





# ENERGY RESEARCH, DEVELOPMENT, AND DEMONSTRATION GRANTS

## Exhibit A SCOPE OF WORK

PIR-14-007, Lawrence Berkeley National Lab

### TASK AND ACRONYM/TERM LISTS

#### A. Task List

Task	CPR <sup>1</sup>	Task Name
1		Project Administration
2		Occupant Survey and Recruitment for Field Study
3	X	Pilot Testing and Field Measurement Protocol Development
4		Field Data Collection
5		Simulation and Analysis
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
CPR	Critical Project Review
IAQ	Indoor Air Quality
IOU	Investor-owned Utilities
IRB	Internal Review Board
LBNL	Lawrence Berkeley National Laboratory
M&V	Measurement and Verification
TAC	Technical Advisory Committee

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

#### A. Purpose of Agreement

The purpose of this Agreement is to fund a field study of indoor air quality (IAQ) and related diagnostics to determine how recent versions of Title 24 have impacted IAQ and to improve ventilation and IAQ in new California homes with natural gas appliances to enable enhanced energy savings.

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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

Most California homes waste energy due to infiltration, including recently built homes. Many have leaky ducts that pump large volumes of conditioned air, resulting in the escape of 1/3 to 1/2 of the conditioned air. Although not efficient, the leaked air dilutes indoor-generated contaminants. Reducing infiltration and duct leakage would save energy but risk negative health impacts due to decreased ventilation. Since 2008, California's Title 24 Building Standards have required mechanical ventilation in new homes to protect the indoor environment. However, there has been no validation of its impacts, nor is it clear that the current requirements will be sufficient as the State of California transitions to zero-energy homes.

Previous work in California has highlighted contaminants of concern and documented their levels, but this occurred before the building standards required mechanical ventilation. It is not known how much ventilation reduced the level of contaminants, nor is it clear which is the best path toward achieving the zero-energy goals. To address these concerns, there is a need for additional and better data on field performance of mechanical ventilation, as well as innovative approaches toward ventilating homes.

### Solution

The technical approach has two parts. The first is a two-tiered field study: a pilot and a main field study. The second is an analysis/modeling activity that extrapolates the results from the small sample of homes in the field study to be more generally applicable to the California population of homes and to investigate the changes in IAQ associated with further air-tightening. The field study will gather data directly from occupants and natural gas homes meeting or exceeding the 2008 standards. The field study will measure IAQ and characterize mechanical ventilation and then use that data to provide recommendations on how to achieve adequate ventilation while reducing the energy associated with conditioning infiltration air.

## C. Goals and Objectives of the Agreement

### Agreement Goals

The goals of this Agreement are to:

- Conduct a field study to measure IAQ and ventilation characteristics of mechanical ventilation in homes with natural gas-burning end uses built to meet the 2008 Title 24 Building Standards.

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- Evaluate how to reduce infiltration and thus reduce energy consumption in homes and still provide adequate ventilation for acceptable IAQ, such as would be needed to reach zero energy homes.
- Publish technical information and provide information to policy makers on implications of these results on current and future new homes.

### Agreement Objectives

The objectives of this Agreement (applicable to homes that have gas-consuming appliances and were built to meet the 2008 Title 24 Building Standards) are to:

- Identify what types of mechanical ventilation devices are useful for improving ventilation and IAQ and determine how they are operated.
- Measure and characterize IAQ, ventilation, and any key potential sources of indoor pollutants and interactions with relevant building systems.
- Determine occupant perceptions of and satisfaction with the IAQ in their homes.
- Examine the relationships among home ventilation characteristics, measured and perceived IAQ, and house and household characteristics.
- Evaluate how to provide adequate ventilation in homes while reducing infiltration beyond the 2008 Title 24 building standards to provide acceptable IAQ.

## II. 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.

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- 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:

- **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

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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 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.

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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)

#### 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

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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)

#### CAM Products:

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

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#### 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

#### REPORTS AND INVOICES

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#### 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:
  - 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.

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#### Recipient Products:

- Final Report Outline (draft and final)

#### CAM Product:

- Style Manual

#### Subtask 1.6.2 Final Report

#### 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:

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- 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*)

#### 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:

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- A list of the permits that identifies: (1) the type of permit; and (2) the name, address, and telephone number of the permitting jurisdictions or lead agencies.
- The schedule the Recipient will follow in applying for and obtaining the permits.

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

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

#### Products:

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

#### Subtask 1.9 Subcontracts

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

#### The Recipient shall:

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

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

#### Products:

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

### **TECHNICAL ADVISORY COMMITTEE**

#### **Subtask 1.10 Technical Advisory Committee (TAC)**

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

- Provide guidance in 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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### 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: Occupant Survey and Recruitment for Field Study**

The goals of this task are to: (1) obtain information about the ventilation characteristics and occupant satisfaction of homes with natural gas appliances built to the 2008 Title 24 standards in California’s investor-owned utility (IOU) service territories; and (2) identify candidate homes for the in-home data collection that will occur in Tasks 3 and 4.

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

- Develop a web-based *Occupant Survey Plan* that will elicit occupant-derived information on the following issues:
  - Location and date of construction of home
  - Household socioeconomic and ethnic demographics
  - Confirmation of 2008 Title 24 compliance and presence of gas appliances
  - Relevant construction and occupancy-related factors
  - Types of ventilation equipment installed and how they are used
  - Perceived acceptability and the presence of unusual pollutant sources
  - Willingness to take part in field study.
- Submit the Occupant Survey Plan to the TAC for review and to the CAM for approval, and incorporate comments as needed.
- Obtain approval from the Lawrence Berkeley National Laboratory (LBNL) Human Subjects Committee Institutional Review Board (IRB) for the final web-based Occupant Survey Plan.
- Deploy the survey using the IRB-approved Occupant Survey Plan.
- Advertise and market the survey to maximize response.
  - If needed for recruiting, augment web data with phone survey data.
  - LBNL and the Gas Technology Institute will use electronic networks to announce the survey; California IOU partners will market to gas customers.
- Prepare a *Survey Technical Report* that includes summaries and preliminary analysis of survey data.
- Submit the Survey Technical Report to the TAC and CAM for review.

#### **Products:**

- Occupant Survey Plan (draft and final)
- Survey Technical Report (draft and final)

#### **TASK 3: Pilot Testing and Field Measurement Protocol Development**

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The goals of this task are to: (1) develop draft protocols for the in-home data collection that will occur during the Task 4 Field Study; (2) conduct pilot field testing to identify potential issues with deployment at a larger scale; and (3) develop a final set of field study protocols and a field study plan for the Task 4 Field Study.

#### The Recipient shall:

- Prepare a draft *Pilot Test Plan* that includes all of the field measurement procedures considered for use in the main study.
  - Include at least two pilot test sites, with additional pilot sites selected as necessary.
  - The pilot tests shall include the operating parameters of interest. They must also include measurements of particulate matter (including mass and ultrafine particle counts), nitrogen dioxide, carbon monoxide, and at least 12 aldehyde and volatile organic compounds combined, some combustion products, radon and methane.
  - The pilot tests shall include activity monitoring of window opening and use of any mechanical systems that contribute to outdoor air exchange.
- Present the draft pilot test plan at the TAC web meeting and obtain the CAM's approval.
- Submit a final Pilot Test Plan to LBNL's Human Subjects Committee IRB for approval.
- Conduct pilot tests per the approved Pilot Test Plan.
- Prepare a *Pilot Data Summary* that includes an analysis of data collected during the pilot study.
- Prepare an *Experimental Field Study Design* for approval by the CAM.
  - Incorporate the results of the occupant survey and pilot tests.
  - Include a total of 100 homes using natural gas across a range of housing styles and sizes. If possible, include a range of mechanical ventilation technologies. This includes testing at least 15 homes each in two distinct seasons (summer and winter) and two or three regions with different climates. A subset of shoulder season samples (spring or fall) will be included for contrast with winter and summer.
- Participate in a CPR per Task 1.3.
- Prepare a final *Experimental Field Study Design*.
- Submit a final *Experimental Field Study Design* to LBNL's Human Subjects Committee IRB for approval as needed.
- Prepare a *Field Measurement Protocol* from experimental design for use in the main field study.
- Submit a final *Field Measurement Protocol* to LBNL's Human Subjects Committee IRB for approval as needed.

# ENERGY RESEARCH, DEVELOPMENT, AND DEMONSTRATION GRANTS

## Exhibit A

### SCOPE OF WORK

PIR-14-007, Lawrence Berkeley National Lab

#### Products:

- Pilot Test Plan (draft and final)
- Pilot Data Summary
- Experimental Field Study Design (draft and final)
- CPR Report
- Field Measurement Protocol

#### TASK 4: Field Data Collection

The goal of this task is to collect the field data necessary to support the goals and objectives of this project as specified by the approved experimental design.

#### The Recipient shall:

- Execute the approved Experimental Field Study Design and Field Measurement Protocol.
  - Select a final sample from pre-screened sites.
  - Collect field data using the field measurement protocol.
  - Document results.
- Prepare a *Mid-term Status Report* that provides status of field test when approximately half way through data collection suitable for TAC review.
- Prepare *Summary of Field Measurements Report* for the complete dataset.

#### Products:

- Mid-term Status Report
- Summary of Field Measurements Report

#### TASK 5: Simulation and Analysis

The goals of this task are to analyze the data collected, augment the data with simulation to determine how recent versions of Title 24 have impacted IAQ, and improve ventilation and IAQ in new California homes.

#### The Recipient shall:

- Characterize recent pre-2008 California new homes properties.
  - Review appropriate literature.
  - Create a representative population.
- Characterize post-2008 homes with gas appliances.
  - Evaluate field and survey data.
  - Create a representative population.
- Analyze post-2008 home data to:
  - Identify what types of mechanical ventilation devices are being installed in new homes and how they are operating.

# ENERGY RESEARCH, DEVELOPMENT, AND DEMONSTRATION GRANTS

## Exhibit A

### SCOPE OF WORK

PIR-14-007, Lawrence Berkeley National Lab

- Characterize IAQ, ventilation, and the potential sources of indoor pollutants.
- Determine occupant perceptions of, and satisfaction with, the IAQ in their homes.
- Examine the relationships among home ventilation characteristics, measured and perceived IAQ, and house and household characteristics.
- Using data and simulations, prepare an *Impacts of Title 24 on IAQ in Homes Report*.
- Evaluate how to provide adequate ventilation in homes while reducing infiltration beyond the 2008 Title 24 Building Standard to provide acceptable IAQ.
  - Characterize potential ventilation systems and tightness levels of new California homes with gas appliances, including near-zero energy option.
  - Create reasonable scenarios based on representative population.
  - Simulate and optimize ventilation and IAQ impacts.
- Prepare Potential *Improvements in Ventilation and IAQ for New California Homes Report*.
- Conduct TAC meeting if required by the CAM.

#### Products:

- Impacts of Title 24 on IAQ in Homes Report (draft and final)
- Potential Improvements in Ventilation and IAQ for new California Homes 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:
  - 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.

# ENERGY RESEARCH, DEVELOPMENT, AND DEMONSTRATION GRANTS

## Exhibit A

### SCOPE OF WORK

PIR-14-007, Lawrence Berkeley National Lab

- 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.
- 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

# ENERGY RESEARCH, DEVELOPMENT, AND DEMONSTRATION GRANTS

## Exhibit A

### SCOPE OF WORK

PIR-14-007, Lawrence Berkeley National Lab

- 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 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)

**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-14-007 with **Lawrence Berkeley National Laboratory** for a \$1,250,000 grant to conduct a field study of indoor air quality (IAQ) and related diagnostics to determine how recent versions of Title 24 have impacted IAQ and to improve ventilation and IAQ in new California homes with natural gas appliances to enable enhanced energy savings. The length of this agreement is 41 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