



**California Energy Commission
March 12, 2026 Business Meeting
Backup Materials for Icebox Heat Pumps Inc.**

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

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

CALIFORNIA ENERGY COMMISSION

PROPOSED RESOLUTION: Icebox Heat Pumps Inc.

RESOLUTION NO: 26-0312-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-25-042 with Icebox Heat Pumps Inc. for a \$1,891,835 grant. This project will support development and demonstration of a high-efficiency, fully electric CO₂-based heat pump that replaces natural gas and high-GWP refrigerant HVAC systems in residential buildings, advancing building decarbonization, reducing greenhouse gas emissions, and lowering energy costs for Californians; 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 12th day of March 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 March 12, 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-25-042

B. Division Information

1. Division Name: ERDD
2. Agreement Manager: Harrison Reynolds
3. MS-:None
4. Phone Number: 916-776-0692

C. Recipient's Information

1. Recipient's Legal Name: Icebox Heat Pumps Inc.

2. Title of Project

Title of project: CO2 Heat Pump Systems for Buildings Across California

D. Term and Amount

1. Start Date: 3/31/2026
2. End Date: 12/31/2030
3. Amount: \$1,891,835.00

E. Business Meeting Information

1. Are the ARFVTP agreements \$75K and under delegated to Executive Director? No
2. The Proposed Business Meeting Date: 3/12/2026 .
3. Consent or Discussion? Discussion
4. Business Meeting Presenter Name: Harrison Reynolds
5. Time Needed for Business Meeting: 5 minutes.
6. The email subscription topic is: Electric Program Investment Charge (EPIC)

Project Description:

Icebox Heat Pumps Inc. Proposed resolution approving agreement EPC-25-042 with Icebox Heat Pumps Inc for a \$1,891,835 grant and adopting staff's recommendation that this action is exempt from CEQA. This project will support the development and demonstration of a high-efficiency, fully electric CO₂-based heat pump, advancing building decarbonization, reducing greenhouse gas emissions, and lowering energy costs for Californians. (EPIC funding) Contact: Harrison Reynolds

F. California Environmental Quality Act (CEQA) Compliance

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

Yes

If yes, skip to question 2.

If no, complete the following (PRC 21065 and 14 CCR 15378) and explain why Agreement is not considered a "Project":

Agreement will not cause direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because:



2. If Agreement is considered a “Project” under CEQA answer the following questions.

a) Agreement **IS** exempt?

Yes

Statutory Exemption?

No

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

PRC section number: None

CCR section number: None

Categorical Exemption?

Yes

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

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

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 the operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing structures, facilities, mechanical equipment or topographical features involving negligible or no expansion of use beyond that existing are categorically exempt from the provisions of CEQA.

This project involves laboratory work and the installation, testing, and replacement of mechanical equipment within existing residential buildings with no expansion of use and no physical alteration of the structures beyond routine HVAC work. The project consists of installing CO₂-based heat pump systems as replacements for existing gas furnaces or conventional HVAC units in single-family and multifamily buildings. Installation activities are limited to standard HVAC scope, including placement of indoor and outdoor units, use of existing or equivalent refrigerant line sets, electrical connections, and mounting on existing pads or building exteriors. No new buildings will be constructed, and no increase in building capacity, occupancy, or square footage will occur. The project does not involve grading, trenching beyond minor electrical or conduit work typical of HVAC replacement, vegetation removal, or disturbance of undisturbed land. All work will occur within previously developed residential sites, and the upgraded equipment will serve the same space-conditioning function as the existing systems. Therefore, there will only be minor alterations of an existing structure and there will no, or negligible expansion of use beyond the current HVAC system. For these reasons, the project will not have a significant effect on the environment and falls under the categorical exemption listed in 14 C.C.R. §15301. Agreement **IS NOT** exempt.



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

Yes or 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

G. Is this project considered “Infrastructure”?

No

H. Subcontractors

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

Delete any unused rows from the table.

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

I. Vendors and Sellers for Equipment and Materials/Miscellaneous

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

Vendor/Seller Legal Company Name	CEC Funds	Match Funds
TBD - California-Based Vendor	\$70,000	\$0
Contrator TBD	\$25,000	\$0
CBE_ TBD Electrical	\$50,000	\$0
TBD Marketing	\$75,000	\$0

J. Key Partners

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

Key Partner Legal Company Name
No key partners to report



K. Budget Information

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

Funding Source	Funding Year of Appropriation	Budget List Number	Amount
EPIC	25-26	301.001M	\$ 1,891,835

TOTAL Amount: \$ 1,891,835

R&D Program Area: ICMB: Buildings

Explanation for “Other” selection Not applicable

Reimbursement Contract #: Not applicable

Federal Agreement #: 101 Local Assistance

L. Recipient’s Contact Information

1. Recipient’s Administrator/Officer

Name: Sanela Causevic

Address: 107 King Road

City, State, Zip: Petaluma, CA 94952

Phone: 707-513-9439

E-Mail: sanela@iceboxenergy.com

2. Recipient’s Project Manager

Name: Sanela Causevic

Address: 107 King Road

City, State, Zip: Petaluma, CA 94952

Phone: 707-513-9439

E-Mail: sanela@iceboxenergy.com

M. Selection Process Used

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

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

N. Attached Items

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



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

Approved By

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

Agreement Manager: Harrison Reynolds

Approval Date: 1/15/2026

Branch Manager: Anthony Ng

Approval Date: 1/29/2026

Director: Jonah Steinbuck (Delegated to Branch Manager)

Approval Date: 1/29/2026

**Exhibit A
Scope of Work
Icebox Heat Pumps Inc.**

I. TASK AND ACRONYM/TERM LISTS

A. Task List

Task #	CPR¹	Task Name
1		General Project Tasks
2		Conduct applied pressure conditions testing using developed test fixture
3		Design and assemble a stack assembly including at least one CO ₂ cavity and surrounding compressive chambers
4	X	Integrate valving for the small CO ₂ chamber into the design and manufacture static flow parts
5		Incorporate valving and back pressure regulators into the compressive fluid path
6	X	Develop stacked version of the design with all required flow paths and integrated valving defined
7	X	Demonstrate pilot system in high demand microclimate Opportunity Zones
8		Evaluation of Project Benefits
9		Technology Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
AI	Artificial Intelligence
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CEC	California Energy Commission
CO ₂	Carbon Dioxide
COP	Coefficient of Performance
CPR	Critical Project Review
DAC	Disadvantaged Community
ERF	Energy Reuse Factor
GWP	Global Warming Potential
SCADA	Supervisory Control and Data Acquisition
TAC	Technical Advisory Committee
WUE	Water Usage Effectiveness

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

A. Purpose of Agreement

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

Exhibit A Scope of Work Icebox Heat Pumps Inc.

The purpose of this Agreement is to fund the development of a first-ever practical and scalable Carbon Dioxide (CO₂) -based cooling system for residential buildings. This project will advance the recipient's heat pump technology from Technology Readiness Level (TRL) 3 to TRL 6, validating system performance through lab testing and field deployment in disadvantaged communities.

At the end of the project, the recipient will deploy examples of the technology to sites across California

B. Problem/ Solution Statement

Problem

Most existing residential cooling systems rely on energy-intensive equipment and outdated refrigerants with high global warming potential (GWP). These systems are inefficient, are costly to operate, and contribute significantly to peak grid stress and long-term climate risk. In many multifamily buildings, particularly those serving low-income communities, centralized cooling systems are outdated, water-dependent, and too expensive to upgrade—creating barriers to electrification and equitable decarbonization.

Solution

Building developers must adopt technologies that minimize energy and water use while improving reliability and performance. The recipient's innovative solution leverages a natural refrigerant with a GWP of 1 and physical properties that are ideally matched to building cooling requirements, distinguishing it from commonly used refrigerants. The recipient's product directly supports energy efficiency goals for thermal management technologies while improving operational resilience. By eliminating water loops and leveraging high-density CO₂ for cooling, the recipient's platform reduces cooling energy consumption and infrastructure complexity.

Recipient's core innovation is a CO₂ compressor that can provide simultaneous compression and cooling, enabling the large-scale use of CO₂ as a refrigerant for heat pumps in buildings. With California Energy Commission's (CEC) support, the recipient will demonstrate the feasibility of this design via the construction and operation of a CO₂ compressor. Using CO₂ enables the recipient's system to be modular, enabling simple sizing for 2-5 ton and 1-20 ton, as either central or individual unit sized systems.

The recipient will first complete component-level testing to address key design challenges and identify an approach for performance optimization based on manufacturability and observed pressure handling capability. The recipient will then manufacture, instrument, and operate a small table-top demonstration of simultaneous compression and heat transfer. This will enable the applicant to demonstrate compressor functionality while limiting controls and mechanical complexity. At the conclusion of the period of performance, the basic design will be replicated in a stacked configuration to achieve larger CO₂ flow rates. The recipient's team will then build, run, and test a fully instrumented and controlled prototype compressor in a stacked architecture. Finally, the recipient will secure one or more locations to deploy examples of their technology for field testing, prioritizing low-income multifamily housing, to gather data sufficient to inform utilities and future design improvements.

C. Goals and Objectives of the Agreement

Exhibit A

Scope of Work

Icebox Heat Pumps Inc.

Agreement Goals

The goal of this agreement is to design, build and deploy a scalable CO₂-driven heat pump to at least one California-based pilot site located in a disadvantaged community (DAC) and serving low-income multifamily housing. The project team will first build the required components, integrate and test the system at a demonstration site. Eventually, the goal is to deploy the product at a network of demonstration sites under various conditions. The recipient will collect data from these deployments and use them to inform utility energy policy and iteratively improve the technology.

Ratepayer Benefits:² This Agreement will result in the ratepayer benefits of greater electricity reliability and lower costs. Building a modular and scalable CO₂ driven heat pump with all hardware and software integrated to achieve a 1-megawatt capacity will provide increased cooling efficiencies and reduce overall energy usage, phase out synthetic high GWP refrigerants, lower the loads on energy systems, and reduce the rate of for future infrastructure upgrades.

Technological Advancement and Breakthroughs:³ This Agreement will lead to technological advancement and help overcome key barriers to achieving California's statutory energy goals by demonstrating the feasibility of an ultra-low-GWP CO₂-based refrigerant system for residential buildings. The recipient's technology is designed to improve energy efficiency and reduce overall electricity usage in both single-family and multifamily homes. The system has a goal to achieve a COP greater than 3 in both heating and cooling modes, meeting Group 3 requirements. Modeled energy savings indicate a 20–30% reduction in annual electricity use compared to conventional systems. CO₂'s GWP of 1 makes it a climate-resilient alternative to synthetic refrigerants, supporting the state's efforts to reduce greenhouse gas emissions under California Air Resource Board's refrigerant phase-down regulations. The recipient's modular platform allows CO₂ to be delivered through compact, high-density loops—enabling targeted space conditioning without increasing system footprint or requiring invasive building modifications. The system's architecture supports both centralized and distributed deployments, making it adaptable across diverse residential building types and climate zones, while improving overall system resilience and long-term flexibility.

Agreement Objectives

The objectives of this Agreement are to:

- Conduct applied pressure conditions testing using the recipient's test fixtures
- Design and assemble a stack assembly including at least one CO₂ cavity and surrounding compressive chambers
- Integrate valving for the small CO₂ chamber and manufacture static flow parts
- Incorporate valving and back pressure regulators into the compressive fluid path

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

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

Exhibit A Scope of Work Icebox Heat Pumps Inc.

- Develop stacked version of the design with all required flow paths and integrated valving
- Demonstrate pilot system in a high demand microclimate Opportunity Zone
- Evaluate project benefits
- Transfer technology to the community

TASK 1 GENERAL PROJECT TASKS

PRODUCTS

Subtask 1.1 Products

The goal of this subtask is to establish the requirements for submitting project products (e.g., reports, summaries, plans, and presentation materials). Unless otherwise specified by the Commission Agreement Manager (CAM), the Recipient must deliver products as required below by the dates listed in the **Project Schedule (Part V)**. All products submitted which will be viewed by the public, must comply with the accessibility requirements of Section 508 of the federal Rehabilitation Act of 1973, as amended (29 U.S.C. Sec. 794d), and regulations implementing that act as set forth in Part 1194 of Title 36 of the Federal Code of Regulations. All technical tasks should include product(s). Products that require a draft version are indicated by marking “**(draft and final)**” after the product name in the “Products” section of the task/subtask. If “(draft and final)” does not appear after the product name, only a final version of the product is required. With respect to due dates within this Scope of Work, “**days**” means working days.

The Recipient shall:

For products that require a draft version, including the Final Report Outline and Final Report

- Submit all draft products to the CAM for review and comment in accordance with the Project Schedule (Part V). The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt, unless otherwise specified in the task/subtask for which the product is required.
- Consider incorporating all CAM comments into the final product. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product.
- Submit the revised product and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period, or approves a request for additional time.

For products that require a final version only

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

For all products

- Submit all data and documents required as products in accordance with the following:

Instructions for Submitting Electronic Files and Developing Software:

- **Electronic File Format**

Exhibit A Scope of Work Icebox Heat Pumps Inc.

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

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

- Data sets will be in MS Access or MS Excel file format (version 2007 or later), or any other format approved by the CAM.
- Text documents will be in MS Word file format, version 2007 or later.
- Project management documents will be in Microsoft Project file format, version 2007 or later.

○ **Software Application Development**

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

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

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

MEETINGS

Subtask 1.2 Kick-off Meeting

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

The Recipient shall:

- Attend a "Kick-off" meeting with the CAM, 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.

Exhibit A Scope of Work Icebox Heat Pumps Inc.

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:

- 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,

Exhibit A Scope of Work Icebox Heat Pumps Inc.

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)

CAM Products:

- CPR Agenda(s)
- Progress Determination

Subtask 1.4 Final Meeting

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

Exhibit A Scope of Work Icebox Heat Pumps Inc.

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.

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.

Exhibit A Scope of Work Icebox Heat Pumps Inc.

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.

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:

Exhibit A
Scope of Work
Icebox Heat Pumps Inc.

- 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 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.
- 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*

Exhibit A Scope of Work Icebox Heat Pumps Inc.

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.
- 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)*

Exhibit A Scope of Work Icebox Heat Pumps Inc.

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*)

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.

Exhibit A
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Icebox Heat Pumps Inc.

- 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
 - 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.

Exhibit A Scope of Work Icebox Heat Pumps Inc.

- 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
- 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.

Exhibit A Scope of Work Icebox Heat Pumps Inc.

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.

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.

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- 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

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III. TECHNICAL TASKS

TASK 2: CONDUCT APPLIED PRESSURE CONDITIONS TESTING USING DEVELOPED TEST FIXTURE

The recipient will identify at least one robust combination of materials and a practical assembly method for seals capable of reliably withstanding operational pressure differentials of 500–1500 psi CO₂. They will then demonstrate seal integrity over a minimum of 10,000 compression cycles without measurable leakage or degradation.

The Recipient shall:

- Test various designs which incorporate different sealing techniques (O-rings, gaskets, etc)
- Test different assembly orders and procedures
- Test different sealants (silicone, polyurethane, acrylic). Materials that will require sealing will include various metals and elastomers
- Establish leak rates ≤ 0.1 cc/min
- Ensure sealing reliability
 - Maximum Pressure Differential 2000 psi
 - CO₂ Test Gas Purity $\geq 99.9\%$
 - Pressure Measurement Accuracy $\pm 0.5\%$ of reading
 - Elastomer Degradation shows no bubbling after 30 cycles @1200 psi
 - Test Temperature 20–40 °C
- Prepare a *Seal Test Verification Report* which includes but not limited to:
 - Testing process documentation
 - Technical issues and lessons learned
- Identify at least one combination of materials and easily performed assembly procedure that yields a seal capable of withstanding operational pressure differentials, for all the different types of seals

Products:

- Seal Test Verification Report (draft and final)

TASK 3: DESIGN AND ASSEMBLE A STACK ASSEMBLY INCLUDING AT LEAST ONE CO₂ CAVITY AND SURROUNDING COMPRESSIVE CHAMBERS

The goal of this task is to demonstrate CO₂ compression from 500 to 1000 psi, verifying heat extraction through measurable post-compression CO₂ temperature control. Project team will confirm a quantifiable reduction in CO₂ temperature rise compared to adiabatic compression by at least 20%, validated by concurrent temperature increase in the heat extraction fluid.

The Recipient shall:

- Demonstrate static CO₂ compression capability from 500-1000 psi
- Verify simultaneous heat extraction for near isothermal compression
- Validate structural integrity and chamber sealing during pressure variations
- Confirm key metrics
 - Initial CO₂ Pressure psi 500
 - Final CO₂ Pressure psi ≥ 1000
 - Compression Ratio - 2.0

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- Maximum CO₂ Temperature ≤35°C
- Temperature Measurement Accuracy ±0.2°C
- COP (Static Compression) - 6–8
- Monitor the temperatures of the CO₂ and neighboring fluids to demonstrate heat transfer from the compressed CO₂ into the neighboring fluid
- Prepare a *Stack Assembly Verification Report* which includes but not limited to:
 - Testing process documentation
 - Technical issues and lessons learned

Products:

- Stack Assembly Verification Report (draft and final)

TASK 4: INTEGRATE VALVING FOR THE SMALL CO₂ CHAMBER INTO THE DESIGN AND MANUFACTURE STATIC FLOW PARTS

The goal of this task is to validate precise valve timing and leak-free cyclic CO₂ flow. The recipient will add and control valves to introduce low-pressure CO₂ into the compression chamber, close the chamber, and then open the exit valve once the CO₂ has been compressed.

The Recipient shall:

- Confirm electronic valve controls achieve set cycle frequencies
- Ensure cycle repeatability at operation flow rates
- Write and assemble software and electronics capable of opening and closing valves with the required timing will be written and assembled
- Verify key metrics:
 - CO₂ Flow Rate ≥0.005 kg/s
 - Valve Cycle Rate 2 Hz
 - Valve Leakage Rate ≤0.05 cc/min
 - Valve Actuation Speed ≤50 ms
 - CO₂ Inlet Pressure 500 psi
 - CO₂ Outlet Pressure ≥1000 psi
- Prepare a draft *Valving Verification Report* which includes but not limited to:
 - Testing process documentation
 - Technical issues and lessons learned
 - Testing results: Compression of CO₂ from 500 to at least 1000 psi CO₂ with a compression cycle rate of 2 cycles per second
- Prepare and submit a *CPR Report #1*.
- Attend the CPR meeting per subtask 1.3.

Products:

- Valving Verification Report (draft and final)
- CPR Report #1

TASK 5: INCORPORATE VALVING AND BACK PRESSURE REGULATORS INTO THE COMPRESSIVE FLUID PATH

The goal of this task is to validate efficient thermal management and heat extraction

Exhibit A Scope of Work Icebox Heat Pumps Inc.

performance. The recipient will demonstrate required flow of the compressing fluid to pull energy from the compressor and keep the overall temperature constant. To act as both a compressive source and adequate heat sink, the fluid must both change pressure and maintain a constant flow.

The Recipient shall:

- Update mechanical design to include the valves and any required modifications to the fluid's flow path
- Update control software and electronics to include the required valve controls
- Source and add to controls any additional components external to the mechanical stack
- Confirm stable compressive fluid flow and CO₂ temperature regulation
- Optimize back pressure accuracy under dynamic CO₂ compression conditions
- Validate efficient thermal management and heat extraction performance
- Prepare a *Regulation Verification Report* which includes but not limited to:
 - Testing process documentation
 - Technical issues and lessons learned
 - Testing results
 - Compression Fluid Flow Rate 2–10 L/min (controlled)
 - Fluid Pressure Control Accuracy ± 5 psi
 - Maximum CO₂ Temperature $\leq 35^{\circ}\text{C}$
 - Heat Extraction Efficiency $\geq 80\%$
 - Compression Cycle Frequency 2 Hz
 - Fluid Temperature Stability $\pm 1.0^{\circ}\text{C}$

Products:

- Regulation Verification Report (draft and final)

TASK 6: DEVELOP STACKED VERSION OF THE DESIGN WITH ALL REQUIRED FLOW PATHS AND INTEGRATED VALVING DEFINED

The goal of this task is to replicate the validated prototype compressor design in a stack to achieve larger CO₂ flow rates. This will require modifications for appropriate gas and fluid paths to access the larger number of chamber inputs and outputs. It will also require an increased number and control of valves. Attention must also be paid to dead volume (any volume of CO₂ that cannot be actively compressed) as it will reduce the overall compression ratio. Minimizing this value is a key design goal.

The Recipient shall:

- Define all required flow paths and integrated valving for the design
- Ensure compatibility with further stacking for ultimately larger flow rates/heat pump capacities
- Make any necessary modifications to control electronics and software to adequately move all valves to their appropriate states with required timing
- Prepare a *Stack Verification Report* which includes but not limited to:
 - Testing process documentation
 - Technical issues and lessons learned
 - Testing results:
 - CO₂ Flow Rate 0.03 kg/s
 - Initial CO₂ Pressure 500 psi
 - Final CO₂ Pressure 1500 psi

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- Maximum CO₂ Temperature ≤35°C
- Dead Volume Percentage ≤2%
- Valve Response Time ≤50ms
- Overall Compression Efficiency ≥85%
- Prepare and submit a *CPR Report #2*.
- Attend the CPR meeting per subtask 1.3.

Products:

- Stack Verification Report (draft and final)
- CPR Report #2

TASK 7: DEMONSTRATE PILOT SYSTEM IN HIGH DEMAND MICROCLIMATE OPPORTUNITY ZONES

The goal of this task is to deploy and evaluate functional examples of the recipient CO₂-based heat pump technology in real-world residential settings. The recipient is in the process of securing a California-based demonstration site in a disadvantaged or low-income community, with a primary focus on multifamily housing or mixed-use developments within designated disadvantaged communities, in line with CEC priorities. The demonstration will validate performance, enable system refinement, and ensure direct community impact and visibility.

In addition to the multifamily deployment, the recipient aims to initiate longer-term fleet testing across both single-family and multifamily sites, distributed across diverse California climate zones. This approach will provide comprehensive performance and use-profile data and enable deeper engagement with utilities, community stakeholders, and grid operators.

To quantify project benefits the project team will fit each prototype and field-deployed unit with: (1) revenue-grade power meters to log compressor and fan energy (kWh) and power (kW); and (2) paired pressure-temperature sensors on the CO₂ loop to determine real-time mass-flow-rate*enthalpy change, yielding delivered heat (Btu) and COP. Hourly data will stream to our cloud dashboard and be compared with an electric-resistance baseline to quantify whole-site kWh, peak-kW, and cost savings. To support required comparison studies, the recipient will explore collaboration opportunities with student researchers from California's Minority Serving Institutions (MSIs) network to ensure inclusive participation and workforce development.

The Recipient shall:

- Secure one or more California-based pilot sites, with at least one located in a disadvantaged community (DAC) and serving low-income multifamily housing, summarized in a *Site Selection Memo*
- Install and interconnect a functional heat pump system at the host site(s) and generate an *Installation and Commissioning Report*
- Monitor and collect performance data via Supervisory Control and Data Acquisition (SCADA) or similar platform for at least 24 months or shorter subject to written CAM approval to generate a *Monitoring Data Sets*
- Conduct comparison analysis (e.g., baseline vs. post-install energy use, refrigerant impacts, comfort)
- Coordinate with local partners and/or student researchers to support data analysis and community engagement
- Fit each prototype and field-deployed unit with

Exhibit A
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- (1) revenue-grade power meters to log compressor and fan energy (kWh) and power (kW).
- (2) paired pressure-temperature sensors on the CO₂ loop to determine real-time mass-flow-rate*enthalpy change, yielding delivered heat (Btu) and COP. Hourly data will stream to our cloud dashboard and be compared with an electric-resistance baseline to quantify whole-site kWh, peak-kW, and cost savings.
- Prepare and submit a *CPR Reports #3 and #4*
- Attend the CPR meetings per subtask 1.3.

Products:

- Site Selection Memo
- Installation and Commissioning Report
- Monitoring Data Sets
- CPR Reports #3 and #4

TASK 8: EVALUATION OF PROJECT BENEFITS

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

The Recipient shall:

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

Exhibit A Scope of Work Icebox Heat Pumps Inc.

TASK 9: 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
- Legal services or licensing to secure necessary intellectual property to further develop the technology
- Market research, business plan development, and cost-performance modeling

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 an explanation why.
- Submit the final *Technology Transfer Plan* to the CAM for approval.
- 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

IV. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.