California Energy Commission
August 14, 2024 Business Meeting
Backup Materials for Prospect Silicon Valley

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

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

[PROPOSED]

RESOLUTION NO: 24-0814-15c

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION: Prospect Silicon Valley

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-24-015 with Prospect Silicon Valley for a $1,800,000 grant. The agreement will install a heat pump system at a facility in Sonoma County to provide low temperature and medium temperature refrigeration through a new hybrid booster system that will interface with a custom evaporator that uses heat reclaimed from the refrigeration cycle to defrost for little to no additional energy; and

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

CERTIFICATION

The undersigned Secretariat to the CEC does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the CEC held on August 14, 2024.

AYE:
NAY:
ABSENT:
ABSTAIN:

Dated:

_____
Kristine Banaag
Secretariat

STATE OF CALIFORNIA
CALIFORNIA ENERGY COMMISSION

CEC-270 (Revised 01/2024)

GRANT REQUEST FORM (GRF)

A. New Agreement Number

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

New Agreement Number: EPC-24-015

B. Division Information

1. Division Name: ERDD
2. Agreement Manager: Christian Fredericks
3. MS-:51
4. Phone Number: 916-776-0755

C. Recipient's Information

1. Recipient's Legal Name: Prospect Silicon Valley
2. Federal ID Number: 27-0220018

D. Title of Project

Title of project: Dynamic, Grid-Flexible Cold Storage Refrigeration Featuring Advanced CO2 Heat Pump, Thermal Storage, and Defrost Controls

E. Term and Amount

1. Start Date: 8/14/2024
2. End Date: 3/31/2027
3. Amount: $1,800,000.00

F. Business Meeting Information

1. Are the ARFVTP agreements $75K and under delegated to Executive Director? No
2. The Proposed Business Meeting Date: 8/14/2024 .
3. Consent or Discussion? Discussion
4. Business Meeting Presenter Name: Christian Fredericks
5. Time Needed for Business Meeting: 10 minutes.
6. The email subscription topic is: EPIC (Electric Program Investment Charge).

Agenda Item Subject and Description:
Prospect Silicon Valley. Proposed resolution approving agreement EPC-24-015 with Prospect Silicon Valley for a $1,800,000 grant and adopting staff's determination that this project is exempt from CEQA. The Project will install a heat pump system at a facility in Sonoma County to provide low temperature and medium temperature refrigeration through a new hybrid booster system that will interface with a custom evaporator that uses heat reclaimed from the refrigeration cycle to defrost for little to no additional energy. (EPIC funding) Contact: Christian Fredericks

G. California Environmental Quality Act (CEQA) Compliance

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

   If yes, skip to question 2.

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

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

2. **If Agreement is considered a "Project" under CEQA answer the following questions.**

a) Agreement **IS** exempt?

Yes

Statutory Exemption?
No

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

PRC section number: None

CCR section number: None

Categorical Exemption?
Yes

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

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

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.

This project is exempt under Cal. Code 15301: Existing Facilities because the project involves upgrading an existing facility's refrigerant system with an updated refrigerant system with a similar cooling capacity. The new system will take up less space and does not involve adding additional square footage to the facility. The updated refrigeration system uses less power and will not result in an additional electrical load.

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

b) Agreement **IS NOT** exempt.

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

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	Yes or No
Negative Declaration	Yes or No
Mitigated Negative Declaration	Yes or No
Environmental Impact Report	Yes or No
Statement of Overriding Considerations	Yes or No
None	Yes or No

H. Is this project considered "Infrastructure"?

No

I. Subcontractors

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

Subcontractor Legal Company Name	CEC Funds	Match Funds
DOE- Lawrence Berkeley National Laboratory	$ 275,000	**$**0
Straus Family Creamery	$ 250,000	**$**0
DMG North, Inc.	$ 754,000	**$**0
AlterEngineers	$ 85,000	**$**0
Avida Energy	$ 50,000	**$**0

J. Vendors and Sellers for Equipment and Materials/Miscellaneous

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

Vendor/Seller Legal Company Name	CEC Funds	Match Funds
No vendors to report	**$**	**$**

K. Key Partners

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

Key Partner Legal Company Name
No key partners to report

L. Budget Information

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

Funding Source	Funding Year of Appropriation	Budget List Number	Amount
EPIC	22-23	301.001J	$ 1,800,000

TOTAL Amount: $ 1,800,000

R&D Program Area: ICMB: IAW

Explanation for “Other” selection Not applicable

Reimbursement Contract #: Not applicable

Federal Agreement #: Not applicable

M. Recipient’s Contact Information

1. Recipient’s Administrator/Officer

Name: Doug Davenport

Address: 1608 Las Plumas Ave

City, State, Zip: San Jose, CA 95133-1655

Phone: 415-867-7498

E-Mail: doug.davenport@prospectsv.org

3. Recipient’s Project Manager

Name: Andrew Huynh

Address: 1608 Las Plumas Ave

City, State, Zip: San Jose, CA 95133-1655

Phone: 414-867-7498

E-Mail:

N. Selection Process Used

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

Selection Process	Additional Information
Competitive Solicitation #	GFO-23-301
First Come First Served Solicitation #	Not applicable
Other	Not applicable

O. Attached Items

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

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

Approved By

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

Agreement Manager: Christian Fredericks

Approval Date: 7/5/2024

Branch Manager: Ilia Krupenich on behalf of Cody Taylor

Approval Date: 7/5/2024

Director: Ilia Krupenich on behalf of Cody Taylor on behalf of Director

Approval Date: 7/5/2024

Exhibit A
Scope of Work
Prospect Silicon Valley

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR[1]	Task Name
1		General Project Tasks
2	X	Project Planning and System Procurement
3		System Installation and Testing
4		Modeling and Design Tools
5	X	Measurement and Verification
6		Evaluation of Project Benefits
7		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
BIM	Building Information Model
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CEC	California Energy Commission
CPR	Critical Project Review
DHW	Domestic Hot Water
DX	Direct Expansion
EUI	Energy Use Intensity
GHG	Greenhouse Gas
GWP	Global Warming Potential
IOU	Investor-Owned Utility
LBNL	Lawrence Berkeley National Lab
MPC	Model Predictive Controller
PFAs	Per- and Polyfluoroalkyl Substances
TAC	Technical Advisory Committee
TFA	Trifluoroacetic Acid

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

A. Purpose of Agreement

The purpose of this Agreement is to fund the testing and demonstration of Flow Environmental Systems' advanced, cost-competitive, high efficiency large air-source and water-source heat pumps that uses an ultra-low GWP refrigerant. The system will be installed production facility located in Sonoma County, CA.

[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.

B. Problem/ Solution Statement

Problem

In the state of California, cold storage facilities consume an estimated five times more energy per square foot compared to conventional warehouses.[2] The annual electric energy use intensity (EUI) is 20.02 kilowatt-hours per square foot (kWh/ft2), and the annual fossil gas EUI is 5.6 thousand British thermal units per square foot (kBtu/ft2), respectively. Improvement of energy efficiency in cold storage facilities is an essential pathway to achieve the carbon emission goal of 40% reduction from the building sector by 2030. In addition, peak demand from large cold storage facilities can have a significant impact on the grid, and system capabilities and operations can result in waste heat, frost buildup, and other inefficiencies. Additionally, the synthetic refrigerants used in these systems have a high GWP, contributing to overall GHG emissions.

Solution

Flow Environmental Systems, Inc has developed a 100% electric advanced heat pump and rack platform utilizing R744 or refrigerant-grade CO2 with a GWP of 1 that can operate as a DX Freezer, DX Cooler, Chiller, Heat Pump Boiler, or DHW system either individually or all at the same time with a single power feed with simultaneous heating and cooling. The system can handle unbalanced loads while optimizing power at all operational conditions to maintain the highest coefficient of performance (COP). Additionally, the proposed technology can perform with the highest efficiency in all modes through a hybrid transcritical CO2 booster system that can seamlessly shift between multiple modes of operation and optimize efficiency based on the mode it is running in.

The technology includes thermal storage of defrost energy via aqueous glycol mix and cooling energy via R744. With the addition of the cooling thermal storage, it would allow load shifting in the cold chain where otherwise it would be detrimental to the facility's operations. The system provides significant efficiency improvement over electric resistance heating.

This project will also showcase how this integrated CO2 heat pump system is ideal for grid flexibility and resiliency by offering a singular point of communication for grid connectivity with the ability to use less or more power beneficially as the grid is taxed positively or negatively by peak loads or excess renewables. The utility will be able to affect an entire building's thermal profile through a singular set point rather than many systems that cannot handle rapid modulation.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Demonstrate a fully functional CO2 heat pump that integrates multiple capabilities to deliver efficiency, peak load reduction, waste heat recovery, and advanced defrost.
- Showcase how the proposed technology can provide grid flexibility and resiliency by offering a singular point of communication for grid connectivity.
- Substantially reduce the cost and GHG emissions currently associated with cold storage refrigeration.

[2] https://www.energy.ca.gov/data-reports/surveys/california-commercial-end-use-survey/2006-california-commercial-end-use-survey

- Demonstrate benefits to end users via partnership with regional utility and community partnerships.
- Provide market-specific data, strategies, and tools derived from demonstration data and model development.

Ratepayer Benefits:[3]
This project will result in benefits to grid and utility operators and building owners in the state. The benefits to California IOU ratepayers include (1) reduced energy bills from high efficiency heat pump operations with a hybrid transcritical CO2 booster system and a hot glycol defrost method; (2) reduced peak demand charge through the dynamic control of the heat pump with optimal defrost cycle and thermal storage operations; and (3) environmentally friendly R744 refrigerant (CO2) in place of legacy R448a refrigerants for low and medium temperature in commercial refrigeration.

Synthetic refrigerants are known sources of Per- and Polyfluoroalkyl Substances (PFAS) and Trifluoroacetic Acid (TFA). Multiple lawsuits regarding the harm caused by these substances are occurring around the world and others are already paying out billions of dollars. This makes anything with PFAS or TFA a liability moving forward. R744 or CO2 is a class A1 safety refrigerant and does not and cannot break down into these toxic chemicals in the atmosphere which significantly reduces risk and liability.

Technological Advancement and Breakthroughs:[4]
This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by demonstrating a fully functional, high efficiency large air-source and water-source heat pump that can provide low temperature and medium temperature refrigeration through a new hybrid booster system that will interface with a custom evaporators that use heat reclaim from the refrigeration cycle to defrost for little to no energy. The system is 100% electric and provides safety benefits from using a safety class A1 (CO2 refrigerant) vs A2L, A3, and B2L, such as the reduction in PFAS, TFA, and other harmful toxic chemicals in the water supply. The advanced CO2 heat pump system also demonstrates advanced intelligent defrost control and improved demand flexibility through thermal storage, controls, and a heat reclaim reservoir.

Agreement Objectives
The objectives of this Agreement are to:

- Develop a detailed plan for testing the advanced CO2 heat pump system at a production facility in Sonoma County, CA.
- Install and commission a CO2 heat pump at a production facility servicing two cold storage rooms. Capture and manage data from testing.

[3] 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).

[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.

- Analyze data collected from testing to calculate performance and efficiency of the advanced CO2 heat pump system for cold storage refrigeration.
- Develop a set of modeling, standard procedures, and design/delivery tools available to industry stakeholders to assist in the deployment of heat pumps in refrigeration systems.
- Evaluate project benefits and report to the CEC.
- Capture technological learnings and disseminate to a range of professions across the Buildings Industry responsible for future deployments of this or similar technologies.
- Demonstrate at least 30kW load reduction of electric resistance heating replacing it with excess heat from the refrigeration cycle.
- Demonstrate thermal storage for up to 4 hours to offset cooling demand for both low temp (-30F) and medium temp loads (35F).
- Demonstrate savings of $22,520 annually via energy efficiency, and reduced defrost loads, and five year payback on installed cost.
- Demonstrate Flow's Answr CO2 system with a hybrid booster CO2 rack configured to optimize cooling efficiency and show at least 40 percent improvement in energy efficiency during peak loads.

III. TASK 1 GENERAL PROJECT TASKS

PRODUCTS

Subtask 1.1 Products

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

The Recipient shall:

<u>For products that require a draft version, including the Final Report Outline and Final Report</u>

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

For products that require a final version only

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

For all products

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

Instructions for Submitting Electronic Files and Developing Software:

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

  The following describes the accepted formats for electronic data and documents provided to the CEC as products under this Agreement, and establishes the software versions that will be required to review and approve all software products:
  - Data sets will be in MS Access or MS Excel file format (version 2007 or later), or any other format approved by the CAM.
  - Text documents will be in MS Word file format, version 2007 or later.
  - Project management documents will be in Microsoft Project file format, version 2007 or later.

- **Software Application Development**
  Use the following standard Application Architecture components in compatible versions for any software application development required by this Agreement (e.g., databases, models, modeling tools), unless the CAM approves other software applications such as open-source programs:
  - Microsoft ASP.NET framework (version 3.5 and up). Recommend 4.0.
  - Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5.
  - Visual Studio.NET (version 2008 and up). Recommend 2010.
  - C# Programming Language with Presentation (UI), Business Object and Data Layers.
  - SQL (Structured Query Language).
  - Microsoft SQL Server 2008, Stored Procedures. Recommend 2008 R2.
  - Microsoft SQL Reporting Services. Recommend 2008 R2.
  - XML (external interfaces).

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

MEETINGS

Subtask 1.2 Kick-off Meeting

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

Exhibit A
Scope of Work
Prospect Silicon Valley

The Recipient shall:

- Attend a "Kick-off" meeting with the CAM, the Commission Agreement Officer (CAO), and any other CEC staff relevant to the Agreement. The Recipient will bring its Project Manager and any other individuals designated by the CAM to this meeting. The administrative and technical aspects of the Agreement will be discussed at the meeting. Prior to the meeting, the CAM will provide an agenda to all potential meeting participants. The meeting may take place in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.
  The administrative portion of the meeting will include discussion of the following:
  - Terms and conditions of the Agreement;
  - Invoicing and auditing procedures;
  - Administrative products (subtask 1.1);
  - CPR meetings (subtask 1.3);
  - Match fund documentation (subtask 1.7);
  - Permit documentation (subtask 1.8);
  - Subcontracts (subtask 1.9); and
  - Any other relevant topics.

  The technical portion of the meeting will include discussion of the following:
  - The CAM's expectations for accomplishing tasks described in the Scope of Work;
  - An updated Project Schedule;
  - Technical products (subtask 1.1);
  - Progress reports (subtask 1.5);
  - Final Report (subtask 1.6);
  - Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
  - Any other relevant topics.

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

- Provide an *Updated Project Schedule, Match Funds Status Letter,* and *Permit Status Letter*, as needed to reflect any changes in the documents.

The CAM shall:

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

Recipient Products:

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

CAM Product:

- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings

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

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

The Recipient shall:

- Prepare and submit a *CPR Report* for each CPR meeting that: (1) discusses the progress of the Agreement toward achieving its goals and objectives; and (2) includes recommendations and conclusions regarding continued work on the project.
- Attend the CPR meeting.
- Present the CPR Report and any other required information at each CPR meeting.

The CAM shall:

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

Recipient Products:

- CPR Report(s)

CAM Products:

- CPR Agenda(s)
- Progress Determination

Subtask 1.4 Final Meeting

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

The Recipient shall:

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

  The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be divided into two separate meetings at the CAM's discretion.
  - The technical portion of the meeting will involve the presentation of findings, conclusions, and recommended next steps (if any) for the Agreement. The CAM will determine the appropriate meeting participants.
  - The administrative portion of the meeting will involve a discussion with the CAM and the CAO of the following Agreement closeout items:
    - Disposition of any procured equipment.
    - The CEC's request for specific "generated" data (not already provided in Agreement products).
    - Need to document the Recipient's disclosure of "subject inventions" developed under the Agreement.
    - "Surviving" Agreement provisions such as repayment provisions and confidential products.
    - Final invoicing and release of retention.
- Prepare a *Final Meeting Agreement Summary* that documents any agreement made between the Recipient and Commission staff during the meeting.
- Prepare a *Schedule for Completing Agreement Closeout Activities*.
- Provide copies of *All Final Products* on a USB memory stick, organized by the tasks in the Agreement.

Products:

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

REPORTS AND INVOICES

Subtask 1.5 Progress Reports and Invoices

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

The Recipient shall:

- Submit a monthly *Progress Report* to the CAM. Each progress report must:
  - Summarize progress made on all Agreement activities as specified in the scope of work for the preceding month, including accomplishments, problems, milestones, products, schedule, fiscal status, and an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. See the Progress Report Format Attachment for the recommended specifications.
- Submit a monthly or quarterly *Invoice* that follows the instructions in the "Payment of

Funds" section of the terms and conditions, including a financial report on Match Funds and in-state expenditures.

Products:

- Progress Reports
- Invoices

Subtask 1.6 Final Report

The goal of this subtask is to prepare a comprehensive Final Report that describes the original purpose, approach, results, and conclusions of the work performed under this Agreement. When creating the Final Report Outline and the Final Report, the Recipient must use the CEC Style Manual provided by the CAM.

Subtask 1.6.1 Final Report Outline

The Recipient shall:

- Prepare a *Final Report Outline* in accordance with the *Energy Commission Style Manual* provided by the CAM.

Recipient Products:

- Final Report Outline (draft and final)

CAM Product:

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

Subtask 1.6.2 Final Report

The Recipient shall:

- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline, Energy Commission Style Manual, and Final Report Template provided by the CAM with the following considerations:
  - Ensure that the report includes the following items, in the following order:
    - Cover page (**required**)
    - Credits page on the reverse side of cover with legal disclaimer (**required**)
    - Acknowledgements page (optional)
    - Preface (**required**)
    - Abstract, keywords, and citation page (**required**)
    - Table of Contents (**required**, followed by List of Figures and List of Tables, if needed)
    - Executive summary (**required**)
    - Body of the report (**required**)
    - References (if applicable)
    - Glossary/Acronyms (If more than 10 acronyms or abbreviations are used, it is required.)
    - Bibliography (if applicable)
    - Appendices (if applicable) (Create a separate volume if very large.)

        - Attachments (if applicable)
    - Submit a draft of the Executive Summary to the TAC for review and comment.
    - Develop and submit a *Summary of TAC Comments on Draft Final Report* received on the Executive Summary. For each comment received, the recipient will identify in the summary the following:
        - Comments the recipient proposes to incorporate.
        - Comments the recipient does propose to incorporate and an explanation for why.
    - Submit a draft of the report to the CAM for review and comment. The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt.
    - Incorporate all CAM comments into the *Final Report*. If the Recipient disagrees with any comment, provide a *Written Responses to Comments* explaining why the comments 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

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds

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

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

The Recipient shall:

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

  If match funds were a part of the proposal that led to the CEC awarding this Agreement, then provide in the letter:
    - A list of the match funds that identifies:
        - The amount of cash match funds, their source(s) (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied.
        - The amount of each in-kind contribution, a description of the contribution type

(e.g., property, services), the documented market or book value, the source (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied. If the in-kind contribution is equipment or other tangible or real property, the Recipient must identify its owner and provide a contact name, address, telephone number, and the address where the property is located.
    - If different from the solicitation application, provide a letter of commitment from an authorized representative of each source of match funding that the funds or contributions have been secured.
- At the Kick-off meeting, discuss match funds and the impact on the project if they are significantly reduced or not obtained as committed. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide a *Supplemental Match Funds Notification Letter* to the CAM of receipt of additional match funds.
- Provide a *Match Funds Reduction Notification Letter* to the CAM if existing match funds are reduced during the course of the Agreement. Reduction of match funds may trigger a CPR meeting.

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

Subtask 1.8 Permits
The goal of this subtask is to obtain all permits required for work completed under this Agreement in advance of the date they are needed to keep the Agreement schedule on track. Permit costs and the expenses associated with obtaining permits are not reimbursable under this Agreement, with the exception of costs incurred by University of California recipients. Permits must be identified and obtained before the Recipient may incur any costs related to the use of the permit(s) for which the Recipient will request reimbursement.

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

  The list of permits and the schedule for obtaining them will be discussed at the Kick-off meeting (subtask 1.2), and a timetable for submitting the updated list, schedule, and copies of the permits will be developed. The impact on the project if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in progress reports and will be a topic at CPR meetings.
- If during the course of the Agreement additional permits become necessary, then provide the CAM with an *Updated List of Permits* (including the appropriate information on each permit) and an *Updated Schedule for Acquiring Permits*.
- Send the CAM a *Copy of Each Approved Permit*.

- If during the course of the Agreement permits are not obtained on time or are denied, notify the CAM within 5 days. Either of these events may trigger a CPR meeting.

Products:

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

Subtask 1.9 Subcontracts

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

The Recipient shall:

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

Products:

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

TECHNICAL ADVISORY COMMITTEE

Subtask 1.10 Technical Advisory Committee (TAC)

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

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

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

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

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

The Recipient shall:

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

Products:

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

Subtask 1.11 TAC Meetings

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

Exhibit A
Scope of Work
Prospect Silicon Valley

The Recipient shall:

- Discuss the TAC meeting schedule with the CAM at the Kick-off meeting. Determine the number and location of meetings (in-person and via teleconference) in consultation with the CAM.
- Prepare a *TAC Meeting Schedule* that will be presented to the TAC members during recruiting. Revise the schedule after the first TAC meeting to incorporate meeting comments.
- Prepare a *TAC Meeting Agenda* and *TAC Meeting Back-up Materials* for each TAC meeting.
- Organize and lead TAC meetings in accordance with the TAC Meeting Schedule. Changes to the schedule must be pre-approved in writing by the CAM.
- Prepare *TAC Meeting Summaries* that include any recommended resolutions of major TAC issues.

The TAC shall:

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

Products:

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

Subtask 1.12 Project Performance Metrics

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

The Recipient shall:

- Complete and submit the project performance metrics section of the *Initial Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task, to the CAM.
- Present the draft project performance metrics at the first TAC meeting to solicit input and comments from the TAC members.

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

Products:

- TAC Performance Metrics Summary
- Project Performance Metrics Results

IV. TECHNICAL TASKS

TASK 2 PROJECT PLANNING & SYSTEM PROCUREMENT

The goal of this task is to develop the plans needed for site testing and demonstration of an advanced CO2 Heat Pump a production facility in Sonoma County, CA.

The Recipient shall:

- Review test configurations at the Flow Innovation Center and the demonstration site's facilities and understand the space, connectivity and integration constraints.
- Develop *Use Case Outlines* pertinent to potential uses of an advanced CO2 heat pump in refrigerated warehouses and commercial cold storage facilities.
- Create a *Demonstration and Testing Plan* based on the outcome of the use case development that includes:
    - Clearly defined testing objectives
    - System setup
    - Scenarios
    - Procedures
    - Performance metrics used to evaluate each use case.
- Develop *Engineering Design Documents* for the advanced CO2 heat pump system installation at the demonstration site.
- Purchase and deliver the advanced CO2 heat pump system with thermal storage and advanced controls to the demonstration site.
- Participate in CPR per Subtask 1.3 and prepare CPR Report #1.

Products:

- Use Case Outlines
- Demonstration and Testing Plan
- Engineering Design Documents
- CPR Report #1

TASK 3 SYSTEM INSTALLATION & TESTING

The goals of this task are to install and perform site testing/analysis of an advanced CO2 heat pump system at the demonstration site in Sonoma County.

The Recipient shall:

- Review system design, installation, and commissioning protocols for the preparation of the site.
- Assemble, transport, install, and commission an advanced CO2 heat pump system in parallel to the existing system at the demonstration site.
- Conduct the demonstration in accordance with the Demonstration Plan.
- Capture and Manage data from the demonstration and summarize in a *Project Data Summary*.
- Compile results in a project *Testing Report*.

Products:

- Project Data Summary
- Testing Report

TASK 4 MODELING & DESIGN TOOLS

The goal of this task is to develop modeling and design tools stemming from the demonstration for use by future designers, installers, or technology providers. Resulting work from this Task will be further used in Knowledge Transfer activities outlined in Task 7.

The Recipient shall:

- Conduct cold storage system modeling that meets criteria in American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Guideline 14-2014
    - Utilize data from the cold storage facility and refrigeration system equipment to construct a physics-based energy model. Recipient will calibrate the model using existing operational data from the refrigeration system to ensure accuracy for integration into a model predictive controller.
- Develop an advanced defrost controller,
    - Dedicated controller will be developed to optimize the management of defrost cycles and runtime, with the goal of minimizing the impact of the defrost process on refrigerated spaces while maintaining evaporators' performance.
- Develop a model predictive controller,
    - Controller(s) will be developed to manage the operation of heat pumps, thermal storage, and the defrost process, while satisfying a set of constraints such as cold storage space temperatures. Recipient will deploy this controller to achieve the following objectives:
        - Peak load shaving or shifting
        - Energy and demand cost savings
        - GHG emission reduction
- Conduct a parametric modeling of the proposed solution and develop a report of parametric simulations,
    - Conduct a parametric analysis of the heat pump with thermal storage solution by varying model component parameters such as the capacity, location, utility rate.

The outcome will be utilized for cost and benefit analysis of the proposed solution under various scenarios.

- Compile modeling and design tools above in a *Modeling & Design Tool Package.*
- Document results of the work in a *Modeling and Design Tool Memorandum.*

Products:

- Modeling & Design Tool Package
- Modeling and Design Tool Memorandum

TASK 5 MEASUREMENT AND VERIFICATION

The goal of this task is to analyze the data collected to calculate performance and efficiency of an advanced CO2 heat pump system.

The Recipient shall:

- Develop a *Measurement and Verification (M&V) Plan,* which details the specific approach to verification of the system's performance.
- Conduct M&V tasks, including results evaluation and 1:1 comparison of demonstration system to existing technology.
- Write a Draft and Final *M&V Report,* detailing results from M&V Tasks above.
- Participate in CPR per Subtask 1.3 and prepare CPR Report #2.

Products:

- Measurement and Verification Plan
- Measurement and Verification (Draft &Final)
- CPR Report #2

TASK 6 EVALUATION OF PROJECT BENEFITS

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

The Recipient shall:

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

provide *Documentation of Project Profile on EnergizeInnovation.fund*, including the profile link.

- If the Prime Recipient is an Innovation Partner on the project, complete and update the organizational profile on the CEC's public online project and recipient directory on the Energize Innovation website (www.energizeinnovation.fund), and provide *Documentation of Organization Profile on EnergizeInnovation.fund*, including the profile link.

Products:

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

TASK 7 TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES

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

Subtask 7.1 Project Case Study

The Recipient Shall:

- Develop and submit a *Project Case Study Plan* that outlines how the Recipient will document the planning, construction, commissioning, and operation of the technology or system being demonstrated. The Project Case Study Plan should include:
  - An outline of the objectives, goals, and activities of the case study.
  - The organization that will be conducting the case study and the plan for conducting it.
  - A list of professions and practitioners involved in the technology's deployment.
  - Specific activities the recipient will take to ensure the learning that results from the project is disseminated to those professions and practitioners.
  - Presentations/webinars/training events to disseminate the results of the case study.
- Present the draft *Project Case Study Plan* to the TAC for review and comment.
- Develop and submit a *Summary of TAC Comments* that summarizes comments received from the TAC members on the draft *Project Case Study Plan*. This document will identify:
  - TAC comments the recipient proposes to incorporate into the final *Technology Transfer Plan*.
  - TAC comments the recipient does not propose to incorporate, with an explanation why.
- Submit the final *Project Case Study Plan* to the CAM for approval.
- Execute the final *Project Case Study Plan* and develop and submit a *Project Case Study*.
- When directed by the CAM, develop presentation materials for a CEC sponsored conference/workshop(s) on the project.

- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the California CEC.
- Provide at least (6) six *High Quality Digital Photographs* (minimum resolution of 1300x500 pixels in landscape ratio) of pre and post technology installation at the project sites or related project photographs.

Products:

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

Subtask 7.2 Engagement Plan

The Recipient Shall:

- Develop an *Engagement Plan* that outlines how Flow will reach key stakeholders in the building industry and share results from the demonstration effort/Project Case Study where the demonstration site is a recognized leader. The *Engagement Plan* shall include:
    - An outline of the objectives, goals, and activities of industry engagement efforts.
    - A list of key building industry stakeholders that may be involved in the technology's deployment, including designers, builders, food industry companies, etc.
    - Specific engagement activities the recipient will take to ensure the learning that results from the project is disseminated to those professions and practitioners.
    - A list of sector specific presentations/webinars/training events to disseminate findings from the project.
- Share the *Engagement Plan* with the TAC for review and comment

Products:

- Engagement Plan

Subtask 7.3 Guidelines and Documentation

The Recipient Shall:

- Assemble project documents and testing data from the demonstration effort
- Develop guidelines and documentation to share with key stakeholders identified in the Engagement Plan, which may include:
    - Initial design guidelines
    - How-to-documentation
    - Value proposition
    - Model specifications for procurement
- Compile resources into a *Guidance Packet* and webinar for long-term engagement purposes
- Present the *Guidance Packet* to the TAC for review and comment.

- Produce a series of sector specific workshops or webinars defined in the Engagement Plan to share the *Guidance Packet* and information from the Case Study to garner feedback and improve the resulting deliverables.

Products:

- Guidance Packet

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet (project schedule).