

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 10/2015)

CALIFORNIA ENERGY COMMISSION

New Agreement EPC-16-013 (To be completed by CGL Office)

Division	Agreement Manager:	MS-	Phone
ERDD	Adel Suleiman	51	916-327-3313

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

Title of Project
Integrating Smart Ceiling Fans and Communicating Thermostats to Provide Energy-Efficient Comfort

Term and Amount	Start Date	End Date	Amount
	9/22/2016	3/30/2020	\$ 1,888,683

Business Meeting Information
 ARFVTP agreements under \$75K delegated to Executive Director.

Proposed Business Meeting Date	8/10/2016	<input type="checkbox"/> Consent	<input checked="" type="checkbox"/> Discussion
Business Meeting Presenter	Adel Suleiman	Time Needed:	5 minutes

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

Agenda Item Subject and Description

UNIVERSITY OF CALIFORNIA, BERKELEY. Proposed resolution approving Agreement EPC-16-013 with the Regents of the University of California, on behalf of the Berkeley campus for a \$1,888,683 grant to develop optimal system configuration for smart comfort controlled ceiling fans integrated with learning thermostats, and evaluate their energy performance and occupant acceptance in low income multi-family residential and small commercial buildings located in disadvantaged communities in California. This research and development will advance the solution's technology readiness level and support market adoption acceleration.

California Environmental Quality Act (CEQA) Compliance

1. Is Agreement considered a "Project" under CEQA?
 Yes (skip to question 2) No (complete the following (PRC 21065 and 14 CCR 15378)):

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

- a) Agreement **IS** exempt. (Attach draft NOE)
- Statutory Exemption. List PRC and/or CCR section number: _____
- Categorical Exemption. List CCR section number: 14 CCR §15301 and 15306
- Common Sense Exemption. 14 CCR 15061 (b) (3)

Explain reason why Agreement is exempt under the above section:

This Agreement is exempt under 14 CCR §15301 Existing Facilities because it will involve the operation and/or minor alteration of existing facilities by way of: (1) installation of small comfort fans and integrated thermostats in dwelling units and common areas of existing multifamily residential buildings which will involve no expansion of use beyond that existing; and (2) laboratory testing of a ceiling fan in an existing laboratory facility which will involve no expansion of use beyond that existing.

This Agreement is exempt under 14 CCR § 15306 Information Collection because it consists of basic data collection activities by collecting data on system energy performance and user experiences which will not result in a serious or major disturbance to an environmental resource.

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

Check all that apply

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

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

Legal Company Name:	Budget
TRC Engineers, Inc.	\$ 915,205
Association for Energy Affordability	\$ 221,865 (from TRC's 915,205)

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

Legal Company Name:

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Budget Information			
Funding Source	Funding Year of Appropriation	Budget List No.	Amount
EPIC	15-16	301.001C	\$1,888,683
			\$
R&D Program Area: EERO: Buildings		TOTAL:	\$1,888,683
Explanation for "Other" selection			
Reimbursement Contract #:		Federal Agreement #:	

Recipient's Administrator/ Officer				Recipient's Project Manager			
Name:	Paul Martinez			Name:	Therese Peffer		
Address:	2150 Shattuck Avenue, Suite #313			Address:	2087 Addison St Fl 2 2nd Floor		
City, State, Zip:	Berkeley, CA 94704-5490			City, State, Zip:	Berkeley, CA 94704-1268		
Phone:	510-642-8115 /	Fax:	- -	Phone:	510-289-4278 /	Fax:	- -
E-Mail:	psmartin@berkeley.edu			E-Mail:	therese.peffer@uc-ciee.org		

Selection Process Used	
<input checked="" type="checkbox"/> Competitive Solicitation	Solicitation #: GFO-15-308
<input type="checkbox"/> First Come First Served Solicitation	

The following items should be attached to this GRF	
1. Exhibit A, Scope of Work	<input checked="" type="checkbox"/> Attached
2. Exhibit B, Budget Detail	<input checked="" type="checkbox"/> Attached
3. CEC 105, Questionnaire for Identifying Conflicts	<input checked="" type="checkbox"/> Attached
4. Recipient Resolution	<input checked="" type="checkbox"/> N/A <input type="checkbox"/> Attached
5. CEQA Documentation	<input checked="" type="checkbox"/> N/A <input type="checkbox"/> Attached

Agreement Manager _____ Date _____ Office Manager _____ Date _____ Deputy Director _____ Date _____

EXHIBIT A Scope of Work

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR ¹	Task Name
1		General Project Tasks
2	X	Laboratory Testing
3	X	Multifamily Common Area and Fitness Room Site Demonstrations
4	X	Multifamily Dwelling Unit Site Demonstrations
5		Technology Readiness
6		Evaluation of Project Benefits
7		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CBE	Center for Built Environment
CO ₂	Carbon Dioxide
CPR	Critical Project Review
Energy Commission	California Energy Commission
Integrated Fan-Thermostat System	An innovative technology solution that combines an automated control for advanced ceiling fans (Haiku fan and SenseME™) with programmable, learning thermostats (Nest™) to control fan speed and HVAC schedules based on occupancy patterns and preferences. Also, called FanStat.
GWh	Giga Watt Hours
HVAC	Heating, Ventilation and Air Conditioning
IOU	Investor Owned Utility
TAC	Technical Advisory Committee

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

A. Purpose of Agreement

The purpose of this Agreement is to fund a field demonstration project to develop optimal system configurations for smart comfort-controlled fans integrated with learning thermostats, and evaluate their energy performance and occupant acceptance in multifamily residential and small commercial buildings.

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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Scope of Work

B. Problem/ Solution Statement

Problem

Conventional control strategies for heating, ventilation and air conditioning (HVAC) systems use a year-round narrow range of temperatures prescribed based on an assumed occupancy schedule. Typically, these schedules are not optimized based on actual occupancy or actual preference of thermal conditions by the occupants. Adding ceiling fans has been proven to provide comfort at 5-8°F higher temperatures than this conventional range during cooling season, significantly reducing cooling energy use. In addition, at low speed, ceiling fans reduce heating energy use by de-stratifying room air temperature.

Solution

This project advances the state of knowledge and practical applications of an integrated strategy to retrofit applications, addressing occupant thermal comfort and HVAC energy use through innovative hardware and software. The innovation starts with the addition of Haiku® ceiling fans to existing spaces that have traditional air conditioning systems and thermostats. The SenseME™ comfort based ceiling fan controller embedded in the Haiku® fan will be used to optimize energy use and occupant comfort to offer the potential for high user satisfaction. This brings the ceiling fan, usually considered a low-tech strategy based on manual control, into high tech automation more similar to conventional HVAC controls.

The second innovation will be in the form of Nest™ communicating and learning thermostats that enable integration of HVAC with human-centered low-energy solutions such as the Haiku® ceiling fans. Third and most important, we propose to demonstrate an integrated solution that provides a higher level of energy-comfort optimization by pairing the Haiku fan and SenseME™ controller with the Nest™ learning thermostat. This integrated solution will automatically increase set points during cooling mode with auto-adjusted fan speed for comfort, and will also automatically de-stratify in heating mode, resulting in energy savings and better occupant comfort year-round.

C. Goals and Objectives of the Agreement

Agreement Goals

The goal of this Agreement is to provide greater insight into the energy use patterns and acceptance of comfort controlled ceiling fans integrated with learning thermostats in multifamily buildings, in both the dwelling units and common areas.

Ratepayer Benefits:² This Agreement will result in the ratepayer benefits of greater electricity reliability, lower costs, economic development, and environmental benefits by providing energy savings up to 37% in cooling and 15% in heating, which could add up to 341 GWh's of savings for California in 15 years. Ceiling fans are an enabling technology for compressor-less cooling with passive and radiant systems by providing comfort at higher space temperatures, thereby reducing refrigerant use. Energy savings could add up to 249 million pounds of CO₂ emissions. Developing cost effective configurations and best practices will reduce the cost of adoption and

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).

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operation, and will reduce the time for payback for the system. This will enable building owners to invest in the technology at lower risk. A cost competitive technology, which is easy to install and use, will support a competitive energy efficiency building industry in California.

Technological Advancement and Breakthroughs:³ 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 advancing the state of knowledge and practical applications of an integrated strategy to retrofit applications, addressing occupant thermal comfort and HVAC energy use through innovative hardware and software. The Haiku® ceiling fans with SenseME™ comfort based ceiling fan controller embedded in the Haiku® fan will be used to optimize energy use and occupant comfort to offer the potential for high user satisfaction. The SenseME™ controller will be integrated with the Nest™ communicating and learning thermostats to offer integrated control of HVAC setpoints and ceiling fan speed.

Agreement Objectives

The objectives of this Agreement are to:

- Demonstrate energy savings and improved comfort of the integrated system in retrofit applications;
- Identify and address market barriers to wider acceptance and adoption;
- Provide guidance on how to implement this technology into energy efficiency retrofit programs and policies; and
- Develop standard rating methods, a design guide, and energy code language to facilitate more widespread implementation.

TASK 1 GENERAL PROJECT TASKS

PRODUCTS

Subtask 1.1 Products

The goal of this subtask is to establish the requirements for submitting project products (e.g., reports, summaries, plans, and presentation materials). Unless otherwise specified by the Commission Agreement Manager (CAM), the Recipient must deliver products as required below by the dates listed in the **Project Schedule (Part V)**. Products that require a draft version are indicated by marking “**(draft and final)**” after the product name in the “Products” section of the task/subtask. If “(draft and final)” does not appear after the product name, only a final version of the product is required. With respect to due dates within this Scope of Work, “**days**” means working days.

The Recipient shall:

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

- Submit all draft products to the CAM for review and comment in accordance with the Project Schedule (Part V). The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt, unless otherwise specified in the task/subtask for which the product is required.

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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- Consider incorporating all CAM comments into the final product. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product.
- Submit the revised product and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period, or approves a request for additional time.

For products that require a final version only

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

For all products

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

Instructions for Submitting Electronic Files and Developing Software:

○ **Electronic File Format**

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

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

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

○ **Software Application Development**

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

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

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

MEETINGS

Subtask 1.2 Kick-off Meeting

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

The Recipient shall:

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

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

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

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

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

The CAM shall:

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

Recipient Products:

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

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CAM Product:

- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings

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

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

The Recipient shall:

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

The CAM shall:

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

Recipient Products:

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

EXHIBIT A Scope of Work

CAM Products:

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

Subtask 1.4 Final Meeting

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

The Recipient shall:

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

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

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

Products:

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

EXHIBIT A

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REPORTS AND INVOICES

Subtask 1.5 Progress Reports and Invoices

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

The Recipient shall:

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

Products:

- Progress Reports
- Invoices

Subtask 1.6 Final Report

The goal of this subtask is to prepare a comprehensive Final Report that describes the original purpose, approach, results, and conclusions of the work performed under this Agreement. The CAM will review the Final Report, which will be due at least **two months** before the Agreement end date. When creating the Final Report Outline and the Final Report, the Recipient must use the Style Manual provided by the CAM.

Subtask 1.6.1 Final Report Outline

The Recipient shall:

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

Recipient Products:

- Final Report Outline (draft and final)

CAM Product:

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

Subtask 1.6.2 Final Report

The Recipient shall:

- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline, Style Manual, and Final Report Template provided by the CAM with the following considerations:
 - Ensure that the report includes the following items, in the following order:

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- Cover page (**required**)
- Credits page on the reverse side of cover with legal disclaimer (**required**)
- Acknowledgements page (optional)
- Preface (**required**)
- Abstract, keywords, and citation page (**required**)
- Table of Contents (**required**, followed by List of Figures and List of Tables, if needed)
- Executive summary (**required**)
- Body of the report (**required**)
- References (if applicable)
- Glossary/Acronyms (If more than 10 acronyms or abbreviations are used, it is required.)
- Bibliography (if applicable)
- Appendices (if applicable) (Create a separate volume if very large.)
- Attachments (if applicable)
- Ensure that the document is written in the third person.
- Ensure that the Executive Summary is understandable to the lay public.
 - Briefly summarize the completed work. Succinctly describe the project results and whether or not the project goals were accomplished.
 - Identify which specific ratepayers can benefit from the project results and how they can achieve the benefits.
 - If it's necessary to use a technical term in the Executive Summary, provide a brief definition or explanation when the technical term is first used.
- Follow the Style Guide format requirements for headings, figures/tables, citations, and acronyms/abbreviations.
- Ensure that the document omits subjective comments and opinions. However, recommendations in the conclusion of the report are allowed.
- Include a brief description of the project results in the Abstract.
- Submit a draft of the report to the CAM for review and comment. The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt
- Consider incorporating all CAM comments into the Final Report. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product
- Submit the revised Final Report and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period or approves a request for additional time.
- Submit one bound copy of the *Final Report* to the CAM along with *Written Responses to Comments on the Draft Final Report*.

Products:

- Final Report (draft and final)
- Written Responses to Comments on the Draft Final Report

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CAM Product:

- Written Comments on the Draft Final Report

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds

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

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

The Recipient shall:

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

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

- A list of the match funds that identifies:
 - The amount of cash match funds, their source(s) (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied.
 - The amount of each in-kind contribution, a description of the contribution type (e.g., property, services), the documented market or book value, the source (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied. If the in-kind contribution is equipment or other tangible or real property, the Recipient must identify its owner and provide a contact name, address, telephone number, and the address where the property is located.
 - A copy of 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*)

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Subtask 1.8 Permits

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

The Recipient shall:

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

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

- If during the course of the Agreement additional permits become necessary, then provide the CAM with an *Updated List of Permits* (including the appropriate information on each permit) and an *Updated Schedule for Acquiring Permits*.
- Send the CAM a *Copy of Each Approved Permit*.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the CAM within 5 days. Either of these events may trigger a CPR meeting.

Products:

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

Subtask 1.9 Subcontracts

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

The Recipient shall:

- Manage and coordinate subcontractor activities in accordance with the requirements of this Agreement.
- Incorporate this Agreement by reference into each subcontract.
- Include any required Energy Commission flow-down provisions in each subcontract, in addition to a statement that the terms of this Agreement will prevail if they conflict with the subcontract terms.
- If required by the CAM, submit a draft of each *Subcontract* required to conduct the work under this Agreement.

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- Submit a final copy of the executed subcontract.
- Notify and receive written approval from the CAM prior to adding any new subcontractors (see the discussion of subcontractor additions in the terms and conditions).

Products:

- Final Subcontracts (*drafts if required by the CAM*)

TECHNICAL ADVISORY COMMITTEE

Subtask 1.10 Technical Advisory Committee (TAC)

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

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

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

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

The Recipient shall:

- Prepare a *List of Potential TAC Members* that includes the names, companies, physical and electronic addresses, and phone numbers of potential members. The list will be discussed at the Kick-off meeting, and a schedule for recruiting members and holding the first TAC meeting will be developed.

EXHIBIT A

Scope of Work

- Recruit TAC members. Ensure that each individual understands member obligations and the TAC meeting schedule developed in subtask 1.11.
- Prepare a *List of TAC Members* once all TAC members have committed to serving on the TAC.
- Submit *Documentation of TAC Member Commitment* (such as Letters of Acceptance) from each TAC member.

Products:

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

Subtask 1.11 TAC Meetings

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

The Recipient shall:

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

Products:

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

EXHIBIT A Scope of Work

III. TECHNICAL TASKS

*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. **Subtask 1.1 (Products)** describes the procedure for submitting products to the CAM.*

TASK 2: LABORATORY TESTING

The goal of this task is to conduct laboratory testing to finalize the configuration, controls and measurement protocols for the Integrated Fan-Thermostat System prior to the solution being applied in the field through subsequent tasks.

The Recipient shall:

- Conduct a scale configuration optimization laboratory test that tests the Integrated Fan-Thermostat System in a test facility that will be used as a mock up prototypical demonstration space. These tests will involve tests with single and multiple fans.
- Prepare *Lab Report #1* which will validate the work needed to develop an application method for fans, and determine the optimum cost effective fan layout and discuss the results of the scale configuration optimization laboratory test.
- Prepare *Lab Report #2* which will examine the interactions of airflows due to multiple-fan applications and will help develop the *Design Tool* and guidance (described below) for sizing and spacing fans, and predicting the air speeds in typical furnished spaces.
- Prepare *Lab Report #3* which will develop a rating system to enable designers to confidently optimize designs and reduce energy costs.
- Develop a *Design Tool* through laboratory testing of variation in ceiling-fan-driven air movements in terms of room size, fan mounting height, furniture, partitions and other influencing factors. This Design Tool is a way of specifying and locating a fan or fans, to achieve a desirable air distribution within a space.
- Develop a *Comfort Performance Index* for evaluating comfort in spaces that use air movement for comfort under both cooling and heating conditions. The Comfort Performance Index is a way of evaluating the impact of the spatial distribution of airflow within a room based on comfort. The Comfort Performance Index will predict and assess occupant thermal comfort in spaces with air movement intensities.
- Prepare *CPR Report #1* and participate in the CPR Meeting #1 in accordance with subtask 1.3 (CPR Meetings).

Products:

- Lab Reports (#1, #2, #3) (draft and final)
- Design Tool (draft and final)
- Comfort Performance Index (draft and final)
- CPR Report #1

TASK 3: MULTIFAMILY COMMON AREA, SMALL COMMERCIAL BUILDINGS, AND FITNESS ROOM SITE DEMONSTRATIONS

The goal of this task is to conduct field demonstrations of the Integrated Fan-Thermostat System in existing multifamily building common areas, small commercial buildings and fitness rooms.

The Recipient shall:

EXHIBIT A Scope of Work

- Conduct site outreach and recruitment to confirm participation of six multifamily buildings in investor owned utility (IOU) service territory for field demonstrations. To ensure that the findings of these demonstrations is as widely applicable, we will perform these demonstrations in spaces that are commonly found and similar across building types (multifamily residential, small commercial, etc.), such as commercial offices, meeting rooms, lobbies, common areas and fitness rooms.
- Install Integrated Fan-Thermostat System and energy monitoring equipment at six different sites in 18 separate spaces located in four different California climate zones. Each of the six sites will be a different physical building in a different California ZIP code. Each of the 18 separate spaces will be a particular room (or rooms) within those six building sites. The actual spaces will be decided after all of the initial site visits are complete, based on criteria such as (a) space type, (b) expected occupancy patterns, (c) ability to separately measure energy consumption of the HVAC system conditioning that space, (d) ability to measure indoor environmental conditions and perform occupant surveys, (e) size of the space and number of fans required - with the target to deploy as many of the fans across all six sites.
- Conduct occupant surveys, install environmental monitoring equipment, and conduct comfort analysis. This comfort analysis will involve both occupant surveys (i.e. subjective survey responses) regarding each occupant's and measure indoor environmental quality data (analyzing the air temperature, radiant temperature, air velocity, etc. in the zone using published comfort metrics).
- Conduct measurement and verification analysis.
- The controls interaction between thermostat and fan have been developed, but not yet extensively evaluated by an independent third party. The Recipient will evaluate their performance as part of the site demonstrations (and laboratory tests) and include findings in the final report.
- Prepare and provide *Interim Reports on Multifamily Common Area Field Study* (#1, #2, #3) for all sites that will demonstrate, validate, and refine configurations and best practices for adopting integrated smart fan and smart thermostat technology at each site. Each interim report will cover all six sites, for a distinct time period (e.g. Interim Report on Multifamily Common Area Field Study #1 will cover all six sites for a time period of 6 months from September 1, 2016 – January 31, 2017). Time periods should be separated by a minimum of six months. Lesser time periods require prior approval in writing by the CAM.
- Develop Report on Multifamily Dwelling Unit Field Study that discusses all work completed in this task including, but not limited to:
 - Details of fans, thermostats and Wi-Fi installations.
 - Results of occupant surveys.
 - Results from the Measurement and Verification analysis regarding the performance of the entire Integrated Fan-Thermostat System and the interactions between energy savings, air quality, controls, occupant behavior and comfort, and whether the energy savings identified in section II.C, goals and objectives, were met. Develop *Report on Multifamily Common Area Field Study* that discusses all work completed in this task including, but not limited to:
 - Details of fans, thermostats and Wi-Fi installations.
 - Results of occupant surveys.
 - Results from the Measurement and Verification analysis regarding the performance of the Integrated Fan-Thermostat System, and the interactions between energy savings, air quality, controls, occupant behavior and comfort, and whether the energy savings identified in section II.C, goals and objectives, were met.

EXHIBIT A

Scope of Work

- Prepare *CPR Report #2* and participate in the CPR meeting #2 in accordance with subtask 1.3 (CPR Meetings).

Products:

- Interim Reports on Multifamily Common Area Field Study (#1, #2, #3)
- Report on Multifamily Common Area Field Study (draft and final)
- CPR Report #2

TASK 4: MULTIFAMILY DWELLING UNIT SITE DEMONSTRATIONS

The goal of this task is to conduct field demonstrations of the Integrated Fan-Thermostat System in existing multifamily building dwelling units.

The Recipient shall:

- Conduct site outreach and recruitment to confirm participation of six multifamily buildings in IOU service territory for field demonstration.
- Install Integrated Fan-Thermostat System and energy monitoring equipment at three sites in six separate dwellings located in three different California climate zones. Each of the three sites will be a different multifamily building in a different California ZIP code. Each of the six separate dwellings will be a particular dwelling within one of the three selected multifamily building sites.
- Conduct occupant surveys, install environmental monitoring equipment, and conduct comfort analysis. The comfort analysis will involve both occupant surveys (i.e. subjective responses), regarding each occupant's reported thermal comfort, and measured indoor environmental quality data (analyzing the air temperature, radiant temperature, air velocity, etc. in the zone using published comfort metrics).
- Conduct measurement and verification analysis.
- Prepare and provide *Interim Reports on Multifamily Dwelling Unit Field Study (#1, #2, #3)* for all sites to document progress that will demonstrate, validate, and refine configurations and best practices for adopting integrated smart fan and smart thermostat technology at each site. Each interim report will cover all sites, for three different time periods similar to the Interim Reports being provided under Task 3.
- Develop *Report on Multifamily Dwelling Unit Field Study* that discusses all work completed in this task including, but not limited to:
 - Details of fans, thermostats and Wi-Fi installations.
 - Results of occupant surveys.
 - Results from the Measurement and Verification analysis regarding the performance of the entire Integrated Fan-Thermostat System and the interactions between energy savings, air quality, controls, occupant behavior and comfort, and whether the energy savings identified in section II.C, goals and objectives, were met.
- Prepare *CPR Report #3* and participate in the CPR Meeting #3 in accordance with subtask 1.3 (CPR Meetings).

Products:

- Interim Reports on Multifamily Dwelling Unit Field Study (#1, #2, #3)
- Report on Multifamily Dwelling Unit Field Study (draft and final)
- CPR Report #3

TASK 5: TECHNOLOGY READINESS

EXHIBIT A

Scope of Work

The goal of this task is to evaluate the current landscape of technologies similar in nature to the proposed demonstration, evaluate the current installations of these technologies and the market opportunities and barriers to the technologies.

The Recipient shall:

- Develop a *Case Study of Ceiling Fan Automation* that will:
 - Include interviews with owners and designers to determine design features, control approach and owners' perceptions of technology.
 - Include spot measurements using Center for Built Environment (CBE) Building Performance Toolkit to determine typical air speeds with automated control settings.
 - Describe challenges and successes of planning and executing retrofits.
 - Discuss lessons learned.
- Develop *Technology Readiness Report* that includes:
 - Identification of current product availability and estimate market size.
 - Estimated current market penetration.
 - Evaluation of market barriers to adoption.
 - Likely market penetration with and without intervention through building codes.

Products:

- Case Study of Ceiling Fan Automation (draft and final)
- Technology Readiness Report (draft and final)

TASK 6: EVALUATION OF PROJECT BENEFITS

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

The Recipient shall:

- Complete three Project Benefits Questionnaires that correspond to three main intervals in the Agreement: (1) *Kick-off Meeting Benefits Questionnaire*; (2) *Mid-term Benefits Questionnaire*; and (3) *Final Meeting Benefits Questionnaire*.
- Provide all key assumptions used to estimate projected benefits, including targeted market sector (e.g., population and geographic location), projected market penetration, baseline and projected energy use and cost, operating conditions, and emission reduction calculations. Examples of information that may be requested in the questionnaires include:
 - For Product Development Projects and Project Demonstrations:
 - Published documents, including date, title, and periodical name.
 - Estimated or actual energy and cost savings, and estimated statewide energy savings once market potential has been realized. Identify all assumptions used in the estimates.
 - Greenhouse gas and criteria emissions reductions.
 - Other non-energy benefits such as reliability, public safety, lower operational cost, environmental improvement, indoor environmental quality, and societal benefits.
 - Data on potential job creation, market potential, economic development, and increased state revenue as a result of the project.

EXHIBIT A

Scope of Work

- A discussion of project product downloads from websites, and publications in technical journals.
- A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
- Additional Information for Product Development Projects:
 - Outcome of product development efforts, such copyrights and license agreements.
 - Units sold or projected to be sold in California and outside of California.
 - Total annual sales or projected annual sales (in dollars) of products developed under the Agreement.
 - Investment dollars/follow-on private funding as a result of Energy Commission funding.
 - Patent numbers and applications, along with dates and brief descriptions.
- Additional Information for Product Demonstrations:
 - Outcome of demonstrations and status of technology.
 - Number of similar installations.
 - Jobs created/retained as a result of the Agreement.
- For Information/Tools and Other Research Studies:
 - Outcome of project.
 - Published documents, including date, title, and periodical name.
 - A discussion of policy development. State if the project has been cited in government policy publications or technical journals, or has been used to inform regulatory bodies.
 - The number of website downloads.
 - An estimate of how the project information has affected energy use and cost, or have resulted in other non-energy benefits.
 - An estimate of energy and non-energy benefits.
 - Data on potential job creation, market potential, economic development, and increased state revenue as a result of project.
 - A discussion of project product downloads from websites, and publications in technical journals.
 - A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
- Respond to CAM questions regarding responses to the questionnaires.

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

Products:

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

TASK 7: TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES

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

The Recipient shall:

- Prepare an *Initial Fact Sheet* at start of the project that describes the project. Use the

EXHIBIT A

Scope of Work

format provided by the CAM.

- Prepare a *Final Project Fact Sheet* at the project's conclusion that discusses results. Use the format provided by the CAM.
- Prepare a *Technology/Knowledge Transfer Plan* that includes:
 - An explanation of how the knowledge gained from the project will be made available to the public, including the targeted market sector and potential outreach to end users, utilities, regulatory agencies, and others.
 - A description of the intended use(s) for and users of the project results.
 - Published documents, including date, title, and periodical name.
 - Copies of documents, fact sheets, journal articles, press releases, and other documents prepared for public dissemination. These documents must include the Legal Notice required in the terms and conditions. Indicate where and when the documents were disseminated.
 - A discussion of policy development. State if project has been or will be cited in government policy publications, or used to inform regulatory bodies.
 - The number of website downloads or public requests for project results.
 - Additional areas as determined by the CAM.
- Conduct technology transfer activities in accordance with the Technology/Knowledge Transfer Plan. These activities will be reported in the Progress Reports.
- When directed by the CAM, develop *Presentation Materials* for an Energy Commission-sponsored conference/workshop on the results of the project.
- When directed by the CAM, participate in annual EPIC symposium sponsored by the California Energy Commission.
- Provide at least six high quality digital photographs (minimum resolution of 1300x500 pixels in landscape ratio) of pre and post technology installation at the project sites.
- Prepare a *Technology/Knowledge Transfer Report* on technology transfer activities conducted during the project.
- Develop an *Online Design Tool* to support optimum fan placement and that will predict comfort performance for user input space dimensions and fan height.
- Development of *Design Guide* that explains and addresses technical, market, and occupant factors for designs including advanced ceiling fans with automated controls.
- *Codes and Standards Support* for developing code changes at appropriate state and federal level standards to be identified in the *Technology/Knowledge Transfer Report*.

Products:

- Initial Fact Sheet (draft and final)
- Final Project Fact Sheet (draft and final)
- Presentation Materials (draft and final)
- High Quality Digital Photographs
- Technology/Knowledge Transfer Plan (draft and final)
- Technology/Knowledge Transfer Report (draft and final)
- Online Design Tool
- Design Guide
- Codes and Standards Support

IV. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: UNIVERSITY OF CALIFORNIA, BERKELEY

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

RESOLVED, that the Energy Commission approves Agreement EPC-16-013 with the Regents of the University of California, on behalf of the Berkeley campus, for a \$1,888,683 grant to develop optimal system configuration for smart comfort controlled ceiling fans integrated with learning thermostats, and evaluate their energy performance and occupant acceptance in low income multi-family residential and small commercial buildings located in disadvantaged communities in California. This research and development will advance the solution's technology readiness level and support market adoption acceleration; and

FURTHER BE IT RESOLVED, that the Executive Director or his/her designee shall execute the same on behalf of the Energy Commission.

CERTIFICATION

The undersigned Secretariat to the Commission 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 California Energy Commission held on August 10, 2016.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

Cody Goldthrite,
Secretariat