



**California Energy Commission
May 13, 2026 Business Meeting**

**Backup Materials for The Regents of the University of California as Manager and
Operator of the Lawrence Berkeley National Laboratory**

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

CALIFORNIA ENERGY COMMISSION

**PROPOSED RESOLUTION: The Regents of the University of California as
Manager and Operator of the Lawrence Berkeley National Laboratory**

RESOLUTION NO: 26-0513-XX

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-25-044 with Lawrence Berkeley National Laboratory for a \$2,000,000 grant. This project will fund the design, prototype construction, and laboratory and field testing of an advanced-refrigerant 120V heat pump water heater. Design considerations also include physical size/form factor, condensate management, and the incorporation of controls for dynamic grid response; and

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

APPROVED AND ADOPTED this 13th day of May 2026, by the following vote:

AYE:

NAY:

ABSENT:

ABSTAIN:

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 approved and adopted by affirmative vote of the CEC at a meeting held on May 13, 2026.

Kim Todd
Secretariat



GRANT REQUEST FORM (GRF)

A. New Agreement Number

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

New Agreement Number: EPC-25-044

B. Division Information

1. Division Name: ERDD
2. Agreement Manager: Jackson Thach
3. MS-:51
4. Phone Number: 916-776-0818

C. Recipient's Information

1. Recipient's Legal Name: The Regents of the University of California as Manager and Operator of the Lawrence Berkeley National Laboratory

D. Title of Project

Title of project: Next Generation Low Peak Power Heat Pump Water Heater

E. Term and Amount

1. Start Date: 5/20/2026
2. End Date: 6/28/2030
3. Amount: \$2,000,000

F. Business Meeting Information

1. Are the ARFVTP agreements \$75K and under delegated to Executive Director? No
2. The Proposed Business Meeting Date: 05/13/2026
3. Consent or Discussion? Consent
4. Business Meeting Presenter Name: N/A
5. Time Needed for Business Meeting: N/A
6. The email subscription topic is: Electric Program Investment Charge (EPIC) Program

Project Description:

The Regents of the University of California as Manager and Operator of the Lawrence Berkeley National Laboratory. Proposed resolution approving agreement EPC-25-044 with Lawrence Berkeley National Laboratory for a \$2,000,000 grant and adopting staff's recommendation that this action is exempt from CEQA. This agreement will fund the design, prototype construction, and laboratory and field testing of an advanced-refrigerant 120V heat pump water heater. Design considerations also include physical size/form factor, condensate management, and the incorporation of controls for dynamic grid response.

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":

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 ;

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.

Cal. Code Regs., tit. 14, Section 15301 provides that projects which consist of the operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, and which involve negligible or no expansion of use beyond that existing at the time of the lead agency's determination, are categorically exempt from the provisions of the California Environmental Quality Act (CEQA). The activities funded by the agreement involve negligible or no expansion of use and will not cause a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because activities involve laboratory testing at the Lawrence Berkeley National Laboratory's FLEXLAB test facility and field testing at the Central Valley Research Homes (CVRH), which are unoccupied test houses.

The FLEXLAB test facility has dedicated facilities for performing experiments on water heating systems and will have a new advanced environmental chamber available for this project. The CVRH are well-instrumented, unoccupied test houses with simulated occupancy. These are houses with a range of vintages, configurations, and sizes that represent a cross-section of existing housing stock in California.



The project will not impact an environmental resource of hazardous or critical concern where designated, precisely mapped, and officially adopted pursuant to law by federal, state, or local agencies; 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 apply to this project, and this project will not have a significant effect on the environment.

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. Is this project considered “Infrastructure”?

No

I. 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
A.O. Smith Corporation	\$ 0	\$500,000



J. 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
Frontier Energy, Inc.	\$300,000	\$0
TBD - FLEXLAB Sub	\$1,000	\$0

K. 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

L. 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	24-25	301.001L	\$ 1,800,000
EPIC	25-26	301.001M	\$ 200,000

TOTAL Amount: \$ 2,000,000

R&D Program Area: ICMB: Buildings

Explanation for “Other” selection Not applicable

Reimbursement Contract #: Not applicable

Federal Agreement #:

M. Recipient’s Contact Information

1. Recipient’s Administrator/Officer

Name: Joanna Santoro

Address: 1 Cyclotron Rd, MS 64-0240A

City, State, Zip: Berkeley, CA 94720-0001

Phone: 510-486-6824

E-Mail: jlsantoro@lbl.gov



2. Recipient’s Project Manager

Name: Iain Walker

Address: 1 Cyclotron Rd

City, State, Zip: Berkeley, CA 94720-8028

Phone: 510-486-4692

E-Mail: ISWalker@lbl.gov

N. Selection Process Used

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

Selection Process	Additional Information
Competitive Solicitation #	GFO-24-305
First Come First Served Solicitation #	Not applicable
Other	Not applicable

O. 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: Jackson Thach

Approval Date: 1/26/2026

Branch Manager: Anthony Ng

Approval Date: 1/27/2026

Director: Jonah Steinbuck (*delegated to Branch Manager*)

Approval Date:

Exhibit A Scope of Work

The Regents of the University of California, Lawrence
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I. TASK AND ACRONYM/TERM LISTS

A. Task List

Task #	CPR ¹	Task Name
1		General Project Tasks
2		Modeling of Advanced 120V HPWH
3	X	Build and Laboratory Test a Prototype Advanced Refrigerant 120V HPWH
4	X	Field Demonstration of Prototype Advanced Refrigerant 120V HPWH
5		Evaluation of Project Benefits
6		Technology 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
HPWH	Heat Pump Water Heater
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 design, prototype construction, and laboratory and field testing of an advanced-refrigerant 120V heat pump water heater (HPWH). The advanced refrigerant(s) used in this Agreement will meet the technical specifications and limits identified in the solicitation. Design considerations also include physical size/form factor, condensate management, and the incorporation of controls for dynamic grid response.

B. Problem/ Solution Statement

Problem

Current 120V HPWH technologies do not use the next-generation advanced refrigerants that meet the concerns of the state; further, they may have performance challenges during high hot water draws. Today's HPWHs also face installation challenges that increase costs to ratepayers and limit the application of HPWH technology. These challenges relate to form factor and physical size restrictions (i.e., current HPWHs are too large), as well as condensate management issues if no drain is close enough to the HPWH installation. This combination of

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.

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performance and cost challenges is limiting the adoption of HPWH technology and restricting consumer choice.

Solution

This project will develop a new HPWH using advanced refrigerants that addresses the above problems. Project partner A.O. Smith, a leading HPWH manufacturer, has the capability to design and construct new compressors and heat exchangers that operate with advanced refrigerants. They are also developing a novel system for condensate management that eliminates the need for a physical drain. The project will create a prototype HPWH that incorporates these new technologies and also meets the solicitation requirements for form factor. Further, the new product will incorporate higher-temperature water storage to allow for higher capacity and fewer issues with hot water runouts.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Design and build a prototype 120V HPWH that uses advanced refrigerants
- Perform laboratory and field testing of the prototype to evaluate energy performance (up to 10% better than current technology) and hot water delivery/capacity (50% improvement over current technology) and to verify acceptable form factors and condensate management.

Ratepayer Benefits:² This Agreement will result in the ratepayer benefits of greater electricity reliability and lower installation costs by overcoming installation barriers that increase costs for HPWH and enabling more of these low-power 120V appliances to be installed. Greater penetration of grid-responsive HPWHs is key to reducing peak demands on the California grid, which in turn will improve grid reliability, reduce the need for additional grid infrastructure, and result in lower future costs for ratepayers.

Technological Advancement and Breakthroughs:³ This Agreement will lead to technological advancement and breakthroughs to overcome barriers to achieving the State of California's energy goals by developing a 120V HPWH that uses advanced refrigerants through the development of novel compressor and heat exchanger designs. Other advancements in product packaging and condensate management remove the need for remodeling and additional plumbing that significantly add to installation costs and will make HPWH adoption much more affordable for more California ratepayers.

Agreement Objectives

The objectives of this Agreement are to:

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 energy goals.

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- Develop more advanced HPWH models and design tools that allow for the design and performance optimization of a new HPWH using advanced refrigerants.
- Use new models to design a prototype 120V HPWH that uses R290 refrigerant, allows the use of elevated water storage temperatures, and incorporates novel condensate management.
- Build a prototype HPWH that meets the requirements of the solicitation.
- Laboratory test the prototype using standard industry metrics and test methods, including Uniform Energy Factor and First Hour Rating.
- Field test the prototype to ensure that installation issues have been met and verify operation in different installation locations.

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.

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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:

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- Attend a “Kick-off” meeting with the CAM, and other CEC staff relevant to the Agreement. The Recipient’s Project Manager and any other individuals deemed necessary by the CAM or the Project Manager shall participate in 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., Teams, Zoom), with approval of the CAM.

The Kick-off meeting will include discussion of the following:

- The CAM’s expectations for accomplishing tasks described in the Scope of Work;
 - An updated Project Schedule;
 - Terms and conditions of the Agreement;
 - Invoicing and auditing procedures;
 - Travel;
 - Equipment purchases;
 - Administrative and Technical products (subtask 1.1);
 - CPR meetings (subtask 1.3);
 - Monthly Calls (subtask 1.5)
 - Quarterly Progress reports (subtask 1.6)
 - Final Report (subtask 1.7)
 - Match funds (subtask 1.8);
 - Permit documentation (subtask 1.9);
 - Obtain and Execute Subawards and Agreements with Site Hosts (subtask 1.10);
 - Technical Advisory Committee meetings (subtasks 1.11 and 1.12);
 - Agreement changes;
 - Performance Evaluations; 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:

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- 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 may 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 may 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. A determination of unsatisfactory progress This may result in project delays, including a potential Stop Work Order, while the CEC determines whether the project should continue.
- 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)

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CAM Products:

- CPR Agenda(s)
- Progress Determination

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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 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* organized by the tasks in the Agreement.

Products:

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

MONTHLY CALLS, REPORTS AND INVOICES

Subtask 1.5 Monthly Calls

The goal of this task is to have calls at least monthly between the CAM and Recipient to verify that satisfactory and continued progress is made towards achieving the objectives of this Agreement on time and within budget.

The objectives of this task are to verbally summarize activities performed during the reporting period, to identify activities planned for the next reporting period, to identify issues that may affect performance and expenditures, to verify match funds are being proportionally spent concurrently or in advance of CEC funds or are being spent in accordance with an approved Match Funding Spending Plan, to form the basis for determining whether invoices are consistent with work performed, and to answer any other questions from the CAM. Monthly calls might not be held on those months when a quarterly progress report is submitted or the CAM determines that a monthly call is unnecessary.

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The CAM shall:

- Schedule monthly calls.
- Provide questions to the Recipient prior to the monthly call.
- Provide call summary notes to Recipient of items discussed during call.

The Recipient shall:

- Review the questions provided by CAM prior to the monthly call
- Provide verbal answers to the CAM during the call.

Product:

- Email to CAM concurring with call summary notes.

Subtask 1.6 Quarterly 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 *Quarterly 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 reporting period, 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. Progress reports are due to the CAM the 10th day of each January, April, July, and October. The Quarterly Progress Report template can be found on the ECAMS Resources webpage available at: <https://www.energy.ca.gov/media/4691>
- Submit a monthly or quarterly *Invoice* on the invoice template(s) provided by the CAM.

Recipient Products:

- Quarterly Progress Reports
- Invoices

CAM Product:

- Invoice template

Subtask 1.7 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.

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Subtask 1.7.1 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 Products:

- Energy Commission Style Manual
- Comments on Draft Final Report Outline
- Acceptance of Final Report Outline

Subtask 1.7.2 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 not 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 were not incorporated into the final product.

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- 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 SUBAWARDS

Subtask 1.8 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. 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 application 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 application 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.

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- 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 1.9 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)*

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Subtask 1.10 Obtain and Execute Subawards and Agreements with Site Hosts

The goal of this task is to ensure quality products and to execute subrecipients and site host agreements, as applicable, required to carry out the tasks under this Agreement consistent with the Agreement Terms and Conditions and the Recipient's own procurement and contracting policies and procedures.

The Recipient shall:

- Execute and manage subawards and coordinate subrecipients activities in accordance with the requirements of this Agreement.
- Execute and manage site host agreements, and ensure the right to use the project site throughout the term of the Agreement, as applicable. A site host agreement is not required if the Recipient is the site host.
- Notify the CEC in writing immediately, but no later than five calendar days, if there is a reasonable likelihood the project site cannot be acquired or can no longer be used for the project.
- Incorporate this Agreement by reference into each subaward.
- Include any required Energy Commission flow-down provisions in each subaward, in addition to a statement that the terms of this Agreement will prevail if they conflict with the subaward terms.
- Submit a *Subaward and Site Letter* to the CAM describing the subawards and any site host agreement needed or stating that no subawards or site host agreements are required.
- If requested by the CAM, submit a draft of each *Subaward* and any *Site Host Agreement* required to conduct the work under this Agreement.
- If requested by the CAM, submit a final copy of each executed *Subaward* and any *Site Host Agreement*.
- Notify and receive written approval from the CAM prior to adding any new subrecipient (see the terms regarding subrecipient additions in the terms and conditions).

Products:

- Subaward and Site Letter
- Draft Subawards (*if requested by the CAM*)
- Draft Site Host Agreement (*if requested by the CAM*)
- Final Subawards (*if requested by the CAM*)
- Final Site Host Agreement (*if requested by the CAM*)

TECHNICAL ADVISORY COMMITTEE

Subtask 1.11 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

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- 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 ensure 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 1.12.
- 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

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- List of TAC Members
- Documentation of TAC Member Commitment

Subtask 1.12 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* for each TAC Meeting 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 ensure 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 1.13 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.

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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

TASK 2: MODELING OF ADVANCED 120V HPWH

The first goal of this task is to develop new models for estimating the performance of heat pump water heaters that incorporate both advanced refrigerants and the latest heat exchanger designs. The second goal of this task is to use the models to optimize the design parameters for a prototype HPWH that will be used to design a prototype.

The Recipient shall:

- Review existing models being used by the Recipient and subrecipient to determine what updates, improvements, and innovations are needed to develop the next generation of advanced refrigerant 120V HPWH
- Perform a safety evaluation of advanced refrigerants, including leak detection equipment and potential leak mitigation controls (e.g., space volume and ventilation)
- Create a new advanced HPWH model with the following innovative features:
 - Models reciprocating compressors for advanced refrigerants
 - Incorporates heat exchangers to optimize storage and limit potential problems (e.g., tank stratification)
 - Includes thermal losses and changes in compressor and heat exchanger performance at water storage temperatures above 140 °F (60 °C).
- Use the model to develop an *Advanced Prototype HPWH Design Report* to be used in prototype design and construction (Task 3). This Report shall include a summary or findings of the above tasks under this Task 2.

Products:

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- Advanced Prototype HPWH Design Report (draft and final)

TASK 3: BUILD AND LABORATORY TEST A PROTOTYPE ADVANCED REFRIGERANT 120V HPWH

The goal of this task is to construct a prototype advanced refrigerant 120V HPWH to be used in the field demonstration in Task 4, and to verify that its performance matches the expected performance from Task 2's advanced HPWH model. This task has three sub-tasks.

Subtask 3.1 Develop new HPWH components

The Recipient shall:

- Develop the components needed for the advanced refrigerant HPWH, such as: advanced refrigerant, low refrigerant mass HP, refrigerant detector, condensate management atomizer, microchannel heat exchangers, high temperature glass.
- Compile the findings of this subtask into the *Memo of Design Drawings, Parts Lists, and Component Specifications*

Products:

- Memo of Design Drawings, Parts Lists, and Component Specifications

Subtask 3.2 Construct Prototype Advanced Refrigerant HPWH

The Recipient shall:

- Construct one or more *Prototype Advanced Refrigerant 120V HPWH* based on the design report from Task 2 and components from Task 3.1
 - Assemble prototype(s)
- Submit *Proof of Prototype Advanced Refrigerant 120V HPWH Construction* for CAM approval. This proof may be documented with photographs, and may require visual inspection, as determined by the CAM.

Products:

- Proof of Prototype Advanced Refrigerant 120V HPWH Construction

Subtask 3.3 Laboratory testing of prototype

The Recipient shall:

- Prepare a *Laboratory Test Plan* that includes but is not limited to:
 - Energy performance from the Uniform Energy Factor standard test procedure
 - First hour rating (in gallons per minute)
- Submit a draft *Laboratory Test Plan* to the CAM for feedback and incorporate changes as requested in the final *Laboratory Test Plan*
- Perform laboratory testing of the prototype according to the *Laboratory Test Plan*
- Prepare a *Laboratory Testing Report* that includes but is not limited to:
 - Summary of test procedures
 - Summary of test results
 - Technical issues arising from the laboratory testing
 - Verification of readiness for field testing
- Submit the draft *Laboratory Testing Report* to the CAM for feedback and incorporate changes as requested in the final *Laboratory Testing Report*
- Prepare a *CPR Report #1* and participate in a CPR meeting accordance with subtask 1.3 (CPR Meetings)

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Products:

- Laboratory Test Plan (draft and final)
- Laboratory Testing Report (draft and final)
- CPR Report #1

TASK 4: FIELD DEMONSTRATION OF PROTOTYPE ADVANCED REFRIGERANT 120V HPWH

The goal of this task is to verify prototype performance in a real home under controlled operating conditions.

The Recipient shall:

- Prepare a *Field Test Plan Report* that includes but is not limited to:
 - Description of the test site facility
 - Description of the measurement equipment and performance parameters to be recorded and calculated
 - Description of the test procedures
- Submit a draft *Field Test Plan* to the CAM for feedback and incorporate changes as requested in the final *Field Test Plan*
- Perform field testing of the prototype according to the *Field Test Plan*
- Prepare a *Field Testing Report* that includes but not limited to:
 - Summary of test procedures
 - Summary of test results
 - Technical issues arising from the field testing
- Submit the draft *Field Testing Report* to the CAM for feedback and incorporate changes as requested in the final *Field Testing Report*
- Prepare a *CPR Report #2* and participate in a CPR meeting accordance with subtask 1.3 (CPR Meetings)

Products:

- Field Test Plan Report (draft and final)
- Field Testing Report (draft and final)
- CPR Report #2

TASK 5: 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

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- 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 \(www.energizeinnovation.fund\)](http://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 \(www.energizeinnovation.fund\)](http://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 6: TECHNOLOGY TRANSFER ACTIVITIES

The goal of this task is to conduct activities that will accelerate the commercial adoption of the technology being supported under this agreement. Eligible activities include, but are not limited to, the following:

- Scale-up analysis including manufacturing analysis, independent design verification, and process improvement efforts.
- Technology verification testing, or application to a test bed program located in California.

The Recipient Shall:

- Develop and submit a *Technology Transfer Plan* that identifies the proposed activities the recipient will conduct to accelerate the successful commercial adoption of the technology.
- Present the draft *Technology Transfer Plan* to the TAC for feedback and comments.
- Develop and submit a *Summary of TAC Comments* that summarizes comments received from the TAC members on the Draft Technology Transfer Plan. This document will identify:
 - TAC comments the Recipient proposes to incorporate into the final *Technology Transfer Plan*.
 - TAC comments the Recipient does not propose to incorporate with and explanation why.
- Submit the final *Technology Transfer Plan* to the CAM for approval.

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- Implement activities identified in final *Technology Transfer Plan*.
- Develop and submit a *Technology Transfer Summary Report* that includes high level summaries of the activities, results, and lessons learned of tasks performed relating to implementing the Final Technology Transfer Plan. This report should not include any proprietary information.
- When directed by the CAM, develop presentation materials for an CEC- sponsored conference/workshop(s) on the project.
- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the 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:

- Technology Transfer Plan (draft and final)
- Summary of TAC Comments
- Technology Transfer Summary Report (draft and final)
- High Quality Digital Photographs

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.