrid: Using Microgrid Technologies to Simultaneously Improve Quality of Life and Electric Grid Operations	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-045 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 29 bidders	The Regents of the University of California, Irvine
EPC-17-046 HiPAS GridLAB-D: A High-Performance Agent-based Simulation using GridLAB-D	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-046 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 29 bidders	SLAC National Accelerator Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-045 Oak View Microgrid: Using Microgrid Technologies to Simultaneously Improve Quality of Life and Electric Grid Operations	Group 2a: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-17-046 HiPAS GridLAB-D: A High-Performance Agent-based Simulation using GridLAB-D	Group 3: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-045 Oak View Microgrid: Using Microgrid Technologies to Simultaneously Improve Quality of Life and Electric Grid Operations	This project is helping overcome challenges in integrating emerging and proven sustainable energy technologies with various end uses in the Oak View community, helping to facilitate the implementation of SB 535 and AB 1550 that require maximizing benefits from low-carbon technologies to disadvantaged communities. This study is assessing ways to reduce particulate matter, nitrogen oxides, and other indoor and outdoor air pollutants associated with appliances used in homes and with electricity generated and served to the subject community. The research team is using big data to develop decarbonization pathways for the community energy system that will include increased energy efficiency improvements within existing residential buildings, renewable energy generation and energy storage technologies, vehicle electrification, and electrification of natural gas appliances.	1f, 1h, 2a, 4a, 4b	The team has completed the following: finalized the URBANopt community energy model and tested 100+ HVAC system configurations; improved modeling capabilities of URBANopt; developed baseline OpenDSS circuit model; developed post-processors reporting transformer and line overloads; improved energy efficiency and financial analysis tool and incorporated updated baselines; projected cost and environmental impacts of future technology; researched energy efficiency options related to building insulation and HVACs; developed emissions predictions based on CEC carbon emission projections; established a market model for person-to-person (P2P) auction trading; created a residential P2P trading framework and model to allow energy trade between residents with PV+; developed battery strategy to help P2P energy trade; corrected Oak View OpenDSS model to account for discovered underground infrastructure and incorporated dynamic PV and ESS systems; developed topology of new methods for islanding.
EPC-17-046 HiPAS GridLAB-D: A High-Performance Agent-based Simulation using GridLAB-D	The project will achieve technology advancement and usability breakthroughs in the following performance areas: 1) Granular object-level parallelization of computations; 2) Large-scale parametric job control; 3) Sensitivity analysis; and 4) Monte Carlo analysis. These advancements will improve the accessibility and applicability of GridLAB-D to California utilities, government agencies, and researchers who are responsible for system policy, planning, operation and oversight in the presence of growing customer-based demand response and renewable energy resources.	1a, 1b, 3a, 5b	In 2020, the project team released alpha versions of HiPAS to coordinate with OpenFIDO and GLOW. The updates are under "beauharnois", which had 13 releases this year. HiPAS has integrated machine learning powerflow and the performance is currently being evaluated. There will be four use-cases developed for HiPAS: integrated capacity analysis, distribution system resilience analysis, tariff design, and end-use load electrification. Online documentation for HiPAS was deployed, including dynamic versioning from Github and direct support for tutorials.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-047 OpenFIDO: An Open-source Framework for Integrated Data Operations	Applied Research and Development	This project will develop OpenFIDO, an open source tool to transfer data between various programs that are part of the suite of tools used in by utilities, distributed energy resource (DER) engineers and regulators in California. The tool is an integration framework to quickly move data from one application to another as part of their engineering, planning, and review activities.	5/9/18
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-048 Engaging Communities in the Design of Sustainable Energy and Localized Futures (SELF) Models in California's San Joaquin Valley	Applied Research and Development	Through the analysis of "big data" comprising remotely-sensed images (e.g. agriculture lands, road networks, and built environment) and Geographic Information System (GIS) layers (e.g., energy consumption, distribution networks, new build construction, reserve areas, and planning documents), the project team is developing an analysis that examines specific dense urban areas with both high potential for retrofits that can help meet the needs of disadvantaged communities. Through the identification of critical "Urban-Agriculture Interface Zones" using a GIS-based hot spot analysis across the southern San Joaquin Valley, the project identifies and engages with communities (with community-based organizations) to conduct Sustainable Energy and Localized Futures (SELF) modeling. This project identifies opportunities in the SELF communities for efficiency and energy system improvements based on analysis of energy optimization tools such as the Solar, Wind, Investment in Technology, Hydropower (SWITCH) model. An optimization model is being developed for these densely populated zones to design "SELF- SWITCH" systems (SELF-SWITCH model).	4/11/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-047 OpenFIDO: An Open-source Framework for Integrated Data Operations	No	Distribution	$1,000,000	$1,000,000	$950,000	N/A
EPC-17-048 Engaging Communities in the Design of Sustainable Energy and Localized Futures (SELF) Models in California's San Joaquin Valley	No	Grid Operations/Market Design	$1,100,000	$1,100,000	$98,632	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-047 OpenFIDO: An Open-source Framework for Integrated Data Operations	$950,000	$367,282	$0	National Grid	$30,000	2.9%
EPC-17-048 Engaging Communities in the Design of Sustainable Energy and Localized Futures (SELF) Models in California's San Joaquin Valley	$98,632	$228,397	$0	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-047 OpenFIDO: An Open-source Framework for Integrated Data Operations	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-047 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 29 bidders	SLAC National Accelerator Laboratory
EPC-17-048 Engaging Communities in the Design of Sustainable Energy and Localized Futures (SELF) Models in California's San Joaquin Valley	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-048 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 29 bidders	The Regents of the University of California, Berkeley Campus

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-047 OpenFIDO: An Open-source Framework for Integrated Data Operations	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-17-048 Engaging Communities in the Design of Sustainable Energy and Localized Futures (SELF) Models in California's San Joaquin Valley	Group 2b: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-047 OpenFIDO: An Open-source Framework for Integrated Data Operations	Current grid simulation tools do not support the exchange of data to other programs. This is not sufficient when many different tools are used to analyze the many multi-disciplinary problems energy system researchers, analysts and regulators must address. OpenFIDO proposes to use an open multi-standard approach to data exchange called polyglot representation. This approach allows data to be exchanged so that data sets of commercial buildings, retail tariffs, and distribution networks can be reliably exchanged between the various distribution system analysis and simulation tools that are currently used. This enables better analysis of the impacts of DERs in distribution planning.	1b, 1c, 5a, 5b	In 2020, the project team developed data import capabilities that can convert end-use load monitoring data and import Advance Metering Infrastructure and Supervisory Control and Data Acquisition and weather data into GridLAB-D simulations. OpenFIDO (Open Framework for Integrated Data Operations) integration with HiPAS (High Performance Agent-Based Simulation) GridLAB-D is currently in progress and the production evaluation versions of OpenFIDO will begin in March 2021. SLAC has entered into an agreement with Presence Product Group to build the first commercial release of OpenFIDO with a view to full commercialization by the end of the project.
EPC-17-048 Engaging Communities in the Design of Sustainable Energy and Localized Futures (SELF) Models in California's San Joaquin Valley	This research is advancing the state of the art by developing a new model that can explore the cost and feasibility of generation, transmission, and storage options for the future electricity system in a sub-regional environment. The model identifies cost-effective investment decisions for meeting electricity demand, taking into account the existing grid as well as projections of future technological developments, renewable energy potential, fuel costs, and public policy. Integrating this model with updated GIS and geographically relevant data and algorithms for a sub-regional development will assist California's energy system planners.	3a	The research team developed a GIS-based dataset for the southern San Joaquin Valley (SSJV) that incorporates a number of layers including population density, built environment, environmental impact, CalEnviroScreen, electrical load, distributed generation, land use, and other data to aid in the development of SELF communities in the SSJV. The research team used this dataset and collaborated with a local community benefits organization, Self Help Enterprises (SHE), to identify six communities with the highest potential for a deeper-dive case study application of the SELF approach. The team is currently working with SHE to perform a household survey of approximately 1,000 households across the six communities to collect more detailed information about demographics, energy use, and willingness to adopt energy upgrade measures.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-049 Port of San Diego Microgrid - Resiliency in Terminal Operations	Technology Demonstration and Deployment	The project will develop a new, permanent, renewable microgrid at the Tenth Avenue Marine Terminal that can be replicated at other seaport terminals and distribution facilities throughout California, the U.S., and internationally. The project will incorporate solar photovoltaic renewable generation, battery energy storage, energy efficiency improvements, and a centralized microgrid controller to allow key elements of the terminal to remain operational when islanded from the electrical grid for a minimum of 12 hours.	5/9/18
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-050 Using Big Data to Holistically Assess Benefits from Building Energy System Transition Pathways in Disadvantaged Communities	Applied Research and Development	This research project supports holistic urban energy planning for the Avocado Heights community that simultaneously considers urban renewables, indoor and outdoor air quality, deep energy efficiency options, retrofitting of homes and buildings, electrification, and issues of environmental justice. The project aims to evaluate the feasibility and effectiveness of advances in four energy transition pathways, including electric vehicles, energy efficiency, residential appliance electrification, and distributed solar generation. The project will analyze Southern California Gas utility usage data, in conjunction with indoor and ambient air quality monitoring data and surveys from volunteer households, to identify economically attractive options for greenhouse gas (GHG) reductions in the unincorporated areas of Bassett and Avocado Heights, CA.	7/11/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-049 Port of San Diego Microgrid - Resiliency in Terminal Operations	No	Distribution	$4,985,272	$4,985,272	$33,898	N/A
EPC-17-050 Using Big Data to Holistically Assess Benefits from Building Energy System Transition Pathways in Disadvantaged Communities	No	Distribution	$1,098,662	$1,098,662	$292,306	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-049 Port of San Diego Microgrid - Resiliency in Terminal Operations	$33,898	$422,043	$0	The Regents of the University of California, San Diego; San Diego Unified Port District (Port of San Diego)	$4,629,936	48.2%
EPC-17-050 Using Big Data to Holistically Assess Benefits from Building Energy System Transition Pathways in Disadvantaged Communities	$292,306	$233,968	$0	Regents of the University of California, Los Angeles	$54,740	4.7%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-049 Port of San Diego Microgrid - Resiliency in Terminal Operations	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-049 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	54 out of 60 bidders	San Diego Unified Port District (Port of San Diego)
EPC-17-050 Using Big Data to Holistically Assess Benefits from Building Energy System Transition Pathways in Disadvantaged Communities	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-050 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 29 bidders	The Regents of the University of California, Los Angeles

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-049 Port of San Diego Microgrid - Resiliency in Terminal Operations	Group 1: Ranked # 5	N/A	N/A	Yes; Calif Based Entity
EPC-17-050 Using Big Data to Holistically Assess Benefits from Building Energy System Transition Pathways in Disadvantaged Communities	Group 2a: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-049 Port of San Diego Microgrid - Resiliency in Terminal Operations	The project will create a replicable approach for developing a solar-powered, resilient microgrid in a port or other industrial setting that will provide power to critical loads and allow key elements of a terminal to remain operational for 12 hours or longer when islanded from the grid.	1b, 1c, 1h, 4a, 5b	The Port developed the preliminary microgrid design at a level sufficient to complete a competitive procurement for final microgrid design and build services. In parallel, the Port has begun warehouse roof replacement work to support the solar PV array installation, as well as energy efficient lighting installation work.
EPC-17-050 Using Big Data to Holistically Assess Benefits from Building Energy System Transition Pathways in Disadvantaged Communities	Energy planning is often conducted in a piecemeal fashion, focusing on opportunities relevant to individual market sectors or fuels. This project is taking a different approach, using a holistic approach for urban energy planning with the final goal of identifying economically attractive options for deep GHG reductions and improved environmental conditions in Bassett and Avocado Heights. The project will additionally analyze four energy transition pathways and determine which are the most economically and environmentally feasible options for California's Disadvantaged Communities.	4a, 4b	The research team monitored 64 homes in the El Monte, Avocado Heights, and Basset neighborhoods in southern California for two weeks in the Summer of 2019 (July) and two weeks in the Winter of 2019 (February). The team used Purple Air Monitors to determine indoor particulate matter levels and Ogawa NO2 monitors to determine indoor Nitrogen Dioxide levels. The research team attended 36 community meetings and sent surveys to homes asking about appliance types, appliance usage, and general occupant behavior. The team received 449 home surveys back. The research team additionally received access to hourly-usage data from SoCal Gas, which was used to finalize the community energy modeling and related analysis of hourly load profiles, included in a Building Models report. These findings and analyses have allowed the research team to run building energy models and develop load profiles for various scenarios related to the different energy transition pathways.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-051 LEED: A Lightwave Energy-Efficient Datacenter	Applied Research and Development	The goal of this federal cost share grant, the Lightwave Energy-Efficiency Datacenter (LEED) program, is to at least double the current energy efficiency of a datacenter. This dramatic improvement is realized by increasing the energy utilization of each server by means of a novel lightwave network. The LEED network can substantially increase the network bandwidth which leads to a corresponding improvement in the server energy utilization. This improvement can be realized at a cost comparable to a state-of-the-art datacenter network based on conventional electrical switching technologies.	5/9/18
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-052 Urban Microgrids for Grid Resiliency and Disaster Readiness	Technology Demonstration and Deployment	This project is developing a software-driven, modular microgrid network for disaster-readiness, resiliency, and grid services and will deploy them at least five demonstration sites in DAC areas and two different IOU service territories. It will connect multiple customer-owned behind-the-meter DER assets into virtual networks of microgrid via cloud-based controls and an optimization platform. Each microgrid will be able to operate independently in a cybersecure way to reduce facility electric costs and to island in the event of an unplanned power outage or public safety power shutoff (PSPS) to keep critical operations and emergency shelters running.	5/9/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-051 LEED: A Lightwave Energy-Efficient Datacenter	No	Demand-side Management	$475,000	$475,000	$474,997	N/A
EPC-17-052 Urban Microgrids for Grid Resiliency and Disaster Readiness	No	Distribution	$4,995,498	$4,995,498	$863,160	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-051 LEED: A Lightwave Energy-Efficient Datacenter	$474,997	$78,440	$4,643,524	None	$0	0.0%
EPC-17-052 Urban Microgrids for Grid Resiliency and Disaster Readiness	$863,160	$562,214	$0	Electric Power Research Institute, Inc.; Chabot-Las Positas Community College District; InTech Energy, Inc.; Gridscape Solutions, Inc.; City of Fontana; TRC Energy Services	$3,281,992	39.6%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-051 LEED: A Lightwave Energy-Efficient Datacenter	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-051 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	43 bidders	The Regents of the University of California, San Diego
EPC-17-052 Urban Microgrids for Grid Resiliency and Disaster Readiness	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-052 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	54 out of 60 bidders	Gridscape Solutions, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-051 LEED: A Lightwave Energy-Efficient Datacenter	N/A ***	N/A ***	N/A	Yes; Calif Based Entity
EPC-17-052 Urban Microgrids for Grid Resiliency and Disaster Readiness	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity, Minority Owned

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-051 LEED: A Lightwave Energy-Efficient Datacenter	This project could lead to technological advancement in lightwave technology for datacenters. It could double the efficiency of datacenters by increasing the speed of response and reducing energy input.	1c, 1f, 2a	The first phase of the project was completed and successfully developed its optical switch and the necessary transmitter and receiver to revolutionize data centers. Currently, fiber optical lines are used for internet, but data centers are still using electrical lines to each data center rack. Using light signals in the optical switches is expected to increase energy efficiency by 50% and would process data faster. The data processing speed is one of the main driving factors in consumer appeal for data centers and should be easily marketed in the data center industry. Funding for the second phase of the program has been approved by Department on Energy and the project will continue the development and demonstration of the technology.
EPC-17-052 Urban Microgrids for Grid Resiliency and Disaster Readiness	This project is leading to technological advancement and breakthroughs by developing and demonstrating the ability to remotely operate multiple microgrids, which can be useful for keeping all critical functions operational in the event of a grid outage, reducing utility costs, and minimizing the reliance on diesel backup generators. The key breakthroughs in this project to overcome barriers are use of clean renewable power in both on-grid and off-grid modes and streamlining interconnection process with the utility grid.	1a, 3h, 4a, 5a, 5b	In 2020, the Gridscape EnergyScope Microgrid System (microgrid-in-a-box) design was finalized and systems are being manufactured. Each system integrates battery energy storage with an interconnection relay, inverter, controller, and other related electrical equipment. The City of Fontana has approved permit drawings for deployment at the City Hall and Community Senior Center by the second quarter of 2021. In April 2020, Gridscape signed an agreement with the Chabot Community College in Hayward for a campus microgrid, which will provide electricity to three essential service buildings. This microgrid is currently in the design stage and the installation is expected by the third quarter of 2021. In addition, Gridscape is in the process of getting approval for a city in Southern California with four additional DAC sites.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-053 Santa Rosa Junior College Urban Microgrid Project	Technology Demonstration and Deployment	Santa Rosa Junior College (SRJC) will demonstrate a microgrid on campus. This project will integrate three types of distributed energy resource (DER) elements: solar photovoltaic (PV) generation, energy storage, and load reduction devices and load control systems, all managed by a single microgrid controller. The goals of this project are to meet 40% of the campus electricity requirement with emissions-free PV solar power, to reduce the campus peak load, to optimize energy use, to provide support services to the surrounding grid, and to create a highly resilient power system benefitting the campus and the community. This project will demonstrate the environmental, economic, and resiliency benefits of a highly flexible campus microgrid. Operational objectives encompass demonstration of power flow, load control, and energy storage in a large multi-building campus, operating at appropriate scale and in actual operating conditions.	6/13/18
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-054 Rialto Resilient Clean Power Microgrid	Technology Demonstration and Deployment	The purpose of this project is to fund a new permanent microgrid installation at the Rialto Bioenergy Facility (RBF), which will generate biogas from food waste. The microgrid will manage energy from biogas production and an energy storage system to support the power demand of the RBF. This will minimize grid draw and enhance renewable electricity export. The project will install battery storage, demand response capabilities, new power production capacity, an enhanced Supervisory Control and Data Acquisition (SCADA) interface, and switchgear to allow islanding in the case of a utility outage.	7/11/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-053 Santa Rosa Junior College Urban Microgrid Project	No	Demand-side Management	$4,999,005	$4,999,005	$0	N/A
EPC-17-054 Rialto Resilient Clean Power Microgrid	No	Grid Operations/Market Design	$5,000,000	$5,000,000	$3,186,190	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-053 Santa Rosa Junior College Urban Microgrid Project	$0	$348,244	$0	SunPower Corporation, Systems; Sonoma County Junior College District/ Santa Rosa Junior College	$8,689,759	63.5%
EPC-17-054 Rialto Resilient Clean Power Microgrid	$3,186,190	$0	$0	The Grant Farm, Inc; Rialto Bioenergy Facility LLC; Trinity Consultants; Southern Electric	$6,515,000	56.6%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-053 Santa Rosa Junior College Urban Microgrid Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-053 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	54 out of 60 bidders	Sonoma County Junior College District/ Santa Rosa Junior College
EPC-17-054 Rialto Resilient Clean Power Microgrid	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-054 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	54 out of 60 bidders	Rialto Bioenergy Facility LLC

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-053 Santa Rosa Junior College Urban Microgrid Project	Group 3: Ranked # 3	N/A	N/A	Yes; Calif Based Entity
EPC-17-054 Rialto Resilient Clean Power Microgrid	Group 2: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-053 Santa Rosa Junior College Urban Microgrid Project	This project will result in advancements in the deployment of a microgrid, including the use of storage technologies, adaptive load management, and the monetization of microgrid assets while providing community support facilities in times of need. This project will also demonstrate coordination of multiple large energy storage devices with different dynamic capabilities. By demonstrating a local approach to stabilizing utility grid frequency, the microgrid will be transformed from a source of load transients to a point of stabilization reaching far beyond the point of interconnection.	1c, 1g, 1h, 2a, 3f, 3h, 4a, 4b, 5a, 5b, 5d	The team is currently working on collecting data from the submeters to ensure pre-microgrid operation baselines are developed for all campus buildings. The team is also in the planning phase for the installation and testing of the 12 kV switchgear and the installation and interconnection of the energy storage system. The energy storage system is currently in procurement and assembly and is anticipated to be ready to be shipped to the site in Q1 of 2021. Additionally, the team is assessing DR program participation and will work on the installation of load shed devices.
EPC-17-054 Rialto Resilient Clean Power Microgrid	This project will demonstrate the business case for a microgrid that can improve operations of a food and biowaste treatment facility, as well as a wastewater treatment facility, located in a disadvantaged community. The microgrid will use a microgrid controller to optimize a biogas cogeneration system, fueled by available feedstock, and utilize energy storage to enable the facility to continue operations during a grid outage. This project will demonstrate the microgrid's ability to provide benefits to the residents of the disadvantaged community by providing opportunities to participate in demand response activities, providing cleaner air quality, and increasing grid reliability and resiliency. The business case could be applicable to the 156 critical waste water treatment plants across California.	1b, 1e, 1f, 1h, 4a, 4b, 4d, 4e, 5b, 5f	In 2020, the project team completed construction of the RBF digester and installation of four combined heat and power units and the supporting electrical and mechanical connections. RBF began operation and taking in organic material and municipal solid material in Fall 2020. The team also installed the necessary transformers, switches, and panels to support the site's microgrid and is in the process of down-selecting vendors for the energy storage system for the microgrid.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-17-055 Redwood Coast Airport Microgrid	Technology Demonstration and Deployment	This project is a community-scale renewable energy microgrid located at the California Redwood Coast-Humboldt County Airport. It will deploy and demonstrate the first multi-customer, front-of-the-meter (FTM) microgrid on PG&E's distribution system. The generation resources will be owned and operated by a CCA (Redwood Coast Energy Authority or RCEA) and will be 100% renewable. The microgrid circuit will be owned and operated by PG&E. This microgrid will allow the CCA to participate in the wholesale electricity market and provide renewable energy for the airport during normal operations, It will also provide low carbon resilience through islanding capabilities that serve critical facilities: a commercial airport and a U.S. Coast Guard Air Station. Controllable EV chargers also will be installed at the airport terminal parking lot.	6/13/18
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-18-001 Port Hueneme Navy Data Center Microgrid	Technology Demonstration and Deployment	This project will demonstrate a standardized, high-penetration distributed energy resource (DER) microgrid to support a data center at the Naval Surface Warfare Center - Port Hueneme Division near Oxnard, CA. The data obtained on capital cost, operating cost, performance and lessons learned will support commercial deployment for both military and non-military applications.	9/21/18

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-17-055 Redwood Coast Airport Microgrid	No	Distribution	$5,000,000	$5,000,000	$1,501,998	N/A
EPC-18-001 Port Hueneme Navy Data Center Microgrid	No	Grid Operations/Market Design	$4,998,345	$4,998,345	$347,646	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-17-055 Redwood Coast Airport Microgrid	$1,501,998	$500,449	$0	Humboldt State University Sponsored Programs Foundation; Redwood Coast Energy Authority	$6,322,728	55.8%
EPC-18-001 Port Hueneme Navy Data Center Microgrid	$347,646	$848,609	$0	Distributed Utility Associates; Electric Power Research Institute, Inc.; Schweitzer Engineering Laboratories, Inc.	$3,502,754	41.2%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-17-055 Redwood Coast Airport Microgrid	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-17-055 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	54 out of 60 bidders	Humboldt State University Sponsored Programs Foundation
EPC-18-001 Port Hueneme Navy Data Center Microgrid	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-001 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	54 out of 60 bidders	Electric Power Research Institute, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-17-055 Redwood Coast Airport Microgrid	Group 3: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-18-001 Port Hueneme Navy Data Center Microgrid	Group 1: Ranked # 6	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-17-055 Redwood Coast Airport Microgrid	In order to manage increased DERs, California needs sophisticated DER management systems and strategies, and microgrids can play an important role. This project will lead to significant technological advancements and breakthroughs by deploying a highly automated, multi-customer microgrid to provide end-use customer resiliency support and wholesale market participation with renewable energy. Islanding will be demonstrated for the customers behind the meter. RCEA will collaborate with PG&E to create experimental tariffs and agreements for operating multi-customer microgrids. These tariffs and agreements will become important examples to other utilities and CCAs and inform the CPUC's microgrid tariff proceeding.	1a, 1b, 1i, 2a, 3h, 5a	Site preparation activities were completed in 2020 and the microgrid is on track to be constructed in the summer of 2021. The final designs were completed for the site electrical and civil works and for the PG&E distribution system upgrades. The interconnection switchgear is fully designed and in the manufacturing queue. The FAA airspace obstruction analysis team approved the project and their environmental team finalized and circulated the Environmental Assessment. The County Supervisors and the RCEA Board of Directors have approved a land lease for the project. A microgrid operating agreement between PG&E and RCEA has been drafted and is in legal review. The team provided valuable input to the CPUC's microgrid proceeding and the CAISO's hybrid resource initiative in multiple meetings and public workshops.
EPC-18-001 Port Hueneme Navy Data Center Microgrid	This project is developing new approaches to microgrids that can ensure stable power to sensitive components, such as in data centers. The team will demonstrate a standardized microgrid, analyze and define the savings and market barriers, and provide new, valuable performance data that will be used to develop a viable market for future deployments.	1a, 1b, 1e, 1h, 1i, 2a, 5a	The project team completed construction, factory testing, transport, installation, commissioning, acceptance testing, and initial performance testing for the microgrid battery storage system (500 kW-4 hours) located at Naval Base Ventura County-Port Hueneme. The measured beginning of life AC round trip efficiency of the overall battery system had a measured value equal to 93.2%, which was 2.9 % points better than the required contract value of 90.3%. Also, the project team completed the design and initial construction of the microgrid's protection relays, switchgear, synchronous condenser, and control system.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-18-002 California Test Bed Initiative	Market Facilitation	This project will develop and implement a voucher program to provide clean energy companies access to testing facilities to test and/or certify prototypes of pre-commercial distributed energy resource technologies, and help them refine their prototype to meet customer specifications. This project will start with an initial network of testing facilities that includes 29 University of California facilities from nine campuses and two National Laboratory facilities. The project intends to grow this network throughout the duration of the project. This network of testing facilities will connect testing facilities throughout California, which would otherwise be disconnected, in order to serve clean energy companies more efficiently and effectively throughout all of California.	12/10/18
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-18-003 Ultra-thin Flexible LED Lighting Panels	Applied Research and Development	The project will produce a custom thin, flexible lighting platform technology for making material-efficient and aesthetically pleasant wide-area LED lighting luminaires at a fraction of the cost of traditional fluorescent and LED fixtures. The objective is to create a universal, area-distributed LED source and associated luminaire technology platform that would (1) set a new standard for wide-area luminaire efficiency, (2) provide much lower cost of ownership compared to other lighting technologies, and (3) dramatically improve aesthetics of lighting fixtures and provide virtually unlimited design opportunities through introducing thin and flexible forms.	1/9/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-18-002 California Test Bed Initiative	No	Demand-side Management	$10,999,701	$10,999,701	$501,599	N/A
EPC-18-003 Ultra-thin Flexible LED Lighting Panels	No	Grid Operations/Market Design	$1,692,069	$1,692,069	$719,902	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-18-002 California Test Bed Initiative	$501,599	$566,364	$0	California Clean Energy Fund dba CalCEF Ventures; University of California, Office of the President	$887,053	7.5%
EPC-18-003 Ultra-thin Flexible LED Lighting Panels	$719,902	$516,434	$0	IVESTA LLC	$169,207	9.1%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-18-002 California Test Bed Initiative	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-002 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	15 out of 15 bidders	California Clean Energy Fund dba CalCEF Ventures
EPC-18-003 Ultra-thin Flexible LED Lighting Panels	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	21 out of 33 bidders	Lucent Optics, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-18-002 California Test Bed Initiative	Group 1: Ranked # 1	N/A	N/A	None
EPC-18-003 Ultra-thin Flexible LED Lighting Panels	Group 1: Ranked # 5	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-18-002 California Test Bed Initiative	CalTestBed will accelerate new, clean, energy-efficient technologies to market and, as a result, reduce ratepayer costs. By early engagement of target customer groups in the refinement of product specifications and the evaluation of commercial viability, CalTestBed will accelerate the rate of development and commercialization of technologies that improve California's air, water and energy profile and drive economic investment, business creation and jobs.	2a, 3a, 3b, 3e	In 2020, the CalTestBed voucher program launched its first solicitation and received over 100 applications. Technical reviewers scored the applications and provided recommendations on which applicants should proceed to the next round of consideration. In this second round, applicants completed consultations with testbed facility staff to determine compatibility of the entrepreneur's testing needs and the facility's capabilities, as well as to create a scope of work. A total of 26 entrepreneurs were selected as voucher recipients and matched with testbed facilities for the 2020 solicitation. In December, the first annual CalTestBed Symposium was held, during which confirmed voucher recipients were announced and featured. Laboratory testing of selected technologies will be performed in 2021. A second solicitation will be issued in 2021 for new applications.
EPC-18-003 Ultra-thin Flexible LED Lighting Panels	This project could improve understanding of metrics and test procedures associated with LED quality and performance; increase the ability of commercial building operators/owners to comply with future energy codes and standards; produce higher quality LED products; and, increase consumer acceptance of LED lighting luminaires.	1e, 1f, 1h, 2a, 3a, 3b, 4a	In 2020, this project successfully completed the development of an innovative additive manufacturing process for optical patterning of plastic sheets and producing large-area optical waveguides which are essential components for making thin and flexible LED lighting panels. The project scaled up the patterning process to the panel sizes of up to 2ft x 4ft and established pilot manufacturing of custom-format optical waveguides in Sacramento. In 2021, the project team will send the first batches of commercially produced large-area waveguides to manufacturers - which make lighting and signage end-products.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-18-004 Accelerating Commercialization of Advanced Energy Efficient Windows	Applied Research and Development	This project will scale Ubiquitous Energy's ClearView PowerTM technology to meet the size requirements and specifications needed for window production. ClearView PowerTM is a transparent solar coating that, when applied to glass, selectively absorbs and converts non-visible light to electricity while also blocking the infrared light that causes heat gains in buildings. As part of this project, Ubiquitous Energy will demonstrate that the solar coating application can be integrated into a standard glass manufacturing process.	1/9/19
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-18-005 Building Energy Impact Analysis of Low Cost NanoEC Electrochromic Window Control Algorithm Optimization	Technology Demonstration and Deployment	Heliotrope's NanoEC is the first neutral grey electrochromic window product that achieves a price point less than $25/sq. ft. This project is aiming to evaluate and optimize the building energy impact of this electrochromic smart window. By reaching the color/cost barriers needed to create mass adoption, Heliotrope will use this project to design, test, and validate energy conservation in building applications through field installations at both a test bed facility and at a real world commercial facility. Data from this study will help optimize window tinting control algorithms to achieve the lowest building energy consumption.	1/9/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-18-004 Accelerating Commercialization of Advanced Energy Efficient Windows	No	Grid Operations/Market Design	$2,998,055	$2,998,055	$1,439,686	N/A
EPC-18-005 Building Energy Impact Analysis of Low Cost NanoEC Electrochromic Window Control Algorithm Optimization	No	Demand-side Management	$3,667,104	$3,667,104	$2,806,672	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-18-004 Accelerating Commercialization of Advanced Energy Efficient Windows	$1,439,686	$407,192	$0	Lawrence Berkeley National Laboratory; Ubiquitous Energy, Inc.	$4,310,659	59.0%
EPC-18-005 Building Energy Impact Analysis of Low Cost NanoEC Electrochromic Window Control Algorithm Optimization	$2,806,672	$1,182,911	$0	Heliotrope Technologies, Inc.	$952,276	20.6%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-18-004 Accelerating Commercialization of Advanced Energy Efficient Windows	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	21 out of 33 bidders	Ubiquitous Energy, Inc.
EPC-18-005 Building Energy Impact Analysis of Low Cost NanoEC Electrochromic Window Control Algorithm Optimization	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	21 out of 33 bidders	Heliotrope Technologies, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-18-004 Accelerating Commercialization of Advanced Energy Efficient Windows	Group 1: Ranked # 1	N/A	N/A	None
EPC-18-005 Building Energy Impact Analysis of Low Cost NanoEC Electrochromic Window Control Algorithm Optimization	Group 2: Ranked # 2	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-18-004 Accelerating Commercialization of Advanced Energy Efficient Windows	The mass-market commercialization of clear windows that generate renewable energy and premium insulation will provide demonstrable improvements over existing low-E windows currently used in commercial buildings. This will allow California to better design and create zero net energy (ZNE) buildings to meet the state's energy efficiency goals. Furthermore, CVP's solar generating capabilities would broaden the application and generation of solar energy throughout California.	1e, 1f, 2a	In 2020, the project team continued testing and refining the larger 14" x 20" RD&D prototype samples to prepare for external evaluation by certified laboratories. They partnered with two independent certified UL facilities in California to provide performance and durability testing for both solar generation and energy efficiency. Testing was delayed by four months due to COVID-19, concluding in September. The results were promising, showing that the film coating was able to maintain its transparency and functionality. In November, LBNL began test modeling on a window facade installed at their facility for energy efficiency and recorded internal temperature measurements. The team also recorded performance results on the window facade previously installed at their offices, for the year. In 2021, the team will refine the second prototype as necessary and continue market validation, talking with different actors in the window industry and looking for opportunities to pilot the windows.
EPC-18-005 Building Energy Impact Analysis of Low Cost NanoEC Electrochromic Window Control Algorithm Optimization	This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by developing a dynamic glass technology that will reduce HVAC energy consumption. By optimizing the control algorithm design in this project, Heliotrope's NanoEC electrochromic smart windows will improve thermal management within buildings. This technology is also showing an increase in light energy savings while providing product improvement of color and overall cost.	1e	In 2020, this project installed a 4 x 2 wooden residential window demo wall to utilize as a testbed for continued development of its proprietary algorithm aimed at improving building energy consumption while maintaining occupant comfort. The 350mm x 500mm window size utilized for the demo wall represented a good approximation for the first field installation at Lawrence Berkeley National Lab (LBNL). The algorithm was tested and validated to meet target specifications. A full system design was completed and sent for production which included new control hardware, wiring, and user interface (wired and wireless). In 2021, the project team will integrate the Alpha system design into the upcoming field installation at LBNL.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-18-006 Radiative Sky Cooling-Enabled Efficiency Improvements on Commercial Cooling Systems	Applied Research and Development	This project is demonstrating a technology that will enable new and existing air conditioning and refrigeration systems to run more efficiently and in certain applications replace AC units with a cooling system requiring only the energy to run a pump. The technology being demonstrated is a rooftop-mounted, radiative sky-cooling panel that has a specialized film to enable daytime radiative cooling. The panels cool without evaporating water and only require electricity to run a small circulating pump. The cooling effect from the panels occurs all day, which is well aligned with the 24/7 operation of refrigeration systems in supermarkets and air conditioning systems in data centers and hotels. In this project, SkyCool Panels will demonstrate its use cases at two sites. The first site's panels will pair with thermal storage and an indoor radiant cooling system to demonstrate a reduction of electricity use for air conditioning by as much as 50% relative to conventional cooling systems. The second site's panels will act as a passive subcooler in a commercial supermarket to increase the system efficiency as much as 10%.	2/20/19
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-18-007 High Efficiency Dynamic Lighting Systems	Applied Research and Development	The purpose of this project is to develop, smart, high-efficiency lighting products that dynamically target light to wherever is needed. For this project, Glint will develop the intuitive control systems and a luminaire motorization system to meet long term durability targets. Furthermore, Glint will demonstrate a sensor-linked luminaire that tracks room occupants and directs a task light that follows their location. This novel capability in solid-state lighting, will improve not only the efficiency with which light is generated, but also the efficiency with which it is utilized. In addition to reduced operating energy, these lighting products will provide new functionality, enable customer cost savings by reducing the number of installed luminaires needed, and provide improved lighting quality and safety in the lit environment.	1/9/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-18-006 Radiative Sky Cooling-Enabled Efficiency Improvements on Commercial Cooling Systems	No	Demand-side Management	$1,770,563	$1,770,563	$312,245	N/A
EPC-18-007 High Efficiency Dynamic Lighting Systems	No	Demand-side Management	$1,999,990	$1,999,990	$1,712,324	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-18-006 Radiative Sky Cooling-Enabled Efficiency Improvements on Commercial Cooling Systems	$312,245	$406,651	$0	Electric Power Research Institute, Inc.; SkyCool Systems Inc.	$288,386	14.0%
EPC-18-007 High Efficiency Dynamic Lighting Systems	$1,712,324	$43,764	$0	Glint Photonics, Inc.; Chaz Teplin	$200,064	9.1%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-18-006 Radiative Sky Cooling-Enabled Efficiency Improvements on Commercial Cooling Systems	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-006 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	21 out of 33 bidders	SkyCool Systems Inc.
EPC-18-007 High Efficiency Dynamic Lighting Systems	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	21 out of 33 bidders	Glint Photonics, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-18-006 Radiative Sky Cooling-Enabled Efficiency Improvements on Commercial Cooling Systems	Group 1: Ranked # 6	N/A	N/A	Yes; Calif Based Entity
EPC-18-007 High Efficiency Dynamic Lighting Systems	Group 1: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-18-006 Radiative Sky Cooling-Enabled Efficiency Improvements on Commercial Cooling Systems	This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals. It will enable the measurement and verification of two promising integrations for a platform cooling technology in operational commercial settings, the results of which might not otherwise have been deployed if pursued purely through a competitive consumer market. SkyCool technology will help California reach policy goals set out in SB 350, AB 32, and AB 758 by reducing barriers for installing the panels in commercial systems and enable the broader adoption across California's cold chain and HVAC sectors.	1e, 1f, 1h, 2a, 3a, 4a, 4c	The SkyCool team has focused its efforts on the design, permitting and implementation of its technology at two sites in California. The first site will demonstrate their panels as an add-on to reduce energy use in a supermarket refrigeration system; the second site will use SkyCool's panels plus thermal storage to replace an air conditioning system at Cal Maritime. Agreements between each site are being finalized and installation designs will be completed in the first half of 2021.
EPC-18-007 High Efficiency Dynamic Lighting Systems	This technology can provide substantial energy savings in California's lighting sector, contributing to the state's Senate Bill 350 energy efficiency savings, and Zero Net Energy Buildings goals outlined in the CPUC's Energy Efficiency Strategic Plan. An estimated savings of up to 18.5 TWh, annually, can be realized in California's investor-owned utility service territories, alone.	1f, 1h, 3h	The recipient has completed the prototype of their automated luminaire. The control software has been demonstrated with upgrades to enable dynamic sensor-linked control in progress. The next task is a pilot installation including integration of their dynamic lighting products with a sensor to detect occupant location and activity, and implementation of control algorithms to optimize the lighting distribution for the room usage. Shelter-in-place orders limited the ability to develop and test control systems intended for application in public areas such as offices, galleries, and retail stores. The agreement term was extended nine months due to COVID-19 affecting both internal operations at Glint, and operations at UC Davis, where the demonstration for this project was initially planned.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-18-008 Improving Energy Efficiency and Performance of Wastewater Recycling	Applied Research and Development	This project will advance the RNEW (Recycle Nutrients Energy and Water) process, which will overcome the seasonal limitation of current wastewater treatment pond processes by the selective use of mechanical aeration to optimize wastewater treatment in winter months and incorporating a two-stage process of biomass settling and filtration for algae - biomass harvesting. The products resulting from this process are unrestricted reuse water, and biomass that can be used to generate biofuels and fertilizers. RNEW is suitable for both small and large communities. The RNEW process can be applied to new, or retrofitted to existing, wastewater treatment plants. The technological and scientific knowledge being advanced by this project are the controlled operation of intensive high-rate algal ponds for year-round wastewater treatment. This includes low-cost harvesting of the algal biomass by a combined algal settling and membrane separation for recovery of energy, fertilizers and reclaimed water.	2/20/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-18-008 Improving Energy Efficiency and Performance of Wastewater Recycling	No	Demand-side Management	$1,550,227	$1,550,227	$254,411	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-18-008 Improving Energy Efficiency and Performance of Wastewater Recycling	$254,411	$548,356	$200,000	MicroBio Engineering, Inc.	$160,000	9.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-18-008 Improving Energy Efficiency and Performance of Wastewater Recycling	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-008 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	21 out of 33 bidders	MicroBio Engineering, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-18-008 Improving Energy Efficiency and Performance of Wastewater Recycling	Group 1: Ranked # 3	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-18-008 Improving Energy Efficiency and Performance of Wastewater Recycling	This project will advance the science and engineering of algae wastewater treatment systems, to enable current and future California wastewater plants to reduce net electricity consumption while improving plant performance and lower overall costs. The RNEW technology has projected 80% lower electricity consumption and 50% lower annualized capital and operating costs than conventional activated sludge, and meets California's Title 22 recycled water standards, with much lower nutrient effluent concentrations than currently required.	1e, 1f, 1h, 2a, 3a, 3b, 4a	In 2020, MicroBio further advanced their RNEW technology for recovering nutrients, energy, and water from the wastewater treatment process in three main ways. They completed the setup of the full-scale experimental system for Test Set 1 (nitrogen conversion improvement testing) and the pilot-scale recycled water filtration experiments for Test Set 2 (nitrogen treatment optimization testing). Their optimization experiments for Test Set 1 and 2 are generating weekly data sets to be used to develop operation models and guidelines. MicroBio's Technical Advisory Committee and Critical Project Review meetings also generated valuable feedback for the project leaders on advancing the RNEW technology. In the closing of 2020, and early 2021, the recipient will focus on continuing optimization experiments for Test Set 1 and 2 (especially going into winter when nitrogen removal is more challenging) and establishing the framework to develop operational models from the results.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-18-009 Energy Savings Through Osmotic Concentration for the Food and Beverage Processing Industry	Technology Demonstration and Deployment	Porifera will demonstrate a commercial-scale system that offers an energy efficient way to create high quality concentrates without using heat or pressure. They will build and install their PFO Concentrator system, using an innovative forward osmosis technology to reduce energy, chemicals, and maintenance required for food and beverage processors. The system will be installed for operations at a watermelon processing plant in California, for the duration of three consecutive processing seasons. The team will generate and analyze various juice samples throughout the season and post-season, and make refinements to the system until a third and final configuration is able to demonstrate production of a sellable concentrate that is superior to current quality levels. Porifera is also partnering with the U.S. Department of Agriculture (USDA) to study and produce freeze-dry products from the concentrates to demonstrate other applications of the system. Measurement and Verification will be performed by the USDA and results will be shared with Energy Commission staff, industry stakeholders, and the demonstration host site.	3/12/19
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-18-010 Energy and Water Savings in Food and Beverage Wastewater Reuse	Applied Research and Development	The goal of this agreement is to develop new capabilities with the Porifera Forward Osmosis (PFO) Recycler so that it can treat high-starch wastewater from food and beverage manufacturing facilities and turn it into clean water for onsite reuse. If successful, this project will open up new market opportunities for the PFO Recycler and provide California's food and beverage manufacturers with a new energy efficient solution to rising water prices and wastewater disposal costs.	3/12/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-18-009 Energy Savings Through Osmotic Concentration for the Food and Beverage Processing Industry	No	Demand-side Management	$2,800,687	$2,800,687	$2,087,540	N/A
EPC-18-010 Energy and Water Savings in Food and Beverage Wastewater Reuse	No	Demand-side Management	$1,777,132	$1,777,132	$889,211	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-18-009 Energy Savings Through Osmotic Concentration for the Food and Beverage Processing Industry	$2,087,540	$908,606	$0	Porifera, Inc.	$605,073	17.8%
EPC-18-010 Energy and Water Savings in Food and Beverage Wastewater Reuse	$889,211	$480,430	$0	Porifera, Inc.	$195,000	9.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-18-009 Energy Savings Through Osmotic Concentration for the Food and Beverage Processing Industry	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	21 out of 33 bidders	Porifera, Inc.
EPC-18-010 Energy and Water Savings in Food and Beverage Wastewater Reuse	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	21 out of 33 bidders	Porifera, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-18-009 Energy Savings Through Osmotic Concentration for the Food and Beverage Processing Industry	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity, Minority Owned, Woman Own
EPC-18-010 Energy and Water Savings in Food and Beverage Wastewater Reuse	Group 1: Ranked # 4	N/A	N/A	Yes; Calif Based Entity, Minority Owned, Woman Own

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-18-009 Energy Savings Through Osmotic Concentration for the Food and Beverage Processing Industry	This project will help the state achieve its statutory energy goals by demonstrating an innovative technology that can produce juice concentrate and freeze-dried powder products that meet food safety standards, is cheaper, and more energy efficient than current mainstream thermal evaporator systems.	1f, 1h, 3a, 3g, 4a, 4c, 4d, 4e	Porifera has successfully doubled the capacity of their forward osmosis concentrator at their demonstration site hosted by Van Groningen and Sons, a third-generation California watermelon grower and processor. With the close of their second watermelon season the team has processed 17,035 L of fresh juice into 1,583 L of 65 brix juice concentrate. There has been positive feedback from interested parties on the quality of product produced. The team is now beginning the preparation of their final season and demonstration, where they will evaluate the energy intensity of their system under ideal processing conditions for producing high quality product.
EPC-18-010 Energy and Water Savings in Food and Beverage Wastewater Reuse	California recognizes the relationship between water use and energy use. California food and beverage processors are large energy and consumers. This project has the potential to produce an energy efficient method for treating water at the source of its production.	1f, 1h, 3a, 4c, 4d, 4e	Porifera is currently in the planning of installation phase for their initial PFO recycler pilot demonstration. The team finalized their agreement and installation plans with Frito-Lay to arrange the terms of their initial testing of treating wastewater consisting of high starch content. The team, meanwhile, has been performing in house testing of sample wastewater from the facility. The system is currently being fabricated and is scheduled to begin installation and field testing in quarter two of 2021.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-18-011 ** Lancaster Advanced Energy Community (AEC) Project	Technology Demonstration and Deployment	This project will deploy energy storage and microgrids at sites throughout Lancaster and integrate these DERs into a first-of-its-kind Virtual Power Plant (VPP). The project will demonstrate the power of local renewables, storage, and flexible load to balance the local grid, mitigate the duck curve, and provide valuable new grid services. These shovel-ready projects include two master-metered, ZNE affordable housing developments that island as microgrids. Renewable microgrids will be deployed at three Lancaster city schools, allowing these schools to provide critical services and act as shelters in an emergency. In addition, 3 MWh of energy storage will be deployed at commercial sites throughout Lancaster via the Lancaster Green District program, which will demonstrate an innovative public-private partnership model. All of these resources will be integrated into the Lancaster VPP, which will enable optimized performance of 5 MW of solar PV and 10 MWh of energy storage. The Lancaster VPP will demonstrate how local load-serving entities can help mitigate the problem of solar over-generation and intermittency with economic DER solutions.	5/15/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-18-011 ** Lancaster Advanced Energy Community (AEC) Project	No	Grid Operations/Market Design	$3,738,300	$3,738,300	$1,047,057	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-18-011 ** Lancaster Advanced Energy Community (AEC) Project	$1,047,057	$809,583	$0	City of Lancaster; Amber Kinetics, Inc.; Gridscape Solutions, Inc.; Blue Strike Environmental, Inc.; Lancaster School District	$5,674,720	53.2%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-18-011 ** Lancaster Advanced Energy Community (AEC) Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-011 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	9 out of 9 bidders	Zero Net Energy (ZNE) Alliance

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-18-011 ** Lancaster Advanced Energy Community (AEC) Project	Group 6: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-18-011 ** Lancaster Advanced Energy Community (AEC) Project	This project will support the development and commercialization of technological advancements and breakthroughs that overcome barriers to the achievement of the State of California's statutory energy goals by demonstrating a virtual power plant that can optimize the value and improve the economic attractiveness of distributed energy resources. In addition, the project will act as a demonstration for promising technical solutions that will lower costs and provide superior operational value, including a side-by-side demonstration of flywheel and lithium-ion storage systems, as well as several deployments of modular microgrids.	1a, 1b, 1c, 1e, 1f, 1h, 1i, 2a, 3a, 3b, 3f, 4a, 5a	In 2020, the project team finalized technical assessments as well as the cost and load-modeling for the microgrid sites. Additional battery storage was installed at school sites and the team helped formalize the school district's participation in the Green District Program with LCE. The team began the technical design for the VPP and drafted a program design for the Green District Program. Delays occurred in June when SCE raised concerns regarding regulatory and interconnection-related challenges to the residential microgrid's master-meter design. The team identified options for moving forward on the residential microgrid and hired a legal expert to provide analysis on these options. In 2021, the city will consider the final analysis and determine the best option. Once the city decides, the team will meet with CEC staff to determine any impacts on the project. The team remains optimistic that the project goals will be met.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-18-011 ** Lancaster Advanced Energy Community (AEC) Project	Technology Demonstration and Deployment	This project will deploy energy storage and microgrids at sites throughout Lancaster and integrate these DERs into a first-of-its-kind Virtual Power Plant (VPP). The project will demonstrate the power of local renewables, storage, and flexible load to balance the local grid, mitigate the duck curve, and provide valuable new grid services. These shovel-ready projects include two master-metered, ZNE affordable housing developments that island as microgrids. Renewable microgrids will be deployed at three Lancaster city schools, allowing these schools to provide critical services and act as shelters in an emergency. In addition, 3 MWh of energy storage will be deployed at commercial sites throughout Lancaster via the Lancaster Green District program, which will demonstrate an innovative public-private partnership model. All of these resources will be integrated into the Lancaster VPP, which will enable optimized performance of 5 MW of solar PV and 10 MWh of energy storage. The Lancaster VPP will demonstrate how local load-serving entities can help mitigate the problem of solar over-generation and intermittency with economic DER solutions.	5/15/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-18-011 ** Lancaster Advanced Energy Community (AEC) Project	No	Grid Operations/Market Design	$1,260,760	$1,260,760	$0	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-18-011 ** Lancaster Advanced Energy Community (AEC) Project	$0	$0	$0	City of Lancaster; Amber Kinetics, Inc.; Gridscape Solutions, Inc.; Blue Strike Environmental, Inc.; Lancaster School District	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-18-011 ** Lancaster Advanced Energy Community (AEC) Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-011 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	9 out of 9 bidders	Zero Net Energy (ZNE) Alliance

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-18-011 ** Lancaster Advanced Energy Community (AEC) Project	Group 6: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-18-011 ** Lancaster Advanced Energy Community (AEC) Project	This project will support the development and commercialization of technological advancements and breakthroughs that overcome barriers to the achievement of the State of California's statutory energy goals by demonstrating a virtual power plant that can optimize the value and improve the economic attractiveness of distributed energy resources. In addition, the project will act as a demonstration for promising technical solutions that will lower costs and provide superior operational value, including a side-by-side demonstration of flywheel and lithium-ion storage systems, as well as several deployments of modular microgrids.	1a, 1b, 1c, 1e, 1f, 1h, 1i, 2a, 3a, 3b, 3f, 4a, 5a	In 2020, the project team finalized technical assessments as well as the cost and load-modeling for the microgrid sites. Additional battery storage was installed at school sites and the team helped formalize the school district's participation in the Green District Program with LCE. The team began the technical design for the VPP and drafted a program design for the Green District Program. Delays occurred in June when SCE raised concerns regarding regulatory and interconnection-related challenges to the residential microgrid's master-meter design. The team identified options for moving forward on the residential microgrid and hired a legal expert to provide analysis on these options. In 2021, the city will consider the final analysis and determine the best option. Once the city decides, the team will meet with CEC staff to determine any impacts on the project. The team remains optimistic that the project goals will be met.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-18-012 Production Scale-Up of Low-Cost, Long-Life Flow Battery	Market Facilitation	This project will support the production scale-up of the EnergyPod 2 (EnergyPod) from MRL 7 (Manufacturing Readiness Level) to MRL 8. The EnergyPod is a zinc bromide flow battery that offers energy storage with an estimated five hours of continuous output at 25 kW, a useful life of 20 years, no electrode stack replacement and no fire risk. The Recipient (Primus) will transition to a mature, high volume manufacturing process using a contract manufacturing strategy that leverages existing high-volume manufacturing equipment and processes. Primus will receive the major subassemblies for the flow battery from contract manufacturing partners and complete the final assembly in its existing facility. Using this new process of contract manufacturing; Primus will be able to increase production while lowering costs, which will lead to Primus' ability to offer more cost-effective energy storage.	6/12/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-18-012 Production Scale-Up of Low-Cost, Long-Life Flow Battery	No	Grid Operations/Market Design	$4,000,000	$4,000,000	$0	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-18-012 Production Scale-Up of Low-Cost, Long-Life Flow Battery	$0	$400,000	$0	Primus Power Corporation	$6,319,321	61.2%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-18-012 Production Scale-Up of Low-Cost, Long-Life Flow Battery	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-012 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 31 bidders	Primus Power Corporation

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-18-012 Production Scale-Up of Low-Cost, Long-Life Flow Battery	Group 3: Ranked # 1	N/A	N/A	Yes; Micro Business, Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-18-012 Production Scale-Up of Low-Cost, Long-Life Flow Battery	This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by scaling up production of the Recipient's flow battery with rated power of 25kW and discharge energy of 125 kWh. Primus' technology offers a battery with no membrane, single flow loop and high voltage with low cost chemistry. The Recipient's flow battery differs from traditional flow batteries in that it does not require an ion exchange membrane and it uses a single electrolyte flow loop. These differences provide significant competitive advantages because they require fewer parts and have longer system cycle life, higher power density, higher reliability and reduced safety risks. The Recipient's flow battery units may be interconnected with each other to form larger energy storage systems.	1i, 2a, 3a, 3b, 3h, 4a, 5d, 5e	The start of this project has been delayed due to COVID-19 related issues. The recipient is expected to start this project in early 2021 and will focus on preparing their facility for manufacturing their product (EnergyPod 2) at scale. The recipient will test their product and refine its design for manufacturability. This will include buying and installing equipment for manufacturing at scale, followed by performing initial production tests with design refinements, certifying their product's design, and performing pilot production tests to prepare their product for Low Rate Initial Production.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-18-013 ** The Oakland EcoBlock, Phase II: A Zero Net Energy, Low Water-Use Retrofit Neighborhood	Technology Demonstration and Deployment	Leveraging economies of scale, the EcoBlock advances a new model for scaling DER in existing neighborhoods through holistic block-scale retrofitting that combines deep energy efficiency retrofit strategies, integrated distributed energy generation systems, and water conservation and capture systems in a low-to-middle income neighborhood in the City of Oakland. This project is the second Phase of the EPIC Challenge: Accelerating the Deployment of Advanced Energy Communities. This project will implement the master plan developed in Phase I.	6/12/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-18-013 ** The Oakland EcoBlock, Phase II: A Zero Net Energy, Low Water-Use Retrofit Neighborhood	No	Grid Operations/Market Design	$3,740,181	$3,740,181	$417,216	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-18-013 ** The Oakland EcoBlock, Phase II: A Zero Net Energy, Low Water-Use Retrofit Neighborhood	$417,216	$700,249	$0	City of Oakland; EMerge Alliance; Morgan, Lewis and Bockius LLP; Spectrum Energy Development, Inc.; Spie Batignolles; ARDA Power Inc.; Rexel USA, Inc. DBA Platt Electric Supply; Building and Construction Trades Council of Alameda, AFL-CIO; Stanford University - Civil and Environmental Engineering; Siegel and Strain Architects	$3,491,600	41.1%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-18-013 ** The Oakland EcoBlock, Phase II: A Zero Net Energy, Low Water-Use Retrofit Neighborhood	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	9 out of 9 bidders	The Regents of the University of California, Berkeley

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-18-013 ** The Oakland EcoBlock, Phase II: A Zero Net Energy, Low Water-Use Retrofit Neighborhood	Group 5: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-18-013 ** The Oakland EcoBlock, Phase II: A Zero Net Energy, Low Water-Use Retrofit Neighborhood	SB 350 sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Deploying customer-side of the meter technologies at scale will help meet this goal, but will require new innovations to how local jurisdictions design, plan, finance, and manage energy upgrades at the community level. This project is deploying sustainable financing structures, clear owner-operator responsibilities, and streamlined planning and permitting processes, which are critical to successfully deploying community-scale energy retrofits throughout the state.	1f, 4a	After conducting outreach and corresponding with residents of the original residential block planned for this demonstration, the project team decided to select a new block in Oakland. UC Berkeley put together technical criteria for selecting a new demonstration site, conducted a campaign for blocks to self-elect themselves, and chose a block in the Fruitvale neighborhood of Oakland. Due to COVID-19, the recipient has developed a Disease Action Plan that will cover all interactions with the residents, including future meetings, signed forms and in home assessments and retrofits. The project team has also begun conducting deep energy audits on residences to use the data to create engineering and design documents. In 2021, the recipient plans to finalize design and engineering plans and the governing structure of the EcoBlock which will take over after the agreement and finance the ongoing operation and maintenance costs of the communal and energy and water installations.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-18-013 ** The Oakland EcoBlock, Phase II: A Zero Net Energy, Low Water-Use Retrofit Neighborhood	Technology Demonstration and Deployment	Leveraging economies of scale, the EcoBlock advances a new model for scaling DER in existing neighborhoods through holistic block-scale retrofitting that combines deep energy efficiency retrofit strategies, integrated distributed energy generation systems, and water conservation and capture systems in a low-to-middle income neighborhood in the City of Oakland. This project is the second Phase of the EPIC Challenge: Accelerating the Deployment of Advanced Energy Communities. This project will implement the master plan developed in Phase I.	6/12/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-18-013 ** The Oakland EcoBlock, Phase II: A Zero Net Energy, Low Water-Use Retrofit Neighborhood	No	Grid Operations/Market Design	$1,259,819	$1,259,819	$0	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-18-013 ** The Oakland EcoBlock, Phase II: A Zero Net Energy, Low Water-Use Retrofit Neighborhood	$0	$0	$0	City of Oakland; EMerge Alliance; Morgan, Lewis and Bockius LLP; Spectrum Energy Development, Inc.; Spie Batignolles; ARDA Power Inc.; Rexel USA, Inc. DBA Platt Electric Supply; Building and Construction Trades Council of Alameda, AFL-CIO; Stanford University - Civil and Environmental Engineering; Siegel and Strain Architects	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-18-013 ** The Oakland EcoBlock, Phase II: A Zero Net Energy, Low Water-Use Retrofit Neighborhood	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	9 out of 9 bidders	The Regents of the University of California, Berkeley

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-18-013 ** The Oakland EcoBlock, Phase II: A Zero Net Energy, Low Water-Use Retrofit Neighborhood	Group 5: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-18-013 ** The Oakland EcoBlock, Phase II: A Zero Net Energy, Low Water-Use Retrofit Neighborhood	SB 350 sets a 50 percent renewable energy standard and a goal of doubling energy efficiency savings by 2030. Deploying customer-side of the meter technologies at scale will help meet this goal, but will require new innovations to how local jurisdictions design, plan, finance, and manage energy upgrades at the community level. This project is deploying sustainable financing structures, clear owner-operator responsibilities, and streamlined planning and permitting processes, which are critical to successfully deploying community-scale energy retrofits throughout the state.	1f, 4a	After conducting outreach and corresponding with residents of the original residential block planned for this demonstration, the project team decided to select a new block in Oakland. UC Berkeley put together technical criteria for selecting a new demonstration site, conducted a campaign for blocks to self-elect themselves, and chose a block in the Fruitvale neighborhood of Oakland. Due to COVID-19, the recipient has developed a Disease Action Plan that will cover all interactions with the residents, including future meetings, signed forms and in home assessments and retrofits. The project team has also begun conducting deep energy audits on residences to use the data to create engineering and design documents. In 2021, the recipient plans to finalize design and engineering plans and the governing structure of the EcoBlock which will take over after the agreement and finance the ongoing operation and maintenance costs of the communal and energy and water installations.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-18-014 Production Scale-Up of Thermionic Energy Harvesters	Market Facilitation	This agreement is to fund the production scale-up of Spark Thermionics' thermionic energy converter, to low rate production stage. When combined with next-generation CSP, the Recipient's technology can increase the power output by 75-90% relative to today's best CSP plants. This additional power can drive down the cost to 5.6 cents/kWh. Under this agreement, the project team will analyze cost reduction for process development and manufacturing for the core and encapsulation components within the energy harvesters. The project will also validate that the thermionic topping cycle within the energy harvester has adequate heat rejection from CSP that would be necessary for thermal energy storage (TES) to increase the efficiency and power output of a power generating system. With this technology, flexible generation can address the grid-level challenges of solar PV- generated electricity, namely variability, uncertainty, and nonsynchronous generation.	6/12/19
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-18-015 Improved Batteries for California's Zero-Emissions Vehicle Future	Market Facilitation	The purpose of this Agreement is to fund the setup and commissioning of a pilot-scale production facility for manufacturing lithium-metal battery pouch cells. These innovative lithium-metal battery cells have a high energy density and are non-flammable. The Recipient has pioneered a capital-efficient approach to scale up by using low-cost foreign contract manufacturers to produce the parts of the lithium metal battery that are standard and finishing the manufacturing in-house. During in-house manufacturing, dry cells are cut open, injected with a unique electrolyte and vacuum-sealed. The Recipient hopes to avoid more than 95% of the capital expense typically required to scale up a new battery technology to pilot production while still retaining tight control over all IP (contained in the liquid electrolyte formulation and formation cycling protocols, which are all done in-house).	6/12/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-18-014 Production Scale-Up of Thermionic Energy Harvesters	No	Grid Operations/Market Design	$1,349,933	$1,349,933	$341,655	N/A
EPC-18-015 Improved Batteries for California's Zero-Emissions Vehicle Future	No	Demand-side Management	$1,566,639	$1,566,639	$1,158,993	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-18-014 Production Scale-Up of Thermionic Energy Harvesters	$341,655	$184,914	$1,650,000	Spark Thermionics, Inc.	$270,000	16.7%
EPC-18-015 Improved Batteries for California's Zero-Emissions Vehicle Future	$1,158,993	$229,783	$1,049,989	Cuberg	$316,200	16.8%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-18-014 Production Scale-Up of Thermionic Energy Harvesters	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-014 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 31 bidders	Spark Thermionics, Inc.
EPC-18-015 Improved Batteries for California's Zero-Emissions Vehicle Future	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-015 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 31 bidders	Cuberg, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-18-014 Production Scale-Up of Thermionic Energy Harvesters	Group 2: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-18-015 Improved Batteries for California's Zero-Emissions Vehicle Future	Group 3: Ranked # 5	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-18-014 Production Scale-Up of Thermionic Energy Harvesters	The high-temperature energy harvesting technology will improve the efficiency of concentrated solar power generation, reducing the capital and operating costs associated with power generating systems. The combination of having a technology that can absorb adaptable amounts of heat and then utilize the heat for time-varying electrical consumption will expedite further large-scale integration of renewable resources to enable California's highly ambitious energy goals. This technology will allow for more integration of renewables for California at a lower cost.	1b, 1e, 1f, 1h, 1i, 2a, 3b, 4a, 5d	In 2020, this project has acquired and commissioned important equipment, such as a leak detector, glovebox, and multiple furnaces. For portions of fabrication, manufacturing, and assembly performed in-house, this equipment has accelerated the development of processes and testing for energy harvester components. Following the completion of cost modeling at the LRIP stage, evaluation of multiple manufacturing routes for components and identifying promising manufacturing vendors and partners. This cost modeling has also illuminated simplifications to the harvester design that will further reduce long-term costs.
EPC-18-015 Improved Batteries for California's Zero-Emissions Vehicle Future	This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by enabling low rate initial production of high energy and safe lithium batteries, which increase the safety and range of electric vehicles to increase electric vehicle adoption in California. Currently, California aims to have 5 million zero emission vehicles by 2030. Enabling the scale up in pilot production scale will eventually accelerate the mass market adoption of electric vehicles as cheaper, higher range and safer electric vehicles are produced. This will assist California to achieve statutory goals as electric vehicles become more economically and functionally more appealing for the customers.	4a	Over the past year, even amidst supplier and labor challenges due to COVID-19, the project team has been able to design and build an LRIP pilot line for Cuberg's commercial cells with production volumes up to 3,000 cells/month with a yield > 80%. The team has also received substantial interest from potential customers, selling enough battery cells for evaluation to generate several hundred thousand dollars in income. Lastly, due to efforts and results from this CEC project, Cuberg has secured a high-profile, strategic partnership with a large-scale preeminent EV battery manufacturer (to be announced in Q1 2021).

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-18-016 Production Scale-Up of Advanced Wafer Technology for Drastic Solar Photovoltaics Cost Reduction	Market Facilitation	The purpose of this Agreement is to fund the production scale-up and validation of a novel solar photovoltaics wafer manufacturing technology, proven at the full-scale prototype level, to low rate production stage. This technology uses silicon laser processing technology which results in no silicon material loss and nearly five times thinner wafers and five times less variation in thickness. This new process does not require water and reduces the GHG emissions embedded in the wafer manufacturing process by 50% while increasing quality and performance.	6/12/19
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-18-017 Scaling Up Pilot Production of Nanoporous Membranes for Battery Storage Technologies	Market Facilitation	The purpose of this project is to scale-up the production of an advanced battery membrane platform for market facilitation of safe, low-cost, and energy-dense batteries. The proposed approach is to establish optimal processes for each key component of the innovative membrane (polymer, polymer ink, and roll-to-roll coating) to generate quality assurance and quality control metrics that will lead to an in-house low rate initial production of the membrane for batteries. The intent is to establish a steady commercialized platform technology that will create multiple market opportunities in a variety of battery chemistries. The innovative membrane, in addition to improving the cycle life of batteries, enables more energy to be extracted from the same cathodes used under previously abusive conditions, operate at elevated temperatures, and allows use of more abundant materials such as manganese instead of cobalt.	6/12/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-18-016 Production Scale-Up of Advanced Wafer Technology for Drastic Solar Photovoltaics Cost Reduction	No	Generation	$4,000,000	$4,000,000	$635,677	N/A
EPC-18-017 Scaling Up Pilot Production of Nanoporous Membranes for Battery Storage Technologies	No	Grid Operations/Market Design	$2,675,793	$2,675,793	$1,057,546	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-18-016 Production Scale-Up of Advanced Wafer Technology for Drastic Solar Photovoltaics Cost Reduction	$635,677	$584,267	$0	Halo Industries	$1,250,000	23.8%
EPC-18-017 Scaling Up Pilot Production of Nanoporous Membranes for Battery Storage Technologies	$1,057,546	$382,307	$0	Argonne National Laboratory; Sepion Technologies, Inc.; CAMX Power; Washington Clean Energy Testbeds; Ambrosi Donahue Congdon Certified Public Accountant	$2,489,417	48.2%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-18-016 Production Scale-Up of Advanced Wafer Technology for Drastic Solar Photovoltaics Cost Reduction	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-016 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 31 bidders	Halo Industries, Inc.
EPC-18-017 Scaling Up Pilot Production of Nanoporous Membranes for Battery Storage Technologies	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-017 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 31 bidders	Sepion Technologies, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-18-016 Production Scale-Up of Advanced Wafer Technology for Drastic Solar Photovoltaics Cost Reduction	Group 2: Ranked # 1	N/A	N/A	None
EPC-18-017 Scaling Up Pilot Production of Nanoporous Membranes for Battery Storage Technologies	Group 3: Ranked # 3	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-18-016 Production Scale-Up of Advanced Wafer Technology for Drastic Solar Photovoltaics Cost Reduction	This Agreement will scale up and validate a novel solar wafer manufacturing technology to low rate initial production and generate significant long-term benefits in the solar photovoltaics field including: a decrease in costs associated with solar modules, an increase in the efficiency of solar modules, a reduction in the environmental impact of the manufacturing of solar modules and an enabling of next-generation solar cell/module architectures.	1c, 1h	The first phase of the project, which involved the engineering and design work needed to determine and achieve target pilot production metrics using both in-house capabilities and outsourced expertise, has been largely concluded. The second phase of the project, which involves the development of a stable, scalable supply chain and the construction of the pilot production system to the design specifications determined in the first phase, is currently in progress. Steady headway is being made in engaging with suppliers, sourcing components and testing parts as they come in to verify performance and suitability. The project remains on budget and on track to achieve the targeted performance metrics.
EPC-18-017 Scaling Up Pilot Production of Nanoporous Membranes for Battery Storage Technologies	The nanoporous membrane platform opens paths to safely increasing Li-metal battery energy density by 40%, dropping the cost below $100/kWh while developing manufacturing capabilities for advanced battery components in California. This technology can be integrated with existing Li-metal battery manufacturing infrastructure to reduce barriers to market entry. Beyond Li-metal batteries, this platform membrane technology is already being leveraged to enable breakthroughs in Li-metal batteries for advanced electric vehicles with greater than 350 mile range and ultra-low-cost flow batteries for long-duration grid storage, multiplying the potential for impact.	1b, 1c, 1e, 2a, 3a, 3f, 3g, 3h, 4a	In 2020, this project scoped, installed, and validated a roll-to-roll coating tool essential to demonstrating and de-risking low-rate initial production of the novel battery membrane product. Optimization of the roll-to-roll process has already unlocked a 60-fold increase in membrane production throughput alongside notable improvements in coating quality and batch-to-batch reproducibility. In-house validation of these membranes in lithium-metal cells designed for long-range and low-cost electric vehicles yielded promising results for safe lithium metal plating. Sample membranes produced with the roll-to-roll coating tool were successfully validated in energy-dense lithium metal cells with a commercial partner. In 2021, the project team will support the following priorities in the new year: additional customer testing, in-house optimization of membrane-enabled lithium-metal cells, and deepening understanding of unit economics at scale.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-18-018 Prototype to Production: Modular Battery Platform Project for California Critical Infrastructure	Market Facilitation	This project will scale-up manufacturing for a dedicated, modular battery platform for critical infrastructure (initially targeting telecommunication towers) and make it possible for the manufacturing to be in California. The high-energy-density battery pack has best-of-class battery management and control software to remotely meter, monitor, and control the units. The battery platform is designed for fire resiliency and will withstand extreme temperatures. In combination with onsite renewable energy, the equipment can bring a cell tower under environmental distress back online. In case of Public Safety Power Shutoffs (PSPS), the platform can power telecommunication systems and critical infrastructure for hours or days, restoring communication immediately after a fire, no matter the damage to the grid infrastructure or power lines. The modular battery platform also can be used as a pop-up energy source to be quickly deployed to disaster areas to restore electricity for lights, water, heating, and cooling.	6/12/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-18-018 Prototype to Production: Modular Battery Platform Project for California Critical Infrastructure	No	Demand-side Management	$1,878,760	$1,878,760	$1,690,765	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-18-018 Prototype to Production: Modular Battery Platform Project for California Critical Infrastructure	$1,690,765	$0	$0	Caban Systems, Inc.	$1,396,943	42.6%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-18-018 Prototype to Production: Modular Battery Platform Project for California Critical Infrastructure	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-018 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 31 bidders	Caban Systems, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-18-018 Prototype to Production: Modular Battery Platform Project for California Critical Infrastructure	Group 3: Ranked # 4	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-18-018 Prototype to Production: Modular Battery Platform Project for California Critical Infrastructure	This project will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by accelerating the production of an emerging, best-of-class energy storage technology that will improve public safety, lower costs, and reduce emissions. Ratepayers rely on critical infrastructure for communication to keep them connected during power outages often related to wildfires and severe weather events. Currently, critical infrastructure, including telecomm base stations, radio signal towers, and cell phone towers rely heavily on fossil fuel-powered generators for back-up power. To maintain communication during outages, there is an immediate need to scale-up production for a clean-energy storage platform that can provide services to critical infrastructure during outages.	1c, 1e, 1h, 1i, 2a, 3b, 3c, 4a, 4b, 5a, 5d, 5e	In 2020, Caban Systems has completed validation and testing of their core product, the Enduro System. They improved their manufacturing capability from a pilot line to beginning low rate initial production, identified and purchased all required capital equipment (CTL, laser welder, etc.), and will be at MRL 9 by the end of 2020. Caban Systems will have shipped approximately 70-80 Enduro energy systems to customers worldwide by the end of the year. They completed all required UN certifications, begun required UL certifications and have successfully stayed on or ahead of their project schedule. In early 2021, Caban will focus on scaling production to reach full capacity at their manufacturing facility, growing their sales and customer pipeline, and completing UL testing and certification. They will continue to lower costs across materials and production and plan to raise a Series B round of financing to support their continued growth.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-18-019 Treau: Low-GWP, High-Efficiency Heat Pump and Air Conditioner	Market Facilitation	The purpose is to scale-up a manufacturing line of quieter, less expensive, and easy-to-install, retrofit window electric heat pumps. The unique design allows unfettered access to the window where the unit is placed. Customers are able to install the unit without expensive tools or professional installation. The proposed approach is to build successive prototypes, which will be tested for performance and usability to finalize a product ready for manufacturing scale-up. The project will result in quality assurance and quality control metrics, relationships with suppliers, and a system design that leads to initial low-rate production of air conditioners for the residential market. The benefits of the project, as related to California IOU electricity ratepayers, are lower heating and cooling costs, more comfortable homes, and reduced air pollution. Successful execution will accelerate the reduction of cost and emissions of building heating and cooling goals for existing buildings at significant scale, especially among users of window A/C. Additionally, this technology can provide a high-efficiency all-electric product for achieving California's residential Zero Net Energy Action Plan.	6/12/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-18-019 Treau: Low-GWP, High-Efficiency Heat Pump and Air Conditioner	No	Demand-side Management	$2,805,907	$2,805,907	$771,854	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-18-019 Treau: Low-GWP, High-Efficiency Heat Pump and Air Conditioner	$771,854	$834,152	$0	Treau, Inc.	$1,901,907	40.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-18-019 Treau: Low-GWP, High-Efficiency Heat Pump and Air Conditioner	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-019 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 31 bidders	Treau, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-18-019 Treau: Low-GWP, High-Efficiency Heat Pump and Air Conditioner	Group 1: Ranked # 3	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-18-019 Treau: Low-GWP, High-Efficiency Heat Pump and Air Conditioner	The project would help displace low-efficiency window air conditioners, displace the use of polluting HFC refrigerants, and increase adoption of efficient air conditioners and heat pumps in homes and multi-family units. Additionally, because the Treau system uses a hermetically, factory-sealed, leak-tested refrigerant circuit, the unit substantially reduces the release of methane emissions compared to expensive mini-split systems. With energy savings up to 70% in heating, the technology can help achieve improved building efficiency goals for existing buildings in California. Additionally, Treau can provide a high-efficiency all-electric product for achieving California's residential Zero Net Energy Action Plan.	1e, 1f, 1h, 2a, 3a, 3b, 3c, 4a	Treau is developing models for final design verification to begin manufacturing. They are testing pre-launch systems for feedback on installation, user interface, and phone app. Treau has tested different compressors and refrigerants, refined prototype test plans, and assembled three generations of prototypes and installed them in homes. Treau characterized how the unit performs on a system and component level, and considered dimensions, weight, and noise. They have built out the supply chain and begun conversations with manufacturing partners. After passing verification tests, Treau will select a manufacturing partner and develop tooling for plastic and sheet metal parts. Treau will complete reliability testing and regulatory certifications necessary for sale to customers. Treau will begin manufacturing units at the manufacturing partner's facility and verify all specifications are met. Treau expects to reach low-rate initial production of at least 300 units/year in 2021.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-18-020 Production Scale-Up of High Efficiency Adjustable Lighting Products	Market Facilitation	Glint Photonics has pioneered revolutionary high-efficiency solid-state lighting products that use proprietary optical designs to provide precise control over light distribution, greatly increasing the amount of light that is delivered to the intended target and reducing unpleasant glare. The production scale-up work will focus on Glint's Hero family of luminaires. The objectives are (1) to refine the product design for production, focusing on improvements to manufacturability, quality, and cost; (2) to develop and qualify manufacturing processes, and build Glint's organizational capability to manage pilot production quality and operations; and (3) establish, qualify, and certify a pilot production line in partnership with a California-based contract manufacturer. At the conclusion of the project, the recipient will be ready to begin low-rate pilot production of Hero products and will have a strong foundation in place for scaling to mass production over time.	6/12/19
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-18-021 ** Production Scale-Up for Next Generation Batteries Using Liquefied Gas Electrolytes	Market Facilitation	South 8 Technologies has developed a liquefied gas electrolyte chemistry with increased performance metrics to traditional Li-ion battery electrolytes. These electrolytes enable lithium metal batteries to be produced having an increased temperature range and nearly twice the specific energy compared to traditional Li-ion batteries. Additionally these lithium metal batteries eliminate the risk of thermal runaway hazards. The purpose of this Agreement is to fund the design and build-out for a Low Rate Initial Production (LRIP) pilot line for the manufacture of liquefied gas electrolyte batteries with lithium metal anodes which have high energy density and increased safety.	6/12/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-18-020 Production Scale-Up of High Efficiency Adjustable Lighting Products	No	Demand-side Management	$1,998,922	$1,998,922	$1,592,673	N/A
EPC-18-021 ** Production Scale-Up for Next Generation Batteries Using Liquefied Gas Electrolytes	No	Grid Operations/Market Design	$231,451	$231,451	$231,451	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-18-020 Production Scale-Up of High Efficiency Adjustable Lighting Products	$1,592,673	$619,177	$0	Glint Photonics, Inc.	$399,831	16.7%
EPC-18-021 ** Production Scale-Up for Next Generation Batteries Using Liquefied Gas Electrolytes	$231,451	$230,205	$0	South 8 Technologies	$466,416	31.2%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-18-020 Production Scale-Up of High Efficiency Adjustable Lighting Products	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-020 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 31 bidders	Glint Photonics, Inc.
EPC-18-021 ** Production Scale-Up for Next Generation Batteries Using Liquefied Gas Electrolytes	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-021 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 31 bidders	South 8 Technologies

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-18-020 Production Scale-Up of High Efficiency Adjustable Lighting Products	Group 1: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-18-021 ** Production Scale-Up for Next Generation Batteries Using Liquefied Gas Electrolytes	Group 3: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-18-020 Production Scale-Up of High Efficiency Adjustable Lighting Products	This technology can provide up to 10.2 TWh annual energy savings in California IOU territories. This a very significant contributor to the state's Zero Net Energy building goals, as set out in the CPUC's Energy Efficiency Strategic Plan and the Energy Commission's IEPR. The luminaires can also help meet the California Air Resources Board's Climate Change Scoping Plan target of 32 TWh of reduced energy consumption via energy efficiency improvements.	1f, 3a, 3b, 4a	In 2020, the recipient continued to refine the product design, assembly processes, and supplier relationships required for Glint's lighting technology products to improve manufacturability, ensure quality, achieve certification, and reduce production cost. Glint recently redesigned internal mechanical parts to address issues in optical alignment and has since built test units which have met cosmetic appearance and photometric performance targets. In early 2021, Glint will submit their Hero product to a nationally recognized test laboratory for test and certification against the relevant safety standards. Glint also plans to establish and qualify an in-house pilot line in order to be capable of low rate initial production of the Hero product by the end of this agreement.
EPC-18-021 ** Production Scale-Up for Next Generation Batteries Using Liquefied Gas Electrolytes	This technology is advancing alternatives to Li-ion batteries that increase the safety of energy storage while also increasing the energy density. This technology does this by allowing the use of lithium metal anodes through a liquefied gas electrolyte. The developed battery technology will serve as an ideal flexible solution for both grid storage batteries and electric vehicles.	1i, 2a, 3a, 3b, 3h, 4a, 5d, 5e	South 8 is currently finalizing designs and starting installation of various components of their scaled-up manufacturing system. A key area of development is design of the equipment to accurately fill cells with the proprietary electrolyte; the battery cell injection and crimp design is currently being finalized. The recipient's gas storage and distribution system installation is close to completion. Construction of the gas delivery manifold is expected to begin in the first quarter of 2021. With the manufacturing system in place, demonstration pilot builds are expected to begin in the third quarter of 2021.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-18-021 ** Production Scale-Up for Next Generation Batteries Using Liquefied Gas Electrolytes	Market Facilitation	South 8 Technologies has developed a liquefied gas electrolyte chemistry with increased performance metrics to traditional Li-ion battery electrolytes. These electrolytes enable lithium metal batteries to be produced having an increased temperature range and nearly twice the specific energy compared to traditional Li-ion batteries. Additionally these lithium metal batteries eliminate the risk of thermal runaway hazards. The purpose of this Agreement is to fund the design and build-out for a Low Rate Initial Production (LRIP) pilot line for the manufacture of liquefied gas electrolyte batteries with lithium metal anodes which have high energy density and increased safety.	6/12/19
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-18-022 Advanced Energy Storage for Electric Vehicle Charging Support	Technology Demonstration and Deployment	For this project, Natron will produce an energy storage system (ESS) based on its new Prussian Blue/Sodium Ion (PB/Na-ion) battery technology. UCSD will perform on-grid performance validation of the ESS, and an existing publicly accessible EVFC station will be upgraded with a new ESS, inverter, and energy management software (EMS). This project will result in a cost-competitive alternative to Li-ion batteries that offers superior performance for high power / short-duration dispatch and long cycle life applications such as for EVFCs, frequency regulation, and grid stability during short-term utility and ISO outages. Natron will advance the battery manufacturing and product design of the ESS to Technology Readiness Level 8, enabling prompt commercial sales of PB ESS systems into the EVFC market.	6/12/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-18-021 ** Production Scale-Up for Next Generation Batteries Using Liquefied Gas Electrolytes	No	Grid Operations/Market Design	$796,608	$796,608	$241,996	N/A
EPC-18-022 Advanced Energy Storage for Electric Vehicle Charging Support	No	Grid Operations/Market Design	$2,998,064	$2,998,064	$0	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-18-021 ** Production Scale-Up for Next Generation Batteries Using Liquefied Gas Electrolytes	$241,996	$0	$0	South 8 Technologies	$0	0.0%
EPC-18-022 Advanced Energy Storage for Electric Vehicle Charging Support	$0	$96,753	$0	Natron Energy, Inc.	$1,239,515	29.3%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-18-021 ** Production Scale-Up for Next Generation Batteries Using Liquefied Gas Electrolytes	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-021 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 31 bidders	South 8 Technologies
EPC-18-022 Advanced Energy Storage for Electric Vehicle Charging Support	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-022 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	7 out of 8 bidders	Natron Energy, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-18-021 ** Production Scale-Up for Next Generation Batteries Using Liquefied Gas Electrolytes	Group 3: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-18-022 Advanced Energy Storage for Electric Vehicle Charging Support	Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-18-021 ** Production Scale-Up for Next Generation Batteries Using Liquefied Gas Electrolytes	This technology is advancing alternatives to Li-ion batteries that increase the safety of energy storage while also increasing the energy density. This technology does this by allowing the use of lithium metal anodes through a liquefied gas electrolyte. The developed battery technology will serve as an ideal flexible solution for both grid storage batteries and electric vehicles.	1i, 2a, 3a, 3b, 3h, 4a, 5d, 5e	South 8 is currently finalizing designs and starting installation of various components of their scaled-up manufacturing system. A key area of development is design of the equipment to accurately fill cells with the proprietary electrolyte; the battery cell injection and crimp design is currently being finalized. The recipient's gas storage and distribution system installation is close to completion. Construction of the gas delivery manifold is expected to begin in the first quarter of 2021. With the manufacturing system in place, demonstration pilot builds are expected to begin in the third quarter of 2021.
EPC-18-022 Advanced Energy Storage for Electric Vehicle Charging Support	The proposed project will generate greater market competition by creating superior alternative to Li-ion batteries for the EVFC market, accelerating EVFC station buildouts, and thus supporting progress towards California's GHG (AB 32, Exec. Order B-30-15), energy storage (AB 2514, AB 2868) and vehicle and rideshare electrification (SB 1014) goals.	2a, 3f, 5b	COVID-19 resulted in shutting down Natron facilities for RD&D, engineering, and manufacturing for a majority of 2020. The facilities have recently reopened and the team resumed battery cell design. The EV fast chargers have been installed at UCSD. The Natron team is reassessing the project's schedule.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-18-023 Utility Demonstration of Non-Flammable, Aqueous-Zinc Battery Storage: Innovation Scale-Up to Alleviate T&D Congestion and Mitigate Wildfire Risks	Technology Demonstration and Deployment	This project will demonstrate and deploy an Eos Generation 3 zinc hybrid cathode battery storage system at San Diego Gas and Electric's distribution station in Pala, San Diego County. The project will demonstrate the system, which is being designed to improve power and energy density by more than 25% over the previous Generation 2 system. The demonstration will support commercialization of the storage solution by providing data on system performance and safety that are necessary to create confidence in the market.	6/12/19
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-18-024 ** Large-Scale Sulfur Thermal Battery Demonstration for Enhanced Grid Flexibility and Increased Renewable Penetration	Technology Demonstration and Deployment	Element 16's sulfur thermal battery provides a low-cost solution to store and deliver high quality thermal energy due to its low cost, simple chemical composition, high heat transfer rates, and little to no need for any electrical heat tracing due to its low freezing point (~239 Fahrenheit), which guarantees low parasitic load and low O&M cost. The proposed project demonstrates sulfur thermal energy storage technology for electricity storage and generation, thus establishing new paradigms for increasing stored energy capacity and providing new forms of stationary electricity storage systems with the potential to drastically reduce the levelized cost of electricity.	6/12/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-18-023 Utility Demonstration of Non-Flammable, Aqueous-Zinc Battery Storage: Innovation Scale-Up to Alleviate T&D Congestion and Mitigate Wildfire Risks	No	Grid Operations/Market Design	$2,986,110	$2,986,110	$1,178,015	N/A
EPC-18-024 ** Large-Scale Sulfur Thermal Battery Demonstration for Enhanced Grid Flexibility and Increased Renewable Penetration	No	Generation	$262,119	$262,119	$262,119	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-18-023 Utility Demonstration of Non-Flammable, Aqueous-Zinc Battery Storage: Innovation Scale-Up to Alleviate T&D Congestion and Mitigate Wildfire Risks	$1,178,015	$356,447	$0	Eos Energy Storage, LLC; TBD - Contractor; First Priority GreenFleet	$3,122,852	51.1%
EPC-18-024 ** Large-Scale Sulfur Thermal Battery Demonstration for Enhanced Grid Flexibility and Increased Renewable Penetration	$262,119	$430,000	$0	Element 16 Technologies, Inc; Brad Alan LLC.	$640,000	17.6%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-18-023 Utility Demonstration of Non-Flammable, Aqueous-Zinc Battery Storage: Innovation Scale-Up to Alleviate T&D Congestion and Mitigate Wildfire Risks	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-023 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	7 out of 8 bidders	Eos Energy Storage, LLC
EPC-18-024 ** Large-Scale Sulfur Thermal Battery Demonstration for Enhanced Grid Flexibility and Increased Renewable Penetration	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-024 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	7 out of 8 bidders	Element 16 Technologies, Inc

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-18-023 Utility Demonstration of Non-Flammable, Aqueous-Zinc Battery Storage: Innovation Scale-Up to Alleviate T&D Congestion and Mitigate Wildfire Risks	Ranked # 2	N/A	N/A	None
EPC-18-024 ** Large-Scale Sulfur Thermal Battery Demonstration for Enhanced Grid Flexibility and Increased Renewable Penetration	Ranked # 3	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-18-023 Utility Demonstration of Non-Flammable, Aqueous-Zinc Battery Storage: Innovation Scale-Up to Alleviate T&D Congestion and Mitigate Wildfire Risks	The project will demonstrate the application and benefits of a cost-effective and efficient non-lithium-ion energy storage solution to help with load shifting, reduction in grid congestion, and deployment of renewable energy resources to help the state meet its energy goals.	2a, 5a, 5d	Eos completed the design and manufacturing of the Gen 3 system. Components were transported to and assembled in California and the system was installed at San Diego Gas and Electric's facility in Pala, San Diego County. The system was recently commissioned and testing is now underway.
EPC-18-024 ** Large-Scale Sulfur Thermal Battery Demonstration for Enhanced Grid Flexibility and Increased Renewable Penetration	The development of this project will enhance grid resiliency, support the transmission and distribution infrastructure, and will provide low-cost, long-duration electric storage capacity to the CA grid. Electrically charging the low-cost sulfur thermal battery gives rise to system flexibility with respect to coupling to different types of energy sources and will drive the expansion of intermittent renewable sources such as wind and solar in California. The installation of low-cost sulfur thermal battery systems provides a financial benefit in the upcoming carbon market scenarios due to reduced levelized cost of electric storage, enables delivery of electricity at peak price periods, provides long-lasting backup power in the event of power outages during storm, etc., and substantially increases overall customer plant revenue.	1e, 1f, 3a	In 2020, the project team created computational models to simulate the performance of the energy storage system for design/cost optimization. A full-scale, high fidelity, 3D simulation was conducted to verify the natural convection activities and the expected transient system performance of the proposed specification. Based on these simulations, the project team determined the system size and design parameters required to meet the technical specifications of the 1500 kWhth demonstration unit, which is the ultimate goal of the project. The project team is now selecting the remaining components of the demonstration unit in order to present a final system-level design at a CPR meeting scheduled for December 1, 2020. The second year of the project will be spent on constructing and implementing the thermal battery demonstration.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-18-024 ** Large-Scale Sulfur Thermal Battery Demonstration for Enhanced Grid Flexibility and Increased Renewable Penetration	Technology Demonstration and Deployment	Element 16's sulfur thermal battery provides a low-cost solution to store and deliver high quality thermal energy due to its low cost, simple chemical composition, high heat transfer rates, and little to no need for any electrical heat tracing due to its low freezing point (~239 Fahrenheit), which guarantees low parasitic load and low O&M cost. The proposed project demonstrates sulfur thermal energy storage technology for electricity storage and generation, thus establishing new paradigms for increasing stored energy capacity and providing new forms of stationary electricity storage systems with the potential to drastically reduce the levelized cost of electricity.	6/12/19
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-18-025 Scale-up of Magnetocaloric Materials for High Efficiency Magnetic Refrigeration	Market Facilitation	General Engineering and Research's (GEandR) has developed MCE compositions that meet both the performance and cost requirements to be compatible with large scale implementation of magnetic refrigeration systems. For this project, GEandR will develop the processing systems to manufacture their MCE materials in forms needed for integration into magnetic refrigeration systems (spheres and thin plates). Equipment with 1kg or larger batch processing will be installed to accommodate 1kg/day low-rate initial production. Production at this scale will allow for end users to develop and test magnetic refrigeration prototypes, and ultimately move these systems into production.	6/12/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-18-024 ** Large-Scale Sulfur Thermal Battery Demonstration for Enhanced Grid Flexibility and Increased Renewable Penetration	No	Generation	$2,737,881	$2,737,881	$642,234	N/A
EPC-18-025 Scale-up of Magnetocaloric Materials for High Efficiency Magnetic Refrigeration	No	Distribution	$1,088,188	$1,088,188	$532,460	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-18-024 ** Large-Scale Sulfur Thermal Battery Demonstration for Enhanced Grid Flexibility and Increased Renewable Penetration	$642,234	$0	$0	Element 16 Technologies, Inc; Brad Alan LLC.	$0	0.0%
EPC-18-025 Scale-up of Magnetocaloric Materials for High Efficiency Magnetic Refrigeration	$532,460	$409,462	$0	Pacific Northwest National Laboratory; General Engineering and Research, L.L.C.	$306,791	22.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-18-024 ** Large-Scale Sulfur Thermal Battery Demonstration for Enhanced Grid Flexibility and Increased Renewable Penetration	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-024 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	7 out of 8 bidders	Element 16 Technologies, Inc
EPC-18-025 Scale-up of Magnetocaloric Materials for High Efficiency Magnetic Refrigeration	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-025 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	28 out of 31 bidders	General Engineering & Research, L.L.C.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-18-024 ** Large-Scale Sulfur Thermal Battery Demonstration for Enhanced Grid Flexibility and Increased Renewable Penetration	Ranked # 3	N/A	N/A	Yes; Calif Based Entity
EPC-18-025 Scale-up of Magnetocaloric Materials for High Efficiency Magnetic Refrigeration	Group 1: Ranked # 1	N/A	N/A	Yes; Small Business, Calif Based Entity, Woman Own

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-18-024 ** Large-Scale Sulfur Thermal Battery Demonstration for Enhanced Grid Flexibility and Increased Renewable Penetration	The development of this project will enhance grid resiliency, support the transmission and distribution infrastructure, and will provide low-cost, long-duration electric storage capacity to the CA grid. Electrically charging the low-cost sulfur thermal battery gives rise to system flexibility with respect to coupling to different types of energy sources and will drive the expansion of intermittent renewable sources such as wind and solar in California. The installation of low-cost sulfur thermal battery systems provides a financial benefit in the upcoming carbon market scenarios due to reduced levelized cost of electric storage, enables delivery of electricity at peak price periods, provides long-lasting backup power in the event of power outages during storm, etc., and substantially increases overall customer plant revenue.	1e, 1f, 3a	In 2020, the project team created computational models to simulate the performance of the energy storage system for design/cost optimization. A full-scale, high fidelity, 3D simulation was conducted to verify the natural convection activities and the expected transient system performance of the proposed specification. Based on these simulations, the project team determined the system size and design parameters required to meet the technical specifications of the 1500 kWhth demonstration unit, which is the ultimate goal of the project. The project team is now selecting the remaining components of the demonstration unit in order to present a final system-level design at a CPR meeting scheduled for December 1, 2020. The second year of the project will be spent on constructing and implementing the thermal battery demonstration.
EPC-18-025 Scale-up of Magnetocaloric Materials for High Efficiency Magnetic Refrigeration	This project will help facilitate further development and deployment of magnetic refrigeration systems, which offer significant efficiency improvements over traditional vapor compression cooling systems while using no hydrodrofluorocarbons. Increased use of magnetic refrigeration can lead to lower energy use and GHG emissions.	2a, 3c, 3f, 3h, 4a	In 2020, this project acquired and installed a new arc melting furnace to enable the in-house casting of innovative magnetocaloric materials that achieve 1kg per day production capacity target. Casting process development has been done to optimize performance of the materials and started to form the materials into sub-mm sized spheres using an atomization technique on this new furnace. In 2021, the project team will continue to optimize the post-casting anneals for each of the unique magnetocaloric compositions, optimize the atomization process, and acquire a new hydraulic pressing system and develop techniques to form the materials into thin plates.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-18-026 ** Comprehensive Open Source Development of Next Generation Wildfire Models for Grid Resiliency	Applied Research and Development	The project is advancing wildfire science by incorporating the interaction of tree mortality and extreme fire weather into next-generation fire models. The project is developing zero-to-seven-day risk forecasts for the grid with predictive capabilities, and computational efficiency and scalability. To support planning, the team is developing long-term fire projections using a coupled fire-climate-vegetation statistical and dynamical model to integrate the latest climate projections, tree mortality, development in the wildland-urban interface, and adaptation strategies. To integrate the models into electric utility management and planning, the team is facilitating workshops with IOUs. To support the California's Fifth Climate Change Assessment, the team is developing a web-based scenario analysis tool to visualize and explore the impacts of climate change and adaptation strategies on the grid.	6/12/19
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-18-026 ** Comprehensive Open Source Development of Next Generation Wildfire Models for Grid Resiliency	Applied Research and Development	The project is advancing wildfire science by incorporating the interaction of tree mortality and extreme fire weather into next-generation fire models. The project is developing zero-to-seven-day risk forecasts for the grid with predictive capabilities, and computational efficiency and scalability. To support planning, the team is developing long-term fire projections using a coupled fire-climate-vegetation statistical and dynamical model to integrate the latest climate projections, tree mortality, development in the wildland-urban interface, and adaptation strategies. To integrate the models into electric utility management and planning, the team is facilitating workshops with IOUs. To support the California's Fifth Climate Change Assessment, the team is developing a web-based scenario analysis tool to visualize and explore the impacts of climate change and adaptation strategies on the grid.	6/12/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-18-026 ** Comprehensive Open Source Development of Next Generation Wildfire Models for Grid Resiliency	No	Distribution	$4,021,416	$4,021,416	$951,723	N/A
EPC-18-026 ** Comprehensive Open Source Development of Next Generation Wildfire Models for Grid Resiliency	No	Distribution	$978,584	$978,584	$0	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-18-026 ** Comprehensive Open Source Development of Next Generation Wildfire Models for Grid Resiliency	$951,723	$546,431	$0	The Brattle Group; Eagle Rock Analytics; US Geological Society (USGS); Spatial Informatics Group, LLC; Reax Engineering Inc.; University Corporation for Atmospheric Research ; Missoula Fire Sciences Laboratory; Pyrologix, LLC	$1,656,600	24.9%
EPC-18-026 ** Comprehensive Open Source Development of Next Generation Wildfire Models for Grid Resiliency	$0	$0	$0	The Brattle Group; Eagle Rock Analytics; US Geological Society (USGS); Spatial Informatics Group, LLC; Reax Engineering Inc.; University Corporation for Atmospheric Research ; Missoula Fire Sciences Laboratory; Pyrologix, LLC	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-18-026 ** Comprehensive Open Source Development of Next Generation Wildfire Models for Grid Resiliency	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-026 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	9 out of 9 bidders	Spatial Informatics Group, LLC
EPC-18-026 ** Comprehensive Open Source Development of Next Generation Wildfire Models for Grid Resiliency	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-18-026 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	9 out of 9 bidders	Spatial Informatics Group, LLC

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-18-026 ** Comprehensive Open Source Development of Next Generation Wildfire Models for Grid Resiliency	Ranked # 1	N/A	N/A	Yes; Micro Business, Calif Based Entity
EPC-18-026 ** Comprehensive Open Source Development of Next Generation Wildfire Models for Grid Resiliency	Ranked # 1	N/A	N/A	Yes; Micro Business, Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-18-026 ** Comprehensive Open Source Development of Next Generation Wildfire Models for Grid Resiliency	The project will aid regulators and stakeholders in meeting statutory goals by addressing critical fire science gaps and applying the science to provide advanced forecasting capability. Specifically, the project will: 1) advance the science of measuring, modeling, and analyzing extreme weather events, tree mortality, and fire spread at scale; 2) advance risk modeling frameworks to include wind extrema, statewide maps of fuel loads, updated parameterizations, and indicators of where risk forecasting may underestimate fire risk due to gaps in science; and 3) advance the integration of science relating to vegetation dynamics, the wildland-urban interface, land-use, climate, and adaptation strategies, by building on existing models and comparing approaches.	3a, 3b, 3c, 4a, 4b, 5a	A beta version of the near-term fire risk forecast tool became available in May 2020 (pyregence.org). The tool displays forecasts for active fires and fire risk at a five-day horizon. An API allows for flexible integration with an organization's unique and existing workflows to assist in tactical fire and ignition risk decision-making. The research team also developed beta versions of experimental fire size distribution and fractional fire severity class models covering all of California. They utilized a sample of the beta version fractional fire severity models with observed historical fire sizes to begin testing and validating a bootstrapping procedure for expressing spatial autocorrelation in the clustering of high severity burn patches within fire perimeters. The second technical advisory meeting was held in May 2020.
EPC-18-026 ** Comprehensive Open Source Development of Next Generation Wildfire Models for Grid Resiliency	The project will aid regulators and stakeholders in meeting statutory goals by addressing critical fire science gaps and applying the science to provide advanced forecasting capability. Specifically, the project will: 1) advance the science of measuring, modeling, and analyzing extreme weather events, tree mortality, and fire spread at scale; 2) advance risk modeling frameworks to include wind extrema, statewide maps of fuel loads, updated parameterizations, and indicators of where risk forecasting may underestimate fire risk due to gaps in science; and 3) advance the integration of science relating to vegetation dynamics, the wildland-urban interface, land-use, climate, and adaptation strategies, by building on existing models and comparing approaches.	3a, 3b, 3c, 4a, 4b, 5a	A beta version of the near-term fire risk forecast tool became available in May 2020 (pyregence.org). The tool displays forecasts for active fires and fire risk at a five-day horizon. An API allows for flexible integration with an organization's unique and existing workflows to assist in tactical fire and ignition risk decision-making. The research team also developed beta versions of experimental fire size distribution and fractional fire severity class models covering all of California. They utilized a sample of the beta version fractional fire severity models with observed historical fire sizes to begin testing and validating a bootstrapping procedure for expressing spatial autocorrelation in the clustering of high severity burn patches within fire perimeters. The second technical advisory meeting was held in May 2020.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-001 Reflex Flow Battery at Farm ACW	Technology Demonstration and Deployment	This project will entail the deployment of an advanced vanadium redox flow battery, and the other elements to create a 1MW and 4MWh AC Energy Storage System (ESS) at US Marine Corps Base Camp Pendleton. The project will prove the scalability, the integration requirements, the reliability and the bankability of UET's newest high-performing ReFlex battery product. The 1MW and 4MWh system will consist of roughly 109 ReFlex modules connected in 8 DC strings. The system will deliver critical operational flexibility for the Camp Pendleton microgrid to incorporate maximum use of onsite variable renewable generation and optimize the use of dispatchable generators when needed. For SDG&E, the system will provide voltage support at a remote feeder. It will also provide the benefit to SDG&E of a net solar energy time shift to the later peak hours.	8/14/19
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-002 "Smart Greenhouse": Integrated Photovoltaics/Photosynthesis for Energy and Food	Applied Research and Development	This project will improve the understanding of materials science and manufacturing approaches for transparent organic photovoltaic (TOPV) materials with conversion efficiency of 15 percent and average visible light transmittance of 30 percent. Moreover, the manufactured TOPV will be installed in a "smart greenhouse" and tested to assess their efficiency, transmittance, stability, reliability, and also their effect on plant growth.	9/11/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-001 Reflex Flow Battery at Farm ACW	No	Generation	$2,969,998	$2,969,998	$0	N/A
EPC-19-002 "Smart Greenhouse": Integrated Photovoltaics/Photosynthesis for Energy and Food	No	Generation	$600,000	$600,000	$71,841	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-001 Reflex Flow Battery at Farm ACW	$0	$0	$0	UniEnergy Technologies, LLC; Indian Energy LLC; Webcor	$956,961	24.4%
EPC-19-002 "Smart Greenhouse": Integrated Photovoltaics/Photosynthesis for Energy and Food	$71,841	$97,807	$0	The Regents of the University of California, Los Angeles	$60,000	9.1%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-001 Reflex Flow Battery at Farm ACW	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-001 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	7 out of 8 bidders	UniEnergy Technologies, LLC
EPC-19-002 "Smart Greenhouse": Integrated Photovoltaics/Photosynthesis for Energy and Food	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-002 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	5 out of 7 bidders	University of California, Los Angeles

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-001 Reflex Flow Battery at Farm ACW	Ranked # 4	N/A	N/A	Yes; Calif Based Entity
EPC-19-002 "Smart Greenhouse": Integrated Photovoltaics/Photosynthesis for Energy and Food	Ranked # 3	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-001 Reflex Flow Battery at Farm ACW	The development of this project will enhance grid resiliency, support the transmission and distribution infrastructure, and will provide low-cost, long-duration electric storage capacity to the California grid. The integration of the advanced vanadium flow battery system and the Power Conversion System (PCS) and peak power controller will provide a working solution for the California market and grid. The design and permitting of the storage system will provide customers and developers working in California with credible operational data, credible budgetary data and a credible pro-forma design.	1e, 1f, 1h, 4a, 5a, 5d	The project team advanced the design of the ReFlex product to achieve UL certification. In this process, they further improved product resiliency and ease of deployment. The project was placed under a stop work order on February 7, 2020. During the stop work order, the original host site dropped out. UET found a replacement site at US Marine Corps Camp Pendleton. The stop work order was lifted on October 13, 2020. The project value to California is notably improved due to the more rigorous US Marine Corps requirements and clear follow-on opportunities with all project partners.
EPC-19-002 "Smart Greenhouse": Integrated Photovoltaics/Photosynthesis for Energy and Food	Development of innovative transparent photovoltaic technologies that can be integrated in buildings will help to achieve California's renewable energy generation goals and statewide requirement for all new buildings to have solar photovoltaic installed even with rooftop space constraints.	1f, 2a, 3a, 3g, 4a, 4c	The project kicked off in May 2020. During the first quarter, the project focused mainly on the development, fabrication, and examination of the absorption and transmittance spectrum of polymers. Because of the covid-19 pandemic, supplies of necessary chemicals were delayed and time spent in the lab was constrained.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-003 Processing and Architecture Design to Develop and Demonstrate Stable and Efficient Perovskite + Silicon Tandem Modules	Applied Research and Development	This project will improve the durability of perovskite solar cells and advance large-area perovskite deposition processes which demonstrate high performance, yield, and throughput. Specifically, it will develop scalable processing of perovskite photovoltaic layers through spray deposition and rapid thermal annealing to fabricate and test 6x6 inch perovskite/silicon tandem devices with 25% cell efficiency. Combinations of these two developments will result in demonstrations of product readiness for perovskite durability. These demonstrations will provide confidence to manufacturers and potential customers of solar panels using perovskite technology.	9/11/19
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-004 High-Efficiency Perovskite Tandem Modules with Resilient Interfaces	Applied Research and Development	The purpose of this project is to develop robust, high-power perovskite-on-silicon tandem photovoltaic (PV) modules that achieve a power conversion efficiency of greater than 32%, using low-cost manufacturing approaches. The perovskite top cell will be deposited on textured silicon cells, increasing energy production by 30% when the sun is near the horizon, reducing the ramp rate necessary for other grid participants, and improving reliability at future high PV penetration that is under statutory mandate.	9/11/19

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-003 Processing and Architecture Design to Develop and Demonstrate Stable and Efficient Perovskite + Silicon Tandem Modules	No	Generation	$999,802	$999,802	$196,911	N/A
EPC-19-004 High-Efficiency Perovskite Tandem Modules with Resilient Interfaces	No	Grid Operations/Market Design	$993,458	$993,458	$65,003	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-003 Processing and Architecture Design to Develop and Demonstrate Stable and Efficient Perovskite + Silicon Tandem Modules	$196,911	$161,295	$0	Tandem PV, Inc.	$999,986	50.0%
EPC-19-004 High-Efficiency Perovskite Tandem Modules with Resilient Interfaces	$65,003	$103,945	$0	The Regents of the University of California, San Diego; D2Solar LLC	$659,295	39.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-003 Processing and Architecture Design to Develop and Demonstrate Stable and Efficient Perovskite + Silicon Tandem Modules	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	5 out of 7 bidders	Tandem PV, Inc.
EPC-19-004 High-Efficiency Perovskite Tandem Modules with Resilient Interfaces	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-004 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	5 out of 7 bidders	The Regents of the University of California, San Diego

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-003 Processing and Architecture Design to Develop and Demonstrate Stable and Efficient Perovskite + Silicon Tandem Modules	Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-19-004 High-Efficiency Perovskite Tandem Modules with Resilient Interfaces	Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-003 Processing and Architecture Design to Develop and Demonstrate Stable and Efficient Perovskite + Silicon Tandem Modules	Lower cost and higher power density solar PV through higher-efficiency and lower cost solar panels consisting of a combination of perovskite and silicon in tandem.	1c, 2a, 3b, 4a, 5a	The project kicked off in November 2019. The project team is steadily improving their scaled rapid coating and drying processes for both the first transport layer and the perovskite layer and have made efficient solar cells using only scalable processes. On the barrier material and durability, there was a breakthrough in the solution-applied material on top of the perovskite. No damage is detected when droplets of water were placed on top of the un-encapsulated solar cell for more than 10 minutes and did not see full penetration of the water through the perovskite layer until ~2h of direct water exposure (without this barrier material, the film degrades in seconds). They succeeded in scaling this layer as well. A next step is to begin module fabrication and accelerated durability testing on tandem cells.
EPC-19-004 High-Efficiency Perovskite Tandem Modules with Resilient Interfaces	Perovskite-on-silicon tandem PV modules seek to achieve a power conversion efficiency of greater than 32% during the project period using low-cost manufacturing approaches that can scale to square meter (m2) products with a projected levelized cost of electricity of $0.031 per kilowatt-hour ($/kWh). These modules will incorporate optimized light-trapping and anti-reflection approaches to collect sunlight at wide angles, increasing energy production in the early morning and late evening to facilitate flattening of the duck curve.	1f, 2a, 4a	The project conducted the kick-off meeting in early 2020. The team successfully performed polymer film transfer experiments to textured silicon and evaluated the role that film thickness and mechanical properties play in the polymer film transfer. The diodes atop the silicon was also tested and achieved successful rectification, indicating electronic contact was made. Additionally, the team submitted a test plan focused on the preparation and characterization of a novel mechanically-compliant conductive adhesive (MCCA) material.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-005 Richmond Advanced Energy Community (AEC) Phase II Project	Technology Demonstration and Deployment	The Richmond Advanced Energy Community (AEC) Phase II project demonstrates two breakthrough AEC models that will advance state and local goals for energy and carbon savings, while maximizing benefits to the local community, the grid, and low-income residents in greatest need. These include: (1) Implementation of a DER Community program that optimizes economic and resilience value at the community and grid level, while directing new revenues and societal benefits to low-income residents residing in California's Disadvantaged Communities (DACs); and (2) Implementation of the Zero Net Carbon Ready (ZNCR) Homes Program to finance the rehabilitation of blighted homes to ZNCR status and their re-sale as affordable infill and retrofit properties to low-to-middle income residents using capital provided by Social Impact Bonds. The scale-up of these strategies will be supported by preparation of an AEC Solutions Toolkit and an AEC Finance Toolkit disseminated through the Local Government Commission and the state's leading network of regional climate action collaboratives.	3/11/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-005 Richmond Advanced Energy Community (AEC) Phase II Project	Yes	Grid Operations/Market Design	$4,998,555	$4,998,555	$66,104	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-005 Richmond Advanced Energy Community (AEC) Phase II Project	$66,104	$1,092,030	$0	City of Richmond; Olivine, Inc.; Richmond Community Foundation; GRID Alternatives; Blue Strike Environmental, Inc.	$2,813,454	36.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-005 Richmond Advanced Energy Community (AEC) Phase II Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-005 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	5 out of 5 bidders	Zero Net Energy (ZNE) Alliance

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-005 Richmond Advanced Energy Community (AEC) Phase II Project	Group 7: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-005 Richmond Advanced Energy Community (AEC) Phase II Project	This Agreement will support the development and commercialization of technological advancements and breakthroughs that overcome barriers to the achievement of California's statutory energy goals by: 1) demonstrating how DER aggregation can balance local energy load and generation to reduce transmission and distribution costs and provide value to local communities; 2) demonstrating how a Social Impact Bond can be used to rehabilitate abandoned, blighted, and distressed properties to be ZNCR and sell them at market rates to low-to-middle income first-time homebuyers; and 3) demonstrating an energy efficiency financing model and related tools and policies that overcome the tenant/landlord split incentive.	1h, 1i, 4a	The project kicked-off in August and the team immediately began conducting technology assessments (determining current/baseline capabilities and necessary updates) to prepare for installation planning of the DER Community and homes to be remodeled under the ZNCR program. Additionally, the team began working with the City of Richmond to develop different design options for the ZNCR homes. Given the constraints of Stay-At-Home orders and COVID-19, the team is revising the community outreach plan in collaboration with the CBO partners. In 2021, the team will complete the site technology assessments and ZNCR home design options, planning to begin installations at these sites. Once the outreach plan is finalized, the team will begin community engagement including conducting focus groups to help inform educational materials that will be developed for the ZNCR homes. Finally, the team will begin development on the AEC Solutions Toolkit.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-006 Basset-Avocado Advanced Energy Community	Technology Demonstration and Deployment	The project will use private sites within the community to generate local, renewable and competitively priced electricity from a smart community solar system. The Bassett Avocado Heights Advanced Energy Community (BAAEC) project will include a resiliency microgrid to provide refuge to the community during emergencies and/or blackouts. The BAAEC aims to demonstrate the benefits of advanced energy homes with a prosumer network that includes installation of residential solar photovoltaics, battery storage and heat pump water heaters in single family homes. The prosumer network will feature a blockchain-enabled transactive energy pilot, simulating a scenario where enrolled participants generate, actively manage and sell energy. This approach tests a potential business model for converting passive bill-payers into discerning "prosumers", thereby empowering communities to benefit from their own local generation. Residential batteries will be aggregated and operate as a virtual power plant in partnership with the local utility to demonstrate how important grid services can be provided by DERs.	5/13/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-006 Basset-Avocado Advanced Energy Community	Yes	Grid Operations/Market Design	$9,093,833	$9,093,833	$300,574	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-006 Basset-Avocado Advanced Energy Community	$300,574	$0	$0	Zeco Systems dba Greenlots; Green Commuter Inc.; GRID Alternatives; Enel X North America, Inc.; Community Electricity; Green Convergence; Space AI; SensorComm Technologies, Inc.	$5,459,863	37.5%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-006 Basset-Avocado Advanced Energy Community	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-006 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	5 out of 5 bidders	The Energy Coalition

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-006 Basset-Avocado Advanced Energy Community	Group 8: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-006 Basset-Avocado Advanced Energy Community	A lack of capital to invest in energy solutions is a significant barrier. The BAAEC team has developed a comprehensive design that leverages private capital to develop local integrated renewable energy systems and alternative transportation opportunities. The proposed Smart Community Solar will provide participants, at least 50% of which will be low-income, with risk-free access to 100% renewable and locally produced electricity at a 20% discount over their current electricity rates through a Community Solar Green Tariff program offered by the Clean Power Alliance. The BAAEC will create new community assets that have significant long term value and, once the model is tested and proven, its approach and benefits can be replicated in DACs throughout the state.	1d, 1e, 1f, 1h, 4a, 4b	Work on this agreement started in July of 2020. Since the kickoff, the recipient has developed a community outreach plan with its CBO partners in order to define the goals, objectives, and strategies to engage community members to actively take part in the implementation of their advanced energy communities. Currently, the project team is working to leverage Southern California Edison's Charge Ready 2 program which would provide funding for make-ready infrastructure and offer a rebate towards the EV charging equipment for the project. The project team is also finalizing energy system designs and power purchase agreements under the Community Solar Green Tariff program in order to begin construction in 2021.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-007 On-site 3D Concrete Printing for Next-Generation Low-Cost Wind Plants	Applied Research and Development	This agreement aims to manufacture, demonstrate, and test wind tower sections and offshore wind energy components using an onsite three-dimensional concrete printed (3DCP) manufacturing process and design. The advancement in scientific knowledge in 3DCP materials, manufacturing methods and large-scale structural performance will facilitate the deployment of large land-based and offshore wind technologies that use 3DCP components to increase the cost-competitiveness of the wind energy generation needed to meet California's statutory energy goals.	4/8/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-008 NextWind Real-time Monitoring System	Applied Research and Development	This agreement aims to establish a digital representation - or digital twin - of a floating offshore wind installation, enabling continuous improvements in production optimization, lower levelized cost of energy, and improved understanding of potential environmental impacts and associated mitigation measures.	4/8/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-007 On-site 3D Concrete Printing for Next-Generation Low-Cost Wind Plants	Yes	Generation	$2,999,979	$2,999,979	$0	N/A
EPC-19-008 NextWind Real-time Monitoring System	Yes	Generation	$2,000,000	$2,000,000	$747,077	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-007 On-site 3D Concrete Printing for Next-Generation Low-Cost Wind Plants	$0	$507,530	$0	RCAM Technologies	$302,000	9.1%
EPC-19-008 NextWind Real-time Monitoring System	$747,077	$503,271	$0	H.T. Harvey and Associates; Aker Solutions, Inc.; Cognite	$201,775	9.2%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-007 On-site 3D Concrete Printing for Next-Generation Low-Cost Wind Plants	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-007 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	9 out of 9 bidders	RCAM Technologies
EPC-19-008 NextWind Real-time Monitoring System	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-008 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	9 out of 9 bidders	Aker Solutions, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-007 On-site 3D Concrete Printing for Next-Generation Low-Cost Wind Plants	Group 1: Ranked # 1	N/A	N/A	None
EPC-19-008 NextWind Real-time Monitoring System	Group 2: Ranked # 2	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-007 On-site 3D Concrete Printing for Next-Generation Low-Cost Wind Plants	Reinforced concrete additive manufacturing (RCAM)'s 3D printed (3DCP) towers will reduce tower capital costs by up to approximately 50% compared to 140-m steel tower for a 7.5-MW next generation turbine. RCAM is faster and safer than conventional concrete construction methods, while providing new transformative design possibilities that reduce cost and energy consumed by using less concrete than conventional construction and by eliminating concrete forms. The highly mobile 3DCP equipment and California's existing concrete supply chain can cost-effectively produce towers and foundations on-site in manufacturing lots of any size needed for California wind plants. The scope includes design, fabrication, pilot testing and demonstration of tower sections at up to 1:2 scale in laboratory and outdoor environments.	2a, 3b, 4a, 4e, 4f	The kick-off meeting was conducted in June 2020. The team conducted some preliminary activities, such as reviewing 3D concrete printing (3DCP) materials and techniques for tower design, developing conceptual design drawings for a 3DCP segmented tower with various strategies for reinforcement, and initiating work on a finite element analysis.
EPC-19-008 NextWind Real-time Monitoring System	The configuration of a digital platform that processes real-time data from offshore wind operations can help reduce the leveled cost of energy via reduced operation and maintenance costs and also improve understanding of and mitigation of potential environmental impacts.	2a, 3a, 4a, 4f, 4g, 5a, 5d	The kick-off meeting was conducted in June 2020. The team is engaging in discussions with project partners and stakeholders to obtain technical data to configure the offshore wind data platform and to facilitate environmental monitoring. The first technical advisory committee meeting was in October 2020 and included discussion on project status and needs for environmental monitoring analysis.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-009 A Risk Assessment Framework to Evaluate Effects of Offshore Wind Farms on the California Upwelling Ecosystem	Applied Research and Development	The project team is conducting a numerical modeling study to determine potential changes in coastal upwelling due to offshore wind project development over a variety of environmental conditions. A number of baseline cases (no wind farms) will be modeled for a variety of climatologies and compared with modeled cases that include simulated offshore wind farms with varying characteristics in identified areas of interest. The methodology will combine coupled numerical atmospheric-ocean models. Results from the coupled models will provide an enhanced scientific understanding of the effects of wind energy reduction on nearshore ocean circulation.	4/8/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-010 Integrated Distributed Fiber Optic Sensing for Real-Time Monitoring of OWT Gearbox and Tower Operation and Marine Animal Activities	Applied Research and Development	This project aims to develop a fiber optic sensing system for real-time monitoring of offshore wind turbines (OWTs). This approach will provides critical data to allow (1) real time monitoring of OWT operational conditions and diagnostic signal of potential malfunctions to allow effective operation management that can significantly reduce O&M costs, and (2) real time monitoring of dynamic marine mammal activities near OWTs to better understand potential impacts of OWT developments on marine life.	4/8/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-009 A Risk Assessment Framework to Evaluate Effects of Offshore Wind Farms on the California Upwelling Ecosystem	Yes	Generation	$500,000	$500,000	$122,803	N/A
EPC-19-010 Integrated Distributed Fiber Optic Sensing for Real-Time Monitoring of OWT Gearbox and Tower Operation and Marine Animal Activities	Yes	Grid Operations/Market Design	$2,000,000	$2,000,000	$300,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-009 A Risk Assessment Framework to Evaluate Effects of Offshore Wind Farms on the California Upwelling Ecosystem	$122,803	$174,739	$0	University of California, Santa Cruz; Integral Consulting Inc.	$152,821	23.4%
EPC-19-010 Integrated Distributed Fiber Optic Sensing for Real-Time Monitoring of OWT Gearbox and Tower Operation and Marine Animal Activities	$300,000	$684,912	$0	Lawrence Berkeley National Laboratory	$520,000	20.6%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-009 A Risk Assessment Framework to Evaluate Effects of Offshore Wind Farms on the California Upwelling Ecosystem	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-009 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	9 out of 9 bidders	Integral Consulting Inc.
EPC-19-010 Integrated Distributed Fiber Optic Sensing for Real-Time Monitoring of OWT Gearbox and Tower Operation and Marine Animal Activities	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-010 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	9 out of 9 bidders	Lawrence Berkeley National Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-009 A Risk Assessment Framework to Evaluate Effects of Offshore Wind Farms on the California Upwelling Ecosystem	Group 3: Ranked # 2	N/A	N/A	None
EPC-19-010 Integrated Distributed Fiber Optic Sensing for Real-Time Monitoring of OWT Gearbox and Tower Operation and Marine Animal Activities	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-009 A Risk Assessment Framework to Evaluate Effects of Offshore Wind Farms on the California Upwelling Ecosystem	This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by understanding potential environmental impacts of offshore wind, identifying data gaps and prioritizing research, informing monitoring and mitigation actions, and streamlining planning through a quantification of ecological risk. This project will directly support the National Environmental Policy Act, California Environmental Quality Act, and other federal, state, and local statutory and regulatory reviews and approvals. These barriers need to be addressed early in California in a comprehensive approach that considers physical processes and their links to biological processes as the basis for assessing significance of anticipated environmental changes.	2a, 4f	The agreement was approved at the April 2020 business meeting and kicked-off in the summer. The first TAC meeting was held in September. The research team is coordinating closely with the team from EPC-19-011 to use a common set of parameters for offshore wind turbines and wind facility locations and configurations with industry guidance.
EPC-19-010 Integrated Distributed Fiber Optic Sensing for Real-Time Monitoring of OWT Gearbox and Tower Operation and Marine Animal Activities	The potential contribution from offshore wind energy to the renewable energy portfolio of California is key to achieve the 100% clean energy goals established in Senate Bill 100. Among the key challenges to floating offshore wind energy development is the high operation and maintenance cost. This project will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by enabling real time OWT gearbox and tower operation and marine animal activities monitoring, which can lead to reduced O&M cost, reduced LCOE, greater OWT reliability and safety, and enhanced environmental sustainability.	2a, 3a, 3b, 4a, 4g, 5e	The kick-off meeting was conducted in June 2020. The team started the design of the testing facility and conducted an initial test to investigate the feasibility of using a distributed fiber optic sensor to measure the dynamic strain of a mock wind turbine. The team drafted the Technology Evaluation report, which discusses the state-of-the-art of fiber optic sensing technologies.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-011 Seabird 3D Distribution and Relative Risk from California Offshore Wind Turbines	Applied Research and Development	The project is creating a three-dimensional spatial distribution of seabird density, species composition, and flight height for the entire California coast. The seabird model will be developed using a dataset including over 120 ship and aerial surveys spanning the period of 1976-2016. Using seabird density data that incorporates flight height will allow this project to study how different turbine heights and locations will overlap with the presence of different seabirds. After completing the seabird distribution model, several different wind farm scenarios will be investigated to evaluate the relative risk that offshore wind farms have on seabirds. For each offshore wind scenario, the project team will create power generation profiles using modeled wind speed and turbine performance parameters. The power generation and three-dimensional seabird models will be combined and compared using a multi-objective optimization to assess the tradeoffs between wind farm performance and bird mortality risk.	4/8/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-012 Affordable Space Conditioning and Domestic Hot Water Systems with Low Emissions and High Performance	Applied Research and Development	This project will develop, test, and demonstrate a combined electric space conditioning and hot water system that incorporates built-in load shifting and will deliver clean, affordable space conditioning and domestic hot water to existing and new homes. The integrated pod will be installed in residential buildings to evaluate cost-effectiveness, load flexibility, and GHG emissions reductions.	5/13/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-011 Seabird 3D Distribution and Relative Risk from California Offshore Wind Turbines	Yes	Generation	$500,000	$500,000	$0	N/A
EPC-19-012 Affordable Space Conditioning and Domestic Hot Water Systems with Low Emissions and High Performance	Yes	Grid Operations/Market Design	$1,499,925	$1,499,925	$0	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-011 Seabird 3D Distribution and Relative Risk from California Offshore Wind Turbines	$0	$123,126	$0	Humboldt State University Sponsored Programs Foundation	$20,046	3.9%
EPC-19-012 Affordable Space Conditioning and Domestic Hot Water Systems with Low Emissions and High Performance	$0	$343,790	$0	Franklin Energy Services, LLC; Harvest Thermal, Inc	$163,750	9.8%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-011 Seabird 3D Distribution and Relative Risk from California Offshore Wind Turbines	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-011 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	9 out of 9 bidders	Humboldt State University Sponsored Programs Foundation
EPC-19-012 Affordable Space Conditioning and Domestic Hot Water Systems with Low Emissions and High Performance	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-012 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	17 out of 17 bidders	Franklin Energy Services, LLC

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-011 Seabird 3D Distribution and Relative Risk from California Offshore Wind Turbines	Group 3: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-19-012 Affordable Space Conditioning and Domestic Hot Water Systems with Low Emissions and High Performance	Group 2A: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-011 Seabird 3D Distribution and Relative Risk from California Offshore Wind Turbines	This project will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by providing information to project developers, permitting agencies, and turbine manufacturers about the conflicts between seabirds and turbines at various heights above the sea surface and allow them to design turbines and projects that minimize the impacts. The efforts to support environmentally responsible offshore wind development would help enable California to achieve high renewable energy penetration in the electric grid. Furthermore, the 3D seabird model, will allow project developers to understand the conflict between seabirds and turbines at different heights above the sea surface.	2a, 4f, 4g	The agreement was approved at the April 2020 business meeting and kicked off in the summer of 2020. The first technical advisory committee meeting was held in the fall. The research team is coordinating closely with the team from EPC-19-009 to use a common set of parameters for offshore wind turbines and wind facility locations and configurations with industry guidance.
EPC-19-012 Affordable Space Conditioning and Domestic Hot Water Systems with Low Emissions and High Performance	This project intends to achieve technological advancements and breakthroughs in thermal storage and load shifting. By developing a shared heat-pump system for air conditioning and water heating, along with advanced controls, the new technology proposed under this project will provide (1) Between 70 and 90 percent GHG emissions reductions compared to natural gas and 85 to 95 percent compared to conventional heat pumps without load shifting; (2) Up to 30 percent operational cost reductions compared to existing heat pump technology and 30 to 40 percent compared to existing natural gas technology.	1c, 1d, 1e, 1f, 1g, 1h, 4a, 5a	The agreement was executed on 10/28/2020. The kick-off meeting has been scheduled for December.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-013 HP-Flex: Next Generation Heat Pump Load Flexibility	Applied Research and Development	This project develops and tests an open-source building energy management system, called HP-Flex, that controls heat pump (HP) settings in SMC buildings to provide load flexibility (LF); shape, shift, shed, and/or shimmy; while meeting occupant needs and minimizing operating cost. The system includes new optimization software and equipment interfaces that together optimize HP operation, while being extensible to manage additional equipment such as refrigeration, water heaters, electrochemical and thermal storage. HP-Flex's standardized, modular design aims to make it easier to configure than existing systems, thus enabling a more cost-effective and reliable control for SMC applications.	5/13/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-014 A zero GWP heat pump and distribution system for all-electric heating and cooling in California	Applied Research and Development	The recipient is developing, testing and demonstrating an advanced heat pump system that will reduce energy demand for multi-family (MF) or small to medium commercial (SMC) applications, with 10 to 20 tons of refrigerating capacity, based on a reversible heat pump that uses ammonia (NH3) and carbon dioxide (CO2) in a unique way: NH3 is the primary refrigerant, while CO2 is used both as a refrigerant and as a distribution fluid, depending on operating mode.	5/13/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-013 HP-Flex: Next Generation Heat Pump Load Flexibility	Yes	Demand-side Management	$3,000,000	$3,000,000	$1,313,000	N/A
EPC-19-014 A zero GWP heat pump and distribution system for all-electric heating and cooling in California	Yes	Demand-side Management	$2,498,557	$2,498,557	$0	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-013 HP-Flex: Next Generation Heat Pump Load Flexibility	$1,313,000	$989,122	$0	Lawrence Berkeley National Laboratory	$386,500	11.4%
EPC-19-014 A zero GWP heat pump and distribution system for all-electric heating and cooling in California	$0	$648,140	$0	Electric Power Research Institute, Inc.; San Diego Gas and Electric Company; Optimized Thermal Systems, Inc.	$440,000	15.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-013 HP-Flex: Next Generation Heat Pump Load Flexibility	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-013 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	17 out of 17 bidders	Lawrence Berkeley National Laboratory
EPC-19-014 A zero GWP heat pump and distribution system for all-electric heating and cooling in California	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-014 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	17 out of 17 bidders	Electric Power Research Institute, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-013 HP-Flex: Next Generation Heat Pump Load Flexibility	Group 4: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-19-014 A zero GWP heat pump and distribution system for all-electric heating and cooling in California	Group 1: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-013 HP-Flex: Next Generation Heat Pump Load Flexibility	This project hopes to remove barriers to the widespread adoption of this newly developed HP-Flex system by using experience from this project's field tests to develop educational curricula to train future engineers and technicians who will design, install, and maintain these systems. Industry partners who participate in the TAC will help disseminate findings and may adopt the resulting software (HP-Flex). The HP-Flex package supports the emerging business model of optimization as a service; which lowers the barriers to entry by providing energy management on a subscription basis. The findings from the long-term site demonstration will improve understanding of LF capabilities of HPs, along with impacts on grid and building end users, which will inform the development of a guidebook for future installations.	1c, 1e, 1f, 1g, 1h	The project held a kick-off meeting in summer 2020. Subcontracts are being developed and the first stages of system design has begun.
EPC-19-014 A zero GWP heat pump and distribution system for all-electric heating and cooling in California	This project develops a heat pump to provide both heating and cooling that uses ammonia (NH3) as a primary refrigerant to exchange thermal energy between the outside air and the carbon dioxide (CO2) refrigerant in the distribution fluid loop. A heat pump using NH3 offers advantages over other low GWP refrigerants, such as hydrocarbons. NH3 is inexpensive, has superior efficiency properties, low flammability compared to hydrocarbons, and its odor makes it detectable for leaks. NH3 is not for direct use as a distribution fluid in commercial or residential systems and needs a secondary fluid, such as CO2 which has been demonstrated promising efficiency results and lower cost than traditional mixtures as a distribution fluid.. The heat pump system will use the ability of CO2 to transfer more heat per unit mass, thereby reducing piping sizes, installation, and operating costs.	1f, 1h, 4a	The project kicked off in late June 2020. The Technical Advisory Committee has been established and their first meeting is set for January 2021. The project team performed preliminary engineering calculations to determine design parameters and constraints and is currently refining the heat pump's design to minimize the number of components while realizing the required performance and cost characteristics.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-015 Optimizing Heat Pump Load Flexibility for Cost, Comfort, and Carbon Emissions	Applied Research and Development	This project develops and tests an advanced control system that saves energy, improves grid reliability, and reduces carbon emissions by optimizing heat pump operation based on building owner/occupant preferences, comfort and use patterns, electricity pricing, electricity grid needs, real-time carbon emission rates, and weather data. Load flexibility controls offer a way to mitigate the impact of electrification on low-income customers by empowering households to shift consumption to times of day with lower rates without compromising their comfort. The recipient will test controls for heat pump water heaters in multiple low-income households (across two climate zones). The developed controls for water heating will also be adapted to heat pumps that provide space conditioning and field test them in two low-income households. The controls will be futureproofed to facilitate integration with other smart home devices.	5/13/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-016 Affordable Near- and Medium-Term Solutions for Integration of Low GWP Heat Pumps in Residential Buildings	Applied Research and Development	This project develops and demonstrates affordable near-term (TRL 4- high 7) and medium-term (TRL 4- low 7) solutions for integration of lower cost, low- and ultra-low global warming potential (GWP) heat pumps. The combination of addressing both near-term (GWP < 750) and medium-term (ultra-low GWP < 10) needs is necessary to meet California's carbon reduction goals. The near-term solution focuses on a closer-to-market emerging technology that uses a proprietary, a lower cost compressor drive. This technology will be demonstrated for cost and energy savings at 10 pilot sites. The goal is to provide a market-ready product that is more efficient and 10% lower cost. The medium-term solution incorporates an innovative heat exchanger in the secondary loop to improve its efficiency, enabling use of hermetically-sealed ultra-low GWP flammable refrigerants in heat pumps. This technology will be tested at a laboratory scale.	5/13/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-015 Optimizing Heat Pump Load Flexibility for Cost, Comfort, and Carbon Emissions	Yes	Demand-side Management	$2,537,436	$2,537,436	$7,946	N/A
EPC-19-016 Affordable Near- and Medium-Term Solutions for Integration of Low GWP Heat Pumps in Residential Buildings	Yes	Demand-side Management	$1,916,306	$1,916,306	$11,564	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-015 Optimizing Heat Pump Load Flexibility for Cost, Comfort, and Carbon Emissions	$7,946	$570,955	$0	Southern California Edison; Western Cooling Efficiency Center - UC Davis; WattTime; ecobee	$256,701	9.2%
EPC-19-016 Affordable Near- and Medium-Term Solutions for Integration of Low GWP Heat Pumps in Residential Buildings	$11,564	$455,123	$0	Southern California Edison; The Regents of the University of California, Davis; Rheem; Dr. Prath Vaishnav	$200,000	9.5%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-015 Optimizing Heat Pump Load Flexibility for Cost, Comfort, and Carbon Emissions	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-015 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	17 out of 17 bidders	Western Cooling Efficiency Center - UC Davis
EPC-19-016 Affordable Near- and Medium-Term Solutions for Integration of Low GWP Heat Pumps in Residential Buildings	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-016 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	17 out of 17 bidders	Western Cooling Efficiency Center - UC Davis

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-015 Optimizing Heat Pump Load Flexibility for Cost, Comfort, and Carbon Emissions	Group 4: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-19-016 Affordable Near- and Medium-Term Solutions for Integration of Low GWP Heat Pumps in Residential Buildings	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-015 Optimizing Heat Pump Load Flexibility for Cost, Comfort, and Carbon Emissions	Electrifying California's housing stock to reduce carbon emissions could yield some unintended negative consequences, including creating a winter peak and increasing residential utility bills, especially when larger time-of-use rate differentials are anticipated. The recipient will develop load flexibility controls for heat pumps that will play a vital role in mitigating the impacts of switching water and space heating away from natural gas. The load flexibility controls have the potential to improve grid reliability, lower emissions, and reduce utility bills for households with heat pumps.	1c, 1e, 1f, 1h, 4a	This project kicked off in July 2020. Initial progress includes finalizing subcontracts, organizing the technical advisory committee, and completing the project kickoff benefits questionnaire.
EPC-19-016 Affordable Near- and Medium-Term Solutions for Integration of Low GWP Heat Pumps in Residential Buildings	This project advances high efficiency heat pump equipment at a lower installed cost compared to current competing heat pump technology, improve the appeal and affordability of heat pumps. Heat pumps are vitally important in the effort to meet California's carbon reduction goals through building electrification, but until now their cost has hindered widespread adoption.	1f, 1h, 2a, 3a, 3b, 4a	This project kicked-off in the summer of 2020. The project team is now in the early stages of lab testing the near-term heat pump solution that uses a combination of lower cost compressor drive and a low-GWP refrigerant. The units will be tested using the updated DOE SEER2 and HSPF2 methods that will be adopted for all products coming to the market in 2023. The team is also in the early stage development of the innovative heat exchanger that will be used in the medium-term solution heat pump.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-017 Pilot Scale Recovery of Lithium from Geothermal Brines	Applied Research and Development	This project will demonstrate a pilot scale integrated process for the recovery of lithium from geothermal brines based on: (1) a high-capacity selective solid sorbent for the extraction of lithium; and (2) a carbon negative sorbent regeneration process for the direct formation of high-purity lithium carbonate (Li2CO3). Compared to traditional methods of Li recovery from brines, the proposed high-capacity selective sorbent and its regeneration process is expected to lower the cost of Li production by enabling separation with high recovery efficiency and minimizing processing time. Co-production of lithium at geothermal facilities will bring additional revenue to the power plants thus making geothermal power more economically viable.	5/13/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-018 Hell's Kitchen Geothermal Lithium Extraction Pilot	Applied Research and Development	The goal of this project is to design a pre-treatment process based on the chemical composition of the geothermal fluids at the project site and demonstrate its technical performance on a pilot-scale. The process will remove silica and heavy metals and essentially make the brine ready for subsequent extraction of lithium. The developed process will provide a path to a technically feasible lithium extraction process with favorable commercial scale economics.	6/10/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-017 Pilot Scale Recovery of Lithium from Geothermal Brines	Yes	Generation	$1,878,634	$1,878,634	$327,197	N/A
EPC-19-018 Hell's Kitchen Geothermal Lithium Extraction Pilot	Yes	Generation	$1,460,735	$1,460,735	$0	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-017 Pilot Scale Recovery of Lithium from Geothermal Brines	$327,197	$265,480	$0	None	$0	0.0%
EPC-19-018 Hell's Kitchen Geothermal Lithium Extraction Pilot	$0	$117,874	$675,000	Hell's Kitchen Geothermal LLC; Hatch	$480,000	24.7%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-017 Pilot Scale Recovery of Lithium from Geothermal Brines	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-017 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	13 out of 13 bidders	Materials Research LLC
EPC-19-018 Hell's Kitchen Geothermal Lithium Extraction Pilot	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-018 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	13 out of 13 bidders	Hell's Kitchen Geothermal LLC

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-017 Pilot Scale Recovery of Lithium from Geothermal Brines	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-19-018 Hell's Kitchen Geothermal Lithium Extraction Pilot	Group 2: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-017 Pilot Scale Recovery of Lithium from Geothermal Brines	This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by reducing the cost of energy production from geothermal resources. This agreement will also help spur a new industry of lithium production that will displace the current practices using mining or solar ponds. Both current methods have large footprints and result in degradation of land resources.	1c, 2a, 3g, 3h	Project team has begun building the pilot scale system.
EPC-19-018 Hell's Kitchen Geothermal Lithium Extraction Pilot	This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by paving the path to the establishment of a stable, secure, low-cost source of lithium needed to manufacture lithium-ion batteries. A supply of lithium-ion batteries is paramount to the state of California achieving its renewable energy goals as increased energy storage systems will be required to integrate intermittent generation sources like wind and solar. A supply of lithium-ion batteries will also be necessary to support the emerging electric vehicle (EV) industry. It is critical for manufacturers of EV batteries to have a reliable supply of affordable lithium.	2a, 3a, 3e, 3g	Several administrated tasks have been completed including the project kick-off meeting and TAC member commitment.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-019 Joint Time-Lapse Acquisition and Inversion of Passive Seismic and Magnetotelluric Data for Monitoring Reservoir Processes at the Geysers Geothermal Field	Applied Research and Development	This project will demonstrate the advantages of concurrently acquiring time-lapse magnetotelluric and passive seismic data over a producing geothermal reservoir. The data will be jointly inverted for images of resistivity and seismic velocities using workflows and algorithms that enforce structural similarity constraints between the different physical properties, and subsequently correlating the spatio-temporal information in the joint-inversion geophysical images to working reservoir models. The technical advancements of this project are provided via concurrent monitoring of time-lapse changes in both resistivity and seismic velocity and the joint inversion of the multi-physics data. Ultimately, these images can be used for better estimates of rock properties and spatial distribution of steam and water at depth, for more accurate reservoir modeling and monitoring which will lead to more accurate placement of production wells. A field demonstration at The Geysers will be carried out to evaluate the value added by applying this technology.	5/13/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-019 Joint Time-Lapse Acquisition and Inversion of Passive Seismic and Magnetotelluric Data for Monitoring Reservoir Processes at the Geysers Geothermal Field	Yes	Generation	$1,661,032	$1,661,032	$300,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-019 Joint Time-Lapse Acquisition and Inversion of Passive Seismic and Magnetotelluric Data for Monitoring Reservoir Processes at the Geysers Geothermal Field	$300,000	$705,287	$0	U.S. Geological Survey	$247,611	13.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-019 Joint Time-Lapse Acquisition and Inversion of Passive Seismic and Magnetotelluric Data for Monitoring Reservoir Processes at the Geysers Geothermal Field	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-019 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	13 out of 13 bidders	Lawrence Berkeley National Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-019 Joint Time-Lapse Acquisition and Inversion of Passive Seismic and Magnetotelluric Data for Monitoring Reservoir Processes at the Geysers Geothermal Field	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-019 Joint Time-Lapse Acquisition and Inversion of Passive Seismic and Magnetotelluric Data for Monitoring Reservoir Processes at the Geysers Geothermal Field	This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by assisting the continued growth of California's broad portfolio of renewable energy, including geothermal, as required to achieve the goals of SB 350. This project will demonstrate the advantages of concurrently acquiring time-lapse magnetotelluric and passive seismic data over a producing geothermal reservoir, jointly inverting these time-lapse data for images of resistivity and seismic velocities using workflows and algorithms that enforce structural similarity constraints between the different physical properties, and subsequently correlating the spatio-temporal information in the joint-inversion geophysical images to working reservoir models to update these models and to adjust injection and production rates.	1c, 2a, 3b	The project recently had its kickoff in August 2020 and the project team has begun work on the project.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-020 Salton Sea Geothermal Lithium Recovery Demonstration Project	Technology Demonstration and Deployment	BHER Minerals, LLC (BHERM) -- a wholly owned indirect subsidiary of BHE Renewables, LLC (BHER) -- will design, build, and demonstrate an integrated, 1/10-commercial-scale, geothermal brine pre-treatment and lithium recovery system at its existing geothermal power facilities in Calipatria, California, an area categorized as both a low-income and a disadvantaged community. The lithium recovery system will demonstrate on a pre-commercial scale the recovery of approximately 85% of the lithium in geothermal brine at a cost of less than $4,000 per metric ton. The demonstration plant will consist of brine pretreatment to remove heavy metals and onsite conversion of the initial lithium chloride solution into battery-grade lithium carbonate. Demonstrated technology could positively shift the economics of geothermal power production in California by enabling the low-cost production of a co-product with vast commercial value. The opportunity to share the cost of brine production with a lithium recovery business could open the doors to the development of new geothermal power plants, supporting achievement of the state's energy goals.	5/13/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-020 Salton Sea Geothermal Lithium Recovery Demonstration Project	Yes	Generation	$6,000,000	$6,000,000	$89,100	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-020 Salton Sea Geothermal Lithium Recovery Demonstration Project	$89,100	$0	$0	BHER Minerals, LLC; Momentum; ZAP Construction and Engineering; Aquamin	$4,025,000	40.1%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-020 Salton Sea Geothermal Lithium Recovery Demonstration Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-020 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	13 out of 13 bidders	BHER Minerals, LLC

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-020 Salton Sea Geothermal Lithium Recovery Demonstration Project	Group 3: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-020 Salton Sea Geothermal Lithium Recovery Demonstration Project	This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by demonstrating an advanced lithium recovery technology. The closed-loop demonstration system would become the world's most environmentally friendly lithium recovery plant and one of the most cost-effective. Thus, it could serve as the foundation for numerous new commercial-scale development projects seeking to take advantage of the ability to share the cost of brine management with geothermal power producers. This, in turn, could lead to the construction of a regional network of lithium recovery facilities that could produce as much as 300,000 metric tons per annum of battery-grade lithium carbonate equivalent, making the Imperial Valley the foremost lithium production center in the world.	2a, 3a, 3g	The project, which had its kickoff on August 12, 2020, completed some identified preliminary activities and is on schedule. This included: bench testing of system components and process simulation; electrical load study and foundation design; geotechnical assessment of the site; preliminary computational fluid dynamic modeling of the contractor design; and completion of preliminary facility layout, including piping and instrumentation diagrams.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-021 High Efficiency Magnetic Refrigeration for Industrial Cryogenic Applications	Applied Research and Development	The Recipient will develop a new magnetic refrigeration technology that will improve efficiency in the cryogenic temperature regime four times compared to the baseline compression-based technology. By replacing compression-based refrigeration with magnetic refrigeration technology both the operating and capital costs of cryogenic cooling can be reduced.	5/13/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-022 Stirling cycle heat pumps for industrial heat recovery	Applied Research and Development	The Recipient will develop a novel Stirling cycle with liquid piston technology that: alleviates temperature limits imposed by refrigerants experiencing phase change, improves heat transfer performance, and reduces construction complexity and cost.	5/13/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-021 High Efficiency Magnetic Refrigeration for Industrial Cryogenic Applications	Yes	Demand-side Management	$1,699,066	$1,699,066	$2,418	N/A
EPC-19-022 Stirling cycle heat pumps for industrial heat recovery	Yes	Demand-side Management	$656,630	$656,630	$21,171	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-021 High Efficiency Magnetic Refrigeration for Industrial Cryogenic Applications	$2,418	$0	$0	U.S. Department of Energy; General Engineering and Research, L.L.C.	$545,658	24.3%
EPC-19-022 Stirling cycle heat pumps for industrial heat recovery	$21,171	$0	$0	University of California Merced	$135,927	17.2%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-021 High Efficiency Magnetic Refrigeration for Industrial Cryogenic Applications	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-021 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	7 out of 8 bidders	General Engineering & Research, L.L.C.
EPC-19-022 Stirling cycle heat pumps for industrial heat recovery	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-022 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	7 out of 8 bidders	The Regents of the University of California, Merced

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-021 High Efficiency Magnetic Refrigeration for Industrial Cryogenic Applications	Group 3: Ranked # 2	N/A	N/A	Yes; Small Business, Calif Based Entity, Woman Own
EPC-19-022 Stirling cycle heat pumps for industrial heat recovery	Group 2: Ranked # 3	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-021 High Efficiency Magnetic Refrigeration for Industrial Cryogenic Applications	The technology is anticipated to enable high efficiency cryogenic magnetic refrigeration systems to replace energy intensive compression-based systems in California's industrial sector. The largest application for cryogenic refrigeration is in the high-tech manufacturing industry, which is also the largest and fasting growing industrial market segment in California. With a magnetic refrigeration system with 50% efficiency operating in the 10-80K region, the average daily electricity consumption for the standard cryogenic refrigeration units reduces from an estimated 406 kWh to 44 kWh. With successful deployment of these systems the annual energy savings by 2040 in California are estimated to be 2,500 GWh, with $270M of savings in electricity costs, and approximately 7 million metric tonnes of carbon dioxide emissions avoided.	1f, 3a	The project was approved by the CEC in May 2020 and the project was kicked off in June. Liquid nitrogen generator is back and running. Focus is currently on manufacturing the magnetocaloric powder for the first stage of refrigeration. The project is progressing according to the schedule.
EPC-19-022 Stirling cycle heat pumps for industrial heat recovery	This project could result in improvements to industrial heat pump efficiency based on the implementation of Stirling cycles and liquid piston technology. The use of industrial heat pumps for heat recovery will reduce energy usage for heating, resulting in the ratepayer benefits of reduced greenhouse gas emissions and reduced energy consumption.	1f, 1h	The project was approved in May 2020 and kicked off in June. Project efforts focus on system modeling to enhance the porous media description of the regenerator and piston models, evaluate their transient response, and couple these to the thermodynamic system models. The project is underway according to schedule.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-023 Booster Ejector Enhancement of Compressor Refrigeration Facilities Utilizing Industrial Process Waste Heat	Applied Research and Development	Gas Technology Institute has partnered with Wilson Engineering Technologies, Del Real Foods (one of the largest Mexican food processors in CA), and advanced chiller manufactures to develop and install a modular Booster Ejector Enhancement of Compressor Refrigeration Facilities (BEECR) system scalable to a wide range of industrial heat pumps. This project will develop and test a novel heat recovery system which is integrated with a booster ejector enhanced refrigeration system utilizing industrial process waste heat. The proposed solution recovers waste heat from the food processing plant and configures the existing chiller plant with an ejector. The project goal includes the design, manufacture, assemble, install, and testing of a pilot unit to achieve higher integrated performance and at least 10% energy savings over the conventional equipment as per the targeted metrics of the solicitation.	5/13/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-024 Development of an Advanced High Temperature Heat Pump for the Efficient Recovery of Low-Grade Industrial Waste Heat	Applied Research and Development	This project develops and tests an advanced high temperature heat pump (HTHP) for the efficient recovery of low-grade industrial waste heat. The prototype system can produce low pressure steam for use in the industrial facilities and employs a very low global warming potential (GWP) refrigerant and offers a very high coefficient of performance (COP) that is greater than 3.4.	5/13/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-023 Booster Ejector Enhancement of Compressor Refrigeration Facilites Utilizing Industrial Process Waste Heat	Yes	Demand-side Management	$1,621,556	$1,621,556	$33,751	N/A
EPC-19-024 Development of an Advanced High Temperature Heat Pump for the Efficient Recovery of Low-Grade Industrial Waste Heat	Yes	Demand-side Management	$1,999,483	$1,999,483	$0	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-023 Booster Ejector Enhancement of Compressor Refrigeration Facilites Utilizing Industrial Process Waste Heat	$33,751	$404,995	$0	Wilson Engineering Technologies; Del Real Foods	$173,707	9.7%
EPC-19-024 Development of an Advanced High Temperature Heat Pump for the Efficient Recovery of Low-Grade Industrial Waste Heat	$0	$458,916	$0	Electric Power Research Institute, Inc.	$405,848	16.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-023 Booster Ejector Enhancement of Compressor Refrigeration Facilites Utilizing Industrial Process Waste Heat	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-023 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	7 out of 8 bidders	Institute of Gas Technology dba Gas Technology Institute
EPC-19-024 Development of an Advanced High Temperature Heat Pump for the Efficient Recovery of Low-Grade Industrial Waste Heat	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-024 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	7 out of 8 bidders	Electric Power Research Institute, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-023 Booster Ejector Enhancement of Compressor Refrigeration Facilites Utilizing Industrial Process Waste Heat	Group 2: Ranked # 2	N/A	N/A	None
EPC-19-024 Development of an Advanced High Temperature Heat Pump for the Efficient Recovery of Low-Grade Industrial Waste Heat	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-023 Booster Ejector Enhancement of Compressor Refrigeration Facilites Utilizing Industrial Process Waste Heat	The food processing and beverage industries in California annually consume 570 million therms and nearly 6,200 million kilowatt hours as well as 36,000 million gallons of clean water. The novel BEECR technology has the potential to reduce electrical and natural gas consumption by recovering waste heat and integrating it with a booster ejector enhanced refrigeration system. This technology is estimated to reduce energy use by over 2% (92 million kWh with 30% adoption rate). This technology also has the potential reducing clean water demand from California's food processing industry by an estimated 440 million gallons per year.	1f, 3h, 4a	Project was approved in May 2020 and kicked off in July. The project is in progress.
EPC-19-024 Development of an Advanced High Temperature Heat Pump for the Efficient Recovery of Low-Grade Industrial Waste Heat	The recipient will develop an advanced high temperature heat pump system with the following characteristics: 1. The near-zero GWP refrigerant has characteristics to operate it in a sub-critical mode with an ability to exist in two-phases and can help to extract low grade waste heat to transform to high temperature useful steam. 2. The control system and heat pump design could deliver the temperature lift of more than 40 degrees centigrade (104 degrees Fahrenheit) with a 3.4 coefficient of performance (COP).	1f, 1h, 2a, 3a	This project kicked off in August 2020. The recipient is doing literature analysis on various newer refrigerants. The recipient has completed and submitted the initial Kick-off Benefits Questionnaire

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-025 Advanced Heat Exchanger Coatings to Improve Energy Efficiency of Industrial Refrigeration System	Applied Research and Development	Nelumbo, Inc. has developed surface modified coated evaporator coils to address the inefficiencies from frost formation and the need to defrost. To date there are no anti-ice coating products available for industrial heat exchangers. . The surface modification will utilize an innovative advanced coating comprised of a nano-structured ceramic to overcome these barriers by (1) reducing the onset of frost formation, (2) slowing the rate of frost growth, and (3) enhancing the removal of frost. The project's goal is to advance the Technology Readiness Level (TRL) of the innovative advanced coating technology from TRL 3 through TRL 5. During this process, the technology will be taken from proof of concept component to an extensively tested at the system level in a laboratory environment to develop the dataset necessary to verify performance prior to future field deployment projects.	5/13/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-025 Advanced Heat Exchanger Coatings to Improve Energy Efficiency of Industrial Refrigeration System	Yes	Demand-side Management	$1,997,411	$1,997,411	$133,183	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-025 Advanced Heat Exchanger Coatings to Improve Energy Efficiency of Industrial Refrigeration System	$133,183	$59,837	$0	Nelumbo Inc.	$925,500	31.7%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-025 Advanced Heat Exchanger Coatings to Improve Energy Efficiency of Industrial Refrigeration System	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-025 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	7 out of 8 bidders	Nelumbo Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-025 Advanced Heat Exchanger Coatings to Improve Energy Efficiency of Industrial Refrigeration System	Group 3: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-025 Advanced Heat Exchanger Coatings to Improve Energy Efficiency of Industrial Refrigeration System	To date there are no anti-ice heat exchanger technologies available for industrial refrigeration heat exchangers. Previous research into anti-ice coating technologies have relied on polymers and fluorinated-compounds which are brittle at low temperatures, are not durable under the thermal cycling, and/or not chemically stable to the cleaning requirements in the industrial refrigeration sector. The competitive advantage of Nelumbo's advanced coating over other attempted anti-ice coatings is that it is a durable ceramic that is chemically bonded to the surface. The ceramic utilizes both surface chemistry and nanostructuring to reduce the rate of ice formation and repel water. It is thin, conformal, durable, and strongly bonded to the surface which allows the coating to flex during the expansion and contraction which occurs during freeze and defrost cycles.	1f, 1h	This project was approved at the June 2020 CEC Business Meeting and the kick-off meeting was held in July 2020. Unfortunately, the COVID-19 shelter-in-place limited ability for the project team to work together but the team has completed the mini-coil test plan and will proceed to the actual testing of the mini coils.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-026 Developing Lessons Learned, Best Practices, Training Materials, and Guidebooks for Customer Side of the Meter Energy Storage	Market Facilitation	The project's goal is to develop a guidebook with concise, replicable permitting best practices for diverse types of BTM energy storage technologies that Authorities Having Jurisdiction (AHJ) and industry can use to develop standardized, streamlined permitting processes. The best practices will be developed using input gathered from key stakeholders such as permitting officials, energy storage developers, first responders, and codes and standards professionals. The best practices will also interface with the Solar Automated Permitting Process (SolarAPP), currently being developed by the National Renewable Energy Laboratory (NREL), to combine energy storage permitting best practices with solar PV permitting. The Guidebook and SolarAPP will advance California's energy storage permitting practices, help reduce costs and allow energy storage to provide utility bill reductions, and enhance resilience and safety considerations during Public Safety Power Shutoff (PSPS) events.	5/13/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-026 Developing Lessons Learned, Best Practices, Training Materials, and Guidebooks for Customer Side of the Meter Energy Storage	Yes	Distribution	$1,000,000	$1,000,000	$0	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-026 Developing Lessons Learned, Best Practices, Training Materials, and Guidebooks for Customer Side of the Meter Energy Storage	$0	$349,527	$0	National Renewable Energy Laboratory; Center for Sustainable Energy	$244,000	19.6%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-026 Developing Lessons Learned, Best Practices, Training Materials, and Guidebooks for Customer Side of the Meter Energy Storage	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-026 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	5 out of 5 bidders	Center for Sustainable Energy

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-026 Developing Lessons Learned, Best Practices, Training Materials, and Guidebooks for Customer Side of the Meter Energy Storage	Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-026 Developing Lessons Learned, Best Practices, Training Materials, and Guidebooks for Customer Side of the Meter Energy Storage	This project will result in a replicable, actionable set of guidelines that AHJs can implement and modify to meet local needs. This will be done via a standardized permitting review and approval process created for BTM energy storage systems. These guidelines will interface with the SolarAPP software platform. This will be provided to local governments as a free and simple online permitting tool to help provide instantaneous permitting and innovative inspection service. Stakeholders throughout the state will provide input for guidebook content and help disseminate best practices of energy storage permitting and the SolarAPP to ensure maximum adoption.	2a, 3e	The project held its kickoff meeting on November 13, 2020. The project is in the beginning stages of information gathering for relevant technology types and identification of stakeholders in preparation for the first public workshops to engage stakeholders.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-029 Improved Silica Removal for Enhanced Geothermal Plant Performance	Applied Research and Development	This project will develop and demonstrate a fundamentally new and innovative method for managing silica in geothermal operations. The new technology, Geothermal Micropillar Enabled Particle Separator (GMEPS) separates solid particles based on their size as they flow through a series of carefully positioned staggered/offset posts. The particles bouncing off the ordered array of posts are systematically moved to one side of the separator. As a result, the bulk of the flow is cleared of particles and a concentrated slurry containing the particles is separated from the stream. There is no need for addition of corrosion inhibitors or flocculants, and the separation system does not require cycling or the allowance for large settling volumes. Instead, the separation is accomplished dynamically under a wide range of flow conditions. Larger particles separate faster than smaller particles, enabling size separation and purification for value added products. Novel designs and manufacturing methods allow these GMEPS separators to be made cost effectively, at industrial scale, and in a form-factor that allows deployment within existing geothermal piping.	6/10/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-030 Large Capacity CO2 Central Heat Pump Water Heating Technology Evaluation and Demonstration	Technology Demonstration and Deployment	This project tests and demonstrates the field performance of a low-GWP variable capacity central heat pump water heating system in five multifamily building applications, each with a different design approach and configuration. The technology is highly configurable and has grid integrated controls capable of responding to time-of-use rates and enabling load shifting. The project provides field data to validate Title 24 Part 6 energy code compliance modeling assumptions and algorithms; and seeks to accelerate the market for low-GWP central heat pump water heaters by documenting best-class design and installation practices. The demonstrations are installed in and benefit low-income and disadvantaged communities.	6/10/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-029 Improved Silica Removal for Enhanced Geothermal Plant Performance	Yes	Generation	$2,999,599	$2,999,599	$355,003	N/A
EPC-19-030 Large Capacity CO2 Central Heat Pump Water Heating Technology Evaluation and Demonstration	Yes	Demand-side Management	$2,800,193	$2,800,193	$112,045	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-029 Improved Silica Removal for Enhanced Geothermal Plant Performance	$355,003	$326,428	$0	Hell's Kitchen Geothermal LLC	$45,000	1.5%
EPC-19-030 Large Capacity CO2 Central Heat Pump Water Heating Technology Evaluation and Demonstration	$112,045	$422,709	$1,227,128	Electric Power Research Institute, Inc.; New Buildings Institute, Inc.; Mitsubishi; Brightpower	$1,227,128	30.5%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-029 Improved Silica Removal for Enhanced Geothermal Plant Performance	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-029 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	13 out of 13 bidders	Hell's Kitchen Geothermal LLC
EPC-19-030 Large Capacity CO2 Central Heat Pump Water Heating Technology Evaluation and Demonstration	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-030 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	17 out of 17 bidders	Association for Energy Affordability

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-029 Improved Silica Removal for Enhanced Geothermal Plant Performance	Group 1: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-19-030 Large Capacity CO2 Central Heat Pump Water Heating Technology Evaluation and Demonstration	Group 2B: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-029 Improved Silica Removal for Enhanced Geothermal Plant Performance	This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by improving the cost and flexibility of geothermal power through significantly advancing silica management technology in geothermal operations. This will enable flexible operations by providing an effective silica removal system across a dynamic and wide flow regime, provide a pathway to producing value-added products from the silica and other minerals removed from the brine, and reduce the capital and operating cost requirements of geothermal plants.	1c, 2a, 3a, 3b, 3g	Several administrated tasks have been completed including the project kick-off meeting and TAC member commitment.
EPC-19-030 Large Capacity CO2 Central Heat Pump Water Heating Technology Evaluation and Demonstration	Electrification of water heating has the potential to reduce greenhouse gas emissions and provides an opportunity for grid harmonization through thermal load shifting. This project seeks to accelerate adoption of an emerging low-GWP central heat pump water heating technology to address the needs of a large percentage of California multifamily buildings. Field tests will validate system performance, and streamlined design approaches and installation practices will be developed and disseminated to increase industry adoption and proper application of this technology.	2a, 4a	The research team is conducting site visits to collect data on existing conditions and begin system design on the first of five project sites. The project team continues engaging with property owners for the remaining demonstration sites.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-031 Solid-state Long Duration Energy Storage for Industrial Applications	Applied Research and Development	The project involves development, testing, and pilot-scale demonstration of an energy storage system based on thermophotovoltaic (TPV) technology. The technology includes using electricity to heat graphite blocks, and then reconverting the heat to electricity at a later time. After development and testing of the approach in a laboratory setting, the recipient will build a pilot-scale TPV system at an existing cogeneration power plant site east of the City of San Joaquin in Fresno County. The system will be connected with existing cogeneration, solar power, and agricultural by-products processing.	6/10/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-032 Low-GWP Mechanical Modules for Rapid Deployment Project (LG-MM)	Applied Research and Development	The project develops a pre-fabricated central mechanical system module for retrofit applications. The mechanical module will include heating, ventilation and air conditioning (HVAC), domestic hot water, and real time energy use monitoring, control and feedback for multifamily buildings. The compact, lightweight, package will be designed to be mass produced offsite and installed quickly. All demonstration sites will be located in disadvantaged communities. This agreement continues on research initiated in the EPC 17-040 grant, which identified a market gap for packaged mechanical systems in CA. The SystemAir operates on R410 regfrigerant, and the prototypes will be designed to change out the refrigerant to R32. The team will also replace the SystemAir 40 gallon DHW storage tank with 7 kWh of phase change material thermal energy storage which is expected to provide an equivalent volume of domestic hot water, but will occupy substantially less space than the existing tank.	6/10/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-031 Solid-state Long Duration Energy Storage for Industrial Applications	Yes	Distribution	$1,999,787	$1,999,787	$0	N/A
EPC-19-032 Low-GWP Mechanical Modules for Rapid Deployment Project (LG-MM)	Yes	Transmission	$1,499,926	$1,499,926	$115,590	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-031 Solid-state Long Duration Energy Storage for Industrial Applications	$0	$99,176	$0	Antora Energy, Inc.	$2,071,313	50.9%
EPC-19-032 Low-GWP Mechanical Modules for Rapid Deployment Project (LG-MM)	$115,590	$104,657	$0	Association for Energy Affordability; Mitsubishi; sanden	$58,520	3.8%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-031 Solid-state Long Duration Energy Storage for Industrial Applications	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-031 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	37 out of 37 bidders	Antora Energy, Inc.
EPC-19-032 Low-GWP Mechanical Modules for Rapid Deployment Project (LG-MM)	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-032 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	17 out of 17 bidders	Association for Energy Affordability

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-031 Solid-state Long Duration Energy Storage for Industrial Applications	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-19-032 Low-GWP Mechanical Modules for Rapid Deployment Project (LG-MM)	Group 2A: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-031 Solid-state Long Duration Energy Storage for Industrial Applications	Energy storage has been identified as an enabler to increase renewable penetration. Lithium Ion batteries with storage duration of up to four hours are widely accepted and dominate recent new energy storage procurement and deployment in California. However; long duration, multi-hour to multi-day energy storage will be required to meet California's future energy goals. This project will test and validate a new long duration energy storage technology that, once commercialized, has the potential to achieve an order of magnitude lower costs compared to Lithium Ion batteries.	1f, 4a, 4b, 5a, 5b	The project is anticipated to start in early 2021.
EPC-19-032 Low-GWP Mechanical Modules for Rapid Deployment Project (LG-MM)	The project develops low GWP mechanical module prototypes, optimized for the most common multifamily building types in California. The system will show at a proof-of-concept level that these combined systems are well suited for the California market. This will serve as an example to American manufacturers, potential fabricators, and technology startups for the retrofit industry.	1f, 1h	The Team finalized the design modification for the prototypes based on existing SystemAir product as a basis of design. Team has scheduled monthly partnership meeting with SystemAir to gain feedback regarding modifications needed. They are also developing (proactively) the future permitting data for future site demonstrations next year.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-033 Demonstrating Benefits of Highly Insulating Thin-Triple Window Retrofits in California	Technology Demonstration and Deployment	This project aims to deploy and demonstrate a new thin triple-pane window system in two multi-family residences and 30 single-family homes, to demonstrate its much higher insulation properties compared to single- and double-pane windows. The thinness of the glass allows the system to function as well as traditional triple-pane windows, and by saving on weight and costs, the system becomes competitive with other energy saving envelope retrofits. The project quantifies the field performance of the window by measuring energy savings and verifies the build quality and long-term performance benefits of the triple-pane windows through accelerated aging techniques. Finally, the project team will assess window manufacturing markets and determine the current and future market potential for high performance thin-glass triple-pane windows. They will identify market barriers, opportunities, and long-term market cost of these technologies through engagement with leading window manufacturers, home builders, and retrofitters, and with market pull partners such as building codes, utility rebate/incentive programs, and ENERGY STAR. Stakeholder surveys will be given.	6/10/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-034 Commercialization of Lowest-Cost, Long Duration Energy Storage Systems	Applied Research and Development	This project will demonstration an e-Zn long-duration energy storage system, and test and validate the e-Zn technology at the commercial scale. e-Zn's technology is material based, as adding more hours of runtime does not require an additional device (or battery), but only additional zinc, potassium hydroxide (the electrolyte), and plastic (for containment), at a material cost of approximately $20/kWh. This makes e-Zn's technology exceptionally well suited for long-duration energy storage applications, particularly greater than 24 hours duration (at rated power), and at a power node size of 1 kW to 10 MW.	6/10/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-033 Demonstrating Benefits of Highly Insulating Thin-Triple Window Retrofits in California	Yes	Demand-side Management	$1,850,000	$1,850,000	$867,608	N/A
EPC-19-034 Commercialization of Lowest-Cost, Long Duration Energy Storage Systems	Yes	Demand-side Management	$1,286,777	$1,286,777	$0	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-033 Demonstrating Benefits of Highly Insulating Thin-Triple Window Retrofits in California	$867,608	$465,885	$0	United States Department of Energy; Cornerstone Building Brands/ Ply Gem	$630,000	25.4%
EPC-19-034 Commercialization of Lowest-Cost, Long Duration Energy Storage Systems	$0	$0	$0	e-Zn Inc.	$411,010	24.2%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-033 Demonstrating Benefits of Highly Insulating Thin-Triple Window Retrofits in California	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-033 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	9 out of 9 bidders	Lawrence Berkeley National Laboratory
EPC-19-034 Commercialization of Lowest-Cost, Long Duration Energy Storage Systems	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-034 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	37 out of 37 bidders	e-Zn Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-033 Demonstrating Benefits of Highly Insulating Thin-Triple Window Retrofits in California	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-19-034 Commercialization of Lowest-Cost, Long Duration Energy Storage Systems	Group 1: Ranked # 4	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-033 Demonstrating Benefits of Highly Insulating Thin-Triple Window Retrofits in California	This project demonstrates the ability of builders and remodelers to deliver high-performance window solutions at incremental costs competitive with other building envelope solutions, facilitating their use as a cost-competitive solution to reduce energy use in California homes. The thin-glass triple-pane configuration utilized for this demonstration project delivers the same thermal performance benefits to homeowners as traditional triple-pane windows without requiring the window manufacturer to redesign the framing system, thus reducing cost and risk to the manufacturers while delivering a lower overall	1f, 1h, 2a, 3b, 4a, 5d	The agreement was executed in August 2020 and recipient submitted their draft list of TAC members in September 2020 . The TAC includes window manufacturers, single-family and multifamily expert architects , and energy efficiency consultants such as Cardinal, Quanex Building Products Corporation, PDS IG Equipment, Northwest Energy Efficiency Alliance (NEEA), and Consortium for Energy efficacy. The TAC also includes staff from the US Environmental Protection Agency's Energy Star Homes Program and CEC's Existing Building Office and Equity Team. To support disadvantaged and low-income community activities, the TAC also has two DAC community-based organizations (CBO), Built It Green and Actera. Project team is still in the process of identifying 30 single family home demonstration sites located in disadvantaged communities. Recipient will identify local community based organizations to add to the TAC, This will ensure project receives community feedback.
EPC-19-034 Commercialization of Lowest-Cost, Long Duration Energy Storage Systems	e-Zinc's technology is a paradigm shift in energy storage. By storing electrical energy within zinc metal, the system can store hundreds of hours of energy capacity while being significantly cheaper than battery technologies. This has the potential to dramatically improve the value proposition of intermittent, renewable electricity sources such as wind and solar. e-Zinc's system uses water based electrolyte which is non-flammable and has no risk of thermal runaway or igniting in a fire. e-Zinc's storage system retains 100% of its usable capacity throughout its lifetime. e-Zinc's technology decouples power from energy, allowing low-cost scaling of energy capacity.	1e, 1h, 5a	The kick-off meeting was held on August 19, 2020. Product development and testing of e-Zinc's latest iteration of cells continues. The current focus is on building cells for e-Zinc's first in-field deployment, which will precede this CEC project and be installed in Ontario, Canada in early 2021. e-Zinc is currently renovating a new production facility, and will be moving into this new facility in early 2021. e-Zinc's business development team continues to explore and validate the use case for e-Zinc's technology in the California market, specifically for backup power with daily cycling (focused on commercial and industrial customers).

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-035 Advancing Energy Efficiency in Manufactured Homes Through High Performance Envelope	Applied Research and Development	The project integrates several advances in manufactured home design and construction that taken together will provide a model for how the industry can cost-effectively achieve the state's energy and fire safety goals. To achieve these goals, the project consists of two parallel and overlapping design-development tracks: innovative envelope (wall and roof) systems and comprehensive solutions for meeting requirements of Title 24. In crafting solutions, the team focuses on advancing envelope innovations that hold the promise of improving thermal performance without adding cost. Outreach will be held to the industry through the manufacturing subcontractors, as well as the manufacturing partners on the TAC.	6/10/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-036 Varieties of Prefabricated Envelope Solutions for CA Low-Rise Buildings	Applied Research and Development	The project aims to develop and demonstrate an industrialized approach to deep carbon emission reducing retrofits, and enable the scaling of the industry to the point where mass deployment of Zero Net Carbon retrofits can occur in California. The project is centered around the utilization of two primary technologies which do not currently exist in the US market:1) pre-fabricated, unitized, high-performance retrofit envelope panels, and 2) compact, packaged, modularized, grid interactive, multi-function mechanical systems that provide heating, cooling, ventilation, and domestic hot water. The Netherland's Energiesprong model also takes a more industrialized approach to combining and installing these two systems by creating standardized retrofit packages that can be rapidly deployed on ubiquitous building typologies across California.	6/10/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-035 Advancing Energy Efficiency in Manufactured Homes Through High Performance Envelope	Yes	Demand-side Management	$1,999,982	$1,999,982	$0	N/A
EPC-19-036 Varieties of Prefabricated Envelope Solutions for CA Low-Rise Buildings	Yes	Grid Operations/Market Design	$1,917,967	$1,917,967	$44,659	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-035 Advancing Energy Efficiency in Manufactured Homes Through High Performance Envelope	$0	$457,245	$0	Electric Power Research Institute, Inc.; Systems Building Research Alliance; Clayton Homes; Cavco Industries, Inc.; Champion Home Builders, Inc.	$402,998	16.8%
EPC-19-036 Varieties of Prefabricated Envelope Solutions for CA Low-Rise Buildings	$44,659	$269,494	$0	Association for Energy Affordability; Rocky Mountain Institute; Signetron, Inc.; RDH Building Science Inc.	$170,624	8.2%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-035 Advancing Energy Efficiency in Manufactured Homes Through High Performance Envelope	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-035 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	9 out of 9 bidders	Electric Power Research Institute, Inc.
EPC-19-036 Varieties of Prefabricated Envelope Solutions for CA Low-Rise Buildings	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-036 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	9 out of 9 bidders	Rocky Mountain Institute

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-035 Advancing Energy Efficiency in Manufactured Homes Through High Performance Envelope	Group 3: Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-19-036 Varieties of Prefabricated Envelope Solutions for CA Low-Rise Buildings	Group 2: Ranked # 1	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-035 Advancing Energy Efficiency in Manufactured Homes Through High Performance Envelope	Advancing the energy efficiency from national HUD standards to CA Title 24 standards while keeping both first costs and utility bills low will create efficient and healthy manufactured homes that could substantially transform the need for housing in the state and help address the affordability crisis. When adding in the costs of health impacts, resulting from better indoor air quality by eliminating combustion, it provides even greater benefits to the society and its occupants as a whole. These innovations will improve competitiveness of manufactured homes against standard single family homes, and provide ratepayers with an attractive option for housing that will simultaneously reduce energy bills.	1e, 1f, 1h, 3a, 3b, 3h, 4a	Project is underway. The kickoff meeting was held on July 24, 2020. The project team is looking toward technologies available for multiple expected situations of amperage availability. They have begun drafting a list of potential technologies for evaluation. A TAC has been proposed which includes four additional manufacturers to help with tech transfer.
EPC-19-036 Varieties of Prefabricated Envelope Solutions for CA Low-Rise Buildings	This project designs and develops exterior envelop panels to allow the existing building to remain largely intact and retrofit work is mainly performed outside, which makes the process less disruptive and less sensitive to the building's existing conditions and tenants. Prefabricated exterior retrofit panels improves quality assurance, reduces renovation time and costs, and significantly reduces thermal loads thereby reducing HVAC energy use and allowing for full electrification of buildings without disrupting utility bill affordability. By increasing the rate of low-load, all-electric retrofits as a turnkey technology, these facade panels can enable California to transition its building stock to running on carbon neutral electricity.	1h, 4a	The team is developing two prefabricated exterior retrofit panel prototypes with Dryvit/Tremco to install on two low-rise multifamily buildings. Prototype designs are being drafted. The team is collecting information about the demonstration sites in via 3D scanning, structural assessments, and an on-site walk throughs.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-037 Demand Based Renewable Hydrogen Power-to-Power Project	Applied Research and Development	This project will field test a containerized hydrogen energy storage system integrated with renewable wind generation and a microgrid at a water district customer site. The project will validate the hydrogen system's ability to provide customer energy cost savings by improving the use of renewable generation and providing resiliency to the water district during Public Safety Power Shutoff events. The data obtained on capital cost, operating cost, performance and lessons learned will support commercial deployment.	6/10/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-038 Low-Cost and Easy-to-Integrate Second-Life Battery HUB	Applied Research and Development	Smartville Inc., the University of California San Diego (UCSD), and the Electric Power Research Institute (EPRI), in collaboration with ARPA-E research partners Utah State and Colorado State, are characterizing the degradation of repurposed Tesla Model S and Nissan Leaf battery modules and validating the ability of these resources to provide building resiliency and load shifting services (paired with solar PV) at a small/medium sized commercial building with critical 24/7 power needs. Additionally, Smartville is deploying a pilot system that demonstrates Smartville's innovative Heterogenous Unifying Battery (HUB) energy storage system. Finally, Smartville is demonstrating how such a system can simultaneously condition used batteries to ensure safety and reliability while extending battery life.	6/10/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-037 Demand Based Renewable Hydrogen Power-to-Power Project	Yes	Demand-side Management	$1,275,475	$1,275,475	$0	N/A
EPC-19-038 Low-Cost and Easy-to-Integrate Second-Life Battery HUB	Yes	Generation	$2,035,787	$2,035,787	$105,388	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-037 Demand Based Renewable Hydrogen Power-to-Power Project	$0	$70,935	$0	Advanced Carbon Technologies, LLC	$275,000	17.7%
EPC-19-038 Low-Cost and Easy-to-Integrate Second-Life Battery HUB	$105,388	$79,875	$845,176	Electric Power Research Institute, Inc.; The Regents of the University of California, San Diego; Smartville, Inc.; Big Battery	$955,256	31.9%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-037 Demand Based Renewable Hydrogen Power-to-Power Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-037 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	37 out of 37 bidders	DasH2energy LLC
EPC-19-038 Low-Cost and Easy-to-Integrate Second-Life Battery HUB	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-038 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	10 out of 11 bidders	Smartville, Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-037 Demand Based Renewable Hydrogen Power-to-Power Project	Group 2: Ranked # 1	N/A	N/A	Yes; Calif Based Entity, Minority Owned
EPC-19-038 Low-Cost and Easy-to-Integrate Second-Life Battery HUB	Ranked # 2	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-037 Demand Based Renewable Hydrogen Power-to-Power Project	The project will validate the hydrogen system's ability to: provide customer energy cost savings and price stability; resiliency during Public Safety Power Shutoff events, load follow; provide baseload renewables; and, provide long duration storage of large amounts of power. The data obtained on capital cost, operating cost, performance and lessons learned will support commercial deployment. This project will provide benefits for the Water District, utility grid, and IOU ratepayers.	1i, 5a	The project was initiated late in 2020. Preliminary work is focused on gathering site energy load profiles, onsite wind power generation profiles, utility tariff data, and energy costs. The data gathered will establish project baselines and inform system design.
EPC-19-038 Low-Cost and Easy-to-Integrate Second-Life Battery HUB	Smartville Inc., teaming with UCSD and EPRI, will develop and demonstrate a low-cost, easy-to integrate second-life HUB energy storage system. The primary innovations include the ability of the HUB system to accommodate multiple battery types (e.g. Tesla and Nissan), and the allowance of hot swapping modules to reduce downtime. The HUB system will use a unique distributed battery estimation and "life balancing" energy management system to achieve superior performance in extending battery cycle life. Last, Smartville's approach to testing second-life batteries should eliminate high labor costs and reduces "shelved time" by utilizing independent power control and model-based estimation to automatically learn battery health information.	1b, 1c, 1e, 1f, 1h, 1i, 2a, 3a, 3b, 3e, 3f, 3h, 4a, 4b, 4c, 4d, 4e, 5b, 5d	This project held its kickoff meeting on September 9, 2020. The team has purchased Nissan Leaf and Tesla battery packs and has begun electrical work at the testing lab. The team has also started to coordinate with the demonstration site manager to obtain updated facility data. Smartville has also been working on sourcing materials for the project.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-039 Reuse of Electric Vehicle Batteries for Solar Energy Storage	Applied Research and Development	RePurpose Energy is conducting a series of laboratory-based cycling tests to identify the degradation rate and effective useful life of individual used EV battery cells based on a variety of control strategies. The team is creating a scale model of a second life EV storage system connected to a grid emulator to validate the optimal control strategy for a solar PV and energy storage system. Finally, the team is taking the learnings from the laboratory testing and deploying a full-scale demonstration installation to collect data on actual system performance. The demonstration site showcases resiliency and cost benefits to the identified business and local economy.	6/10/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-040 California Zinc-ion Energy Storage Development and Validation Project	Applied Research and Development	The project will develop, field test, and validate a zinc-ion battery prototype for applications on the customer side of the meter. The recipient has developed a non-lithium-ion battery for residential applications that is less expensive, safer, and longer lasting than lithium-ion batteries. Using the current cell design, the recipient will produce a larger format cell design. The recipient will design, assemble and integrate the zinc-ion cells into a residential energy storage system, which will be tested by a third party. The integrated pilot-scale system will then be validated in a relevant environment. The validation environment will simulate residential applications to fully test and validate a complete zinc-ion battery storage system.	6/10/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-039 Reuse of Electric Vehicle Batteries for Solar Energy Storage	Yes	Demand-side Management	$3,000,000	$3,000,000	$0	N/A
EPC-19-040 California Zinc-ion Energy Storage Development and Validation Project	Yes	Demand-side Management	$1,583,125	$1,583,125	$0	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-039 Reuse of Electric Vehicle Batteries for Solar Energy Storage	$0	$210,998	$0	Electric Power Research Institute, Inc.; Gridscape Solutions, Inc.; RePurpose Energy, Inc.; Chroma	$1,042,541	25.8%
EPC-19-040 California Zinc-ion Energy Storage Development and Validation Project	$0	$64,904	$0	Salient Energy Inc.	$1,370,402	46.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-039 Reuse of Electric Vehicle Batteries for Solar Energy Storage	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-039 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	10 out of 11 bidders	RePurpose Energy, Inc.
EPC-19-040 California Zinc-ion Energy Storage Development and Validation Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-040 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	37 out of 37 bidders	Salient Energy Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-039 Reuse of Electric Vehicle Batteries for Solar Energy Storage	Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-19-040 California Zinc-ion Energy Storage Development and Validation Project	Group 1: Ranked # 3	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-039 Reuse of Electric Vehicle Batteries for Solar Energy Storage	The continued adoption of electric vehicles will generate waves of lithium-ion battery waste, which is difficult and expensive to recycle. This project will facilitate diversion of battery waste and deferment of recycling costs by giving EV batteries a second life. One of the main barriers to second-life energy storage systems is the need for extensive cell testing and characterization. This traditionally requires a great deal of testing time and expense, resulting in erosion of the cost advantage of the used batteries. This project will result in a methodology to quickly and accurately estimate the remaining useful cycle life of a retired EV battery cell in a stationary energy storage system. This project will demonstrate a second-life energy storage system consisting of full EV battery packs without disassembly to reduce the time and cost of repurposing EV batteries.	1d, 1e, 1g, 1h, 1i, 2a, 3b, 3g, 3h, 4a, 5a	This agreement was formally executed on October 15, 2020, and held its kick-off meeting on November 3, 2020.
EPC-19-040 California Zinc-ion Energy Storage Development and Validation Project	The recipient has developed and designed a unique, rechargeable zinc-ion battery built entirely of non-toxic components. A core innovation is the development of a special class of materials used at the positive electrode that can reversibly move Zn2+ into their crystal structure. The recipient has also developed unique designs/formulations for the negative electrode, electrolyte, and separator that allow the battery to be recharged thousands of times before it needs to be recycled. Developing a battery based on Zn2+ inclusion is a technological advancement that helps improve energy density, daily cycle capability, longevity, safety and, ultimately, reduce costs and further technology adoption, as compared to lithium-ion technology.	1b, 1c, 1e, 1h, 1i, 2a, 3a, 3b, 3c, 3e, 3f, 3g, 3h, 4a, 4b, 4e, 5b	This project had their kick-off meeting in November 2020 and is now working on system design.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-041 Demonstrating an Aqueous Air-Breathing Energy Storage System for Multi-Day Resiliency	Applied Research and Development	This project will be the first fielded and independently verified prototype-scale demonstration of a new form of low-cost, long-duration thermal energy storage that has the potential to be over 100-times cheaper per kWh than lithium-ion energy storage and provide multiple days-to-weeks of continuous zero-carbon backup power in customer and grid applications. The prototype will use breakthrough battery materials sourced from super-abundant, ultra-low-cost, globally scalable materials from existing supply chains.	6/10/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-042 Anzode: Zinc Batteries for California Electrical Customer Power Backup	Applied Research and Development	The purpose of this Agreement is to fund prototyping efforts of a novel rechargeable alkaline battery technology enabling reliable, and safe energy storage solutions for different applications, including storage for renewable energy generation, long-term backup power, and micro-grid applications. This technology will bring long-life rechargeability to the alkaline battery chemistry, and is environmentally benign, low-cost, and safe. The battery is built using water-based, non-flammable electrolytes and non-toxic earth-abundant electrode materials such as zinc (Zn) and manganese dioxide (MnO2). All materials are highly energy dense and low cost.	6/10/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-041 Demonstrating an Aqueous Air-Breathing Energy Storage System for Multi-Day Resiliency	Yes	Distribution	$1,998,215	$1,998,215	$0	N/A
EPC-19-042 Anzode: Zinc Batteries for California Electrical Customer Power Backup	Yes	Distribution	$1,747,721	$1,747,721	$31,931	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-041 Demonstrating an Aqueous Air-Breathing Energy Storage System for Multi-Day Resiliency	$0	$0	$0	Electric Power Research Institute, Inc.; The Regents of the University of California, Irvine; Form Energy, Inc.; MGA Research	$1,603,079	44.5%
EPC-19-042 Anzode: Zinc Batteries for California Electrical Customer Power Backup	$31,931	$0	$0	To Be Determined; TBD- Analytics Contractor; TBD - Market Analysis; To Be Determined #2; Anzode Inc.; The University of Newcastle; Lithiumion Expert Services LLC	$621,870	26.2%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-041 Demonstrating an Aqueous Air-Breathing Energy Storage System for Multi-Day Resiliency	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-041 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	37 out of 37 bidders	Form Energy, Inc.
EPC-19-042 Anzode: Zinc Batteries for California Electrical Customer Power Backup	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-042 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	37 out of 37 bidders	Anzode Inc.

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-041 Demonstrating an Aqueous Air-Breathing Energy Storage System for Multi-Day Resiliency	Group 1: Ranked # 2	N/A	N/A	None
EPC-19-042 Anzode: Zinc Batteries for California Electrical Customer Power Backup	Group 1: Ranked # 5	N/A	N/A	None

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-041 Demonstrating an Aqueous Air-Breathing Energy Storage System for Multi-Day Resiliency	This project will help accelerate the knowledge and understanding of long duration energy storage technologies that can operate for 100 hours or more. Additionally, this project will help understand how longer duration energy storage technologies can support rising grid resiliency challenges. If these long duration technologies can perform as they project, energy storage can also be used to replace natural gas power powerplants in the future. This effort will also provide performance information that help validate if very low-cost energy storage can actually be developed, fielded and demonstrated.	1b, 1c, 1f, 3h, 4a, 4b, 5a, 5f	This project had its kick-off meeting in September 2020. As part of their technology development, the project team also completed their Codes and Standards evaluation to assess how they might affect long-duration storage deployment. This included a comprehensive review of relevant safety codes for similar battery technologies, cross-referenced with an internal Failure Mode and Effects Analysis (FMEA) which ranks expected failure modes by priority. This will lead to future work supporting appropriate safety testing procedures that will be both written and executed for Sub-Scale Cells and Full-Scale Cells (FSCs). The results will be evaluated to improve safe design of FSCs.
EPC-19-042 Anzode: Zinc Batteries for California Electrical Customer Power Backup	Anzode's battery is built using water-based, non-flammable electrolytes and non-toxic earth-abundant electrode materials such as zinc (Zn) and manganese dioxide (MnO2). All materials are energy dense and low cost. While primary alkaline zinc-manganese dioxide batteries are common, it is difficult to make them rechargeable, for reasons including Zn dendrite growth. Anzode's novel approach stabilizes the anode in alkaline electrolyte by applying protective substances. As of early 2020, Zn anodes with Anzode's technology remained stable for 400 to 600 cycles, while comparison anodes lasted fewer than 50 cycles.	1b, 1d, 1h, 5a, 5b, 5d, 5e, 5f	The kick-off meeting was held on September 4, 2020, and the project is progressing well. All planned tasks are on schedule. Technical advisers and subcontractors have been updated on the project goals and schedule. A detailed testing plan has been developed, and is currently being executed without delays. Some major analytical equipment has been purchased, commissioned, and is now fully operational and supporting further development of the technology. Scaled-up electrode fabrication for multi-layer battery cell designs has also been initiated and will continue through the end of 2020.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-043 Advanced Energy-efficient and Fire-resistive Envelope Systems Utilizing Vacuum Insulation for Manufactured Homes	Applied Research and Development	The project focuses on using vacuum insulation panel (VIP) based pre-fabricated envelope systems that can achieve R26-29 and R49 for walls and roofs, respectively.	6/10/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-044 Ultra-high Efficiency, Lower-Cost, Green Electrolytic H2 for Microgrids in California	Applied Research and Development	Conventional electrolysis produces hydrogen from purified water and electricity. The hydrogen technology in this project can generate hydrogen in a conventional electrolysis configuration. The technology can also be configured in an Advanced Electrolyzer System (AES) configuration to recover dilute hydrogen from waste streams such as gasified biomass. Depending on the input waste stream, the AES may be configured to produce water as a byproduct (rather than requiring purified water as an input). This project will test and validate a laboratory scale baseline system and one with an AES to assess performance. This project will develop conceptual system designs for a commercial scale AES system. The data obtained on cost, performance and lessons learned will support commercial deployment. This project will develop an advanced energy storage technology with the potential to deliver benefits for the utility grid, and IOU ratepayers and support achieving California's energy goals.	6/10/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-043 Advanced Energy-efficient and Fire-resistive Envelope Systems Utilizing Vacuum Insulation for Manufactured Homes	Yes	Grid Operations/Market Design	$2,000,000	$2,000,000	$0	N/A
EPC-19-044 Ultra-high Efficiency, Lower-Cost, Green Electrolytic H2 for Microgrids in California	Yes	Demand-side Management	$995,250	$995,250	$134,957	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-043 Advanced Energy-efficient and Fire-resistive Envelope Systems Utilizing Vacuum Insulation for Manufactured Homes	$0	$658,603	$334,586	Utilization Technology Development; Southern California Gas Company; Gas Technology Institute ; Dvele, Inc.; Microtherm; Huber	$801,557	28.6%
EPC-19-044 Ultra-high Efficiency, Lower-Cost, Green Electrolytic H2 for Microgrids in California	$134,957	$117,500	$0	T2M Global LLC ; SAFCell, Inc.	$210,000	17.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-043 Advanced Energy-efficient and Fire-resistive Envelope Systems Utilizing Vacuum Insulation for Manufactured Homes	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-043 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	9 out of 9 bidders	Institute of Gas Technology dba Gas Technology Institute
EPC-19-044 Ultra-high Efficiency, Lower-Cost, Green Electrolytic H2 for Microgrids in California	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-044 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	37 out of 37 bidders	T2M Global LLC

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-043 Advanced Energy-efficient and Fire-resistive Envelope Systems Utilizing Vacuum Insulation for Manufactured Homes	Group 3: Ranked # 2	N/A	N/A	None
EPC-19-044 Ultra-high Efficiency, Lower-Cost, Green Electrolytic H2 for Microgrids in California	Group 2: Ranked # 2	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-043 Advanced Energy-efficient and Fire-resistive Envelope Systems Utilizing Vacuum Insulation for Manufactured Homes	The project uses vacuum insulation panel (VIP) based pre-fabricated envelope systems that can achieve R26-29 and R49 for walls and roofs, respectively. This type of envelope system with very high insulating values are not currently used in modular construction.	1e	The project was approved at the June 2020 business meeting.
EPC-19-044 Ultra-high Efficiency, Lower-Cost, Green Electrolytic H2 for Microgrids in California	This project will test and validate a laboratory scale AES. The AES hydrogen energy storage technology has the potential to integrate renewable electrical generation and capture value from waste streams such as gasified biomass, enabling the storage of large amounts of energy for providing long duration energy services to the grid.	1h	The project started later in 2020. The project team has configured the laboratory testing facility and begun preliminary technology performance evaluations under a range of operating conditions.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-045 Critical Resilience for Fire and Emergency Facilities with the Soboba Band of Luiseño	Technology Demonstration and Deployment	This project will demonstrate a vanadium redox flow battery combined with solar PV at the Tribal community fire station to provide at least 10 hours of energy storage. The project will validate the system's performance as an integrated hardware and software solution that can provide: long duration energy storage, load shifting, peak shaving, and resiliency during utility power outages. The data obtained on capital cost, operating cost, performance and lessons learned will support commercial deployment.	7/8/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-046 Demonstrating a Long-duration Flywheel Energy Storage System	Technology Demonstration and Deployment	The Recipient will install a practical and low-cost kinetic energy flywheel energy storage system and a solar photovoltaic (PV) array to provide energy to the Viejas Tribal Land. The device consists of a rotating disk that is spun up by a motor to store energy; switching the motor to generation mode causes the disk to spin down and discharge energy to the load. Long duration is achieved by using an innovative technology that employs a large rotor with sufficient inertia to store the required energy with very low loss by employing a proprietary electromagnetic off-loading arrangement. The project will prepare a Multi-Unit Operation Report that describes the layout, instrumentation used, and Measurement and Verification data.	7/8/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-045 Critical Resilience for Fire and Emergency Facilities with the Soboba Band of Luiseño	Yes	Grid Operations/Market Design	$1,710,494	$1,710,494	$112,381	N/A
EPC-19-046 Demonstrating a Long-duration Flywheel Energy Storage System	Yes	Distribution	$1,218,374	$1,218,374	$0	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-045 Critical Resilience for Fire and Emergency Facilities with the Soboba Band of Luiseño	$112,381	$298,664	$0	The Regents of the University of California, on behalf of its Riverside campus; GRID Alternatives; Invinity Energy Systems, PLC	$472,610	21.6%
EPC-19-046 Demonstrating a Long-duration Flywheel Energy Storage System	$0	$0	$0	Indian Energy LLC	$822,400	40.3%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-045 Critical Resilience for Fire and Emergency Facilities with the Soboba Band of Luiseño	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-045 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	22 out of 23 bidders	GRID Alternatives
EPC-19-046 Demonstrating a Long-duration Flywheel Energy Storage System	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-046 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	22 out of 23 bidders	Indian Energy LLC

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-045 Critical Resilience for Fire and Emergency Facilities with the Soboba Band of Luiseño	Group 2: Ranked # 4	Two finalists in Group 2, Rank 1 Rincon Band of Luiseno Indians and Rank 3 Prosper Sustainably, LLC, were not awarded. These projects were duplicates in scope to other projects awarded in Group 1. These Group 1 projects were for a higher award value.	N/A	Yes; Calif Based Entity
EPC-19-046 Demonstrating a Long-duration Flywheel Energy Storage System	Group 2: Ranked # 5	Two finalists in Group 2, Rank 1 Rincon Band of Luiseno Indians and Rank 3 Prosper Sustainably, LLC, were not awarded. These projects were duplicates in scope to other projects awarded in Group 1. These Group 1 projects were for a higher award value.	N/A	Yes; Calif Based Entity, Minority Owned

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-045 Critical Resilience for Fire and Emergency Facilities with the Soboba Band of Luiseño	This project will demonstrate the ability of a flow battery to provide at least 10 hours of duration. Additionally, the project team will test the integration of the battery energy management system and microgrid controller to provide cost savings and resilience to the fire station.	3h	The project started in late 2020. The project team began community outreach and engagement activities to establish project baselines and inform systems design.
EPC-19-046 Demonstrating a Long-duration Flywheel Energy Storage System	This project will install a long-duration non-Li ion energy storage system and a solar photovoltaic (PV) array to provide energy to the Viejas Tribal Land using an innovative kinetic energy storage device (flywheel) that is practical and low-cost. The device consists of a rotating disk that is spun up by a motor to store energy; switching the motor to generation mode causes the disk to spin down and discharge energy to the load. Long duration is achieved by using an innovative technology that employs a large rotor with sufficient inertia to store the required energy with very low loss by employing a proprietary electromagnetic off-loading arrangement. This Project will result in greater electricity reliability, and lower costs, by demonstrating flywheel integrated motor-generators for high round-trip efficiencies, and the use of commercial off-the-shelf technologies to minimize cost.	1e, 1g, 1h, 2a, 3a, 3c, 3h, 5a	The kick-off meeting was held on September 18, 2020. The flywheel technology provider is working on the development, design and construction of the initial unit for this project. The estimated timeframe for the construction and remote testing of this unit is January 31, 2021.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-047 CATAPULT: "California Title 24 Advanced Power Utilization Technology"	Technology Demonstration and Deployment	This project will demonstrate a modular containerized solar plus energy storage system at fifteen residential customer sites. The project will demonstrate the system performance as an integrated hardware and software platform that is Title 24 compliant with the ability to provide: behind the meter customer energy cost savings; emissions savings; grid services; and resiliency during utility power outages. The data obtained on capital cost, operating cost, performance and lessons learned will support commercial deployment.	7/8/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-050 Rincon Long Duration Multi-Storage Solar Microgrid	Technology Demonstration and Deployment	This project will demonstrate the integration of two types of non-lithium ion energy storage technologies: vanadium redox flow battery and flywheel storage systems, which will each provide 400kW of load for up to 12 hours. The two technologies will be interconnected with solar PV to create a microgrid that will provide resiliency and cost savings for multiple buildings, including a wastewater treatment plant and an emergency public shelter.	7/8/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-047 CATAPULT: "California Title 24 Advanced Power Utilization Technology"	Yes	Demand-side Management	$999,099	$999,099	$27,342	N/A
EPC-19-050 Rincon Long Duration Multi-Storage Solar Microgrid	Yes	Demand-side Management	$7,282,496	$7,282,496	$0	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-047 CATAPULT: "California Title 24 Advanced Power Utilization Technology"	$27,342	$287,885	$0	BoxPower Inc.; Evergreen Innovations LLC	$253,095	20.2%
EPC-19-050 Rincon Long Duration Multi-Storage Solar Microgrid	$0	$0	$0	Amber Kinetics, Inc.; Rincon Band of Luiseño Indians; Invinity Energy Systems, PLC	$9,500,454	56.6%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-047 CATAPULT: "California Title 24 Advanced Power Utilization Technology"	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-047 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	22 out of 23 bidders	BoxPower Inc.
EPC-19-050 Rincon Long Duration Multi-Storage Solar Microgrid	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-050 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	22 out of 23 bidders	Rincon Band of Luiseño Indians

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-047 CATAPULT: "California Title 24 Advanced Power Utilization Technology"	Group 4: Ranked # 2	N/A	N/A	Yes; Micro Business, Calif Based Entity
EPC-19-050 Rincon Long Duration Multi-Storage Solar Microgrid	Group 1: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-047 CATAPULT: "California Title 24 Advanced Power Utilization Technology"	This project will develop new hardware and software integration solutions to demonstrate and validate the cost and performance of solar plus storage systems in residential behind the meter applications. The system will be able to be configured to integrate the energy storage adjacent to the home with new or existing rooftop solar. It can also be configured as a stand-alone solar plus storage unit that can be placed in the yard. The project will also develop a software platform for aggregating the distributed solar plus storage systems to provide grid services that can be dispatched like a single resource.	1h	The project started in late 2020. The project team has begun preliminary design work on the system hardware and software.
EPC-19-050 Rincon Long Duration Multi-Storage Solar Microgrid	By demonstrating the integration of these two different energy storage systems in a commercial microgrid, the project will support the understanding of how their complementary performance characteristics can be combined to support a microgrid. Commercializing these technologies will enable them to contribute more to meeting California goals for resiliency, sustainability, cost savings, and safety.	1a, 1e, 1h, 1i, 3h, 4a, 5a	The project agreement was executed on September 22, 2020. The recipient has begun preparing the SDG&E interconnection application, and microgrid design engineering is in progress.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-051 Hybrid Modular Storage System (HMSS) as a long-duration energy storage technology Demonstration	Technology Demonstration and Deployment	This project will develop a highly customizable solution for energy storage that will efficiently deliver the optimal system configuration of energy storage technologies that will best fit the application needed by the DOD and other end users. The approach to dealing with a highly customized problem is to create an energy storage solution that equally customized to meet the requirements of each application. Indian Energy's solution accomplishes this through a Hybrid Modular Storage System (HMSS). The project will use the HMSS with three diverse non-Li ion energy storage technologies consisting of flow batteries, zinc hybrid cathodes batteries, and a fast responding mechanical energy storage system to determine which system or combination of systems best responds to the needs of the Marines and the DOD. The final selected systems will provide 10 hours or more of energy storage capability to a critical facility on the Pendleton Marine Corp Air Station.	7/8/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-053 Cost-Effective Integration of Second-life EV Batteries with Solar PV Systems for Commercial Buildings	Applied Research and Development	This project pairs second-life EV batteries with a solar PV system and develops key technologies to quickly identify battery health and optimize usage. These key technologies include developing control and operation algorithms to enable 1) proactive maintenance, 2) predictive thermal management, 3) active cell balancing, and 4) dynamic demand response management. Together, these technological advancements extend the life of the repurposed EV batteries and lower the cost to California ratepayers. The goal is to ensure that second-life EV batteries will last for a minimum of 10 years as part of a grid storage application with a degradation rate of 3% or less annually.	7/8/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-051 Hybrid Modular Storage System (HMSS) as a long-duration energy storage technology Demonstration	Yes	Distribution	$5,002,334	$5,002,334	$0	N/A
EPC-19-053 Cost-Effective Integration of Second-life EV Batteries with Solar PV Systems for Commercial Buildings	Yes	Demand-side Management	$2,837,672	$2,837,672	$6,420	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-051 Hybrid Modular Storage System (HMSS) as a long-duration energy storage technology Demonstration	$0	$0	$0	Webcor Builders; United States Marine Corps, Camp Pendleton	$10,766,756	68.3%
EPC-19-053 Cost-Effective Integration of Second-life EV Batteries with Solar PV Systems for Commercial Buildings	$6,420	$407,945	$0	University of California, Riverside; San Diego State University; The Regents of the University of California, San Diego ; TBD - Contractor	$835,375	22.7%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-051 Hybrid Modular Storage System (HMSS) as a long-duration energy storage technology Demonstration	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-051 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	22 out of 23 bidders	Indian Energy LLC
EPC-19-053 Cost-Effective Integration of Second-life EV Batteries with Solar PV Systems for Commercial Buildings	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-053 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	10 out of 11 bidders	San Diego State University Research Foundation

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-051 Hybrid Modular Storage System (HMSS) as a long-duration energy storage technology Demonstration	Group 1: Ranked # 3	N/A	N/A	Yes; Calif Based Entity, Minority Owned
EPC-19-053 Cost-Effective Integration of Second-life EV Batteries with Solar PV Systems for Commercial Buildings	Ranked # 3	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-051 Hybrid Modular Storage System (HMSS) as a long-duration energy storage technology Demonstration	This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by helping to characterize the performance of a few different energy storage solutions at TRL 4 in a targeted new scalable microgrid architecture that is a candidate for wide deployment over the next few years in California and worldwide, and to advance those solutions to TRL 6. By enabling more energy storage technologies to be integrated into a full solution, this project will enable greater renewable energy penetration by creating greater flexibility for storing excess renewable energy generation.	1h, 1i, 3a, 3b, 4a, 4b, 5a	This grant was fully executed in November 2020 and has begun the development of the required subcontracts needed to develop and implement the Hybrid Modular Storage System.
EPC-19-053 Cost-Effective Integration of Second-life EV Batteries with Solar PV Systems for Commercial Buildings	The project is developing battery management system technologies, algorithms, and operation strategies that enable second life EV batteries to last for a minimum of 10 years with a degradation rate of 3% or less annually. The battery management systems and second life batteries will be tested at two pilot test facilities where the battery management algorithms and hardware will be deployed. The technological developments from this project will increase the versatility, lifetime/durability, and efficiency of second life EV batteries while also lowering the total cost of these systems.	1f, 1h, 1i, 2a, 3a, 3b, 5d	The project kick-off meeting and technical advisory committee meeting were held in September and November 2020, respectively. The recipient has developed the battery testing plan and issued a purchased order of a Chroma 17212R-5-100 battery cycle equipment designed specifically for testing lithium-ion secondary batteries. The recipient coordinated with staff at the two demonstration sites (SDSU Children's Center and Chula Vista's Veterans Park) to determine the space needs, site deployment approaches, and finalize the site plan. The recipient finalized the preliminary design of the container for the energy storage systems and further evaluated the benefits of various electric architecture of the energy storage system.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-054 Demonstrating Code-compliant Energy Storage Systems and Their Capabilities for Grid Harmonization	Technology Demonstration and Deployment	This project will install and connect energy storage units to existing solar panels at 13 - 18 new construction single family homes and two multifamily affordable housing units in three different California climate zones. The recipient will test and evaluate the control and operation of the systems to capture best operational practices of the systems for the residents and the grid. The recipient will also provide insight into any future changes to Title 24 building code to help realize these values.	7/8/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-055 Enabling EV Battery Circular Economy	Applied Research and Development	ReJoule, Inc. is developing a battery-grading tool for assessing the health of repurposed batteries and validating its battery management system's ability to extend the life and performance of second-life batteries. The research team is also piloting its operational strategy for optimizing the performance of second-life batteries to integrate solar and provide resiliency at two commercial sites located in low-income, disadvantaged communities.	7/8/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-054 Demonstrating Code-compliant Energy Storage Systems and Their Capabilities for Grid Harmonization	Yes	Demand-side Management	$999,841	$999,841	$0	N/A
EPC-19-055 Enabling EV Battery Circular Economy	Yes	Demand-side Management	$2,970,774	$2,970,774	$110,297	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-054 Demonstrating Code-compliant Energy Storage Systems and Their Capabilities for Grid Harmonization	$0	$344,172	$0	Electric Power Research Institute, Inc.; TRC Engineers, Inc.	$200,017	16.7%
EPC-19-055 Enabling EV Battery Circular Economy	$110,297	$162,057	$0	Ford Motor Company; CleanSpark LLC; GRID Alternatives; ReJoule Incorporated	$331,891	10.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-054 Demonstrating Code-compliant Energy Storage Systems and Their Capabilities for Grid Harmonization	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-054 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	22 out of 23 bidders	Electric Power Research Institute, Inc.
EPC-19-055 Enabling EV Battery Circular Economy	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-055 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	10 out of 11 bidders	ReJoule Incorporated

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-054 Demonstrating Code-compliant Energy Storage Systems and Their Capabilities for Grid Harmonization	Group 4: Ranked # 3	N/A	N/A	Yes; Calif Based Entity
EPC-19-055 Enabling EV Battery Circular Economy	Ranked # 4	N/A	N/A	Yes; Minority Owned

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-054 Demonstrating Code-compliant Energy Storage Systems and Their Capabilities for Grid Harmonization	The project will help overcome barriers to implementing residential storage by providing recommendations derived from field demonstrations. The project will also help to enhance Title 24 building code to better suit California's plans for decarbonizing the grid through more and better use of renewable generation. Potential new homes built in alignment with a better developed Title 24 building code favoring controllable energy storage could provide greater cost savings to homeowners and greater grid stability. This project will assess the operation of commercially available residential battery storage systems and develop new use cases through exploring tariff structures, independent control strategies (such as helping to optimize residential energy use, particularly during the evening ramp) and cost considerations that provide maximum benefits to both the customer and the grid.	1h, 5a	The project agreement was executed on August 21, 2020 and the kick-off meeting was conducted on September 25, 2020. The team has identified the project sites along with participating builders. Contractual and legal terms were completed to enable data collection from customers. The team has started to evaluate various methods to control and aggregate energy storage systems behind the meter. In addition, the team has been working with various vendors and evaluating the capability and capacity of their residential energy storage systems to determine which will be installed. The first installations are in the design phase.
EPC-19-055 Enabling EV Battery Circular Economy	ReJoule is conducting accelerated cycling testing to establish a relationship between AC impedance, DC internal resistance, and battery degradation. This degradation rate model feeds into the pilot testing phase, where the team is deploying a second-life battery system that consists of both Nissan LEAF and Ford battery modules at a multi-business commercial building and a Salvation Army Homeless Shelter, both in disadvantaged and low-income communities. Through this pilot demonstration, ReJoule is validating that its battery management system is capable of active load-balancing and real-time degradation monitoring.	1h, 1i, 2a, 3a, 3b, 5a, 5d	ReJoule held its Kickoff Meeting for the project on August 12, 2020, and the research team procured the retired EV batteries and began the initial accelerated aging tests in November 2020.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-056 Assessing Long-duration Energy Storage Deployment Scenarios to Meet California's Energy Goals	Applied Research and Development	The E3 team is working with the CEC, technical experts, and the public to identify a realistic and appropriate range of scenarios to evaluate the role of LODES technologies in meeting the state's climate and energy goals. Analysis will evaluate tradeoffs among energy storage duration, performance, and cost against a range of resource supply options and electricity demand conditions. Through this research, the team will fill gaps in current modeling approaches to explicitly assess the role of energy storage of up to 100 hours or more of duration in California's deeply decarbonized future. With a focus on modeling emerging LODES technologies, the toolkit will also capture the operational needs	7/8/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-056 Assessing Long-duration Energy Storage Deployment Scenarios to Meet California's Energy Goals	Yes	Grid Operations/Market Design	$1,500,000	$1,500,000	$49,621	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-056 Assessing Long-duration Energy Storage Deployment Scenarios to Meet California's Energy Goals	$49,621	$540,062	$0	Energy and Environmental Economics, Inc. (E3); UC San Diego; Form Energy, Inc.	$315,322	17.4%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-056 Assessing Long-duration Energy Storage Deployment Scenarios to Meet California's Energy Goals	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-056 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	11 out of 11 bidders	Energy and Environmental Economics, Inc. (E3)

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-056 Assessing Long-duration Energy Storage Deployment Scenarios to Meet California's Energy Goals	Ranked # 2	N/A	N/A	Yes; Small Business, Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-056 Assessing Long-duration Energy Storage Deployment Scenarios to Meet California's Energy Goals	The E3 team's proposed project will help overcome barriers to achieving California's climate and energy goals by developing a clearer understanding of the role that LODES can and should play in achieving these goals.	1c, 3b, 5c	The project kicked off in September 2020 and the Initial Public Workshop took place in December 2020. The workshop engaged research stakeholders and other members of the public with the project. Feedback from the workshop informed the project's efforts in developing scenarios involving the use of emerging energy storage and generation technologies in the future of California's grid.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-058 Long Duration 50 kW Energy Storage with Aquifer Pumped Hydro	Technology Demonstration and Deployment	A groundwater storage facility will be developed for the demonstration. Groundwater will be used to fill and drain a small surface reservoir. An existing well with 150 kW (200 HP) nameplate capacity will be retrofitted to also act as generator. At 35% generation efficiency, the well will produce 52.5 kW of power. The technology is behind-the-meter and will require a Net Energy Metering (NEM) interconnection agreement with SCE. For the demonstration, the stored energy will be discharged to provide on-peak power to SCE during the evening ramp up and recharged off-peak. The facility will be operated for one year to demonstrate that up to 25-hour discharges can be produced reliably. The regeneration well will be operated to provide 50 kW of energy discharge using local groundwater. They will also be operated with imported water to show 100+ hour energy discharge during simulated PSPS outages. The test well will be used to demonstrate both the two-way groundwater dependent aquifer pumped hydro, as well as the one-way configuration that stores energy when imported water is available.	7/8/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-059 Residential Solar+Storage Control Unit for Providing Grid Services and Demand Side Management	Technology Demonstration and Deployment	A control unit will be developed and included in residential solar plus storage systems for deployment at fifteen housing units in low-income, disadvantaged, and Native American tribal communities in High Fire-Threat Zones. The combined systems will be controlled remotely by a new platform developed by the recipient. The platform will have optimization logic that will enable control of multiple solar plus storage systems to achieve benefits for the residents and the grid. The recipient will evaluate use cases and develop and test different innovative tariff options.	7/8/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-058 Long Duration 50 kW Energy Storage with Aquifer Pumped Hydro	Yes	Demand-side Management	$2,000,000	$2,000,000	$0	N/A
EPC-19-059 Residential Solar+Storage Control Unit for Providing Grid Services and Demand Side Management	Yes	Demand-side Management	$939,232	$939,232	$0	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-058 Long Duration 50 kW Energy Storage with Aquifer Pumped Hydro	$0	$12,402	$0	Antelope Valley Water Storage, LLC	$500,000	20.0%
EPC-19-059 Residential Solar+Storage Control Unit for Providing Grid Services and Demand Side Management	$0	$90,520	$0	GRID Alternatives; The Regents of the University of California, Riverside; Oklahoma State University - Advanced Technology Research Center	$362,250	27.8%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-058 Long Duration 50 kW Energy Storage with Aquifer Pumped Hydro	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-058 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	22 out of 23 bidders	Antelope Valley Water Storage, LLC
EPC-19-059 Residential Solar+Storage Control Unit for Providing Grid Services and Demand Side Management	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-059 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	22 out of 23 bidders	The Regents of the University of California, Riverside

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-058 Long Duration 50 kW Energy Storage with Aquifer Pumped Hydro	Group 3: Ranked # 2	N/A	N/A	Yes; Calif Based Entity
EPC-19-059 Residential Solar+Storage Control Unit for Providing Grid Services and Demand Side Management	Group 4: Ranked # 1	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-058 Long Duration 50 kW Energy Storage with Aquifer Pumped Hydro	The proposed project demonstrates a new way to implement pumped storage on a small scale and in a flat area (innovations over previous pumped storage). The project will use a well and a reservoir for stand-alone energy storage. This storage system uses local groundwater to store energy and builds on any aquifer in a distributed network. The motor on an existing well can be repurposed to act as generator to provide a 25-hour discharge duration of 50 kW. The system will be charged (groundwater is pumped, reservoir is filled) during the weekend off-peak or super off-peak hours. Power will be discharged (reservoir water is injected) during the five on-peak hours each weekday. New storage technologies like aquifer pumped hydro will help facilitate integration of distributed renewables and create a path towards state energy goals.	1a, 1b, 1c, 1i, 2a, 3a, 3b, 3c, 3e, 3f, 3h, 4a, 4b, 5a, 5b, 5d, 5f	This project had a kick-off meeting in August 2020. The team is in the design phase and also conducted their first technical advisory meeting in Fall 2020.
EPC-19-059 Residential Solar+Storage Control Unit for Providing Grid Services and Demand Side Management	The project will demonstrate approaches to maximize the value of energy storage systems to residential customers and the grid by optimizing participation in demand side management and grid services simultaneously. This technology will control the residential solar and storage systems to mitigate extreme voltage fluctuations, enabling safer operation on the grid. The new technology controls and reduces line and transformer losses on feeders and allows operation of the distribution grid close to the minimum allowable voltage level.	1e, 1h, 2a	The kickoff meeting was held recently and the project is in its beginning stages of analyzing the requirements and limitations of the technology design, development, and deployment in compliance with building code requirements.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-060 Modeling of Long-Duration Storage for Decarbonization of California Energy System	Applied Research and Development	The project team will expand on the past work using the SWITCH model to define the role and useful cost targets for long-duration storage. The project will improve inputs to the model based on interviews with industry experts (from its Storage Advisory Board) and analysis based on those interviews. Additionally, the project will compare results from two models (RESOLVE and SWITCH) to model expansion of the grid, analyze relevant technologies, and define and analyze relevant scenarios. The project will estimate the anticipated prices of promising technologies as they are scaled to gigawatt levels, and the potential for rapid scale up will be evaluated in light of the extent to which the new technology leverages existing supply chains and other attractive market opportunities.	7/8/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-20-001 Energy-Water Desalination Hub	Applied Research and Development	Lawrence Berkeley National Laboratory (LBNL) is the technical and administrative lead of the Department of Energy's Energy-Water Desalination Hub, a 5-year, $100 million contract. LBNL will lead early-stage applied research program to develop innovative new technologies to lower the cost of desalination and associated water treatment, focusing on enabling distributed desalination and localized water reuse. The program will be organized into 4 Topic Areas: Materials and Manufacturing Research and Development (RD&D), Process Innovation and Intensification RD&D, Modeling and Simulation RD&D and Integrated Data and Analysis.	8/12/20

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-19-060 Modeling of Long-Duration Storage for Decarbonization of California Energy System	Yes	Grid Operations/Market Design	$1,254,955	$1,254,955	$7,840	N/A
EPC-20-001 Energy-Water Desalination Hub	Yes	Grid Operations/Market Design	$3,000,000	$3,000,000	$1,060,000	N/A

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-19-060 Modeling of Long-Duration Storage for Decarbonization of California Energy System	$7,840	$221,519	$0	The Regents of the University of California, Merced; The Regents of the University of California, Berkeley; UC San Diego	$505,826	28.7%
EPC-20-001 Energy-Water Desalination Hub	$1,060,000	$1,493,597	$130,619,623	None	$0	0.0%

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-19-060 Modeling of Long-Duration Storage for Decarbonization of California Energy System	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-19-060 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	11 out of 11 bidders	The Regents of the University of California, Merced
EPC-20-001 Energy-Water Desalination Hub	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-20-001 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	9 bidders	Lawrence Berkeley National Laboratory

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-19-060 Modeling of Long-Duration Storage for Decarbonization of California Energy System	Ranked # 1	N/A	N/A	Yes; Calif Based Entity
EPC-20-001 Energy-Water Desalination Hub	N/A	N/A	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-19-060 Modeling of Long-Duration Storage for Decarbonization of California Energy System	The project team will develop scenarios to reach California's clean-energy targets by updating modeling tools and analyzing broad datasets. Emerging LODES technologies are expected to have a critical role in achieving a zero-carbon grid by 2045, and understanding the interaction of LODES with other energy resources is an integral component of the study.	1c, 3b, 5c	The project began in August 2020 and its first public workshop was held in December 2020. The workshop gave research stakeholders and other members of the public an opportunity to comment on the goals and strategies of the project team prior to developing new modeling tools that are necessary for the development of potential grid scenarios involving new and emerging storage and generation technologies.
EPC-20-001 Energy-Water Desalination Hub	The water desalination hub will conduct research that will help develop new water sources and specific activities pertinent to California include: 1)Conduct applied research on new technologies and methods to lower the cost and energy of desalination on "non-traditional" waters such as inland brackish groundwater, oil and gas produced water and wastewater from power plants. 2)Develop and release a new database (Water-DAMS) that enable users to find current energy and cost data for water treatment in a wide variety of settings and industries. 3)Develop and release a computer modeling program (PROTEUS) that enables water treatment engineers and researchers to simulate treatment operations for the purpose of energy and cost optimization. 4)Conduct research into the causes and solutions for reducing mineral scaling in RO systems, a leading cause of energy loss in desalination.	1g, 3a, 3b, 4c, 4d	The project recently started with the initial kickoff meeting held in September 2020. The NAWI team has had its first request for proposals for brackish water concentrating technologies. During phase one, they received 150 applications. NAWI requested that 20 recipients provide a more detailed application for final review. The team expects to choose the proposal winners in March 2021 expects to have a final draft for their roadmap around July 2021. The project is currently on schedule.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-20-002 Essential Power Support for the Kaiser Permanente Ontario Medical Center using Long Duration Batteries within a Renewable Energy Microgrid	Technology Demonstration and Deployment	The team will demonstrate a 10-hour flow battery system combined with solar PV and a microgrid controller to support the Victor Valley Global Medical Center. This builds on a prior EPIC project at a hospital in Richmond, California and allows a direct performance comparison. The recipient will measure performance by energy production, round-trip efficiency, demand reduction, islanding frequency, island duration, and ancillary services. The project will show financial benefit through the energy savings as well as ancillary services. Environmental benefits will emerge directly through reduction of on-site backup diesel generation and indirectly from reduction of power from the grid. Strategies to mitigate "Duck Curve" impacts will be demonstrated. The system will be tested for the ability to serve nearly 100% of hospital loads for 12-hours or more. The team will also further develop the microgrid controller to utilize machine learning, self-diagnosis and healing, and optimize generation and storage.	9/9/20
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-20-003 Pechanga Tribal Microgrid Long Duration Storage Project	Technology Demonstration and Deployment	As a first step in providing broader resilience for the community, this project will install 2,000 kWhs of vanadium redox flow batteries at Pechanga's recreational center and emergency shelter building to provide a minimum 10 hours of backup power. This will allow the facility to remain online during both planned and unplanned outages. When not providing backup power, the battery storage system will cycle daily in order to mitigate energy price changes experienced daily. The savings in energy costs will allow the Recipient to add additional funds to important programs like Pechanga native language education and translation services, economic development, and further development of governmental services.	10/14/20
			Active, Completed, and Terminated as of Dec 31, 2020		

Project Name	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****
EPC-20-002 Essential Power Support for the Kaiser Permanente Ontario Medical Center using Long Duration Batteries within a Renewable Energy Microgrid	Yes	Demand-side Management	$8,351,000	$8,351,000	$0	N/A
EPC-20-003 Pechanga Tribal Microgrid Long Duration Storage Project	Yes	Demand-side Management	$1,998,101	$1,998,101	$0	N/A
			$845,624,417	**$845,624,417**	**$482,041,124**	**$0**

Project Name	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split
EPC-20-002 Essential Power Support for the Kaiser Permanente Ontario Medical Center using Long Duration Batteries within a Renewable Energy Microgrid	$0	$142,698	$0	Charge Bliss, Inc.; Charge Bliss Construction California, Inc.; Victor Valley Global Medical Center	$7,549,000	47.5%
EPC-20-003 Pechanga Tribal Microgrid Long Duration Storage Project	$0	$0	$0	The Pechanga Band of Luiseño Indians; Invinity Energy Systems, PLC	$849,140	29.8%
	$482,041,124	**$153,992,389**	**$278,003,119**		**$446,997,417**	

Project Name	Funding Mechanism	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder
EPC-20-002 Essential Power Support for the Kaiser Permanente Ontario Medical Center using Long Duration Batteries within a Renewable Energy Microgrid	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-20-002 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	22 out of 23 bidders	Charge Bliss, Inc.
EPC-20-003 Pechanga Tribal Microgrid Long Duration Storage Project	Grant	TREATMENT OF IP: Pre-existing intellectual property identified in agreement EPC-20-003 (Confidential Products and Pre-Existing Intellectual Property Lists, Attachment C-2) will reside with the recipient. New intellectual property developed under this agreement will be subject to the agreement Terms and Conditions.	Competitive	22 out of 23 bidders	The Pechanga Band of Luiseño Indians

Project Name	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?
EPC-20-002 Essential Power Support for the Kaiser Permanente Ontario Medical Center using Long Duration Batteries within a Renewable Energy Microgrid	Group 1: Ranked # 2	N/A	N/A	Yes; Micro Business, Calif Based Entity
EPC-20-003 Pechanga Tribal Microgrid Long Duration Storage Project	Group 2: Ranked # 2	Two finalists in Group 2, Rank 1 Rincon Band of Luiseno Indians and Rank 3 Prosper Sustainably, LLC, were not awarded. These projects were duplicates in scope to other projects awarded in Group 1. These Group 1 projects were for a higher award value.	N/A	Yes; Calif Based Entity

Project Name	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-20-002 Essential Power Support for the Kaiser Permanente Ontario Medical Center using Long Duration Batteries within a Renewable Energy Microgrid	Deployment of an 8MWh/11-hour flow battery with a 2.2MW solar array and integrated by a microgrid controller will be connected to the hospital's critical power. The team will evaluate long-term battery performance and provide direct comparison with lithium-ion technology installed at the Richmond hospital from the prior EPIC project. The team will evaluate various scenarios of energy time-shifting, demand management, ancillary services, and facility islanding, to determine economic performance and reduction of GHG production.	1a, 1b, 1c, 1d, 1e, 1g, 1h, 1i, 2a, 3c, 3e, 3f, 3h, 4a, 4b, 5a, 5b, 5d, 5f	This project had the kick-off meeting in November 2020 and the team is beginning energy system and microgrid design.
EPC-20-003 Pechanga Tribal Microgrid Long Duration Storage Project	The key advancement of the project is from designing a vanadium flow battery system to achieve 10-hour duration . Current electrolyte tanks for vanadium flow batteries are too small to support 10 hours of duration and the system needs to be redesigned, while taking into account ease of construction for replicability and deployment costs (shipping, installation, commissioning). The system also needs to be configured such that it enables more component integration at the factory to achieve economies of scale. Any amount of component integration in-the-field or on-site translates into additional cost burdens for project owners, developers, and/or engineering, procurement and construction.	1c, 1h, 2a, 3e, 3h, 5a	The kickoff meeting was held in October 2020 and the project is in the beginning phase of designing the vanadium redox flow (VRF) battery for 10-hour long-duration operation.

			Canceled and Terminated Projects with no Funds Spent - Not Included in the EPIC Annual Report Project Count or Amount. *****						
Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-14-020 Pilot testing and demonstration of a solar hybrid system with advanced storage and low temperature turbine to produce on-demand solar electricity	Applied Research and Development	The project's use of combined PV and thermal energy with an organic Rankine cycle is radical and as such, is outside the scope of the rich incentive programs for conventional technologies. While the costs offered by large-volume deployments will offer an LCOE competitive with grid-purchased electricity, the significant non-recurring one-time engineering expenses involved in technology integration, deployment and optimization work do not make this a possibility today.	4/8/15	No	Distribution	$2,530,952	$2,530,952
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-011 Isothermal Compressed Air Energy Storage with Solar and Load Forecasting Integration	Applied Research and Development	LightSail Energy, along with its partner, the University of California San Diego (UCSD), was to design build, operate, monitor, and analyze an I-CAES system on the Eliot Field PV station owned by UCSD. The energy storage system was to be a pilot unit for testing the capabilities and performance potential of I-CAES for load following and ancillary services, as well as renewable integration. The project was to also gather data needed to reduce the cost of I-CAES, increase its efficiency, and support its incorporation into the California electric grid. The installed energy storage system was to be capable of charging from both the installed PV on site and the electric grid (operated by SDG&E) and was to be capable of 200kW of discharging power and was to store up 800kWh of energy.	12/9/15	No	Distribution	$1,200,276	$1,200,276
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-014 Advanced Hybrid Battery-Fuel Cell Energy Storage System	Applied Research and Development	To account for the increasing demand for energy storage and shifting energy market, the Recipient was to develop a hybrid battery-fuel cell (B-FC) energy storage system for rapid response and modular design with flexible capacity for distributed energy reserve. The integration between battery and fuel cell partitions enables the system to store excess electricity from the grid as both battery power, plus chemical power in the form of hydrogen gas. The hydrogen is supplied by a waste-derived source (not electrolyzers). The system can then dispatch the stored power through the ultra-rapid response of the battery, and the load-following fuel cell using the stored hydrogen. The waste-derived dilute hydrogen coupled with battery storage promises greater than 80% cycle efficiency and to meet the Energy Commission's cost goals. The B-FC system can provide clean, green, on-demand, rapid response power with no emissions or environmental impact.	1/13/16	No	Demand-side Management	$1,199,975	$1,199,975

Project Name	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split	Funding Mechanism
EPC-14-020 Pilot testing and demonstration of a solar hybrid system with advanced storage and low temperature turbine to produce on-demand solar electricity	$0	N/A	$0	$792,667	$0	None	$2,350,650	48.2%	Grant
EPC-15-011 Isothermal Compressed Air Energy Storage with Solar and Load Forecasting Integration	$0	N/A	$0	$102,846	$0	LightSail Energy	$779,400	39.4%	Grant
EPC-15-014 Advanced Hybrid Battery-Fuel Cell Energy Storage System	$0	N/A	$0	$406,835	$0	None	$1,169,580	49.4%	Grant

Project Name	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *
EPC-14-020 Pilot testing and demonstration of a solar hybrid system with advanced storage and low temperature turbine to produce on-demand solar electricity	N/A	Competitive	35 out of 38 bidders	Cogenra Solar, Inc.	Group 2: Ranked # 2	N/A	N/A
EPC-15-011 Isothermal Compressed Air Energy Storage with Solar and Load Forecasting Integration	N/A	Competitive	35 out of 38 bidders	LightSail Energy	Group 2: Ranked # 5	N/A	N/A
EPC-15-014 Advanced Hybrid Battery-Fuel Cell Energy Storage System	N/A	Competitive	35 out of 38 bidders	FuelCell Energy, Inc.	Group 2: Ranked # 8	N/A	N/A

Project Name	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-14-020 Pilot testing and demonstration of a solar hybrid system with advanced storage and low temperature turbine to produce on-demand solar electricity	Yes; Calif Based Entity	N/A	N/A	This project was canceled and not executed. No work was completed and no EPIC funds were disbursed for this project.
EPC-15-011 Isothermal Compressed Air Energy Storage with Solar and Load Forecasting Integration	Yes; Calif Based Entity	N/A	N/A	This project was terminated. No work was completed and no EPIC funds were disbursed for this project.
EPC-15-014 Advanced Hybrid Battery-Fuel Cell Energy Storage System	Yes; Calif Based Entity	N/A	N/A	This project was canceled and not executed. No work was completed and no EPIC funds were disbursed for this project.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-017 Utilizing Waste Heat to Increase Efficiency of Isothermal Compressed Air Energy Storage in a Smart Microgrid Environment	Applied Research and Development	LightSail Energy was to install and pilot test a 200kW I-CAES system at the UCI campus in Irvine California. The storage unit was to be operated in conjunction with UCI's 1,000kW solar PV array and 300kW advanced natural gas turbine, all interconnected through an advanced "smart" microgrid. The I-CAES system was to use waste heat from the gas turbine to increase round-trip efficiency. This is possible because I-CAES uses large water tanks as thermal storage, capturing and storing the heat of compression for use when the system is expanding air and producing electricity. The waste heat from the gas turbine was to be captured and stored in the I-CAES thermal storage tanks and later converted into electricity. This project was to provide the state's first real-world data on the operation and performance of an isothermal compressed air energy storage system and its ability to utilize waste heat for increased efficiency.	1/13/16	No	Grid Operations/Market Design	$1,085,125	$1,085,125
2012-2014 EPIC Program 1st Triennial Investment Plan	CEC	EPC-15-052 ZipPower San Leandro	Market Facilitation	This project was to develop and pilot a platform that optimizes distributed energy resource planning by integrating and automating all the data required to target optimal sites across city areas, and streamline pre-approval of the permitting and interconnection at those sites. The project was to also use aggregated customer financing as an option to design, finance, deploy, scale, and replicate Advanced Energy Communities.	5/17/16	No	Demand-side Management	$1,495,338	$1,495,338
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-060 Adaptive Chargers for Delivery Customers Demonstrating California Advances in Charging	Technology Demonstration and Deployment	Motiv Power Systems was to develop both a smart charger solution and a bi-directional charger solution to enable vehicle-grid integration (VGI) with electric fleet vehicles. This technology wss to be demonstrated with AmeriPride Services delivery trucks in Fresno, Bakersfield, Merced, and Stockton. Motiv was to develop both a software-only smart charger solution as well as a bi-directional on-board charger solution for vehicles that can be easily purchased as an option for installation on existing vehicles. This solution was to fit within a scalable and modular powertrain already used in a variety of vehicle applications, thus allowing VGI solutions to fit within a variety of emerging markets and be supplied to vehicle builders from a variety of delivery trucks, work trucks, shuttle buses, and school buses. This was to allow VGI to fit both within goods movement and freight plans as well as clean transit and zero-emission bus plans.	5/10/17	No	Demand-side Management	$4,529,956	$4,529,956

Project Name	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split	Funding Mechanism
EPC-15-017 Utilizing Waste Heat to Increase Efficiency of Isothermal Compressed Air Energy Storage in a Smart Microgrid Environment	$0	N/A	$0	$89,979	$0	LightSail Energy	$811,645	42.8%	Grant
EPC-15-052 ZipPower San Leandro	$0	N/A	$0	$158,370	$0	ZipPower, LLC	$486,000	24.5%	Grant
EPC-16-060 Adaptive Chargers for Delivery Customers Demonstrating California Advances in Charging	$0	N/A	$0	$818,672	$0	Motiv Power Systems, Inc.	$1,513,524	25.0%	Grant

Project Name	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *
EPC-15-017 Utilizing Waste Heat to Increase Efficiency of Isothermal Compressed Air Energy Storage in a Smart Microgrid Environment	N/A	Competitive	35 out of 38 bidders	LightSail Energy	Group 2: Ranked # 6	N/A	N/A
EPC-15-052 ZipPower San Leandro	N/A	Competitive	27 out of 28 bidders	ZipPower, LLC	Group 1: Ranked # 2	N/A	N/A
EPC-16-060 Adaptive Chargers for Delivery Customers Demonstrating California Advances in Charging	N/A	Competitive	29 out of 31 bidders	Motiv Power Systems, Inc.	Group 4: Ranked # 2	N/A	N/A

Project Name	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-15-017 Utilizing Waste Heat to Increase Efficiency of Isothermal Compressed Air Energy Storage in a Smart Microgrid Environment	Yes; Calif Based Entity	N/A	N/A	This project was terminated. No work was completed and no EPIC funds were disbursed for this project.
EPC-15-052 ZipPower San Leandro	Yes; Calif Based Entity	N/A	N/A	This project was terminated. No work was completed and no EPIC funds were disbursed for this project.
EPC-16-060 Adaptive Chargers for Delivery Customers Demonstrating California Advances in Charging	Yes; Calif Based Entity	N/A	N/A	This project was terminated. No work was completed and no EPIC funds were disbursed for this project.

Investment Program Period	Program Administrator	Project Name	Project Type	A brief description of the project	Date of the award	Was this project awarded in the immediately prior calendar year?	Assignment to Value Chain	Encumbered Funding Amount ($)	Committed Funding Amount ($)
2015-2017 EPIC Program 2nd Triennial Investment Plan	CEC	EPC-16-069 Demonstrate the Phase III functions of a PV smart inverter and a storage inverter.	Applied Research and Development	Demonstrate the eight phase III functions of smart inverters in the field. This project was to test and validate the Phase III functions of a PV smart inverter and a storage inverter to support higher penetrations of solar on the feeder to the South Coast AQMD Headquarters in Diamond Bar, California. This project was to test, validate, and demonstrate all eight Smart Inverter Working Group (SIWG) Phase III functions in a system composed of a PV smart inverter, a bi-directional storage inverter, using behind-the-meter solar and storage. This was to increase circuit hosting capacity for solar and decrease distributed PV integration costs.	6/14/17	No	Distribution	$2,729,943	$2,729,943
2018-2020 EPIC Program 3rd Triennial Investment	CEC	EPC-19-048 Reflex Flow Battery at Mission Produce	Technology Demonstration and Deployment	The project's primary technology is a flow battery that will fill an important need for California's grid. Most notably, the flow battery has an unlimited cycle life, which will be required when California's solar penetration passes 40-50%. With this project, the recipient will be able to rescale prior products in the lab to address 10-hour duration and outdoor applications, bringing these technologies from TRL 6 to TRL 7. Deploying the 500 kW system at the project site and testing the system for an entire year, enables the technology to reach TRL 8. The project site will deploy the improved flow battery units in a use case that relies on all available energy in the system during day-to-day operations and uses a slower, 10-hour discharge in microgrid operations.	7/8/20	Yes	Demand-side Management	$2,000,000	$2,000,000
Canceled and Terminated with No Funds Spent as of Dec 31, 2020								**$16,771,565**	

Project Name	Funds Expended to date:Contract/Grant Amount ($)	Funds Expended to date: In house expenditures ($) ****	Funds Expended to date: Total Spent to date ($)	Administrative and overhead costs to be incurred for each project	Leveraged Funds	Partners	Match Funding	Match Funding Split	Funding Mechanism
EPC-16-069 Demonstrate the Phase III functions of a PV smart inverter and a storage inverter.	$0	N/A	$0	$594,333	$0	South Coast Air Quality Management District; Advanced Microgrid Solutions, Inc.; Nemaste Solar	$2,173,382	44.3%	Grant
EPC-19-048 Reflex Flow Battery at Mission Produce	$0	N/A	$0	$0	$0	Mission Produce, Inc.	$500,000	20.0%	Grant

Project Name	Intellectual Property	Identification of the method used to grant awards	If competitively selected, provide the number of bidders passing the initial pass/fail screening for project	If competitively selected, provide the name of selected bidder	If competitively selected, provide the rank of the selected bidder in the selection process	If competitively selected, explain why the bidder was not the highest scoring bidder, explain why a lower scoring bidder was selected	If interagency or sole source agreement, specify date of notification to the Joint Legislative Budget Committee (JLBC) was notified and date of JLBC authorization *
EPC-16-069 Demonstrate the Phase III functions of a PV smart inverter and a storage inverter.	N/A	Competitive	31 out of 35 bidders	Advanced Microgrid Solutions, Inc.	Group 4: Ranked # 2	N/A	N/A
EPC-19-048 Reflex Flow Battery at Mission Produce	N/A	Competitive	23 out of 23 bidders	Mission Produce, Inc.	Ranked # 10	N/A	N/A

Project Name	Does the recipient for this award identify as a California-based entity, small business, or businesses owned by women, minorities, or disabled veterans?	How the project leads to technological advancement or breakthroughs to overcome barriers to achieving the state's statutory energy goals	Applicable Metrics	Update
EPC-16-069 Demonstrate the Phase III functions of a PV smart inverter and a storage inverter.	Yes; Calif Based Entity, Woman Own	N/A	N/A	This project was terminated. No work was completed and no EPIC funds were disbursed for this project.
EPC-19-048 Reflex Flow Battery at Mission Produce	None	N/A	N/A	This project was canceled and not executed. No work was completed and no EPIC funds were disbursed for this project.

Notes

* Pursuant to Public Resources Code section 25711.5(h)(2) the Energy Commission may use a sole source or interagency agreement if it notifies JLBC at least 60 days prior to making the award and JLBC either approves or does not disapprove within 60 days following the notification. Following Energy Commission notification, JLBC approved or did not disapprove all Energy Commission sole source or interagency agreements and they were deemed authorized after 60 days.

** Projects include funds from EPIC Plan 2012-2014 and EPIC Plan 2015-2017, or EPIC Plan 2015-2017 and EPIC Plan 2018-2020, or more than one investment area. There is a total of 385 projects.

*** The federal cost share solicitation was on-going and funds were awarded to passing proposals on a first-come, first-served basis.

**** Funds Expended to date: In House Expenditures: Reporting of In-house Expenditures is required of the IOUs, but not the Energy Commission per CPUC D.13-11-025 page 51 and ordering paragraph 20.

***** Projects were approved at an Energy Commission Business Meeting, but later canceled or terminated by the recipient; however, no work was done on these projects and no EPIC funds were spent (Not included in project count and amount).

Note: Each amendment to a project with an adjustment to the EPIC encumbered funding amount is listed on a separate row.