



**CALIFORNIA
ENERGY COMMISSION**



**California Energy Commission
May 8, 2024 Business Meeting
Backup Materials for The Regents of the University of California on behalf of the
Berkeley Campus**

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

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

[PROPOSED]

RESOLUTION NO: 24-0508-15d

**STATE OF CALIFORNIA
STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION**

**RESOLUTION: The Regents of the University of California, on behalf of the
Berkeley Campus**

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

RESOLVED, that the CEC approves agreement EPC-23-032 with The Regents of the University of California, on behalf of the Berkeley Campus, for a \$5,999,540 grant to install and demonstrate a large heat recovery chiller that uses an ultra-low GWP refrigerant at a Kaiser Permanente hospital building located in San Francisco. The project will assess a range of other equipment combinations for use in other large commercial buildings and site-specific constraints through case studies, interviews with designers, energy modeling, and life cycle cost assessment; and

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

CERTIFICATION

The undersigned Secretariat to the CEC does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the CEC held on May 8, 2024.

AYE:

NAY:

ABSENT:

ABSTAIN:

Dated:

Kristine Banaag
Secretariat



GRANT REQUEST FORM (GRF)

A. New Agreement Number

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

New Agreement Number: EPC-23-032

B. Division Information

1. Division Name: ERDD
2. Agreement Manager: Brad Meister
3. MS-:51
4. Phone Number: 5302106026

C. Recipient's Information

1. Recipient's Legal Name: The Regents of the University of California on behalf of the Berkeley campus
2. Federal ID Number: 94-6002123

D. Title of Project

Title of project: Decarbonizing large commercial buildings through heat recovery

E. Term and Amount

1. Start Date: 6/3/2024
2. End Date: 6/30/2029
3. Amount: \$5,999,540.00

F. Business Meeting Information

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

Agenda Item Subject and Description:

The Regents of the University of California, on behalf of the Berkeley Campus. Proposed resolution approving agreement EPC-23-032 with The Regents of the University of California, on behalf of the Berkeley Campus, for a \$5,999,540 grant to install and demonstrate a large heat recovery chiller that uses an ultra-low GWP refrigerant at a Kaiser Permanente hospital building located in San Francisco and adopting staff's determination that this action is exempt from CEQA. The project will assess a range of other equipment combinations for use in other large commercial buildings and site-specific constraints through case studies, interviews with designers, energy modeling, and life cycle cost assessment.

G. California Environmental Quality Act (CEQA) Compliance

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

Yes



If yes, skip to question 2.

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

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

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

a) Agreement **IS** exempt?

Yes

Statutory Exemption?

No

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

PRC section number: None

CCR section number: None

Categorical Exemption?

Yes

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

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

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

No

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

Cal. Code Regs., tit. 14, sec. 15301 provides that projects which consist of the operation, repair, maintenance, permitting, licensing, or minor alteration of existing or public or private structures, facilities, mechanical equipment, or topographical features, and which involve negligible or no expansion of existing or former use, are categorically exempt from the provisions of the California Environmental Quality Act (CEQA). This project involves minor construction and equipment installation at an existing Kaiser Permanente hospital facility, with no expansion of capacity. This installation is at an existing, developed urban site on land that is not environmentally sensitive. No historic resources or buildings will be affected. Noise and odors will not be generated by these installations in excess of existing permitted amounts. The installation will not increase traffic to the sites. The installation will not require permits for air, water, conditional use, building expansion, hazardous waste, or rezoning. The project therefore falls under the categorical exemption listed in CEQA Guidelines Section 15301 Existing Facilities.

In addition, this project fits within Cal. Code Regs., tit. 14, sect. 15306, which provides that projects which consist of basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource are categorically exempt from the



provisions of the California Environmental Quality Act. This project involves collecting data on the demonstration of a heat recovery chiller that uses a refrigerant with an ultra-low GWP to reduce the emissions from a hospital's heating and cooling system. The project's objective is to acquire data, assess life cycle costs, perform simulations, and develop solutions and resources to aid designers and owners with effectively decarbonizing various large commercial building types. This project involves basic data collection which will not result in a serious or major disturbance to an environmental resource and therefore falls under the categorical exemption listed in CEQA Guidelines Section 15306 Information Collection.

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.

For these reasons, the proposed work will not have any significant effect on the environment and falls under sections 15301 and 15306.

b) Agreement **IS NOT** exempt.

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

No

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

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

H. Subcontractors

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



Subcontractor Legal Company Name	CEC Funds	Match Funds
Taylor Engineering, LLC	\$ 3,500,000	\$0
DOE- Lawrence Berkeley National Laboratory	\$ 600,000	\$0

I. Vendors and Sellers for Equipment and Materials/Miscellaneous

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

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

J. Key Partners

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

Key Partner Legal Company Name
Taylor Engineering, LLC

K. Budget Information

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

Funding Source	Funding Year of Appropriation	Budget List Number	Amount
EPIC	22-23	301.001J	\$ 5,999,540

TOTAL Amount: \$ 5,999,540

R&D Program Area: ICMB: Buildings

Explanation for “Other” selection Not applicable

Reimbursement Contract #: Not applicable

Federal Agreement #: Not applicable

L. Recipient’s Contact Information

1. Recipient’s Administrator/Officer

Name: Therese Peffer

Address: 2087 Addison St Fl 2 2nd Floor

City, State, Zip: Berkeley, CA 94704-1268

Phone: 510-289-4278



E-Mail: therese.peffer@uc-ciee.org

3. Recipient’s Project Manager

Name: Paul Raftery

Address: 390 Wurster Hall # 1389

City, State, Zip: Berkeley, CA 94720-1839

Phone:

E-Mail: p.raftery@berkeley.edu

M. Selection Process Used

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

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

N. Attached Items

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

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

Approved By

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

Agreement Manager: Bradley Meister

Approval Date: 3/22/2024

Branch Manager: Anthony Ng

Approval Date: 3/22/2024

Director: Anthony Ng for Cammy Peterson



STATE OF CALIFORNIA
CALIFORNIA ENERGY COMMISSION

Approval Date: 3/22/2024

Grant Request Form
CEC-270 (Revised 9/2022)

Exhibit A
Scope of Work
The Regents of the University of California on behalf of the Berkeley Campus

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR¹	Task Name
1		General Project Tasks
2	X	Demonstration
3	X	Data Driven Analysis
4	X	Advanced Simulation for Optimized Sizing and Controls
5	X	Market Transformation
6		Evaluation of Project Benefits
7		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
AWHP	Air to Water Heat Pump
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CBE	Center for the Built Environment
CEC	California Energy Commission
CPR	Critical Project Review
GWP	Global Warming Potential
HR	Heat Recovery
OSP	California Office of Statewide Health Planning and Development Special Seismic Certification Preapproval (OSP)
TAC	Technical Advisory Committee
TES	Thermal Energy Storage

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

A. Purpose of Agreement

The purpose of this Agreement is to demonstrate a new large heat recovery chiller that uses an ultra-low Global Warming Potential (GWP) refrigerant at a Kaiser Permanente hospital building located in San Francisco, CA, as well as assess a range of other equipment combinations for other large commercial building types and site-specific constraints through case studies, interviews with designers, energy modeling, and life cycle cost assessment.

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

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B. Problem/ Solution Statement

Problem

Building owners are challenged with efficiently and cost-effectively heating and cooling large buildings in light of a rapid shift toward building decarbonization through electrification. There are many challenges to overcome, such as availability of suitable equipment and site-specific size, weight of equipment, electricity capacity constraints due to existing conditions, and high first cost and limited cost-effectiveness due to current utility tariffs.

Solution

This project will demonstrate a solution which captures a currently overlooked opportunity to cost-effectively reduce carbon emissions in hospitals and overcome barriers to scaling this solution to other hospitals. Furthermore, the Recipient will develop solutions and resources applicable to other large commercial building types and site-specific constraints, to reduce carbon emissions from large commercial buildings across the state.

C. Goals and Objectives of the Agreement

Agreement Goals

The goal of this Agreement is to substantially reduce carbon emissions produced by large commercial buildings through heat pumps and thermal storage using methods that are more efficient and cost-effective than what is currently implemented.

Ratepayer Benefits:² This Agreement will result in the ratepayer benefits of lower greenhouse gas emissions, reduced energy, and lower costs by demonstrating a cost-effective decarbonization strategy that offsets 70% of the existing gas-fired heating load in a hospital with a new, high-efficiency heat recovery chiller that uses an ultra-low GWP refrigerant, overcoming substantial market barriers (e.g., such as lack of California Office of Statewide Health Planning and Development (now Department of Health Care Access and Information) Special Seismic Certification Preapproval (OSP)), conducting extensive analysis and simulation, and performing robust market transformation activities.

Technological Advancement and Breakthroughs:³ This Agreement will lead to technological advancement and breakthroughs to overcome barriers to achieving California's statutory energy goals. The project will demonstrate a new heat recovery chiller that uses an ultra-low GWP refrigerant, and providing solutions for decarbonizing large commercial buildings using a combination of efficient and cost-effective heat recovery chillers, air-to-water heat pumps, and thermal storage.

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.

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Agreement Objectives

The objectives of this Agreement are to:

- Demonstrate a new large heat recovery chiller that uses a refrigerant with an ultra-low GWP to reduce the emissions from a hospital's heating and cooling system and make it easier to scale this demonstration to other hospitals.
- Acquire data, assess life cycle costs, perform simulations, and develop solutions and resources to aid designers and owners to effectively decarbonize other building types.

III. TASK 1 GENERAL PROJECT TASKS

PRODUCTS

Subtask 1.1 Products

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

The Recipient shall:

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

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

For products that require a final version only

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

For all products

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

Instructions for Submitting Electronic Files and Developing Software:

- **Electronic File Format**

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

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

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

○ **Software Application Development**

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

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

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

MEETINGS

Subtask 1.2 Kick-off Meeting

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

The Recipient shall:

- Attend a "Kick-off" meeting with the CAM, the Commission Agreement Officer (CAO), and any other CEC staff relevant to the Agreement. The Recipient will bring its Project Manager and any other individuals designated by the CAM to this meeting. The administrative and technical aspects of the Agreement will be discussed at the meeting. Prior to the meeting, the CAM will provide an agenda to all potential meeting

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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.

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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.

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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.

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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.)

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- 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

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will be applied.

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

Products:

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

Subtask 1.8 Permits

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

The Recipient shall:

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

The list of permits and the schedule for obtaining them will be discussed at the Kick-off meeting (subtask 1.2), and a timetable for submitting the updated list, schedule, and copies of the permits will be developed. The impact on the project if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in progress reports and will be a topic at CPR meetings.

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- 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

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- Linkages between the agreement work and other past, present, or future projects (both public and private sectors) that TAC members are aware of in a particular area.
- Review products and provide recommendations for needed product adjustments, refinements, or enhancements.
- Evaluate the tangible benefits of the project to the state of California, and provide recommendations as needed to enhance the benefits.
- Provide recommendations regarding information dissemination, market pathways, or commercialization strategies relevant to the project products.
- Help set the project team's goals and contribute to the development and evaluation of its statement of proposed objectives as the project evolves.
- Provide a credible and objective sounding board on the wide range of technical and financial barriers and opportunities.
- Help identify key areas where the project has a competitive advantage, value proposition, or strength upon which to build.
- Advocate, to the extent the TAC members feel is appropriate, on behalf of the project in its effort to build partnerships, governmental support, and relationships with a national spectrum of influential leaders.
- Ask probing questions that 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:

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

Subtask 1.11 TAC Meetings

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

The Recipient shall:

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

The TAC shall:

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

Products:

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

Subtask 1.12 Project Performance Metrics

The goal of this subtask is to finalize key performance targets for the project based on feedback from the TAC and report on final results in achieving those targets. The performance targets should be a combination of scientific, engineering, techno-economic, and/or programmatic

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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 DEMONSTRATION

The goal of this task is to demonstrate a large heat recovery chiller that uses a refrigerant with an ultra-low global warming potential, and to measure the associated impacts.

The Recipient shall:

- Perform investigation to assist with design of replacement heat recovery chiller, optimizing for the most cost-effective carbon savings opportunity, including assessing potential for exhaust air heat recovery.
- Create a *Measurement & Verification Plan* that includes, but is not limited to an outline of:
 - Measurement tools and sensors required for verification
 - The procedure to be used for measurement and verification
 - The timeline for the installation and associated acquisition of data
- Install new (or calibrate existing) submetering equipment at the demonstration site as required to measure gas and electricity consumption of the heating and cooling plant.
- Perform California Office of Statewide Health Planning and Development Special Seismic Certification Preapproval (OSP) required seismic testing for selected equipment. This is a once-off destructive test that all models of HVAC equipment serving a hospital

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are required to pass, thus overcoming a major barrier (and cost) to future sites using this approach. Report in *OSP Testing Memo*.

- Install and commission the new heat recovery chiller.
- Develop *Low Global Warming Potential Heat Recovery Chiller Demonstration Report* describing the demonstration project impacts which includes but not limited to:
 - At least 1 year of pre- and post- installation measured data, normalized for weather.
 - Change in performance in HVAC gas use, HVAC electricity consumption and associated dynamic carbon emissions (using grid marginal carbon emissions from Watttime) and energy cost.
 - Testing of the product
 - Technical issues and lessons learned
 - Submit the draft Report to the CAM for feedback and incorporate changes as requested in the final Verification Report.
- Prepare a *CPR Report #1* in accordance with subtask 1.3 (CPR Meetings).
- Participate in a CPR meeting.

Products:

- Measurement & Verification Plan
- OSP Testing Memo
- Low Global Warming Potential Heat Recovery Chiller Demonstration Report (draft and final)
- CPR Report #1

TASK 3 DATA DRIVEN ANALYSIS

The goal of this task is to acquire data from existing buildings to identify opportunities and develop design strategies to reduce carbon emissions in large commercial buildings.

The Recipient shall:

- Develop *Decarbonization Solutions for Existing and New Buildings Report* including but not limited to:
 - Collect and evaluate operating data from existing and currently under construction all-electric heating and cooling plants to assess real, as-built performance.
 - Acquire cooling load data from existing buildings (leveraging contacts and data already obtained during tasks under current PIER funded research project, PIR-19-013) to assess real-world decarbonization potential at scale, through heat recovery, AWHPs, and thermal storage.
 - Develop design scenarios for different load profiles and other project/site constraints, leveraging and further developing the existing spreadsheet tool.
 - Evaluate economic and life cycle costs for alternative all-electric and hybrid plant configurations and applications (including first costs and operating costs) to feed into simulations and web tool development.
- Prepare a *Hospital Decarbonization at Scale Report* which evaluates the potential for scaling the demonstration site approach to hospitals throughout California, leveraging the scale of Kaiser Permanente-owned facilities and associated data to do so.

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- Support analysis for additional demonstrations as Kaiser Permanente performs chilled water plant upgrades at its (many) hospitals in CA during the research project.
- Prepare a *CPR Report #2* in accordance with subtask 1.3 (CPR Meetings).
- Participate in a CPR meeting.

Products:

- Decarbonization Solutions for Existing and New Buildings Report
- Hospital Decarbonization at Scale Report
- CPR Report #2

TASK 4 ADVANCED SIMULATION FOR OPTIMIZED SIZING AND CONTROLS

The goal of this task is to perform simulations to develop and design new decarbonized plant configurations, sizing, and control schemes.

The Recipient shall:

- Develop model-based design workflow to analyze performance of the whole heating and cooling plant in different configurations. Report in *Initial Simulation Results Memo*
- Perform sensitivity analysis of the impact of major factors on results. Summarize in *Simulation Results Sensitivity Memo*
- Conduct detailed simulations performed using Modelica (and/or EnergyPlus) to effectively size and control these plants, including but not limited to:
 - Different load profiles and other project/site constraints
 - Different combinations of AWHPs, HR chillers, thermal energy storage, and existing gas equipment
 - Report in *Simulation Results For Different Example Use Cases Memo*
- Apply detailed dynamic model to validate the simplified spreadsheet calculation tool currently in use by project team and web tool developed within this project.
- Prepare an *Advanced Simulation for Optimized Sizing and Control of All-Electric and Hybrid Heating and Cooling Plants Report*
- Prepare a *CPR Report #3* in accordance with subtask 1.3 (CPR Meetings).
- Participate in a CPR meeting.

Products:

- Initial Simulation Results Memo
- Simulation Sensitivity Memo
- Simulation Results for Different Example Use Cases Memo
- Advanced Simulation for Optimized Sizing and Control of All-Electric and Hybrid Heating and Cooling Plants Report
- CPR Report #3

TASK 5 MARKET TRANSFORMATION

The goal of this task is to develop public resources, hold workshops with stakeholders, and develop tools that drive electrification and decarbonization of large commercial buildings.

The Recipient shall:

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- Perform stakeholder interviews to compile lessons learned and success stories from early large commercial building decarbonization projects.
- Develop a web-based *Simplified Design Tool* to aid designers in exploring the performance of different options for prospective new and existing large commercial building decarbonization projects including:
 - Preloaded 'example' cooling/heating load profiles and capability for hourly annual data (heating/cooling loads, and potentially also supply/return temps)
 - Allowing users to select location (weather and carbon data), add site specific parameters, utility costs + escalation rate, space/size/weight constraints, etc.
 - Generating different design options (equip sizing, tank sizes, etc.)
 - Quantifying energy & carbon impacts of those options
 - Visualizing footprint of equipment for different options
- Develop, publish, and maintain a *List of Electric Heating and Cooling Equipment for Large Commercial Buildings* with key high-level characteristics to allow stakeholders to understand the available options at a glance.
- Develop a *Quick Guide for Designers on Changing Refrigerant Requirements* which succinctly describes the changing refrigerant phase requirements and the impacts on building HVAC applications, including safety classifications.
- Develop and publish at least three *Example Electrification Case Studies* of existing building electrification projects or novel all-electric plant designs for new construction (separate from the Demonstration Site Case Study)
- Create and maintain a publicly accessible *Commercial Building Electrification Map* that highlights the key features of existing building electrification projects, as well as all-electric new construction projects that use a novel approach.
- Collaborate with HVAC equipment manufacturers to support development of modular, pre-designed packages of all-electric heating and cooling systems, including integrated system-level controls, to scale delivery for large commercial buildings.
- Develop a *Large Commercial Building Decarbonization Design Guide* for large commercial building electrification leveraging other tasks. Guide will include discussion of key design considerations for electrification, lessons learned and success stories from completed projects, and recommendations for solutions for different applications based on life cycle cost effectiveness.
- Based on evaluation results, produce a *Large Commercial Building Decarbonization Policy Recommendations Memo* that describes recommendations for changes to incentive programs, and codes and standards to drive adoption of these measures.
- Prepare a *CPR Report #4* in accordance with subtask 1.3 (CPR Meetings).
- Participate in a CPR meeting.

Products:

- Simplified Design Tool
- List of Electric Heating and Cooling Equipment for Large Commercial Buildings
- Quick Guide for Designers on Changing Refrigerant Requirements
- Example Electrification Case Studies
- Commercial Building Electrification Map
- Large Commercial Building Decarbonization Design Guide
- Large Commercial Building Decarbonization Policy Recommendations Memo
- CPR Report #4

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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.

The Recipient Shall:

Subtask 7.1

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- 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 and explanation why.
- Submit the final *Project Case Study Plan* to the CAM for approval.
- Execute the final Project Case Study Plan and develop and submit a *Project Case Study*.
- When directed by the CAM, develop presentation materials for a CEC sponsored conference/workshop(s) on the project.
- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the California CEC.
- Provide at least (6) six *High Quality Digital Photographs* (minimum resolution of 1300x500 pixels in landscape ratio) of pre and post technology installation at the project sites or related project photographs.

Subtask 7.2

- Publish at least three *Peer-Reviewed Papers* in relevant academic and industry venues leveraging work in the above tasks.
- Create a *Decarbonization of Large Commercial Buildings Video* summarizing impacts of the demonstration project and public resources created by the research team.
- Host extensive industry outreach through at least six presentations at different conference venues including but not limited to: relevant academic and industry conferences such as ASHRAE, ACEEE and IBPSA, the CBE industry conference,
- Host a free-to-public continuing education class (e.g., in collaboration with PG&E).

Products:

- Project Case Study Plan (draft and final)
- Summary of TAC Comments

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- Technology Transfer Plan
- Project Case Study (draft and final)
- High Quality Digital Photographs
- Peer-Reviewed Papers
- Decarbonization of Large Commercial Buildings Video

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.