



STATE OF CALIFORNIA

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 12/2019)

CALIFORNIA ENERGY COMMISSION

A) New Agreement # EPC-20-004

B) Division	Agreement Manager:	MS-	Phone
ERDD	Kadir Bedir	51	916-327-1411

C) Recipient's Legal Name	Federal ID Number
Redwood Energy	45-5447073

D) Title of Project
Central Heat Pump Water Heater Load Flexibility

E) Term and Amount

Start Date	End Date	Amount
2/3/2021	3/31/2025	\$ 2,043,755

F) Business Meeting Information

☐ ARFVTP agreements \$75K and under delegated to Executive Director

Proposed Business Meeting Date 01/25/2021 ☐ Consent ☒ Discussion

Business Meeting Presenter Kadir Bedir Time Needed: 5 minutes

Please select one list serve. EPIC (Electric Program Investment Charge)

Agenda Item Subject and Description:

REDWOOD ENERGY. Proposed resolution approving agreement EPC-20-004 with Redwood Energy for a \$2,043,755 grant to demonstrate an advanced heat pump water heater load control technology that will achieve load flexibility for central water heating systems in multifamily buildings and adopting staff's determination that this action is exempt from CEQA. (EPIC funding) Contact: Kadir Bedir. (Staff presentation: 5 minutes)

G) California Environmental Quality Act (CEQA) Compliance

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

☒ Yes (skip to question 2)

☐ No (complete the following (PRC 21065 and 14 CCR 15378)):

Explain why Agreement is not considered a "Project":

2. If Agreement is considered a "Project" under CEQA:

a) ☒ Agreement **IS** exempt.

☐ Statutory Exemption. List PRC and/or CCR section number:

☒ Categorical Exemption. List CCR section number: Cal. Code Regs., tit. 14, § 15301

☐ Common Sense Exemption. 14 CCR 15061 (b) (3)

Explain reason why Agreement is exempt under the above section: 14 CCR section 15301 exempts operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, involving negligible or no expansion of existing or former use. This agreement's building retrofit activities are exempt under 14 CCR section 15301, because they will involve



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retrofitting existing residential buildings consisting of minor alterations and operation of existing facilities with little or no expansion of existing or former use. This project will replace old inefficient water heating equipment along with monitoring devices and hardware and software that optimize the energy use.

- b) Agreement **IS NOT** exempt. (consult with the legal office to determine next steps)

Check all that apply

- ☐ Initial Study
☐ Negative Declaration
☐ Mitigated Negative Declaration
☐ Environmental Impact Report
☐ Statement of Overriding Considerations

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

Legal Company Name:	Budget
Franklin Energy Services, LLC	\$ 237,663
Ecotope	\$ 300,000
ZYD Energy, Inc.	\$ 499,927
TBD - Contractor (legal)	\$ 3,500
TBD - Contractor(s) (plumbing, electrical, general services)	\$ 37,760

I) List all key partners: (attach additional sheets as necessary)

Legal Company Name:

J) Budget Information

Funding Source	Funding Year of Appropriation	Budget List Number	Amount
EPIC	19-20	301.001G	\$2,043,755
			\$
			\$

R&D Program Area: EERO: Buildings

TOTAL: \$ 2,043,755

Explanation for "Other" selection

Reimbursement Contract #: Federal Agreement #:



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K) Recipient's Contact Information

1. Recipient's Administrator/Officer

Name: Emily Higbee

Address: 1887 Q St

City, State, Zip: Arcata, CA 95521-9502

Phone: 805-630-5408

E-Mail: Higbee@gmail.com

2. Recipient's Project Manager

Name: Emily Higbee

Address: 1887 Q St

City, State, Zip: Arcata, CA 95521-9502

Phone: 805-630-5408

E-Mail: Higbee@gmail.com

L) Selection Process Used

☒ Competitive Solicitation Solicitation #: GFO-19-301

☐ First Come First Served Solicitation Solicitation #:

M) The following items should be attached to this GRF

1. Exhibit A, Scope of Work

☒ Attached

2. Exhibit B, Budget Detail

☒ Attached

3. CEC 105, Questionnaire for Identifying Conflicts

☒ Attached

4. Recipient Resolution

☒ N/A

☐ Attached

5. CEQA Documentation

☐ N/A

☒ Attached

Agreement Manager

Date

Office Manager

Date

Deputy Director

Date

Exhibit A
Scope of Work
Redwood Energy

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR¹	Task Name
1		General Project Tasks
2		Project Planning and Baseline Assessment
3	X	Heat Pump Water Heater System Upgrade for Load Management
4		Load Management Characteristics Assessment
5		Load Management Demonstration
6		Performance Evaluation
7		Evaluation of Project Benefits
8		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CPR	Critical Project Review
DER	Distributed Energy Resource
DHW	Domestic hot water
HPWH	Heat pump water heater
PII	Personally Identifiable Information
TAC	Technical Advisory Committee
TSC	Thermal Storage Control

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

A. Purpose of Agreement

The purpose of this Agreement is to fund the field demonstration of an advanced heat pump water heater (HPWH) load control technology that achieve load flexibility for central HPWH systems in multifamily buildings.

B. Problem/ Solution Statement

Problem

Central HPWH systems are usually both the largest peak load and largest annual energy load in an all-electric low-income apartment complex building in California. Because hot water consumption peaks in the morning and late evening, when rooftop solar arrays are less productive

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.

or unproductive, the consequence is higher energy bills, greater air pollution from non-renewable grid-sourced electricity and grid stress.

However, there are very few load control technologies available to mitigate these issues for central HPWH systems. Traditional water heating systems also deal with efficiency issues. Even under perfect operating conditions, the higher temperatures reduce system efficiency as the difference in temperature between the stored hot water and surrounding air accelerates heat loss. Furthermore, of the limited central heat pump control technologies on the market, none have real-time input parameters to reduce operational costs, greenhouse gas (GHG) emissions and grid stress while maintaining or improving tenant hot water services.

Solution

Rather than storing hot water at higher temperatures, this project will use the new-to-market Thermal Storage Control (TSC) technology developed by ZYD Energy to enable flexible load management through hot water storage volume controls. The TSC technology uses optimization algorithms to automatically determine HPWH operation schedules based on hourly/sub-hourly electricity price or pollution factors, as well as demand response signals, and real-time operation conditions, while ensuring reliable hot water supply.

The TSC technology is applicable to all HPWH products and system designs, including HPWH systems designed with “swing” tanks that was recently codified into the Title 24 Part 6 Building Efficiency Standards (Title 24) as the Prescriptive Design path for central HPWH. Temperature modulation control is not applicable to this Title 24 requirement. The TSC technology will be implemented in three multifamily developments, each with different market-leading HPWH systems—Colmac, Sanden and Rheem. The central heat pumps are additionally shared in three distinct fashions—whole building recirculation, decentralized three (3)-unit recirculation, and a manifold to seven (7) units.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to

- Demonstrate the load flexibility of central heat pump water heating systems in multifamily buildings using Thermal Storage Control (TSC) technology.
- Investigate the impact of HPWH system designs on load flexibility.

Ratepayer Benefits:² Electric rates for the central-load meters are heavily influenced by monthly and annual peak electricity use, and such expenses reduce the limited funding available for social services. Grid stress is real, causing brown-outs and even black-outs that affect tenant comfort and safety. This Agreement will result in Ratepayer benefits including lower operating costs and greater electricity reliability. This agreement will help to advance a control technology that reduces and shifts the building’s peak electric load, while also improving system efficiency. The Recipient estimates annual electricity bill reduction for ratepayers is \$5.6 million. For electricity reliability, the Recipient estimates annual peak demand reduction will be 18 MW and annual electricity use reduction will be 15.6 GWh. These estimates are based on the assumption that in about 10 years,

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).

5% of the existing multifamily buildings, in terms of number of dwelling units, will adopt TSC technology (or other advanced control technologies providing levels of similar performance).³

Technological Advancement and Breakthroughs:⁴ This Agreement is intended to lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by demonstrating an innovative control technology that enables all HPWH products and system design types to achieve load flexibility with efficiency improvement to benefit ratepayers, the grid, and the environment.

Agreement Objectives

The objectives of this Agreement are to:

1. Retrofit central HPWH systems in three multifamily developments to incorporate and demonstrate Thermal Storage Control (TSC) load management technology.
2. Demonstrate and assess load management functionality to shape, shift, shed, and shimmy load according to hourly or sub-hourly electricity price and demand response signals.
3. Comprehensively assess the load management performance of TSC technology over a wide range of load control input, operating conditions, and water heater types
4. Assess the benefits of HPWH load management through advanced controls to grid and customers.
5. Assess the impact of HPWH system designs on load flexibility.
6. Provide long-term field performance data of Colmac, Sanden and Rheem HPWH systems in central configurations to support Title 24 building standards and performance software development.
7. Improve the control algorithms within the TSC technology with field results and provide basic research useful to other central HPWH thermal storage control product developers
8. Develop recommendations for future research, development and implementation of advanced central HPWH controls for effective load management.
9. Evaluate performance of the TSC technology to achieve the following performance metrics:

³ Redwood Energy proposal to GFO-19-301, Attachment 4, 2020.

⁴ 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.

Performance Metric	Baseline Performance	Target Performance	Evaluation Method	Metric Significance
Seasonal End-use Load Flexibility (kW, kWh)	None	Shape 0.063 kW (peak), 161 kWh (annual), Shift 0.12kW, 106 kWh, Shed: 0.13kW, 47 kWh, Shimmy: 0.012kW, 7 kWh (per unit per year)	Shape: 8am-10pm, Shift: 4pm-9pm, Shed: 8pm-10pm, Shimmy: 12pm-3pm (March - August)	Very important It provides the most useful information regarding impact on grid operation and duck curve.
Annual End-use Load Flexibility (kW, kWh)	None	Shape: 0.054 kW (peak), 274 kWh (annual), Shift: 0.10 kW, 180 kWh, Shed: 0.11 kW, 80 kWh, Shimmy: 0.01 kW, 11 kWh (per unit per year)	Shape: 8am-10pm, Shift: 4pm- 9pm, Shed: 8pm-10pm, Shimmy: 12pm-3pm (Annual)	Important. It provides useful information to assess total impact of HPWH and advanced load controls
Renewable Energy Over Generation Mitigated	0.35 kWh/day (Energy use per unit during peak solar generation)	0.39 kWh/unit/day (6.9 kWhr/year [6-month period])	Measure HPWH energy use during 12pm - 3pm (peak solar generation) with and without control	Important. It provides useful information to assess total impact of HPWH and advanced load controls
Reduced Peak Energy Cost	\$0.24/unit/day (@ peak rate: \$0.385/kWh)	\$0.021/unit/day (\$27 unit/year [4-month period])	Measure HPWH energy use during 4pm-9pm peak hours with and without control and use peak rate to calculate cost	Less important because it is reflected in the metric on operational cost.

¹¹ Load Flexibility Performance Metric will determine amount of power and energy that is shifted, shed, shaped, and/or shimmied.

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)**. 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 Energy Commission’s software and Microsoft (MS)-operating computing platforms, or with any other format approved by the CAM. Deliver an electronic copy of the full text of any Agreement data and documents in a format specified by the CAM, such as memory stick or CD-ROM.

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

- Data sets will be in MS Access or MS Excel file format (version 2007 or later), or any other format approved by the CAM.
- Text documents will be in MS Word file format, version 2007 or later.
- Documents intended for public distribution will be in PDF file format.
- The Recipient must also provide the native Microsoft file format.
- Project management documents will be in Microsoft Project file format, version 2007 or later.

- **Software Application Development**

Use the following standard Application Architecture components in compatible versions for any software application development required by this Agreement (e.g., databases, models, modeling tools), unless the CAM approves other software applications such as open source programs:

- Microsoft ASP.NET framework (version 3.5 and up). Recommend 4.0.
- Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5.
- Visual Studio.NET (version 2008 and up). Recommend 2010.
- C# Programming Language with Presentation (UI), Business Object and Data Layers.
- SQL (Structured Query Language).
- Microsoft SQL Server 2008, Stored Procedures. Recommend 2008 R2.
- Microsoft SQL Reporting Services. Recommend 2008 R2.
- XML (external interfaces).

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

MEETINGS

Subtask 1.2 Kick-off Meeting

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

The Recipient shall:

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

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

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

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

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

The CAM shall:

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

Recipient Products:

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

CAM Product:

- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings

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

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

The Recipient shall:

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

The CAM shall:

- Determine the location, date, and time of each CPR meeting with the Recipient's input.
- Send the Recipient a *CPR Agenda* and a *List of Expected CPR Participants* in advance of the CPR meeting. If applicable, the agenda will include a discussion of match funding and permits.
- Conduct and make a record of each CPR meeting. Provide the Recipient with a *Schedule for Providing a Progress Determination* on continuation of the project.
- Determine whether to continue the project, and if so whether modifications are needed to the tasks, schedule, products, or budget for the remainder of the Agreement. If the CAM

concludes that satisfactory progress is not being made, this conclusion will be referred to the Deputy Director of the Energy Research and Development Division.

- Provide the Recipient with a *Progress Determination* on continuation of the project, in accordance with the schedule. The Progress Determination may include a requirement that the Recipient revise one or more products.

Recipient Products:

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

CAM Products:

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

Subtask 1.4 Final Meeting

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

The Recipient shall:

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

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

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

Products:

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

REPORTS AND INVOICES

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 Fund 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. The CAM will review the Final Report, which will be due at least **two months** before the Agreement end date. When creating the Final Report Outline and the Final Report, the Recipient must use the Style Manual provided by the CAM.

Subtask 1.6.1 Final Report Outline

The Recipient shall:

- Prepare a *Final Report Outline* in accordance with the *Style Manual* provided by the CAM. (*See Task 1.1 for requirements for draft and final products.*)

Recipient Products:

- Final Report Outline (draft and final)

CAM Product:

- 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, 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)
- Ensure that the document is written in the third person.
- Ensure that the Executive Summary is understandable to the lay public.
 - Briefly summarize the completed work. Succinctly describe the project results and whether or not the project goals were accomplished.
 - Identify which specific ratepayers can benefit from the project results and how they can achieve the benefits.
 - If it's necessary to use a technical term in the Executive Summary, provide a brief definition or explanation when the technical term is first used.
- Follow the Style Guide format requirements for headings, figures/tables, citations, and acronyms/abbreviations.
- Ensure that the document omits subjective comments and opinions. However, recommendations in the conclusion of the report are allowed.
- Include a brief description of the project results in the Abstract.
- 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
- Consider incorporating all CAM comments into the Final Report. 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 Final Report 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.
- Submit one bound copy of the *Final Report* to the CAM along with *Written Responses to Comments on the Draft Final Report*.

Products:

- Final Report (draft and final)
- Written Responses to Comments on the Draft 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 Energy Commission funds. Match funds must be identified in writing, and the Recipient must obtain any associated commitments before incurring any costs for which the Recipient will request reimbursement.

The Recipient shall:

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

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

- A list of the match funds that identifies:
 - The amount of cash match funds, their source(s) (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied.
 - The amount of each in-kind contribution, a description of the contribution type (e.g., property, services), the documented market or book value, the source (including a contact name, address, and telephone number), and the task(s) 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 the executed subcontract.
- Notify and receive written approval from the CAM prior to adding any new subcontractors (see the discussion of subcontractor additions in the terms and conditions).

Products:

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

TECHNICAL ADVISORY COMMITTEE**Subtask 1.10 Technical Advisory Committee (TAC)**

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

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

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

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

The Recipient shall:

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

Products:

- List of Potential TAC Members

- List of TAC Members
- Documentation of TAC Member Commitment

Subtask 1.11 TAC Meetings

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

The Recipient shall:

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

Products:

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

IV. TECHNICAL TASKS

TASK 2: Project Planning and Baseline Assessment

The goal of this task is to develop a research plan to guide the overall project development.

The Recipient shall:

- Perform literature search and review of past studies on load flexibility of central water heating systems with heat-pumps. Develop a *Literature Review Summary* to summarize findings.

- Investigate opportunities and methods to access PG&E and SCE demand response signals to support load control demonstration.
- Identify data sources, e.g. CA ISO, for developing load control parameters for grid operation status and forecast, time-dependent electricity price data, renewable energy generation and over-generation, and the carbon intensity of the hourly electricity supply.
- Develop a detailed site access plan with site management for each demonstration site.
- Collect data and information about the three demonstration sites to support the system upgrade design. Specific activities include:
 - Develop a list of items needed for research plan development, load control upgrade, and baseline assessment.
 - Collect and review relevant data and documentations, including, occupancy statistics, energy bills, as-built architectural and mechanical drawings, maintenance records.
 - Assess local plumbing contractor base for targeting bid solicitation
 - Interview building owners and/or operators regarding performance of existing systems.
- Conduct site visits to:
 - Assess detailed designs of existing DHW systems and spaces for system upgrade.
 - Interview building occupants about hot water service quality.
 - Install power meters and data collection systems to measure energy use patterns of existing HPWH systems.
- Develop a *Baseline Assessment Summary* that includes but not limited to:
 - Assessment of existing DHW system design and controls.
 - Energy use characteristics of existing DHW systems.
 - Summary of tenant perception of existing hot water services.
- Develop a *Project Research Plan* that includes but not limited to:
 - Detailed objectives of each tasks.
 - Preliminary system retrofit plans for load management controls.
 - Preliminary control system integration plan for load management.
 - Preliminary load management performance metrics.
 - Detailed project schedules.
 - Roles and responsibilities of team members.
- Ensure that the program participants' PII will be kept confidential, following Exhibit D of the EPC-20-004 grant agreement.

Products:

- Literature Review Summary
- Baseline Assessment Summary
- Project Research Plan (Draft and Final)

TASK 3: Heat Pump Water Heater System Upgrade for Load Management

The goal of this task is to upgrade existing HPWH systems to enable load flexibility demonstration.

The Recipient shall:

- Perform detailed HPWH system retrofit designs for building permit and building owner approval.
- Develop a *HPWH System Upgrade Plan* that includes:
 - Detailed designs of new HPWH systems.
 - TSC technology installation and commissioning plan.

- Commissioning procedures for new HPWH systems.
 - Specifications and installation plans for performance monitoring and data collection system.
 - Copies of all building permits
- Coordinate with Task 1 to conduct a TAC meeting to collect feedback on the project research plan and HPWH System Upgrade Plan.
- Prepare TSC control systems for installation.
 - Perform necessary development and test to receive utility demand response signals.
 - Configure and test TSC control systems according to specifications of new HPWH systems at three demonstration sites.
- Perform HPWH system upgrade by carrying out the following:
 - Work with contractors performing the installation of thermal storage systems to:
 - Solicit contractor bids for the upgrades,
 - Review submittals from contractors,
 - Respond to contractor questions,
 - Select contractors and issue work orders, and
 - Coordinate with demonstration sites and contractors to resolve possible issues and ensure upgrade progress.
 - Conduct site visits to assure installation quality and consistence with designs.
 - Conduct site visits to commission the new HPWH systems and performance measurement systems.
 - Conduct site visits to install, commission, and test TSC control systems.
- Develop a *Load Flexibility Upgrade Report* that includes but not limited to:
 - New HPWH system configuration and specifications.
 - Building operations and maintenance manuals for building owners.
 - Preliminary system performance monitoring results without load management controls.
 - Preliminary test results of TSC controls.
 - Lessons learned from the upgrade process.
- Participate in a CPR Meeting as described in subtask 1.3 and provide a *CPR Report #1*.

Products:

- HPWH System Upgrade Plan
- Load Flexibility Upgrade Report (draft and final)
- CPR Report #1

TASK 4: Load Management Characteristics Assessment

The goal of this task is to assess characteristics of load management controls to support successful field demonstration and provide in-depth understandings of load management controls.

The Recipient shall:

- Identify a list of load management variables that affect the load management control outcomes. Possible load management variables include:
 - Load control input parameters, including but not limited to time-dependent electricity prices, demand response signals, building operators' preference, time-

dependent carbon intensity of electricity supply, and availability of renewable resources.

- Load control objectives, including but not limited to minimizing operation cost, meeting demand response requirements, minimizing greenhouse gas emissions, and maximizing utilization of renewable resources.
- HPWH operation parameters, including system configurations (e.g. HPWH capacity and efficiency and storage size), hot water draw forecast, and weather forecast.
- Investigate data sources for load management variables identified in the prior step and develop possible values or value ranges for the identified load management variables. Development efforts include but not limited to the following:
 - Develop load control input parameters to reflect a wide range of possible scenarios. The development will be based on analysis of existing studies related to grid support requirements, carbon intensities of future generation mixes, utility rates forecast, and demand response approaches. Input from project TAC members and other relevant stakeholders will be collected to inform the development as well.
 - Develop system configuration parameters based on the three demonstration sites.
 - Develop hot water use schedules and weather conditions based on field measurement data, if available, or Title 24 Alternative Calculation Method.
- Develop multiple sets of load management variables to enable parametric analysis of load management control outcomes. Each set of load management variables represents a load management scenario.
- Create a load management simulator within the open source CBECC-RES and CBECC-NONRES software with prior coding training from Big Ladder, the subcontractor responsible for the CBECC software platforms. Model the HPWH operation schedule for each load management scenario and informed hypotheses about the functionality of the TSC technology with each HPWH system.
- Use the load management simulator to obtain HPWH operation schedule for each load management scenario.
- Identify issues and limitations of the existing optimization algorithms of TSC technology and perform necessary improvement.
- Assess load management control characteristics by analyzing the impact of load management variables on HPWH operational schedule. In particular, perform the following:
 - Assess the sensitivity of HPWH operational schedule on electricity pricing signals.
 - Assess the impact of HPWH system designs on load flexibility.
- Develop load control input parameters that can effectively shape, shift, shed, and shimmy the HPWH electrical load.
- Evaluate and improve the existing method used by TSC technology to coordinate different load management objectives.
- Identify representative load management scenarios for field testing and demonstration.
- Coordinate with Task 1 to conduct a TAC meeting to inform the TAC on progress of both Task 3 and Task 4 to seek their feedbacks.
- Develop a *Load Management Control Characteristics Report*, which includes the following:
 - A summary of the project goals and technical background
 - Methodology and software for load management characteristics assessment
 - Design load management scenarios for the assessment
 - Analyze results and compare the performance of simulated load management strategies
 - A list of load management scenarios identified for field demonstration

- Results of TAC feedback and resulting actions

Products:

- Load Management Control Characteristics Report

TASK 5: Load Management Demonstration

The goal of this task is to demonstrate HPWH load flexibility by testing various load management scenarios and assessing long-term (12 months or more) load flexibility. The duration of data collection may be altered if necessary, with written approval from CAM.

The Recipient shall:

- Develop methods and procedures for performing long-term load flexibility demonstration. The development effort includes:
 - Select data sources to be used to generate load control input parameters, e.g. hourly electricity price, demand response signals, and carbon intensity of electricity supply.
 - Develop methods and tools to generate load control input from selected data sources.
 - Develop schedules to vary load management settings, e.g. load control objectives and building operators' preferences.
 - Develop procedures to automatically incorporate load control input parameters to perform automated load management controls
- Develop methods and load control input parameters to demonstrate coordinated load management among all HPWH systems to achieve specific overall load shapes.
- Develop a field demonstration plan for each site to guide load flexibility demonstration. The plan will include:
 - A list of load management scenarios with corresponding load control input parameters, obtained from Task 4. These scenarios allow focused field performance investigation of representative load control settings, e.g. certain electric price arrangement, demand response signal.
 - Schedule and procedures for testing coordinated load management among all HPWH systems.
 - Schedules and procedures for testing load management scenarios and performing long-term demonstration
 - Methods and procedures for performance verification
 - Tenant survey process and questionnaires for
 - Assessing building occupants' perceptions of the load management control and their experience using this technology.
 - Assessing changes in customers' lifestyles or behavior associated with the load management demonstration.
 - Identifying both positive and negative experiences with the goal of incorporating changes in equipment specifications and/or control strategies that improve the user experience.
- Ensure that the tenant's personally identifiable information (PII) will be handled and kept confidential in accordance with Exhibit D of the EPC-20-004 grant agreement.
- Coordinate with Task 1 to conduct a TAC meeting to obtain feedbacks on the demonstration plan and improve the demonstration plan accordingly.
- Conduct pre-demonstration tenant survey following the field demonstration plan.

- Test individual load management scenarios following the field demonstration plan. Verify test outcome and perform necessary adjustments to control algorithms and load control input parameters.
- Perform long-term load flexibility demonstration according to the field demonstration plan and using the load control input parameters developed in the prior step.
- Coordinate with Task 6 to verify load management control outcome and perform necessary adjustments to control algorithms and load control input parameters.
- Conduct post-demonstration tenant survey following the field demonstration plan.
- Develop a *Tenant Survey Summary* to provide the following:
 - Survey methods and process
 - Survey results and findings
- Develop a *Load Management Field Test Report* to provide the following information:
 - A summary of the project task and technical background
 - Methods and data used to test load management scenarios and perform long-term load flexibility demonstration
 - Methods for verifying load control outcome
 - Compare test results and findings for individual load management scenarios
 - Preliminary results and findings of long-term load flexibility demonstration.
 - TAC member feedback and actions taken

Products:

- Tenant Survey Summary
- Load Management Field Test Report (draft and final)

TASK 6: Performance Evaluation

The goal of this task is to perform comprehensive performance assessment of load management controls demonstrated at the three multifamily buildings.

The Recipient shall:

- Develop a *Performance Assessment Plan* to guide and coordinate performance evaluation efforts among the recipient's team members, for the three multifamily sites, and at different stages of the demonstration. data collection and performance analysis. The plan will include:
 - Roles and responsibilities of team members.
 - Schedules for data collection and performance analysis.
 - Specifications of performance attributes to be assessed.
 - Methods for evaluating each performance attribute.
 - Specifications of performance measurement database
- Create a *Performance Measurement Database* following the specifications provided in the performance assessment plan to organize and store field measurement data collected from all HPWH systems and all project phases, including pre-retrofit, post-retrofit, load management scenarios testing, and long-term load flexibility demonstration phases.
- Follow the performance assessment plan to perform data collection and performance analysis.
- Support Task 5 to perform additional performance assessment, if needed.
- Investigate how HPWH load flexibility is affected by HPWH type, DHW system configurations, and building operational conditions. Develop recommendations on HPWH system designs for good load flexibility.

- Explore possible modeling methods for advanced HPWH load control technologies.
- Develop a *Performance Evaluation Report* that includes but not limited to
 - Performance evaluation methodologies and process.
 - Results of comprehensive performance assessment of load flexibility demonstration, including:
 - Documentation of pre- and post-treatment HPWH consumption patterns
 - Ability to successfully shift, shed, shape, and shimmy demand in response to electricity pricing, grid needs, resident comfort, and DER availability.
 - Ability to automate and optimize the shifting HPWH load out of the evening ramp—particularly in the Spring and Fall when the ramps are steepest—or away from times when the generation mix is producing the highest level of GHG emissions.
 - HPWH operational flexibility in providing grid support under current and future generation mixes while meeting building owner/occupants expectations.
 - Discussion of whether the goals and performance metrics listed in Section II.C of this SOW were achieved and what may be needed to meet these goals.
 - Applicability and feasibility of TSC technology, including
 - Assessment of scalability and future-proofing applicability of TSC technology to accommodate and be compatible with future investments in additional controllable equipment such as smart appliances, home automation, storage, and distributed generation.
 - Assessment and demonstration of load management value propositions to grid operators, utility, and ratepayers (building owners, and occupants).
 - Identifying what and how advanced HPWH load control system knowledge, benefits, and desired impact are expected to be useful to grid operators, policy makers, and ratepayers.
 - Assessment of how much load shifting and thermal charging is optimal to maximize load flexibility value to the ratepayer, utility, and grid operator, while maintaining expectations.
 - Evaluation of competitive advantages of TSC technology over other state-of-the-art technologies and how TSC technology will lead to increased ratepayer benefits.
 - Identifying the limiting factors influencing the cost and deployment of TSC technology and developing technological recommendations for overcoming these factors with the potential to minimize costs.
 - Preliminary recommendations on multifamily HPWH system designs for load flexibility.
 - Preliminary recommendations on opportunities for related building code development.
 - Recommendations on future improvement of HPWH load control technologies.
- Perform additional performance analysis, as needed, to support project report development.
- Perform additional performance analysis, as needed, to support Task 7 and 8.
- Prepare a memorandum describing the measures taken to protect PII (*Summary of Actions Taken to Protect Personally Identifiable Information*).

Products:

- Performance Assessment Plan
- Performance Measurement Database
- Performance Evaluation Report (draft and final)
- Summary of Actions Taken to Protect Personally Identifiable Information

TASK 7 Evaluation of Project Benefits

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

The Recipient shall:

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

- A discussion of policy development. State if the project has been cited in government policy publications or technical journals, or has been used to inform regulatory bodies.
 - The number of website downloads.
 - An estimate of how the project information has affected energy use and cost, or have resulted in other non-energy benefits.
 - An estimate of energy and non-energy benefits.
 - Data on potential job creation, market potential, economic development, and increased state revenue as a result of project.
 - A discussion of project product downloads from websites, and publications in technical journals.
 - A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
- Respond to CAM questions regarding responses to the questionnaires.

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

Products:

- Kick-off Meeting Benefits Questionnaire
- Mid-term Benefits Questionnaire
- Final Meeting Benefits Questionnaire

TASK 8 Technology/Knowledge Transfer Activities

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

The Recipient shall:

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

- When directed by the CAM, develop *Presentation Materials* for an Energy Commission-sponsored conference/workshop(s) on the project.
- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the California Energy Commission.
- 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.
- Prepare a *Technology/Knowledge Transfer Report* on technology transfer activities conducted during the project.

Products:

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

TASK 9 Production Readiness Plan

The goal of this task is to determine the steps that will lead to the manufacturing of technologies developed in this project or to the commercialization of the project's results.

The Recipient shall:

- Prepare a *Production Readiness Plan*. The degree of detail in the plan should be proportional to the complexity of producing or commercializing the proposed product, and to its state of development. As appropriate, the plan will discuss the following:
 - Critical production processes, equipment, facilities, personnel resources, and support systems needed to produce a commercially viable product.
 - Internal manufacturing facilities, supplier technologies, capacity constraints imposed by the design under consideration, design-critical elements, and the use of hazardous or non-recyclable materials. The product manufacturing effort may include "proof of production processes."
 - The estimated cost of production.
 - The expected investment threshold needed to launch the commercial product.
 - An implementation plan to ramp up to full production.
 - The outcome of product development efforts, such as copyrights and license agreements.
 - Patent numbers and applications, along with dates and brief descriptions.
 - Other areas as determined by the CAM.

Products:

- Production Readiness Plan (draft and final)

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: REDWOOD ENERGY

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-20-004 with Redwood Energy for a \$2,043,755 grant to demonstrate an advanced heat pump water heater load control technology that will achieve load flexibility for central water heating systems in multifamily buildings; and

FURTHER BE IT RESOLVED, that the Executive Director or his/her 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 January 25, 2021.

AYE:

NAY:

ABSENT:

ABSTAIN:

Cody Goldthrite
Secretariat