California Energy Commission
May 8, 2024 Business Meeting
Backup Materials for Calion Technologies, Inc.

The following backup materials for the above-referenced agenda item are available in this PDF packet as listed below:

1. Proposed Resolution
2. Grant Request Form
3. Scope of Work

[PROPOSED]

RESOLUTION NO: 24-0508-15b

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION: Calion Technologies, Inc.

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

RESOLVED, that the CEC approves agreement EPC-23-030 with Calion Technologies, Inc. for a $1,500,000 grant to develop a non-vapor compression, ionocaloric heat pump as a heating solution for commercial buildings. This laboratory-based project in Berkeley will develop a 5 kW bench top prototype ionocaloric heat pump with 40 kWh of integrated thermal storage; and

FURTHER BE IT RESOLVED, that the Executive Director or their designee shall execute the same on behalf of the CEC.

CERTIFICATION

The undersigned Secretariat to the CEC 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 CEC held on May 8, 2024.

AYE:
NAY:
ABSENT:
ABSTAIN:

Dated:

_____
Kristine Banaag
Secretariat

STATE OF CALIFORNIA
CALIFORNIA ENERGY COMMISSION

CEC-270 (Revised 9/2022)

GRANT REQUEST FORM (GRF)

A. New Agreement Number

IMPORTANT: New Agreement # to be completed by Contracts, Grants, and Loans Office.

New Agreement Number: EPC-23-030

B. Division Information

1. Division Name: ERDD
2. Agreement Manager: Jeanie Mar
3. MS-:None
4. Phone Number: 916-776-0791

C. Recipient's Information

1. Recipient's Legal Name: Calion Technologies, Inc.
2. Federal ID Number: 92-1921042

D. Title of Project

Title of project: Ionocaloric Heat Pumps for Zero-GWP Heating

E. Term and Amount

1. Start Date: 6/10/2024
2. End Date: 9/30/2026
3. Amount: $1,500,000.00

F. Business Meeting Information

1. Are the ARFVTP agreements $75K and under delegated to Executive Director? No
2. The Proposed Business Meeting Date: 5/8/2024
3. Consent or Discussion? Discussion
4. Business Meeting Presenter Name: Bradley Meister
5. Time Needed for Business Meeting: 5 minutes.
6. The email subscription topic is: EPIC (Electric Program Investment Charge).

Agenda Item Subject and Description:

Calion Technologies, Inc. Proposed resolution approving agreement EPC-23-030 with Calion Technologies, Inc. for a $1,500,000.00 grant to develop a non-vapor compression, ionocaloric heat pump as a heating solution for commercial buildings and adopting staff's determination that this project is exempt from CEQA. This laboratory-based project in Berkeley will develop a 5 kW bench top prototype ionocaloric heat pump with 40 kWh of integrated thermal storage. (EPIC funding) Contact: Bradley Meister

G. California Environmental Quality Act (CEQA) Compliance

1. **Is Agreement considered a "Project" under CEQA?**
   Yes

   If yes, skip to question 2.

   If no, complete the following (PRC 21065 and 14 CCR 15378) and 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 answer the following questions.**

a) Agreement **IS** exempt?

Yes

Statutory Exemption?

No

If yes, list PRC and/or CCR section number(s) and separate each with a comma. If no, enter "None" and go to the next question.

PRC section number: None

CCR section number: None

Categorical Exemption?

Yes

If yes, list CCR section number(s) and separate each with a comma. If no, enter "None" and go to the next question.

CCR section number: Cal. Code Regs., tit. 14, § 15301 ; Cal. Code Regs., tit. 14, § 15306;

Common Sense Exemption? 14 CCR 15061 (b) (3)

No

If yes, explain reason why Agreement is exempt under the above section. If no, enter "Not applicable" and go to the next section.

California Code of Regulations, title 14, section 15301 provides that projects which consist of the operation, repair, maintenance, permitting, licensing, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, and which involve negligible or no expansion of existing or former use, are categorically exempt from the provisions of the California Environmental Quality Act (CEQA). This project involves operating or conducting lab work and creating a prototype heat pump at an existing facility, with no expansion of capacity. This lab work is at an existing, developed site on land that is not environmentally sensitive. No historical resources or buildings will be affected. Noise and odors will not be generated by this activity in excess of existing permitted amounts. The lab work will not increase traffic to these sites and will not require permits for air, water, conditional use, building expansion, hazardous waste, or rezoning. Therefore, the project is exempt from CEQA under section 15301.

California Code of Regulations, title 14, section 15306 provides that projects which consists of basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource are categorically exempt from the provisions of CEQA. This project involves basic data collection, research, experimental management, and resource evaluation activities which do not result in serious or major disturbance to an environmental source. This project includes mechanical design studies and engineering analyses of ionocaloric heat pump designs. Prototype designs and

development will be lab tested in a controlled research laboratory specifically designed for the purpose of testing industrial equipment. This work will not result in a serious or major disturbance to an environmental resource. Therefore, the project is exempt from CEQA under Section 15306.

This project does not involve impacts on any particularly sensitive environment; does not involve any cumulative impacts of successive projects of the same type in the same place that might be considered significant; does not involve unusual circumstances that might have a significant effect on the environment; will not result in damage to scenic resources within a highway officially designated as a state scenic highway; the project site is not included on any list compiled pursuant to Government Code section 65962.5; and the project will not cause a substantial adverse change in the significance of a historical resource. Therefore, none of the exceptions to categorical exemptions listed in CEQA Guidelines section 15300.2.

b) Agreement **IS NOT** exempt.

IMPORTANT: consult with the legal office to determine next steps.

No

If yes, answer yes or no to all that applies. If no, list all as “no” and “None” as “yes”.

Additional Documents	Applies
Initial Study	No
Negative Declaration	No
Mitigated Negative Declaration	No
Environmental Impact Report	No
Statement of Overriding Considerations	No
None	Yes

H. Subcontractors

List all Subcontractors listed in the Budget (s) (major and minor). Insert additional rows if needed. If no subcontractors to report, enter “No subcontractors to report” and “0” to funds. **Delete** any unused rows from the table.

Subcontractor Legal Company Name	CEC Funds	Match Funds
No subcontractors to report	$	**$**

I. Vendors and Sellers for Equipment and Materials/Miscellaneous

List all Vendors and Sellers listed in Budget(s) for Equipment and Materials/Miscellaneous. Insert additional rows if needed. If no vendors or sellers to report, enter “No vendors or sellers to report” and “0” to funds. **Delete** any unused rows from the table.

Vendor/Seller Legal Company Name	CEC Funds	Match Funds

No vendors to report	**$**	**$**

J. Key Partners

List all key partner(s). Insert additional rows if needed. If no key partners to report, enter "No key partners to report." **Delete** any unused rows from the table.

Key Partner Legal Company Name
No key partners to report

K. Budget Information

Include all budget information. Insert additional rows if needed. If no budget information to report, enter "N/A" for "Not Applicable" and "0" to Amount. **Delete** any unused rows from the table.

Funding Source	Funding Year of Appropriation	Budget List Number	Amount
EPIC	22-23	301.001J	$ 1,500,000

TOTAL Amount: $ 1,500,000

R&D Program Area: ICMB: Buildings

Explanation for "Other" selection Not applicable

Reimbursement Contract #: Not applicable

Federal Agreement #: Not applicable

L. Recipient's Contact Information

1. Recipient's Administrator/Officer

Name: Drew Lilley

Address: 4147 Creekpoint Ct

City, State, Zip: Danville, CA 94506-1212

Phone: 973-715-1793

E-Mail: Drewlilley98@gmail.com

3. Recipient's Project Manager

Name: Drew Lilley

Address: 4147 Creekpoint Ct

City, State, Zip: Danville, CA 94506-1212

Phone: 973-715-1793

E-Mail: Drewlilley98@gmail.com

M. Selection Process Used

There are three types of selection process. List the one used for this GRF.

Selection Process	Additional Information
Competitive Solicitation #	GFO-22-308
First Come First Served Solicitation #	Not applicable
Other	Not applicable

N. Attached Items

1. List all items that should be attached to this GRF by entering “Yes” or “No”.

Item Number	Item Name	Attached
1	Exhibit A, Scope of Work/Schedule	Yes
2	Exhibit B, Budget Detail	Yes
3	CEC 105, Questionnaire for Identifying Conflicts	Yes
4	Recipient Resolution	No
5	Awardee CEQA Documentation	No

Approved By

Individuals who approve this form must enter their full name and approval date in the MS Word version.

Agreement Manager: Jeanie Mar

Approval Date: 3/20/2024

Branch Manager: Anthony Ng

Approval Date: 3/22/2024

Director: Anthony Ng for Jonah Steinbuck

Approval Date: 3/22/2024

Exhibit A
Scope of Work
Calion Technologies, Inc.

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR[1]	Task Name
1		General Project Tasks
2		MVR Compressor/Separator and Associated Heat Exchanger Model, Design and Analysis
3		Compressor and Heat Exchanger Component Sourcing/Selection
4	x	MVR Assembly and Component Level Testing
5		MVR Sub-assembly Performance Mapping
6	x	Controls System Design
7		Controls System Component Sourcing for Implementation into Prototype
8		Thermal Storage Reservoir and Hot Side Heat Exchanger
9		Controlled Laboratory Testing of Ionocaloric Heat Pump for Nominal Performance Metrics using “Simulated” Environments
10		Evaluation of Project Benefits
11		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CEC	California Energy Commission
CPR	Critical Project Review
MVR	Mechanical Vapor Recompression
TAC	Technical Advisory Committee

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

A. Purpose of Agreement

The purpose of this Agreement is to fund the advancement of a non-vapor compression, ionocaloric heat pump as a heating solution in commercial buildings. This advancement will focus on developing a bench top prototype to demonstrate the high efficiency and high temperature span of the ionocaloric prototype so that it may further advance to a pilot demonstration.

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

Exhibit A
Scope of Work
Calion Technologies, Inc.

B. Problem/ Solution Statement

Problem

Approximately 38% of total building energy in 2021 was used for heating/cooling purposes, making the decarbonization of building energy a top priority for meeting the nation's climate goals. Electrification is one of the most promising and scalable solutions to decarbonize building energy, and its' decarbonization must focus on (1) Improved heating efficiencies and (2) using lower GWP energy sources through electrification and (3) lower GWP refrigerants/materials. Although direct electrification of the heating demand through resistive heating can provide cleaner energy and lower GWP materials, its operation is expensive and will require significant renewable energy generation capacity. Heat pumps, on the other hand, have the potential to meet both efficiency and clean generation goals.

The major technical hurdles heat pumps must overcome for deployment in the heating of commercial buildings is low heating efficiency. Heat pumps must compete with natural gas heaters both in capital and operational costs. Unfortunately, the operational costs tend to dominate in commercial buildings, so achieving price parity with natural gas heaters is determined directly by the efficiency of the heat pump and current pricing in the energy markets. Until heat pumps can improve their performance, natural gas heaters will simply make more economic sense due to the current favorable energy economics for natural gas. Improving heat pump efficiency for the heating of commercial buildings is non-trivial. Low efficiency is caused by: (1) Heating/Cooling load mismatch, and (2) High expansion and compressor losses due to high pressure ratios needed for large temperature span operation. Moreover, they face all these problems using very high GWP refrigerants, such as R410a or R134a.

Solution

This project will develop non-vapor compression-based ionocaloric heat pumping technology that has the potential to circumvent all the above problems and meet the performance goals. The ionocaloric heat pump is a solid-liquid based heat pumping technology with high efficiencies over very-high temperature spans. It utilizes the ionocaloric effect by changing the concentration of a salt in a mixture to modulate a material's phase transition, and therefore its heat content. Because it relies on the solid/liquid transition, the refrigerant has natural thermal energy storage capabilities. In this project, we will demonstrate 40 kWh of thermal storage built into the heat pump as a simple buffer tank filled with the liquid phase of the ionocaloric material, which sits between the output of the separation step and the heat exchanger.

The first demonstrated prototype was published in Science last year and is CO_2 negative, environmentally benign, non-hazardous, zero-GWP, non-toxic, and non-flammable. Without vapor leaking into the atmosphere, and toxic/hazardous/flammable components, the ionocaloric technologies have the potential to disrupt and decarbonize commercial building heating through more efficient and clean operation. Ionocaloric heat pumping can solve the major challenges vapor-compression heat pumps face in commercial heating of buildings using:

1. Higher efficiency thermodynamic cycle for increased COP at high temperature differences.
2. Thermal storage for hot/cold load balancing.
3. Zero-GWP, non-toxic, non-hazardous, and non-flammable materials.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Deliver a 5 kW ionocaloric heat pump prototype with 40 kWh of thermal storage that can operate at greater than 40% of Carnot efficiency with a system level footprint of at least 50 W/L with a projected cost of $50/kW of heat over a temperature lift of at least 45°C.
- Advance Ionocaloric Heat Pumping technology.
- Reduce Carbon Emissions.
- Reduce energy consumption in the residential and commercial buildings sector.

Ratepayer Benefits:[2] This Agreement will result in the ratepayer benefits of reducing energy use and emissions in California's heating and cooling sectors. Buildings in California used a total of 707 trillion BTUs from natural gas heating in 2018. The proposed ionocaloric heat pump has the potential to replace the natural gas heating for space heating and water heating of buildings. The target performance for this project is a heat pump with relative Carnot efficiency of 40%, which would yield a coefficient of performance of ~4 over a standard operating range in a typical building with a cold side of 10°C and hot side of 45°C. The cost savings associated with a switch from natural gas heating to ionocaloric heating would then be about $7 billion in savings to California ratepayers.

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 and advancing ionocaloric heat pump technology, which promises to provide a highly efficient, sustainable, and zero-GWP solution for heating and cooling in California's residential and commercial buildings. The project not only aligns with California's ambition to reduce greenhouse gas emissions and enhance energy efficiency across sectors but also paves the way for substantial energy savings and cost reductions for consumers, thereby contributing to the state's broader energy equity and environmental objectives. Furthermore, the technology offers a viable alternative to traditional heating systems, supporting the state's transition towards cleaner, electrified heating solutions and reducing dependency on natural gas, thus propelling California towards its energy, environmental, and economic goals.

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[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
Calion Technologies, Inc.

Agreement Objectives

The objective of this Agreement is to develop the first working benchtop scale ionocaloric heat pump prototype with thermal storage in order to advance the ionocaloric heat pumping technology and increase potential commercial sites willingness to agree to a pilot demonstration of the ionocaloric heat pump technology.

Exhibit A
Scope of Work
Calion Technologies, Inc.

III. 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).** All products submitted which will be viewed by the public, must comply with the accessibility requirements of Section 508 of the federal Rehabilitation Act of 1973, as amended (29 U.S.C. Sec. 794d), and regulations implementing that act as set forth in Part 1194 of Title 36 of the Federal Code of Regulations**.** All technical tasks should include product(s). 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, including the Final Report Outline and Final Report

- 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.
- Consider incorporating all CAM comments into the final product. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product.
- Submit the revised product and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period, or approves a request for additional time.

For products that require a final version only

- Submit the product to the CAM for acceptance. The CAM may request minor revisions or explanations prior to acceptance.

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**
  - Submit all data and documents required as products under this Agreement in an electronic file format that is fully editable and compatible with the California Energy Commission's (CEC) 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.

The following describes the accepted formats for electronic data and documents provided to the CEC 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.
- 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 CEC's Information Technology Services Branch to determine whether the exceptions are allowable.

MEETINGS

Subtask 1.2 Kick-off Meeting

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 CEC 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;
  - Invoicing and auditing procedures;
  - 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 (subtask 1.5);
- Final Report (subtask 1.6);
- Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
- Any other relevant topics.

- Provide *Kick-off Meeting Presentation* to include but not limited to:
  - Project overview (i.e. project description, goals and objectives, technical tasks, expected benefits, etc.)
  - Project schedule that identifies milestones
  - List of potential risk factors and hurdles, and mitigation strategy

- Provide an *Updated Project Schedule, Match Funds Status Letter,* and *Permit Status Letter*, 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:

- Kick-off Meeting Presentation
- Updated Project Schedule *(if applicable)*
- Match Funds Status Letter (subtask 1.7) *(if applicable)*
- Permit Status Letter (subtask 1.8) *(if applicable)*

CAM Product:

- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings

The goal of this subtask is to determine if the project should continue to receive CEC 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 CEC 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 CEC.

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 CEC, 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 and submit 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.
- 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* with 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)

CAM Products:

- CPR Agenda(s)
- 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 CEC 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 procured equipment.

  - The CEC'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 copies of *All Final Products* on a USB memory stick, organized by the tasks in the Agreement.

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

REPORTS AND INVOICES

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 progress made on all Agreement activities as specified in the scope of work for the preceding month, including accomplishments, problems, milestones, products, schedule, fiscal status, and 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.
- Submit a monthly or quarterly *Invoice* that follows the instructions in the "Payment of Funds" section of the terms and conditions, including a financial report on Match Funds and in-state 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.

When creating the Final Report Outline and the Final Report, the Recipient must use the CEC 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 *Energy Commission Style Manual* provided by the CAM.

Recipient Products:

- Final Report Outline (draft and final)

CAM Product:

- Energy Commission Style Manual
- Comments on Draft Final Report Outline
- Acceptance 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, Energy Commission Style Manual, and Final Report Template provided by the CAM with the following considerations:
  - Ensure that the report includes the following items, in the following order:
    - Cover page (**required**)
    - Credits page on the reverse side of cover with legal disclaimer (**required**)
    - Acknowledgements page (optional)
    - Preface (**required**)
    - Abstract, keywords, and citation page (**required**)
    - Table of Contents (**required**, followed by List of Figures and List of Tables, if needed)
    - Executive summary (**required**)
    - Body of the report (**required**)
    - References (if applicable)
    - Glossary/Acronyms (If more than 10 acronyms or abbreviations are used, it is required.)
    - Bibliography (if applicable)
    - Appendices (if applicable) (Create a separate volume if very large.)
    - Attachments (if applicable)
- Submit a draft of the Executive Summary to the TAC for review and comment.
- Develop and submit a *Summary of TAC Comments on Draft Final Report* received on the Executive Summary. For each comment received, the recipient will identify in the summary the following:
  - Comments the recipient proposes to incorporate.
  - Comments the recipient does propose to incorporate and an explanation for why.
- Submit a draft of the report to the CAM for review and comment. The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt.
- Incorporate all CAM comments into the *Final Report*. If the Recipient disagrees with any comment, provide a *Written Responses to Comments* explaining why the comments

- Submit the revised *Final Report* electronically with any Written Responses to Comments within 10 days of receipt of CAM's Written Comments on the Draft Final Report, unless the CAM specifies a longer time period or approves a request for additional time.

Products:
- Summary of TAC Comments on Draft Final Report
- Draft Final Report
- Written Responses to Comments *(if applicable)*
- Final Report

CAM Product:
- Written Comments on the 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 CEC 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 CEC 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 CEC 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) 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.
    - If different from the solicitation application, provide 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.

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 each 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.
- Provide recommendations regarding information dissemination, market pathways, or commercialization strategies relevant to the project products.
- Help set the project team's goals and contribute to the development and evaluation of its statement of proposed objectives as the project evolves.
- Provide a credible and objective sounding board on the wide range of technical and financial barriers and opportunities.
- Help identify key areas where the project has a competitive advantage, value proposition, or strength upon which to build.
- Advocate, to the extent the TAC members feel is appropriate, on behalf of the project in its effort to build partnerships, governmental support, and relationships with a national spectrum of influential leaders.
- Ask probing questions that insure a long-term perspective on decision-making and progress toward the project's strategic goals.

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.
- 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.

The TAC shall:

- Help set the project team's goals and contribute to the development and evaluation of its statement of proposed objectives as the project evolves.
- Provide a credible and objective sounding board on the wide range of technical and financial barriers and opportunities.
- Help identify key areas where the project has a competitive advantage, value proposition, or strength upon which to build.
- Advocate on behalf of the project in its effort to build partnerships, governmental support and relationships with a national spectrum of influential leaders.
- Ask probing questions that insure a long-term perspective on decision-making and progress toward the project's strategic goals.
- Review and provide comments to proposed project performance metrics.
- Review and provide comments to proposed project Draft Technology Transfer Plan.

Products:

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

Subtask 1.12 Project Performance Metrics

The goal of this subtask is to finalize key performance targets for the project based on feedback from the TAC and report on final results in achieving those targets. The performance targets should be a combination of scientific, engineering, techno-economic, and/or programmatic metrics that provide the most significant indicator of the research or technology's potential success.

The Recipient shall:

- Complete and submit the project performance metrics section of the *Initial Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task, to the CAM.
- Present the draft project performance metrics at the first TAC meeting to solicit input and comments from the TAC members.
- Develop and submit a *TAC Performance Metrics Summary* that summarizes comments received from the TAC members on the proposed project performance metrics. The *TAC Performance Metrics Summary* will identify:
    - TAC comments the Recipient proposes to incorporate into the *Initial Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task.
    - TAC comments the Recipient does not propose to incorporate with and explanation why.
- Develop and submit a *Project Performance Metrics Results* document describing the extent to which the Recipient met each of the performance metrics in the *Final Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task.
- Discuss the *Project Performance Metrics Results* at the Final Meeting.

Products:

- TAC Performance Metrics Summary
- Project Performance Metrics Results

IV. 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: MVR COMPRESSOR/SEPARATOR AND ASSOCIATED HEAT EXCHANGER MODEL, DESIGN AND ANALYSIS

The goal of this task is to complete the physics-based modeling of the system's subcomponents and design the specifications for those subsystems.

The Recipient shall:

- Develop detailed physics-based models of the Mechanical Vapor Recompression (MVR) separator for different compressor types.
- Define the pressure ratios and volumetric flow rates going into the compressor.
- Use physics-based model to choose the compressor type and size the compressor.
- Design the heat exchanger for the separator subcomponent based on projected flow rates and temperatures from the inlet and outlet of the compressor (from model).
- Quantify design tradeoffs between heat exchanger size, cost, and separation efficiency.
- Finalize design and specifications based on modeling results.
- Prepare a brief *Modeling Results and Performance Predictions Summary* which includes but is not limited to:
    - MVR separator models for the different compressor types;
    - Incoming pressure ratios and volumetric compressor flow rates;
    - Subsystem design specifications and schematic of final compressor/separator and heat exchanger; and
    - Heat exchanger size, costs, and separation efficiency design tradeoffs.

Products:

- Modeling Results and Performance Predictions Summary

TASK 3: COMPRESSOR AND HEAT EXCHANGER COMPONENT SOURCING/SELECTION

The goal of this task is to procure key equipment from US vendors such as heat exchangers and MVR components that meet the technical specifications and design guidelines finalized in the physics-based modeling to achieve acceptable efficiency, reliability, and cost.

The Recipient shall:

- Communicate needs to suppliers and identify equipment within required specifications.
- Purchase and quality check key equipment needed for MVR experiments to ensure they meet required specifications.
- Communicate needs to suppliers and identify sensors that meet the specifications.
- Purchase, install, and calibrate experimental sensors and equipment for characterizing solution properties during future testing.
- Write software for data logging and data interpretation of experiments.
- Validate that all equipment is suited for experimental testing.

- Prepare *Experimental Equipment Validation Completion Letter* which includes but is not limited to:
    - Available key equipment suppliers and costs lists including future potential projected availability and costs of equipment; and
    - Equipment validation documentation including challenges and lessons learned.

Products:

- Experimental Equipment Validation Completion Letter

TASK 4: MVR ASSEMBLY AND COMPONENT LEVEL TESTING

The goal of this task is to leak and pressure test the compressor, heat exchangers, and pumps, along with all supporting hardware for experimentation.

The Recipient shall:

- Prepare an *MVR Assembly and Component Level Test Plan* that includes the test objectives, procedures, conditions, facilities, and equipment.
- Leak test all individual sub-components.
- Pressure test all individual sub-components.
- Remediate all hydraulic, vacuum, and pressure-related issues by component replacement or component modification.
- Prepare an *MVR Mechanical Testing Completion Letter* which includes but is not limited to:
    - Documented results of leak and pressure tests of the compressor, heat exchangers, and pumps, along with all supporting hardware for experimentation which includes challenges and lessons learned.
- Prepare a *CPR Report #1* in accordance with subtask 1.3 (CPR Meetings).
- Participate in a CPR meeting.

Products:

- MVR Assembly and Component Level Test Plan
- MVR Mechanical Testing Completion Letter
- CPR Report #1

TASK 5: MVR SUB-ASSEMBLY PERFORMANCE MAPPING

The goal of this task is to fully assemble the MVR sub-assembly and use it to test the separation performance under various experimental operating conditions.

The Recipient shall:

- Assemble MVR sub assembly and integrate with experimental test setup.
- Investigate a range of operating parameters that would be seen in the full device.
- Calculate separation efficiencies for various operating parameters.
- Project full device performance efficiency using physics models that take in separation efficiencies as input.
- Investigate power density relationship with separation efficiency.
- Predict full system power density using physics-based models that take in separation power density as input.
- Investigate the maximum and minimum concentration changes that can be achieved.

- Prepare a brief *Mechanical Vapor Recompression for Ionocaloric Heat Pumping Report* which includes but is not limited to:
    - Sub-assembly and integration challenges and lessons learned;
    - List of full device operational parameters ranges investigated and calculated separation efficiencies for various operating parameters;
    - Projected full device performance efficiency;
    - Power density relationship with separation power density;
    - Full system power model density prediction; and
    - Potential maximum and minimum concentration changes that can be achieved.

Products:

- Mechanical Vapor Recompression for Ionocaloric Heat Pumping Report (Draft and Final)

TASK 6: CONTROLS SYSTEM DESIGN

The goal of this task is to design a controls system at the system level that bridges the heat exchangers and separators so that hot and cold side temperatures of the heat pump can be set by controlling MVR flow rate and outlet concentrations.

The Recipient shall:

- Investigate various control strategies for temperature setting in ionocaloric heat pump.
- Down select to most promising strategy.
- Identify key sources of signal feedback for controls strategy.
- Develop physics-based model to predict controls behavior.
- Design controller for ionocaloric heat pump.
- Prepare a brief *Controls Strategies for Ionocaloric Heat Pumping Report* which includes but is not limited to:
    - Analysis and discussion of the control strategies, the most effective/promising strategy, the developed predictive controls behavior model, and key sources of signal feedback for the selected strategy; and
    - Controller design for ionocaloric heat pump.
- Prepare a *CPR Report #2* in accordance with subtask 1.3 (CPR Meetings).
- Participate in a CPR meeting.

Products:

- Controls Strategies for Ionocaloric Heat Pumping Report
- CPR Report #2

TASK 7: CONTROLS SYSTEM COMPONENT SOURCING FOR IMPLEMENTATION INTO PROTOTYPE

The goal of this task is to select and source the components needed for the controls system and configure them into a controller to be used for the prototype.

The Recipient shall:

- Communicate needs to suppliers and identify controls equipment within required specifications.
- Purchase and quality check key equipment needed for controller to ensure they meet required specifications.

- Assemble and configure controller.
- Test controller for various inputs and outputs.
- Certify that controller meets requirements for prototype.
- Prepare a brief *Controller for Ionocaloric Heat Pumping Report* which includes but is not limited to:
    - Available controller equipment suppliers and costs lists including future potential projected availability and costs of equipment;
    - Assembly and controller configuration challenges and lessons learned; and
    - Documentation of controller configuration validation.

Products:

- Controller for Ionocaloric Heat Pumping Report (Draft and Final)

TASK 8: THERMAL STORAGE RESERVOIR AND HOT SIDE HEAT EXCHANGER

The goal of this task is to model, design, and fabricate a 40 kWh thermal storage unit to accompany the ionocaloric heat pump prototype.

The Recipient shall:

- Investigate various thermal energy storage architectures.
- Down select to most promising architecture.
- Develop a physics-based model to predict the thermal response of the design under various operating conditions.
- Design a thermal energy storage unit driven by the physics-based model to integrate into the prototype.
- Machine/Fabricate thermal energy storage unit.
- Leak/Pressure test thermal energy storage unit.
- Test thermal energy storage capacity as a function of power draw.
- Prepare a brief *Thermal Energy Storage for Ionocaloric Heat Pumps Report* which includes but is not limited to:
    - An analysis and discussion of thermal energy storage architectures evaluated and selected;
    - Model prediction results of design operating under various conditions;
    - An analysis and discussion of the thermal energy storage unit of the machining/fabrication process, leak and pressure testing, and thermal energy storage capacity results.

Products:

- Thermal Energy Storage for Ionocaloric Heat Pumps Report (Draft and Final)

TASK 9: CONTROLLED LABORATORY TESTING OF IONOCALORIC HEAT PUMP FOR NOMINAL PERFORMANCE METRICS USING "SIMULATED" ENVIRONMENTS

The goal of this task is to integrate all subcomponents into a prototype to operate at 5 kW of heating with an average COP of 3.2 in a typical diurnal ambient temperature profile in northern California while collecting efficiency and power output data for a minimum of 12 months.

The Recipient shall:

- Prepare a *Ionocaloric Heat Pump Laboratory Measurement and Verification Plan (Draft and Final)* which includes but is not limited to:
  - Listing of all instrumentation;
  - Schematic of instrument type (temperature, pressure, humidity, flow, etc.), specific location and installation methods;
  - Data collection method (data logger, use of Wi-Fi to cloud or local storage, etc.);
  - Description of all subcomponents required to assemble the prototype and apparatuses that will be used to monitor and test;
  - Description of commercial buildings of interest;
  - Detailed description of the different "simulated" environments and climate zones; and
  - Third party verification.
- Integrate all sub-systems into a complete device.
- Test for successful integration by designing an appropriate standard operating procedure.
- Interface prototype with sensors and interfacial flow loops that can simulate external environment.
- Run prototype according to the measurement and verification plan.
- Run prototype continuously and collect data for a minimum of 12 months to simulate operation in a real-world environment.
- Model the ionocaloric heat pump performance with and without storage in all 16 California climate zones using a CAM approved modeling software.
- Deliver an average COP of 3.2 in a typical diurnal ambient temperature profile in northern California.
- Prepare a *Ionocaloric Heat Pump Performanc*e *Report* which includes but is not limited to:
  - Cost-effective energy savings and simple payback using M&V testing data;
  - Standard operating procedure developed for testing successful sub-system integration;
  - Challenges and lessons learned from integrated sub-systems in the completed prototype;
  - Results for sub-system integration of the prototype under standard operating procedures;
  - Results and analysis of prototype run under real-world environment which will also include average COP of the 5 kW system with and without the storage system; and
  - Modeled ionocaloric heat pump performance results with and without storage from all 16 California climate zones, analysis of which climate zones would be best served with this system and a comparison of the corresponding climate zone with the simulation results.

Products:

- Ionocaloric Heat Pump Laboratory Measurement and Verification Plan (Draft and Final)
- Ionocaloric Heat Pump Performance Report (Draft and Final)

TASK 10: EVALUATION OF PROJECT BENEFITS

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

The Recipient shall:

- Complete *the Initial Project Benefits Questionnaire*. The Initial Project Benefits Questionnaire shall be initially completed by the Recipient with 'Kick-off' selected for the 'Relevant data collection period' and submitted to the CAM for review and approval.
- Complete the *Annual Survey* by January 31st of each year. The Annual Survey includes but is not limited to the following information:
  - Technology commercialization progress
  - New media and publications
  - Company growth
  - Follow-on funding and awards received
- Complete the *Final Project Benefits Questionnaire*. The Final Project Benefits Questionnaire shall be completed by the Recipient with 'Final' selected for the 'Relevant data collection period' and submitted to the CAM for review and approval.
- Respond to CAM questions regarding the questionnaire drafts.
- Complete and update the project profile on the CEC's public online project and recipient directory on the Energize Innovation website (www.energizeinnovation.fund), and provide *Documentation of Project Profile on EnergizeInnovation.fund*, including the profile link.
- If the Prime Recipient is an Innovation Partner on the project, complete and update the organizational profile on the CEC's public online project and recipient directory on the Energize Innovation website (www.energizeinnovation.fund), and provide *Documentation of Organization Profile on EnergizeInnovation.fund*, including the profile link.

Products:

- Initial Project Benefits Questionnaire
- Annual Survey(s)
- Final Project Benefits Questionnaire
- Documentation of Project Profile on EnergizeInnovation.fund
- Documentation of Organization Profile on EnergizeInnovation.fund

TASK 11: TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES

The goal of this task is to ensure the technological learning that resulted from the demonstration(s) is captured and disseminated to the range of professions that will be responsible for future deployments of this technology or similar technologies.

The Recipient Shall:

- Develop and submit a *Project Case Study Plan* that outlines how the Recipient will document the planning, construction, commissioning, and operation of the technology or system being demonstrated. The Project Case Study Plan should include:
  - An outline of the objectives, goals, and activities of the case study.
  - The organization that will be conducting the case study and the plan for conducting it.
  - A list of professions and practitioners involved in the technology's deployment.
  - Specific activities the recipient will take to ensure the learning that results from the project is disseminated to those professions and practitioners.
  - Presentations/webinars/training events to disseminate the results of the case study.

- Present the draft *Project Case Study Plan* to the TAC for review and comment.
- Develop and submit a *Summary of TAC Comments* that summarizes comments received from the TAC members on the draft *Project Case Study Plan*. This document will identify:
    - TAC comments the recipient proposes to incorporate into the final *Project Case Study Plan*.
    - TAC comments the recipient does not propose to incorporate with and explanation why.
- Submit the final *Project Case Study Plan* to the CAM for approval.
- Execute the final Project Case Study Plan and develop and submit a *Project Case Study*.
- When directed by the CAM, develop presentation materials for a CEC sponsored conference/workshop(s) on the project.
- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the California CEC.
- Provide at least (6) six High Quality Digital Photographs (minimum resolution of 1300x500 pixels in landscape ratio) of pre and post technology installation at the project sites or related project photographs.

Products:

- Project Case Study Plan (draft and final)
- Summary of TAC Comments
- Project Case Study (draft and final)
- High Quality Digital Photographs

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.