

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 02/13)

CALIFORNIA ENERGY COMMISSION

New Agreement EPC-14-085 (To be completed by CGL Office)

| Division | Agreement Manager: | MS- | Phone |
|----------|--------------------|-----|--------------|
| ERDD | Michael Sokol | 43 | 916-327-1416 |

| Recipient's Legal Name | Federal ID Number |
|--|-------------------|
| The Regents of the University of California, Davis | 94-6036494 |

| Title of Project |
|--|
| Demonstration of community scale low cost highly efficient PV and energy management system |

| Term and Amount | Start Date | End Date | Amount |
|-----------------|------------|-----------|--------------|
| | 6/30/2015 | 9/28/2018 | \$ 1,238,491 |

Business Meeting Information
 ARFVTP agreements under \$75K delegated to Executive Director.

| | | | |
|--------------------------------|---------------|----------------------------------|--|
| Proposed Business Meeting Date | 6/10/2015 | <input type="checkbox"/> Consent | <input checked="" type="checkbox"/> Discussion |
| Business Meeting Presenter | Michael Sokol | Time Needed: | 5 minutes |

Please select one list serve. Select

Agenda Item Subject and Description

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA, DAVIS Proposed resolution approving agreement EPC-14-085 with The Regents of the University of California, Davis for a \$1,238,491 grant to demonstrate an innovative energy management system with advanced photovoltaics and second-use electric vehicle battery energy storage to reduce peak demand by at least 10 percent at the Robert Mondavi Institute on the UC Davis Campus. (EPIC funding) Contact: Michael Sokol. (Staff presentation: 5 minutes)

California Environmental Quality Act (CEQA) Compliance

1. Is Agreement considered a "Project" under CEQA?
 Yes (skip to question 2) No (complete the following (PRC 21065 and 14 CCR 15378)):
 Explain why Agreement is not considered a "Project":
 Agreement will not cause direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because
2. If Agreement is considered a "Project" under CEQA:
 a) Agreement **IS** exempt. (Attach draft NOE)
 Statutory Exemption. List PRC and/or CCR section number: _____
 Categorical Exemption. List CCR section number: 14 CCR 15301
 Common Sense Exemption. 14 CCR 15061 (b) (3)
 Explain reason why Agreement is exempt under the above section:
 Class 1 – Operation, repair, maintenance, or minor alteration of existing structures or facilities not expanding existing uses. This work involves the minor alteration of existing facilities and falls within the limits of examples listed in this exemption.

 This project involves the installation of a 100 kilowatt high-performance rooftop photovoltaic system at a building on the UC Davis campus. The project also involves installation of second use lithium ion electric vehicle batteries, and additional electrical components needed to integrate the rooftop system. The installation will also involve less than 100 feet of trenching for medium and low electrical conduit and involve electrical equipment site work. This installation will be at an existing, developed site on land that is not considered environmentally sensitive. Noise and odors will not be generated in excess of existing permitted amounts, nor will traffic increase traffic to the site. The installation will not require permits for air, water, conditional use, building expansion, hazardous waste, or rezoning, but will require an electrical inspection.
- b) Agreement **IS NOT** exempt. (Consult with the legal office to determine next steps.)
 Check all that apply
 Initial Study Environmental Impact Report
 Negative Declaration Statement of Overriding Considerations
 Mitigated Negative Declaration

List all subcontractors (major and minor) and equipment vendors: (attach additional sheets as necessary)

| Legal Company Name: | Budget |
|-------------------------|--|
| OSISoft, LLC | \$ 50,000 (CEC funding), \$479,467 (match) |
| One Cycle Control, Inc. | \$ 30,000 |
| Solexel | \$ 12,000 (match) |

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| |
|---|
| List all key partners: (attach additional sheets as necessary) |
| Legal Company Name: |
| The Regents of the University of California, Davis |
| OSISoft, LLC |
| Solexel, Inc. |
| One-Cycle Control, Inc. |

| Budget Information | | | |
|-----------------------------------|-------------------------------|----------------------|--------------------|
| Funding Source | Funding Year of Appropriation | Budget List No. | Amount |
| EPIC | 13-14 | 301.001A | \$1,211,709 |
| EPIC | 14-15 | 301.001B | \$26,782 |
| | | | \$ |
| R&D Program Area: | EGRO: Renewables | | TOTAL: \$1,238,491 |
| Explanation for "Other" selection | | | |
| Reimbursement Contract #: | | Federal Agreement #: | |

| Recipient's Administrator/ Officer | | | | Recipient's Project Manager | | | |
|------------------------------------|----------------------|------|-----|-----------------------------|----------------------|------|-----|
| Name: | Felicia Smith | | | Name: | Jill Brigham | | |
| Address: | 1 SHIELDS AVE | | | Address: | 1 SHIELDS AVE | | |
| City, State, Zip: | DAVIS, CA 95616-5270 | | | City, State, Zip: | DAVIS, CA 95616-5270 | | |
| Phone: | 530-752-0582 / | Fax: | - - | Phone: | 530-752-4141 / | Fax: | - - |
| E-Mail: | fasmith@ucdavis.edu | | | E-Mail: | jbrigham@ucdavis.edu | | |

| Selection Process Used | |
|---|----------------------------|
| <input checked="" type="checkbox"/> Competitive Solicitation | Solicitation #: PON-14-307 |
| <input type="checkbox"/> First Come First Served Solicitation | |

| The following items should be attached to this GRF | | | |
|---|-------------------------------------|-----|--|
| 1. Exhibit A, Scope of Work | <input checked="" type="checkbox"/> | N/A | <input checked="" type="checkbox"/> Attached |
| 2. Exhibit B, Budget Detail | <input checked="" type="checkbox"/> | N/A | <input checked="" type="checkbox"/> Attached |
| 3. CEC 105, Questionnaire for Identifying Conflicts | <input checked="" type="checkbox"/> | N/A | <input checked="" type="checkbox"/> Attached |
| 4. Recipient Resolution | <input checked="" type="checkbox"/> | N/A | <input type="checkbox"/> Attached |
| 5. CEQA Documentation | <input type="checkbox"/> | N/A | <input checked="" type="checkbox"/> Attached |

| | | | | | |
|----------------------------|---------------|-------------------------|---------------|--------------------------|---------------|
| _____ Agreement Manager | _____ Date | _____ Office Manager | _____ Date | _____ Deputy Director | _____ Date |
|----------------------------|---------------|-------------------------|---------------|--------------------------|---------------|

Exhibit A Scope of Work

A. Task List

| Task # | CPR ¹ | Task Name |
|--------|------------------|--|
| 1 | | GENERAL PROJECT TASKS |
| 2 | | DEFINE SYSTEM ARCHITECTURE |
| 3 | X | INSTALL PRE-COMMERCIAL PV |
| 4 | | ELECTRICAL ENERGY STORAGE SYSTEM |
| 5 | | ENERGY MANAGEMENT SYSTEM |
| 6 | | SYSTEM INTEGRATION |
| 7 | X | SYSTEM COMMISSIONING |
| 8 | | DATA COLLECTION AND REPORTING |
| 9 | | EVALUATION OF PROJECT BENEFITS |
| 10 | | TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES |

B. Acronym/Term List

| Acronym/Term | Meaning |
|--------------|--|
| AB32 | Assembly Bill 32, the California Global Warming Solutions Act |
| CAISO | California Independent System Operator |
| CAM | Commission Agreement Manager |
| CAO | Commission Agreement Officer |
| CPR | Critical Project Review |
| DER | Distributed Energy Resource |
| DR | Demand Response |
| EES | Electrical Energy Storage |
| EMS | Energy Management System |
| EPIC | Electric Program Investment Charge |
| EV | Electric Vehicle |
| OSISoft PI | A proprietary system provided by OSISoft to manage and analyze data in real time |
| PV | Photovoltaic |
| SAIDI | System Average Interruption Duration Index |
| TAC | Technical Advisory Committee |

I. PURPOSE OF AGREEMENT, PROBLEM/SOLUTION STATEMENT, AND GOALS AND OBJECTIVES

A. Purpose of Agreement

The purpose of this Agreement is to develop and demonstrate pre-commercial renewable power generators and energy management systems which reduce peak power and energy demands while facilitating integration with the electric grid. The technologies chosen promise to provide

¹ Please see subtask 1.3 in Part II of the Scope of Work (General Project Tasks) for a description of Critical Project Review (CPR) Meetings.

Exhibit A Scope of Work

cost-effective, efficient, and reliable energy generation and Electrical Energy Storage (EES) solutions at the community scale. Total daily average energy demand during peak times can be significantly reduced, saving the customer money while improving grid stability. Grid stability will be further improved through the use of a grid control Energy Management System (EMS) designed to mitigate grid instability. The demonstration involves testing of second use lithium ion batteries as a way to store electricity generated by rooftop PV.

B. Problem/ Solution Statement

Problem

To meet the requirements of Assembly Bill 32, the California Global Warming Solutions Act, (AB32) and general need for assured access to reliable sources of energy, California must develop distributed renewable energy sources which provide energy surety for the community while improving grid capacity and stability through peak load reduction and improved renewable to grid integration.

Solution

The project will develop and demonstrate a smart EES system using retired Electric Vehicle (EV) batteries. The proposed EES system will provide a cost effective and efficient energy storage solution for a community scale grid with multiple renewable generations. The EES will act as an energy buffer, storing power and shifting energy from distributed energy resources (DER) peak to grid energy consumption peak. Power will be generated by new pre-commercial high performance solar photovoltaic (PV) panels. A commercial grade controller will be developed to control the renewable energy sources and EES system.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Demonstrate 100 kW high-performance, pre-commercial solar PV.
- Develop and demonstrate 250 kWh second-life Lithium ion energy storage system.
- Develop and demonstrate advanced energy management system capable of peak reduction, load shifting, and demand response.
- Commission system and perform system validation and verification testing.
- Operate power generation and management system for at least 12 months, collect performance data, and optimize system to most effectively shift energy from renewable generation peak to energy consumption peak and to tune energy management system controller to mitigate grid instabilities.
- Calculate reductions in electrical demand and emissions. Demonstrate that the energy generation and management systems reduce the community's average daily power and daily peak energy/power demand by more than 10 percent (stretch goal of 60 percent).
- Demonstrate that the system operation will result in significant reduction in community's average electricity cost.
- Demonstrate that the system can perform autonomous frequency and voltage control to mitigate grid instability caused by the operations (charge/discharge) of electrical energy storage.

Exhibit A Scope of Work

- Document and publish results and lessons learned.

Ratepayer Benefits:² This Agreement will result in the ratepayer benefits of greater electricity reliability and lower costs by improving grid reliability by reducing peak demand while producing and storing energy which can be sold through the California Independent System Operator (CAISO) market. With the support of the ESS and proper energy management control, the microgrid can be run at maximum renewable generation of up to 100 percent. The EES and energy management system not only maximizes the use of renewable generation but also can sell the excessive production (or even some portion of PV generation) through the demand response (DR) or CAISO market.

Technological Advancement and Breakthroughs:³ 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 an economical second-life battery energy management system to effectively measure and control state of charge and state of health. A new, pre-commercial PV system which promises to significantly reduce the cost of high performance PV will be field tested. A control and management system will be developed to improve microgrid stability and grid interface.

Agreement Objectives

The objectives of this Agreement are to:

- Demonstrate that the system operation will result in more than 10 percent reduction (stretch goal 60 percent reduction) in the difference between the community's average daily peak power demand and the average daily power demand placed on the grid by the community.
- Demonstrate that the system operation will result in more than 10 percent decrease (stretch goal 60 percent decrease) in the daily average energy demand during peak times, as defined by the utility tariff, placed on the grid by the community.
- Demonstrate that the system will reduce the community's annual average electricity cost by more than 10 percent.
- Demonstrate that the autonomous frequency and voltage control will reduce the System Average Interruption Duration Index (SAIDI) by more than 50 percent.
- Demonstrate that the system can be profitable by selling ancillary services to the CAISO fast regulation market and participating in DR. The project team expects DR will maximize the economic benefits of the system; however it may sacrifice peak reduction/load shifting, which is the main goal of this project. The project will demonstrate

² California Public Resources Code, Section 25711.5(a) requires projects funded by the Electric Program Investment Charge (EPIC) to result in ratepayer benefits. The California Public Utilities Commission, which established the EPIC in 2011, defines ratepayer benefits as greater reliability, lower costs, and increased safety (See CPUC "Phase 2" Decision 12-05-037 at page 19, May 24, 2012, http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/167664.PDF).

³ California Public Resources Code, Section 25711.5(a) also requires EPIC-funded projects to lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory and energy goals.

Exhibit A Scope of Work

the system with CAISO/DR as the highest energy management control priority for a certain period of time and compare the results with other cases in terms of economic benefit, grid stability, peak demand reduction to measure both the economic and performance effects.

II. TASK 1 GENERAL PROJECT TASKS

PRODUCTS

Subtask 1.1 Products

The goal of this subtask is to establish the requirements for submitting project products (e.g., reports, summaries, plans, and presentation materials). Unless otherwise specified by the Commission Agreement Manager (CAM), the Recipient must deliver products as required below by the dates listed in the **Project Schedule (Part V)**. Products that require a draft version are indicated by marking “**(draft and final)**” after the product name in the “Products” section of the task/subtask. If “(draft and final)” does not appear after the product name, only a final version of the product is required. With respect to due dates within this Scope of Work, “**days**” means working days.

The Recipient shall:

For products that require a draft version

- Submit all draft products to the CAM for review and comment in accordance with the Project Schedule (Part V). The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt, unless otherwise specified in the task/subtask for which the product is required.
- Submit the final product to the CAM once agreement has been reached on the draft. The CAM will provide written approval of the final product within 15 days of receipt, unless otherwise specified in the task/subtask for which the product is required.
- If the CAM determines that the final product does not sufficiently incorporate his/her comments, submit the revised product to the CAM within 10 days of notice by the CAM, unless the CAM specifies a longer time period.

For products that require a final version only

- Submit the product to the CAM for approval.
- If the CAM determines that the product requires revision, submit the revised product to the CAM within 10 days of notice by the CAM, unless the CAM specifies a longer time period.

For all products

- Submit all data and documents required as products in accordance with the following Instructions for Submitting Electronic Files and Developing Software:

- **Electronic File Format**

Exhibit A Scope of Work

Submit all data and documents required as products under this Agreement in an electronic file format that is fully editable and compatible with the Energy Commission's software and Microsoft (MS)-operating computing platforms, or with any other format approved by the CAM. Deliver an electronic copy of the full text of any Agreement data and documents in a format specified by the CAM, such as memory stick or CD-ROM.

The following describes the accepted formats for electronic data and documents provided to the Energy Commission as products under this Agreement, and establishes the software versions that will be required to review and approve all software products:

- Data sets will be in MS Access or MS Excel file format (version 2007 or later), or any other format approved by the CAM.
 - Text documents will be in MS Word file format, version 2007 or later.
 - Documents intended for public distribution will be in PDF file format. The Recipient must also provide the native Microsoft file format.
 - Project management documents will be in Microsoft Project file format, version 2007 or later.
-
- ***Software Application Development***
Use the following standard Application Architecture components in compatible versions for any software application development required by this Agreement (e.g., databases, models, modeling tools), unless the CAM approves other software applications such as open source programs:
 - Microsoft ASP.NET framework (version 3.5 and up). Recommend 4.0.
 - Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5.
 - Visual Studio.NET (version 2008 and up). Recommend 2010.
 - C# Programming Language with Presentation (UI), Business Object and Data Layers.
 - SQL (Structured Query Language).
 - Microsoft SQL Server 2008, Stored Procedures. Recommend 2008 R2.
 - Microsoft SQL Reporting Services. Recommend 2008 R2.
 - XML (external interfaces).

Any exceptions to the Electronic File Format requirements above must be approved in writing by the CAM. The CAM will consult with the Energy Commission's Information Technology Services Branch to determine whether the exceptions are allowable.

MEETINGS

Subtask 1.2 Kick-off Meeting

Exhibit A Scope of Work

The goal of this subtask is to establish the lines of communication and procedures for implementing this Agreement.

The Recipient shall:

- Attend a “Kick-off” meeting with the CAM, the Commission Agreement Officer (CAO), and any other Energy Commission staff relevant to the Agreement. The Recipient will bring its Project Manager and any other individuals designated by the CAM to this meeting. The administrative and technical aspects of the Agreement will be discussed at the meeting. Prior to the meeting, the CAM will provide an agenda to all potential meeting participants. The meeting may take place in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.

The administrative portion of the meeting will include discussion of the following:

- Terms and conditions of the Agreement;
- Administrative products (subtask 1.1);
- CPR meetings (subtask 1.3);
- Match fund documentation (subtask 1.7);
- Permit documentation (subtask 1.8);
- Subcontracts (subtask 1.9); and
- Any other relevant topics.

The technical portion of the meeting will include discussion of the following:

- The CAM's expectations for accomplishing tasks described in the Scope of Work;
 - An updated Project Schedule;
 - Technical products (subtask 1.1);
 - Progress reports and invoices (subtask 1.5);
 - Final Report (subtask 1.6);
 - Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
 - Any other relevant topics.
- Provide an *Updated Project Schedule*, *List of Match Funds*, and *List of Permits*, as needed to reflect any changes in the documents.

The CAM shall:

- Designate the date and location of the meeting.
- Send the Recipient a *Kick-off Meeting Agenda*.

Recipient Products:

- Updated Project Schedule *(if applicable)*
- Updated List of Match Funds *(if applicable)*
- Updated List of Permits *(if applicable)*

CAM Product:

- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings

Exhibit A Scope of Work

The goal of this subtask is to determine if the project should continue to receive Energy Commission funding, and if so whether any modifications must be made to the tasks, products, schedule, or budget. CPR meetings provide the opportunity for frank discussions between the Energy Commission and the Recipient. As determined by the CAM, discussions may include project status, challenges, successes, advisory group findings and recommendations, final report preparation, and progress on technical transfer and production readiness activities (if applicable). Participants will include the CAM and the Recipient, and may include the CAO and any other individuals selected by the CAM to provide support to the Energy Commission.

CPR meetings generally take place at key, predetermined points in the Agreement, as determined by the CAM and as shown in the Task List on page 1 of this Exhibit. However, the CAM may schedule additional CPR meetings as necessary. The budget will be reallocated to cover the additional costs borne by the Recipient, but the overall Agreement amount will not increase. CPR meetings generally take place at the Energy Commission, but they may take place at another location, or may be conducted via electronic conferencing (e.g., WebEx) as determined by the CAM.

The Recipient shall:

- Prepare a *CPR Report* for each CPR meeting that: (1) discusses the progress of the Agreement toward achieving its goals and objectives; and (2) includes recommendations and conclusions regarding continued work on the project.
- Submit the CPR Report along with any other *Task Products* that correspond to the technical task for which the CPR meeting is required (i.e., if a CPR meeting is required for Task 2, submit the Task 2 products along with the CPR Report).
- Attend the CPR meeting.
- Present the CPR Report and any other required information at each CPR meeting.

The CAM shall:

- Determine the location, date, and time of each CPR meeting with the Recipient's input.
- Send the Recipient a *CPR Agenda* and a *List of Expected CPR Participants* in advance of the CPR meeting. If applicable, the agenda will include a discussion of match funding and permits.
- Conduct and make a record of each CPR meeting. Provide the Recipient with a *Schedule for Providing a Progress Determination* on continuation of the project.
- Determine whether to continue the project, and if so whether modifications are needed to the tasks, schedule, products, or budget for the remainder of the Agreement. If the CAM concludes that satisfactory progress is not being made, this conclusion will be referred to the Deputy Director of the Energy Research and Development Division.
- Provide the Recipient with a *Progress Determination* on continuation of the project, in accordance with the schedule. The Progress Determination may include a requirement that the Recipient revise one or more products.

Recipient Products:

- CPR Report(s)
- Task Products (draft and/or final as specified in the task)

CAM Products:

Exhibit A Scope of Work

- CPR Agenda
- List of Expected CPR Participants
- Schedule for Providing a Progress Determination
- Progress Determination

Subtask 1.4 Final Meeting

The goal of this subtask is to complete the closeout of this Agreement.

The Recipient shall:

- Meet with Energy Commission staff to present project findings, conclusions, and recommendations. The final meeting must be completed during the closeout of this Agreement. This meeting will be attended by the Recipient and CAM, at a minimum. The meeting may occur in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.

The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be divided into two separate meetings at the CAM's discretion.

- The technical portion of the meeting will involve the presentation of findings, conclusions, and recommended next steps (if any) for the Agreement. The CAM will determine the appropriate meeting participants.
- The administrative portion of the meeting will involve a discussion with the CAM and the CAO of the following Agreement closeout items:
 - Disposition of any state-owned equipment.
 - Need to file a Uniform Commercial Code Financing Statement (Form UCC-1) regarding the Energy Commission's interest in patented technology.
 - The Energy Commission's request for specific "generated" data (not already provided in Agreement products).
 - Need to document the Recipient's disclosure of "subject inventions" developed under the Agreement.
 - "Surviving" Agreement provisions such as repayment provisions and confidential products.
 - Final invoicing and release of retention.
- Prepare a *Final Meeting Agreement Summary* that documents any agreement made between the Recipient and Commission staff during the meeting.
- Prepare a *Schedule for Completing Agreement Closeout Activities*.
- Provide *All Draft and Final Written Products* on a CD-ROM or USB memory stick, organized by the tasks in the Agreement.

Products:

- Final Meeting Agreement Summary (*if applicable*)
- Schedule for Completing Agreement Closeout Activities
- All Draft and Final Written Products

REPORTS AND INVOICES

Exhibit A Scope of Work

Subtask 1.5 Progress Reports and Invoices

The goals of this subtask are to: (1) periodically verify that satisfactory and continued progress is made towards achieving the project objectives of this Agreement; and (2) ensure that invoices contain all required information and are submitted in the appropriate format.

The Recipient shall:

- Submit a monthly *Progress Report* to the CAM. Each progress report must:
 - Summarize all Agreement activities conducted by the Recipient for the preceding month, including an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. See the Progress Report Format Attachment for the recommended specifications.
 - Provide a synopsis of the project progress, including accomplishments, problems, milestones, products, schedule, fiscal status, and any evidence of progress such as photographs.
- Submit a monthly or quarterly *Invoice* that follows the instructions in the “Payment of Funds” section of the terms and conditions. In addition, each invoice must document and verify:
 - Energy Commission funds received by California-based entities;
 - Energy Commission funds spent in California (*if applicable*); and
 - Match fund expenditures.

Products:

- Progress Reports
- Invoices

Subtask 1.6 Final Report

The goal of this subtask is to prepare a comprehensive Final Report that describes the original purpose, approach, results, and conclusions of the work performed under this Agreement. The CAM will review and approve the Final Report, which will be due at least **two months** before the Agreement end date. When creating the Final Report Outline and the Final Report, the Recipient must use a Style Manual provided by the CAM.

Subtask 1.6.1 Final Report Outline

The Recipient shall:

- Prepare a *Final Report Outline* in accordance with the *Style Manual* provided by the CAM.
- Submit a draft of the outline to the CAM for review and comment.
- Once agreement has been reached on the draft, submit the final outline to the CAM. The CAM will provide written approval of the final outline within 10 days of receipt.

Recipient Products:

- Final Report Outline (draft and final)

CAM Products:

- Style Manual
- Comments on Draft Final Report Outline

Exhibit A Scope of Work

- Approval of Final Report Outline

Subtask 1.6.2 Final Report

The Recipient shall:

- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline and the Style Manual provided by the CAM.
- Submit a draft of the report to the CAM for review and comment. Once agreement on the draft report has been reached, the CAM will forward the electronic version for Energy Commission internal approval. Once the CAM receives approval, he/she will provide written approval to the Recipient.
- Submit one bound copy of the Final Report to the CAM.

Products:

- Final Report (draft and final)

CAM Products:

- Comments on Draft Final Report

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds

The goal of this subtask is to ensure that the Recipient obtains any match funds planned for this Agreement and applies them to the Agreement during the Agreement term.

While the costs to obtain and document match funds are not reimbursable under this Agreement, the Recipient may spend match funds for this task. The Recipient may only spend match funds during the Agreement term, either concurrently or prior to the use of Energy Commission funds. Match funds must be identified in writing, and the Recipient must obtain any associated commitments before incurring any costs for which the Recipient will request reimbursement.

The Recipient shall:

- Prepare a *Match Funds Status Letter* that documents the match funds committed to this Agreement. If no match funds were part of the proposal that led to the Energy Commission awarding this Agreement and none have been identified at the time this Agreement starts, then state this in the letter.

If match funds were a part of the proposal that led to the Energy Commission awarding this Agreement, then provide in the letter:

- A list of the match funds that identifies:
 - The amount of cash match funds, their source(s) (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied.
 - The amount of each in-kind contribution, a description of the contribution type (e.g., property, services), the documented market or book value, the source (including a contact name, address, and telephone number), and the task(s)

Exhibit A Scope of Work

to which the match funds will be applied. If the in-kind contribution is equipment or other tangible or real property, the Recipient must identify its owner and provide a contact name, address, telephone number, and the address where the property is located.

- A copy of a letter of commitment from an authorized representative of each source of match funding that the funds or contributions have been secured.
- At the Kick-off meeting, discuss match funds and the impact on the project if they are significantly reduced or not obtained as committed. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide a *Supplemental Match Funds Notification Letter* to the CAM of receipt of additional match funds.
- Provide a *Match Funds Reduction Notification Letter* to the CAM if existing match funds are reduced during the course of the Agreement. Reduction of match funds may trigger a CPR meeting.

Products:

- Match Funds Status Letter
- Supplemental Match Funds Notification Letter (*if applicable*)
- Match Funds Reduction Notification Letter (*if applicable*)

Subtask 1.8 Permits

The goal of this subtask is to obtain all permits required for work completed under this Agreement in advance of the date they are needed to keep the Agreement schedule on track. Permit costs and the expenses associated with obtaining permits are not reimbursable under this Agreement, with the exception of costs incurred by University of California recipients. Permits must be identified and obtained before the Recipient may incur any costs related to the use of the permit(s) for which the Recipient will request reimbursement.

The Recipient shall:

- Prepare a *Permit Status Letter* that documents the permits required to conduct this Agreement. If no permits are required at the start of this Agreement, then state this in the letter. If permits will be required during the course of the Agreement, provide in the letter:
 - A list of the permits that identifies: (1) the type of permit; and (2) the name, address, and telephone number of the permitting jurisdictions or lead agencies.
 - The schedule the Recipient will follow in applying for and obtaining the permits.

The list of permits and the schedule for obtaining them will be discussed at the Kick-off meeting (subtask 1.2), and a timetable for submitting the updated list, schedule, and copies of the permits will be developed. The impact on the project if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in progress reports and will be a topic at CPR meetings.

- If during the course of the Agreement additional permits become necessary, then provide the CAM with an *Updated List of Permits* (including the appropriate information on each permit) and an *Updated Schedule for Acquiring Permits*.
- Send the CAM a *Copy of Each Approved Permit*.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the CAM within 5 days. Either of these events may trigger a CPR meeting.

Exhibit A Scope of Work

Products:

- Permit Status Letter
- Updated List of Permits (*if applicable*)
- Updated Schedule for Acquiring Permits (*if applicable*)
- Copy of each Approved Permit (*if applicable*)

Subtask 1.9 Subcontracts

The goals of this subtask are to: (1) procure subcontracts required to carry out the tasks under this Agreement; and (2) ensure that the subcontracts are consistent with the terms and conditions of this Agreement.

The Recipient shall:

- Manage and coordinate subcontractor activities in accordance with the requirements of this Agreement.
- Incorporate this Agreement by reference into each subcontract.
- Include any required Energy Commission flow-down provisions in each subcontract, in addition to a statement that the terms of this Agreement will prevail if they conflict with the subcontract terms.
- If required by the CAM, submit a draft of each *Subcontract* required to conduct the work under this Agreement.
- Submit a final copy of the executed subcontract.
- Notify and receive written approval from the CAM prior to adding any new subcontractors (see the discussion of subcontractor additions in the terms and conditions).

Products:

- Subcontracts (*draft if required by the CAM*)

TECHNICAL ADVISORY COMMITTEE

Subtask 1.10 Technical Advisory Committee (TAC)

The goal of this subtask is to create an advisory committee for this Agreement. The TAC should be composed of diverse professionals. The composition will vary depending on interest, availability, and need. TAC members will serve at the CAM's discretion. The purpose of the TAC is to:

- Provide guidance in project direction. The guidance may include scope and methodologies, timing, and coordination with other projects. The guidance may be based on:
 - Technical area expertise;
 - Knowledge of market applications; or
 - Linkages between the agreement work and other past, present, or future projects (both public and private sectors) that TAC members are aware of in a particular area.
- Review products and provide recommendations for needed product adjustments, refinements, or enhancements.
- Evaluate the tangible benefits of the project to the state of California, and provide recommendations as needed to enhance the benefits.

Exhibit A Scope of Work

- Provide recommendations regarding information dissemination, market pathways, or commercialization strategies relevant to the project products.

The TAC may be composed of qualified professionals spanning the following types of disciplines:

- Researchers knowledgeable about the project subject matter;
- Members of trades that will apply the results of the project (e.g., designers, engineers, architects, contractors, and trade representatives);
- Public interest market transformation implementers;
- Product developers relevant to the project;
- U.S. Department of Energy research managers, or experts from other federal or state agencies relevant to the project;
- Public interest environmental groups;
- Utility representatives;
- Air district staff; and
- Members of relevant technical society committees.

The Recipient shall:

- Prepare a *List of Potential TAC Members* that includes the names, companies, physical and electronic addresses, and phone numbers of potential members. The list will be discussed at the Kick-off meeting, and a schedule for recruiting members and holding the first TAC meeting will be developed.
- Recruit TAC members. Ensure that each individual understands member obligations and the TAC meeting schedule developed in subtask 1.11.
- Prepare a *List of TAC Members* once all TAC members have committed to serving on the TAC.
- Submit *Documentation of TAC Member Commitment* (such as Letters of Acceptance) from each TAC member.

Products:

- List of Potential TAC Members
- List of TAC Members
- Documentation of TAC Member Commitment

Subtask 1.11 TAC Meetings

The goal of this subtask is for the TAC to provide strategic guidance for the project by participating in regular meetings, which may be held via teleconference.

The Recipient shall:

- Discuss the TAC meeting schedule with the CAM at the Kick-off meeting. Determine the number and location of meetings (in-person and via teleconference) in consultation with the CAM.
- Prepare a *TAC Meeting Schedule* that will be presented to the TAC members during recruiting. Revise the schedule after the first TAC meeting to incorporate meeting comments.
- Prepare a *TAC Meeting Agenda* and *TAC Meeting Back-up Materials* for each TAC meeting.

Exhibit A Scope of Work

- Organize and lead TAC meetings in accordance with the TAC Meeting Schedule. Changes to the schedule must be pre-approved in writing by the CAM.
- Prepare *TAC Meeting Summaries* that include any recommended resolutions of major TAC issues.

Products:

- TAC Meeting Schedule (draft and final)
- TAC Meeting Agendas (draft and final)
- TAC Meeting Back-up Materials
- TAC Meeting Summaries

Exhibit A Scope of Work

III. TECHNICAL TASKS

*Products that require a draft version are indicated by marking “(draft and final)” after the product name in the “Products” section of the task/subtask. If “(draft and final)” does not appear after the product name, only a final version of the product is required. **Subtask 1.1 (Products)** describes the procedure for submitting products to the CAM.*

TASK 2: DEFINE SYSTEM ARCHITECTURE

The goal of this task is to develop a system level, integrated design for the power generation, electrical energy storage and energy management and control systems.

The Recipient shall:

- Define operational objectives and concept of operations.
 - Concept of Operations – will include a description of the timeline and phases of the project, operational scenarios to describe how the system functions in various modes, facilities, and command and data architecture. System performance will be measured via OSIsoft PI system. Team members will monitor the data; any off-nominal measures will cause a warning message to be issued via email or text message.
 - Operational Objectives – integrate cost-effective renewable energy production and storage, reduce daily average power demand by a minimum of 10 percent, shift energy from renewable peak to grid energy production peak, improve grid stability, manage generated power quality, ensure local grid security, and provide a means to profit from selling ancillary services to the CAISO fast regulation market and participating in DR.
- Define system level objectives and constraints.
 - System Level Objectives:
 - Integrate a cost-effective and reliable renewable power generation and storage system.
 - Manage power storage for efficiency and quality power.
 - Manage power source to shift energy from renewable peak generation to peak demand.
 - Control voltage and frequency to mitigate grid instability
 - Manage energy to allow bidding for CAISO and respond to DR.
 - System Level Constraints
 - Roof area available for PV
 - Operations within the limits allowed by The Recipient.
- Define high level requirements – provide cost-effective, reliable, sustainable, and secure power generation and storage system capable of reducing daily average power demand by a minimum of 10 percent.
- Develop system level design meeting stated project goals and objectives.
- Develop *System Architecture Definition Document*, which includes, at a minimum:
 - A description of the hardware, software, communications, and operations that provide for the implementation of the project.
 - Systems are defined – what they do.
 - Interfaces are defined.
 - Systems are broken down into sub-systems.
 - Relationships between systems/subsystems are defined.

Exhibit A Scope of Work

- Power and control signal flow diagram among system components.
- Details of control logic for energy management and system control.
- System constraints are defined.
- Concept of Operations.

The CAM shall:

- Review the Draft System Architecture Definition Document and return comments two weeks after the receipt of the draft.

Recipient Products:

- System Architecture Definition Document (Draft and Final)

CAM Product:

- Comments on Draft System Architecture Definition Document

TASK 3: INSTALL PRE-COMMERCIAL PV

The goal of this task is to procure, install, and commission pre-commercial, high-performance photovoltaic panels at a building on the UC Davis campus in Davis, CA.

The Recipient shall:

- Procure pre-commercial, high performance PV panels.
- Install PV panels on rooftop of site building.
- Integrate PV system into local microgrid.
- Commission system via testing and analysis.
- Produce *PV Subsystem Test Report* which includes, at a minimum the performance of a single panel – voltage and current output in various lighting conditions and temperatures vs. product specifications. It is highly desired to test multiple panels connected in a representative configuration to measure system performance and power quality.
- Produce *PV System Commissioning Test Report* which includes, at a minimum:
 - Verification that the equipment is installed in accordance with design drawings, manufacturer's recommendations, and industry accepted standards.
 - Operational test results.
 - Performance of system.
 - Operations and Maintenance documentation.
 - PV production data including current, voltage, and efficiency.
- Produce *PV System Wiring Diagram* for PV system showing integration into existing electrical system, including panel wiring diagram and circuit diagram of PV and grid interface.
- Participate in CPR per Task 1.3.
- Prepare *CPR Report*.

The CAM shall:

- Review the Draft PV System Commissioning Test Report and return comments two weeks after the receipt of the draft.

Recipient Products:

- PV Subsystem Test Report

Exhibit A Scope of Work

- PV System Wiring Diagram
- PV System Commissioning Test Report (Draft and Final)
- CPR Report

CAM Product:

- Comments on Draft PV System Commissioning Test Report

TASK 4: ELECTRICAL ENERGY STORAGE SYSTEM

The goal of this task is to design and build an EES system utilizing second-life lithium-ion batteries and a power management system to achieve charge/discharge efficiency at a minimum of 80 percent.

The Recipient shall:

- Develop electrical design for battery system based on second-life lithium ion batteries based on a previous 12 kW prototype system.
- Develop modular mechanical design for battery system.
- Develop management system to control battery charge balancing and estimate state of health.
- Develop a stochastic predictive control system that maximizes the efficiency and performance of onsite energy generation, storage, and transmission.
- Develop a probabilistic model of energy consumption from Recipient's historical site data.
- Install the EES system on the UC Davis campus.
- Produce *EES Electrical Design Drawing* that includes, at a minimum:
 - EES circuit diagrams,
 - Battery design and circuit diagram, and
 - Details of battery control logic.
- Produce *EES Mechanical Design Drawing* that includes, at a minimum:
 - Computer-aided design of each module and entire pack assembly;
 - Picture of EES system assembly.
- Produce *EES System Description Report* that includes, at a minimum, a description of the system and subsystems, a description of the control software, and the performance objectives.

Products:

- EES Electrical Design Drawing
- EES Mechanical Design Drawing
- EES System Description Report

TASK 5: ENERGY MANAGEMENT SYSTEM

The goal of this task is to develop an energy management system to provide hierarchical control of the power production, storage, and transmission. The objective is to match the total renewable production to the demand in an optimal fashion. The controller identifies system load flows and applies control strategies for predictive source and demand forecasting. The objective of the day-ahead bidding strategy is to maximize the expected profit of participating in CAISO's frequency regulation and DR markets given scenarios of load, PV generation, and market prices for the next day.

Exhibit A Scope of Work

The Recipient shall:

- Develop a 3 level control system for the project site location:
 - Level 1 – Frequency and Voltage control to mitigate grid stability at EES.
 - Level 2 – Balance power across the loads and DERs using a reduced order state space controller.
 - Level 3 - Day ahead power and energy management for Demand Response.
- Develop an *Energy Management System Description Report* which includes, at a minimum:
 - Definitions of the three levels of the control system at a system level and
 - Descriptions of the functionality, inputs, and outputs of each level of control.
- Install any necessary hardware to enable EMS functions on the UC Davis campus.

Products:

- Energy Management System Description Report

TASK 6: SYSTEM INTEGRATION

The goal of this task is to systematically assemble and test subsystems and systems to provide a fully functional energy generation, storage, and management system meeting all system requirements and project goals.

The Recipient shall:

- Develop a *System Integration Plan* that includes, at a minimum:
 - A high-level description of the integration plan and why it is structured the way it is, given system constraints.
 - A description of each phase in the integration process.
 - For each step of the integration process, in addition to the actual work being performed, identify location, hardware and software to be integrated, support equipment, who is responsible, and
 - A schedule for completing the plan.
- Assemble and test subsystems including EES and battery basic operation test (charging and discharging test) and controller basic operation test (signal inputs and outputs).
- Assemble and test a fully integrated system.

The CAM shall:

- Review the Draft System Integration Plan and return comments two weeks after the receipt of the draft.

Recipient Products:

- System Integration Plan (Draft and Final)

CAM Product:

- Comments on Draft System Commissioning Test Report

TASK 7: SYSTEM COMMISSIONING

The goal of this task is to test the integrated power generation, storage, management and control system to verify performance.

Exhibit A Scope of Work

The Recipient shall:

- Develop a *System Commissioning Plan* that includes, at a minimum:
 - Verification that the equipment is installed in accordance with design drawings, manufacturer's recommendations, and industry accepted standards.
 - Operational test results.
 - Performance of system.
 - Operations and Maintenance documentation.
- Perform system testing in accordance with System Commissioning Plan.
- Write a *System Commissioning Test Report*, which includes at a minimum:
 - Total power generated.
 - Power quality (voltage amplitude and phase).
- Participate in CPR per Task 1.3.
- Prepare *CPR Report*.

Products:

- System Commissioning Plan
- System Commissioning Test Report
- CPR Report

TASK 8 DATA COLLECTION AND REPORTING

The goal of this task is to report the benefits resulting from this project.

The Recipient shall:

- Compile 12 months of historic information on the community electricity demand, natural gas demand,⁴ and the operation of any existing generators in the community. Granularity of the data must be equal to or better than the granularity used for the applicable time-of-use tariff provided by the local utility.
- Collect at least 12 months of technical data collection for the operation of the generation resources, the innovative energy management strategies, and the energy demand of the community (electrical and natural gas,⁵ as applicable).
 - Energy consumption and generation data must have granularity equal to or better than the granularity used for the applicable time-of-use tariff provided by the local utility.
 - Data on the use of innovative energy management strategies must identify in which time period, consistent with the energy consumption and generation data, the strategies were enacted and to what level they were enacted, if multiple levels are available.
- Prepare a *Historic Operational Data Report* using the form in attachment 13 from the solicitation.
- Prepare a *Project Operational Data Report* using the form in attachment 13 from the solicitation.

⁴ Natural gas usage information must only be provided if the community's natural gas demand will change as a direct result of innovative strategies or generation installed in the community.

⁵ Natural gas usage information must only be provided if the community's natural gas demand will change as a direct result of innovative strategies or generation installed in the community.

Exhibit A Scope of Work

- Document the interconnection process in an *Interconnection Process Report* that includes:
 - List of interconnection and permitting costs.
 - Documentation of issues and barriers in the interconnection and permitting process.
 - Provide an interconnection timeline.

Products:

- Historic Operational Data Report
- Project Operational Data Report
- Interconnection Process Report

TASK 9 EVALUATION OF PROJECT BENEFITS

The goal of this task is to report the benefits resulting from this project.

The Recipient shall:

- Complete three Project Benefits Questionnaires that correspond to three main intervals in the Agreement: (1) Kick-off Meeting Benefits Questionnaire; (2) Mid-term Benefits Questionnaire; and (3) Final Meeting Benefits Questionnaire.
- Provide all key assumptions used to estimate projected benefits, including targeted market sector (e.g., population and geographic location), projected market penetration, baseline and projected energy use and cost, operating conditions, and emission reduction calculations. Examples of information that may be requested in the questionnaires include:
 - For Product Development Projects and Project Demonstrations:
 - Published documents, including date, title, and periodical name.
 - Estimated or actual energy and cost savings, and estimated statewide energy savings once market potential has been realized. Identify all assumptions used in the estimates.
 - Greenhouse gas and criteria emissions reductions.
 - Other non-energy benefits such as reliability, public safety, lower operational cost, environmental improvement, indoor environmental quality, and societal benefits.
 - Data on potential job creation, market potential, economic development, and increased state revenue as a result of the project.
 - A discussion of project product downloads from websites, and publications in technical journals.
 - A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
 - Additional Information for Product Development Projects:
 - Outcome of product development efforts, such copyrights and license agreements.
 - Units sold or projected to be sold in California and outside of California.
 - Total annual sales or projected annual sales (in dollars) of products developed under the Agreement.

Exhibit A Scope of Work

- Investment dollars/follow-on private funding as a result of Energy Commission funding.
- Patent numbers and applications, along with dates and brief descriptions.
- Additional Information for Product Demonstrations:
 - Outcome of demonstrations and status of technology.
 - Number of similar installations.
 - Jobs created/retained as a result of the Agreement.
- For Information/Tools and Other Research Studies:
 - Outcome of project.
 - Published documents, including date, title, and periodical name.
 - A discussion of policy development. State if the project has been cited in government policy publications or technical journals, or has been used to inform regulatory bodies.
 - The number of website downloads.
 - An estimate of how the project information has affected energy use and cost, or have resulted in other non-energy benefits.
 - An estimate of energy and non-energy benefits.
 - Data on potential job creation, market potential, economic development, and increased state revenue as a result of project.
 - A discussion of project product downloads from websites, and publications in technical journals.
 - A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
- Respond to CAM questions regarding responses to the questionnaires.

The Energy Commission may send the Recipient similar questionnaires after the Agreement term ends. Responses to these questionnaires will be voluntary.

In addition to the above information the following must be included in the final report.

- A discussion of how the community scale generation and strategies have provided or will provide value and benefits to the community, the local distribution grid, the electric utility, and ratepayers.
- A discussion of the community's use of renewable resources, CHP, innovative generation deployments, demand response, energy storage, and other strategies to help create a more robust grid.
- A discussion of the barriers and solutions to deployment of community scale generation with innovative energy management strategies, including, but not limited to, financing options, permitting requirements, and regulatory activities.
- Documentation of the project outcome, either success or failure, as measured in accordance with parameters approved by the Energy Commission.
- Development of business cases that maximize the daily operating value to the community, local distribution grid, and electric utility.
- A discussion of lessons learned and best practices, including a design configuration that provides the highest value with minimal costs, financial and otherwise.

Exhibit A Scope of Work

Products:

- Kick-off Meeting Benefits Questionnaire
- Mid-term Benefits Questionnaire
- Final Meeting Benefits Questionnaire
- Additions to the final report

TASK 10 TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES

The goal of this task is to develop a plan to make the knowledge gained, experimental results, and lessons learned available to the public and key decision makers.

The Recipient shall:

- Prepare an *Initial Fact Sheet* at start of the project that describes the project. Use the format provided by the CAM.
- Prepare a *Final Project Fact Sheet* at the project's conclusion that discusses results. Use the format provided by the CAM.
- Prepare a *Technology/Knowledge Transfer Plan* that includes:
 - An explanation of how the knowledge gained from the project will be made available to the public, including the targeted market sector and potential outreach to end users, utilities, regulatory agencies, and others.
 - A description of the intended use(s) for and users of the project results.
 - Published documents, including date, title, and periodical name.
 - Copies of documents, fact sheets, journal articles, press releases, and other documents prepared for public dissemination. These documents must include the Legal Notice required in the terms and conditions. Indicate where and when the documents were disseminated.
 - A discussion of policy development. State if project has been or will be cited in government policy publications, or used to inform regulatory bodies.
 - The number of website downloads or public requests for project results.
 - Additional areas as determined by the CAM.
- Conduct technology transfer activities in accordance with the Technology/Knowledge Transfer Plan. These activities will be reported in the Progress Reports.
- When directed by the CAM, develop *Presentation Materials* for an Energy Commission-sponsored conference/workshop on the results of the project.
- Prepare a *Technology/Knowledge Transfer Report* on technology transfer activities conducted during the project.

Products:

- Initial Fact Sheet (draft and final)
- Final Project Fact Sheet (draft and final)
- Presentation Materials (draft and final)
- Technology/Knowledge Transfer Plan (draft and final)
- Technology/Knowledge Transfer Report (draft and final)

IV. PROJECT SCHEDULE

Exhibit A Scope of Work

Please see the attached Excel spreadsheet.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: UNIVERSITY OF CALIFORNIA, DAVIS

RESOLVED, that the State Energy Resources Conservation and Development Commission (Energy Commission) adopts the staff CEQA findings contained in the Agreement Request Form; and

RESOLVED, that the Energy Commission approves Agreement EPC-14-085 from PON-14-307 with **The Regents of the University of California, on behalf of the Davis campus** for a **\$1,238,491** grant to demonstrate an innovative energy management system with advanced photovoltaics and second-use electric vehicle battery energy storage to reduce peak demand by at least 10 percent at the Robert Mondavi Institute on the UC Davis campus; and

FURTHER BE IT RESOLVED, that the Executive Director or his/her designee shall execute the same on behalf of the Energy Commission.

CERTIFICATION

The undersigned Secretariat to the Commission does hereby certify that the foregoing is a full, true, and correct copy of a Resolution duly and regularly adopted at a meeting of the California Energy Commission held on June 10, 2015.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

Harriet Kallemeyn,
Secretariat