



**GRANT REQUEST FORM (GRF)**

CEC-270 (Revised 02/13)

CALIFORNIA ENERGY COMMISSION



<b>List all key partners:</b> (attach additional sheets as necessary)
Legal Company Name:

Budget Information			
Funding Source	Funding Year of Appropriation	Budget List No.	Amount
NG Subaccount, PIERDD	13-14	501.001H	\$750,000
			\$
			\$
			\$
			\$
			\$
R&D Program Area: EGRO: EA		TOTAL:	\$750,000
Explanation for "Other" selection			
Reimbursement Contract #:		Federal Agreement #:	

Recipient's Administrator/ Officer				Recipient's Project Manager			
Name:	Betsy Quayle			Name:	William Fisk		
Address:	1 CYCLOTRON RD BLDG 90R2000			Address:	1 Cyclotron Rd Mail Stop 90R2000		
City, State, Zip:	BERKELEY, CA 94720-8130			City, State, Zip:	Berkeley, CA 94720		
Phone:	510-486-4218 /	Fax:	- -	Phone:	510-486-5910 /	Fax:	- -
E-Mail:	bequayle@lbl.gov			E-Mail:	WJFisk@lbl.gov		

Selection Process Used	
<input checked="" type="checkbox"/> Competitive Solicitation	Solicitation #: PON-13-503
<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"/>	N/A	<input checked="" type="checkbox"/> Attached
2. Exhibit B, Budget Detail	<input checked="" type="checkbox"/>	N/A	<input checked="" type="checkbox"/> Attached
3. CEC 105, Questionnaire for Identifying Conflicts	<input checked="" type="checkbox"/>	N/A	<input checked="" type="checkbox"/> Attached
4. Recipient Resolution	<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/> Attached
5. CEQA Documentation	<input type="checkbox"/>	N/A	<input checked="" type="checkbox"/> Attached

Agreement Manager _____	Date _____	Office Manager _____	Date _____	Deputy Director _____	Date _____
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# ENERGY RESEARCH, DEVELOPMENT, AND DEMONSTRATION GRANTS

## Exhibit A SCOPE OF WORK

PIR-14-003, Lawrence Berkeley National Laboratory

### I. TASK AND ACRONYM/TERM LISTS

#### A. Task List

Task #	CPR <sup>1</sup>	Task Name
1		Project Administration
2		Contract Execution
3		Energy and Indoor Air Quality Advantages of Control of Minimum Ventilation Rates
4	X	Measurement and Control of Ventilation Rates
5		Guidance Development
6		Evaluation of Project Benefits
7		Technology/Knowledge Transfer Activities

#### B. Acronym/Term List

Acronym/Term	Meaning
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CO <sub>2</sub>	Carbon dioxide
CPR	Critical Project Review
DCV	Demand controlled ventilation
HVAC	Heating, ventilating, and air conditioning
IAQ	Indoor air quality
M&V	Measurement and Verification
OA	Outdoor air
RFID	Radio frequency identification
TAC	Technical Advisory Committee
VR	Ventilation rate

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

#### A. Purpose of Agreement

The purpose of this Agreement is to fund research and knowledge transfer activities that will advance the science and technology needed to better control minimum outdoor air (OA) ventilation rates (VRs) in existing and new commercial buildings in California.

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<sup>1</sup> Please see subtask 1.3 in Part III of the Scope of Work (Project Administration) for a description of Critical Project Review (CPR) Meetings.

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## B. Problem/ Solution Statement

### Problem

This research is needed for two reasons. First, minimum VRs in commercial buildings affect health, work and school performance, and energy consumption. Second, minimum VRs are often poorly controlled. With poorly controlled minimum VRs, energy is wasted in some buildings that have excess ventilation. Indoor air quality (IAQ), health, and work performance are substandard in buildings with insufficient ventilation.

### Solution

Key solutions to this problem include: 1) determining and communicating how minimum VRs, and control systems for minimum VRs, affect energy consumption and IAQ in commercial buildings in California's climates; 2) identifying practical and effective technologies for real-time measurement and control of minimum VRs; and 3) providing associated guidance to practitioners and information to policymakers.

## C. Goals and Objectives of the Agreement

### Agreement Goals

The goal of this Agreement is to advance the science and technology needed to better control minimum VRs in existing and new commercial buildings in California. The research will enable buildings to better meet standards specifying minimum VRs that strike a balance between energy efficiency goals and the need to maintain acceptable IAQ. The advancement of VR measurement technologies in the project will also provide a tool for determining when economizer systems are not functioning properly.

### Agreement Objectives

The objectives of this Agreement are to:

1. estimate the effects on energy, peak power, and IAQ of various methods of controlling minimum VRs, and of different fixed minimum VRs, in California commercial buildings
2. evaluate the accuracy of two commercially available technologies for measuring rates of OA intake into air handlers;
3. evaluate the accuracy over time of a set of current-generation carbon dioxide (CO<sub>2</sub>) sensors marketed for demand controlled ventilation (DCV);
4. determine the accuracy of two technologies for tracking building occupancy, potentially suitable for use in VR control systems;
5. assess the accuracy of determinations of building VRs with transient CO<sub>2</sub> mass balance models, when occupancy is tracked over time; and
6. develop occupancy-specific guidelines for using CO<sub>2</sub> in DCV systems, for measurement of VRs, and development of guidance on selection and use of technologies for measuring OA intake rates.

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## III. TASK 1 PROJECT ADMINISTRATION

### 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

- 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.
- Submit the final product to the CAM once agreement has been reached on the draft. The CAM will provide written approval of the final product within 15 days of receipt, unless otherwise specified in the task/subtask for which the product is required.
- If the CAM determines that the final product does not sufficiently incorporate his/her comments, submit the revised product to the CAM within 10 days of notice by the CAM, unless the CAM specifies a longer time period.

##### For products that require a final version only

- Submit the product to the CAM for approval.
- If the CAM determines that the product requires revision, submit the revised product to the CAM within 10 days of notice by the CAM, unless the CAM specifies a longer time period.

##### For all products

- Submit all data and documents required as products in accordance with the following Instructions for Submitting Electronic Files and Developing Software:

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- **Electronic File Format**

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

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

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

- **Software Application Development**

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

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

Any exceptions to the Electronic File Format requirements above must be approved in writing by the CAM. The CAM will consult with the Energy

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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.

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- Provide an *Updated Project Schedule*, *List of Match Funds*, and *List of Permits*, as needed to reflect any changes in the documents.

### The CAM shall:

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

### Recipient Products:

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

### CAM Product:

- Kick-off Meeting Agenda

### Subtask 1.3 Critical Project Review (CPR) Meetings

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

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

### The Recipient shall:

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

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- Submit the CPR Report along with any other *Task Products* that correspond to the technical task for which the CPR meeting is required (i.e., if a CPR meeting is required for Task 2, submit the Task 2 products along with the CPR Report).
- Attend the CPR meeting.
- Present the CPR Report and any other required information at each CPR meeting.

### The CAM shall:

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

### Recipient Products:

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

### CAM Products:

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

### Subtask 1.4 Final Meeting

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

### The Recipient shall:

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

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WebEx), with approval of the CAM.

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

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

#### Products:

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

## REPORTS AND INVOICES

### Subtask 1.5 Progress Reports and Invoices

The goals of this subtask are to: (1) periodically verify that satisfactory and continued progress is made towards achieving the research 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:

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- Summarize all Agreement activities conducted by the Recipient for the preceding month, including 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.
- Provide a synopsis of the project progress, including accomplishments, problems, milestones, products, schedule, fiscal status, and any evidence of progress such as photographs.
- Submit a monthly or quarterly *Invoice* that follows the instructions in the terms and conditions. In addition, each invoice must document and verify:
  - Energy Commission funds received by California-based entities;
  - Energy Commission funds spent in California (*if applicable*); and
  - Match fund 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 and approve 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 a 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.
- Submit a draft of the outline to the CAM for review and comment.
- Once agreement has been reached on the draft, submit the final outline to the CAM. The CAM will provide written approval of the final outline within 10 days of receipt.

#### Recipient Products:

- Final Report Outline (draft and final)

#### CAM Product:

- Style Manual

### Subtask 1.6.2 Final Report

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#### The Recipient shall:

- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline and the Style Manual provided by the CAM.
- Submit a draft of the report to the CAM for review and comment. Once agreement on the draft report has been reached, the CAM will forward the electronic version for Energy Commission internal approval. Once the CAM receives approval, he/she will provide written approval to the Recipient.
- Submit one bound copy of the Final Report to the CAM.

#### Products:

- Final Report (draft and final)

## 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

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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*)

### 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 reimbursable under this Agreement. 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.

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

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

### Products:

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

### Subtask 1.9 Subcontracts

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

### The Recipient shall:

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

### Products:

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

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#### **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 research direction. The guidance may include research scope and methodologies, timing, and coordination with other research. 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 research (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 project research 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 research 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.

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### The Recipient shall:

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

### Products:

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

### Subtask 1.11 TAC Meetings

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

### The Recipient shall:

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

### Products:

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

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#### IV. 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 CONTRACT EXECUTION**

The goals of this task are to: (1) confirm the availability of the project demonstration site and a measurement and verification (M&V) contractor; and (2) execute any agreements necessary to secure the demonstration site and M&V contractor.

##### **Subtask 2.1 Execute a Contract with the Selected Demonstration Site**

###### **The Recipient shall:**

- Reach agreement with the manager(s) of the selected demonstration site regarding the project timeline, space reserved for the project, equipment installation, permit and insurance requirements, indemnity, and the Recipient’s use of any removal or support staff.
- If the selected demonstration site becomes unavailable during the project term, work with the CAM to select a new site.
- Execute a *Contract with the Demonstration Site* that confirms the agreement reached above on the Recipient’s use of the site.

###### **Products:**

- Contract with the Demonstration Site

##### **Subtask 2.2 Execute a Contract with the Selected M&V Contractor (not applicable to this project)**

###### **The Recipient shall:**

- Confirm the selected M&V contractor’s ability to provide required hardware, software, and staff to conduct the required measurements during the project term.
- Confirm that the selected M&V contractor will follow utility M&V protocols, and will prepare a detailed analytical report that verifies energy consumption and engineering calculations for energy and cost savings.
- If the selected M&V contractor becomes unavailable during the project term, the Recipient shall work with the CAM to select a new M&V contractor.

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- Execute a *Contract with the M&V Contractor* that secures the contractor's services during the project term and confirms that the contractor will follow M&V protocol and prepare the detailed analytical report.

#### Products:

- Contract with the M&V Contractor (not applicable to this project)

### TASK 3 ENERGY AND INDOOR AIR QUALITY ADVANTAGES OF CONTROL OF MINIMUM VENTILATION RATES

The goal of this task is to estimate the effects on energy, peak power, and IAQ of various methods of controlling minimum VRs, and of different fixed minimum VRs, in California commercial buildings.

#### The Recipient shall:

- Develop the EnergyPlus or similar models for a 25-zone primary school, a two-story 46-zone secondary school, and a medium-sized five zone retail building
- Use the models, plus existing models for three different size offices, to predict the effects of the following minimum VR control strategies in each California climate zone on gas and electricity energy consumption, peak electrical power, and indoor concentrations of a continuously emitted indoor pollutant:
  - DCV based on CO<sub>2</sub> measurements
  - DCV based on occupant count
  - VR control based on the predicted indoor concentrations of a continuously-emitted indoor pollutant
- Model the office retail buildings with and without economizer controls.
- Model each building with two different fixed baseline (reference case) minimum VRs:
  - the Title 24 required minimum VR
  - an estimate based on empirical data of average minimum VRs that occur in practice
- Use the models to estimate how errors in CO<sub>2</sub> measurement in buildings with DCV affect energy use and indoor air quality.
- Use the results of the modeling to prepare an, *Energy and IAQ Advantages of Control of Minimum VRs Technical Report* that includes but is not limited to the following:
  - Descriptions of the buildings
  - Descriptions of modeling methods
  - Model results
  - A discussion of the implications of model results

# ENERGY RESEARCH, DEVELOPMENT, AND DEMONSTRATION GRANTS

## Exhibit A

### SCOPE OF WORK

PIR-14-003, Lawrence Berkeley National Laboratory

#### Products:

- Energy and IAQ Advantages of Control of Minimum VRs Technical Report (draft and final)

#### TASK 4 MEASUREMENT AND CONTROL OF VENTILATION RATES

The goal of this task is to evaluate multiple technologies applicable to real-time measurement and control of VRs.

#### Subtask 4.1 Conduct Evaluations of Technologies for Measuring OA Intake Flow Rates

##### The Recipient shall:

- Develop a *Real-Time Measurement of OA Intake Rates Test Plan* for evaluation of the accuracy of technologies for measuring OA intake flow rates.
- Develop and obtain approval from the Lawrence Berkeley National Laboratory human subjects committee for a human subjects protocol covering this work and elements of sub tasks 4.2-4.4.
- Implement the test plan to evaluate the real-time measurement of OA intake rates, including:
  - Procure, install, and evaluate the accuracy of the Ruskin EAMS60 technology or similar technology
  - Select a second technology for evaluation in consultation with the TAC
  - Procure, install, and evaluate the accuracy of the second technology
- Analyze the data.
- Participate in a CPR per Task 1.3 and prepare a *CPR Report*.
- Use the results of the modeling to prepare a *Real-Time Measurement of OA Intake Rates Technical Report* that includes but is not limited to the following:
  - Descriptions of the technologies
  - Descriptions of the test methods
  - Test results
  - A discussion of the implications of test results

#### Products:

- Real-Time Measurement of OA Intake Rates Test Plan
- CPR Report
- Real-Time Measurement of OA Intake Rates Technical Report (draft and final)

#### Subtask 4.2 Evaluate CO2 Sensors Marketed for Use in DCV Systems

# ENERGY RESEARCH, DEVELOPMENT, AND DEMONSTRATION GRANTS

## Exhibit A

### SCOPE OF WORK

PIR-14-003, Lawrence Berkeley National Laboratory

#### The Recipient shall:

- Develop an *Evaluation of Accuracy of CO<sub>2</sub> Sensors Test Plan* for evaluation of the accuracy of CO<sub>2</sub> sensors marketed for use in DCV systems. It is expected that five types of sensors will be tested for about two years in three spaces.
- Select sensors for evaluation in consultation with the CAM.
- Procure sensors and other items needed to evaluate sensor accuracy.
- Assemble test systems consisting of arrays of three of each sensor type plus reference instruments and temperature and humidity loggers.
- Implement the test plan to evaluate the accuracy of CO<sub>2</sub> sensors.
  - Deploy the test systems in three buildings, and log data
  - Periodically check the calibrations of reference sensors and download and analyze all data
  - Remove the test systems
- Use the results of the testing to prepare a technical report *CO<sub>2</sub> sensor accuracy* that includes but is not limited to the following:
  - Descriptions of the sensors
  - Descriptions of the test methods
  - Test results
  - A discussion of the implications of test results

#### Products:

- Evaluation of Accuracy of CO<sub>2</sub> Sensors Test Plan
- CO<sub>2</sub> Sensor Accuracy Technical Report (draft and final)

#### Task 4.3 Evaluate Accuracy of Occupant Counting Systems

##### The Recipient shall:

- In consultation with the CAM, select and procure two occupant counting systems for evaluation.
- Develop a an *Evaluating Occupant Counters Test Plan* for evaluation of the accuracy of the occupant counting systems, this plan shall include tests when occupants are unaware of the counters and stress tests designed to assess counter accuracy in challenging situations.
- Install the people counting systems.
- Implement the test plan to evaluate each of the counting systems.
- Download and analyze all data.
- Remove the counting systems.
- Use the results of the testing to prepare an *Occupant Counting Technical Report* on that includes but is not limited to the following:
  - Descriptions of the technologies
  - Descriptions of the test methods
  - Test results
  - A discussion of the implications of test results

# ENERGY RESEARCH, DEVELOPMENT, AND DEMONSTRATION GRANTS

## Exhibit A

### SCOPE OF WORK

PIR-14-003, Lawrence Berkeley National Laboratory

#### Products:

- Evaluating Occupant Counters Test Plan
- Occupant Counting Technical Report (draft and final)

#### Task 4.4 Evaluate Accuracy of Measuring VR based on Measured CO<sub>2</sub> Concentrations and Occupant Counts

##### The Recipient shall:

- Develop a plan for evaluation of the accuracy of measuring VR based on measured CO<sub>2</sub> concentrations and occupant counts, employing a transient CO<sub>2</sub> mass balance model. Install instrumentation systems.
- In two ventilation spaces implement the plan and collect data necessary to determine the accuracy of this method of determining VRs.
- Download and analyze all data.
- Remove the instrumentation.
- Use the results of the measurements to prepare a *Measurement of VRs Using CO<sub>2</sub>, Occupant Counts, and Transient CO<sub>2</sub> Mass Balance Models Technical Report* that includes but is not limited to the following:
  - Description of the measurement approach and required sensors
  - Descriptions of the evaluation methods
  - Measurement results
  - A discussion of the implications of measurement results

#### Products:

- Evaluation of the Accuracy of Measuring VRs Based on Measured CO<sub>2</sub> Concentrations and Occupant Counts Plan
- Measurement of VRs Using CO<sub>2</sub>, Occupant Counts, and Transient CO<sub>2</sub> Mass Balance Models Technical Report (draft and final)

#### TASK 5 GUIDANCE DEVELOPMENT

The goal of this task is to use the results of Tasks 3 and 4 together with other available information to develop occupancy specific guidelines for using CO<sub>2</sub> with and without occupant counters in DCV systems and for measurement of VRs.

##### The Recipient shall:

- Develop a draft website addressing the following topics:
  - CO<sub>2</sub> sensor selection and calibration (based on Task 4 and published information);
  - Required accuracy of CO<sub>2</sub> sensors for DCV;
  - CO<sub>2</sub> sensor placement and density (based on published information);

# ENERGY RESEARCH, DEVELOPMENT, AND DEMONSTRATION GRANTS

## Exhibit A

### SCOPE OF WORK

PIR-14-003, Lawrence Berkeley National Laboratory

- Calculation of VRs based on measured CO<sub>2</sub> (based on Task 4 and published information);
- Selection of CO<sub>2</sub> concentration limits in DCV, which should vary among building type because of variability of CO<sub>2</sub> emission rates with occupant activity and size (based on published data); and
- Selection and use of technologies for measuring outdoor air intake rates.
- Obtain feedback on the draft website from members of the TAC and the CAM.
- Revise the website to address comments and make the web site available to the public.

**Products:** none

### 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.

# ENERGY RESEARCH, DEVELOPMENT, AND DEMONSTRATION GRANTS

## Exhibit A

### SCOPE OF WORK

PIR-14-003, Lawrence Berkeley National Laboratory

- A discussion of research 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 research.
  - Published documents, including date, title, and periodical name.
  - A discussion of policy development. State if the research 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 information and research have 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 research.

# ENERGY RESEARCH, DEVELOPMENT, AND DEMONSTRATION GRANTS

## Exhibit A

### SCOPE OF WORK

PIR-14-003, Lawrence Berkeley National Laboratory

- A discussion of research 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 research. Use the format provided by the CAM.
- Prepare a *Final Project Fact Sheet* at the project's conclusion that discusses research 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 research 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 research 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.
- Prepare a *Technology/Knowledge Transfer Report* on technology transfer

# ENERGY RESEARCH, DEVELOPMENT, AND DEMONSTRATION GRANTS

## Exhibit A

### SCOPE OF WORK

PIR-14-003, Lawrence Berkeley National Laboratory

activities conducted during the project.

#### **Products:**

- Initial Fact Sheet (draft and final)
- Final Project Fact Sheet (draft and final)
- Technology/Knowledge Transfer Plan (draft and final)
- Technology/Knowledge Transfer Report (draft and final)

#### **V. PROJECT SCHEDULE**

Please see the attached Excel spreadsheet.

To: Office of Planning and Research
PO Box 3044, 1400 Tenth Street, Room 222
Sacramento, CA 95812-3044

From: California Energy Commission
1516 Ninth Street, MS-48
Sacramento, CA 95814

Project Title: Measurement and Control of Ventilation Rates in Commercial Buildings in California

Project Location - Specific: 1 CYCLOTRON RD

Project Location - City: BERKELEY, CA Project Location - County: Alameda

Description of Project:

The energy, peak electricity demand, and indoor air quality (IAQ) advantages of control of minimum ventilation rates (VRs) will be analyzed via modeling based on: 1) occupant count; 2) carbon dioxide (CO2) concentration; and 3) the predicted indoor concentrations of a continuously-emitted indoor pollutant. The modeling will be performed for small, medium, and large office buildings, a 25-zone primary school, a two-story 46-zone secondary school, and a medium-size five zone retail building in each California climate zone. For reference, two baseline fixed (e.g., with no DCV) minimum VR conditions will be employed. Multiple technologies and measurement approaches applicable to real-time measurement and control of VRs will be evaluated. This will include: 1) an extension of prior evaluations of commercially available technologies for real-time measurement of flow rates of outdoor air (OA) into air handlers; 2) evaluation of the accuracy over time of deployed current-generation CO2 sensors marketed for DCV; 3) evaluation of the accuracy and practicality of occupant counting using recently developed technologies, which builds upon prior evaluation of occupant counting systems; and 4) an evaluation of the accuracy of determining VRs from transient CO2 mass balance calculations supported by CO2 measurements and occupancy counts, with and without a measurement of the outdoor air CO2 concentration. Project results together with other available data will be used to develop occupancy specific guidelines for using CO2 in DCV systems and for measurement of VRs. Finally, project benefits will be evaluated and knowledge transfer activities will be implemented.

Name of Public Agency Approving Project: California Energy Commission

Name of Person or Agency Carrying Out Project: DOE- Lawrence Berkeley National Laboratory

Exempt Status: (check one)

- Ministerial (Sec. 21080(b)(1); 15268);
Declared Emergency (Sec. 21080(b)(3); 15269(a));
Emergency Project (Sec. 21080(b)(4); 15269(b)(c));
[X] Categorical Exemption. State type and section number 14 CCR 15301
Statutory Exemptions. State code number.
Common Sense Exemption. 15061(b)(3)

Reasons why project is exempt:

The project involves the assembly and installation of building occupancy technologies.

Lead Agency

Contact Person: Marla Mueller Area code/Telephone/Ext: 916-327-1716

If filed by applicant:

- 1. Attach certified document of exemption finding.
2. Has a Notice of Exemption been filed by the public agency approving the project? Yes No

Signature: Date: Title:

[X] Signed by Lead Agency

[ ] Signed by Applicant

Date received for filing at OPR:

RESOLUTION NO:

STATE OF CALIFORNIA

STATE ENERGY RESOURCES  
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: LAWRENCE BERKELEY NATIONAL LABORATORY

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

**RESOLVED**, that the Energy Commission approves Agreement PIR-14-003 with **Lawrence Berkeley National Laboratory** for a \$750,000 grant to advance the science and technology needed to better control minimum outdoor air ventilation rates in existing and new commercial buildings in California. The length of this agreement is 35 months; 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 September 10, 2014.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

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Harriet Kallemeyn,  
Secretariat