





## Exhibit A Scope of Work

### A. Task List

Task #	CPR <sup>1</sup>	Task Name
1		General Project Tasks
2	X	Integration of Enhancing Technologies and Laboratory Evaluation of Phase I Next-Generation Residential Space-Conditioning System for California
3	X	Integration of Enhancing Technologies and Laboratory Evaluation of Phase II Next-Generation Residential Space-Conditioning System for California
4		Field Evaluation of Next-Generation Residential Space-Conditioning System for California (with Approved Technologies from Phases I and II) and Final Report
5		Evaluation of Project Benefits
6		Technology/Knowledge Transfer Activities
7		Production Readiness Plan

### B. Acronym/Term List

Acronym/Term	Meaning
AHRI	Air-Conditioning, Heating, and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating, and Air-conditioning Engineers
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
COP	Coefficient of Performance
CPR	Critical Project Review
DR	Demand Response
Energy Commission	California Energy Commission
FDD	Fault Detection and Diagnostics
GWP	Global Warming Potential
HVAC	Heating, Ventilation, and Air Conditioning
RH	Relative Humidity
SHR	Sensible Heat Ratio
TAC	Technical Advisory Committee
WCEC	Western Cooling Efficiency Center

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

### A. Purpose of Agreement

The purpose of this Agreement is to fund the development of a next-generation residential space-conditioning system optimized for California climates. The system will integrate a portfolio of advanced efficiency solutions for maximum energy efficiency.

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

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### B. Problem/ Solution Statement

#### Problem

Cooling and heating of buildings to achieve comfortable temperature and humidity levels accounts for a large portion of the electricity bills of California ratepayers. Every kilowatt-hour consumed by conventional air-conditioning systems requires the production of even more energy at power plants, resulting in the emission of greenhouse gases and constraint of electricity transmission and distribution systems. Many of technologies that deliver efficiency exist, but they are not integrated into a single heating, ventilation, and air-conditioning (HVAC) system, nor are they optimized for California climates.

#### Solution

The Recipient will develop a next-generation residential space-conditioning system optimized for California climates. Energy efficiency is a primary strategy for reducing energy consumption and thereby reducing the CO<sub>2</sub> emitted by the generation of electricity. The portfolio of advanced efficiency solutions integrated into the proposed HVAC system will include several or all of the following: variable-capacity compressor and variable-speed fans using state-of-the-art inverter technology; integrated ventilation to harness fresh air for “free cooling”; intelligent dual-fuel technology to decrease energy cost and empower consumers to choose between electricity and natural gas; zonal control to prevent conditioning of unoccupied rooms; demand-response interactivity to increase grid flexibility and reliability; advanced fault detection and diagnosis (FDD) to ensure proper installation, operation, and maintenance; and alternative refrigerants for improved operation and significant reductions in the potential for global warming.

Additionally, the project will use modeling to verify the efficacy of prototype designs and customize the system for California climates. The project will evaluate thermal storage as a supplemental source of cooling, storing energy when it is the least expensive and releasing it during peak hours.

### C. Goals and Objectives of the Agreement

#### Agreement Goals

The goals of this Agreement are to:

- Develop a next-generation residential space-conditioning system that integrates the best energy-efficient technologies for California consumers.
- Test the system in independent laboratories in multiple phases to continue to develop the system and integrate more energy-saving technologies.
- Model various configurations of the next-generation system to optimize its performance for California consumers.
- Test the system at three field locations—in real-world operating environments—and compare its performance to traditional HVAC systems.
- Through multiple technology-transfer efforts, impart the findings of the project to stakeholders and the public.

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Ratepayer Benefits:<sup>2</sup> This Agreement will result in the ratepayer benefits of greater electricity reliability, lower costs, and increased safety by integrating advanced energy-efficient and intelligent technologies into a single next-generation HVAC system. Inverter technology enables compressors and fans to run at capacities and speeds that match the load of a residence, and zonal control prevents the conditioning of unoccupied spaces. The ability to intelligently switch between electricity and natural gas to heat a home saves energy and ratepayer money. HVAC systems that respond to demand-response signals from electric utilities enable the utilities to conserve capacity during peak energy consumption, creating a more reliable grid, and advanced FDD enhance the reliability of the HVAC system. The lower carbon footprint of alternative refrigerants will increase the safety of all California residents.

Technological Advancement and Breakthroughs:<sup>3</sup> This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by integrating multiple advanced energy solutions into a single next-generation HVAC system. The intelligent integration of energy-saving technologies will constitute a sea change in the way that residential buildings are conditioned to ensure the comfort of occupants. Intelligent electronics will control fresh-air ventilation, zonal dampers, compressor speed, fan speed, fuel selection, and FDD, in addition to processing demand-response messages from electric utilities to curtail the consumption of residential consumers who voluntarily participate. Alternative refrigerants contribute to the sea change by greatly reducing the potential for global warming.

### **Agreement Objectives**

The objectives of this Agreement are to:

- Obtain performance data from laboratory testing of two prototype next-generation residential space-conditioning systems.
- Obtain performance data from field testing of three existing HVAC systems and a final prototype next-generation residential space-conditioning system.
- Create a model of the next-generation residential space-conditioning system.
- Achieve a minimum of 50% energy savings for residential HVAC.

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<sup>2</sup> California Public Resources Code, Section 25711.5(a) requires projects funded by the Electric Program Investment Charge (EPIC) to result in ratepayer benefits. The California Public Utilities Commission, which established the EPIC in 2011, defines ratepayer benefits as greater reliability, lower costs, and increased safety (See CPUC "Phase 2" Decision 12-05-037 at page 19, May 24, 2012, [http://docs.cpuc.ca.gov/PublishedDocs/WORD\\_PDF/FINAL\\_DECISION/167664.PDF](http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/167664.PDF)).

<sup>3</sup> California Public Resources Code, Section 25711.5(a) also requires EPIC-funded projects to lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory and energy goals.

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### II. TASK 1 GENERAL PROJECT TASKS

#### PRODUCTS

##### Subtask 1.1 Products

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

##### The Recipient shall:

###### For products that require a draft version

- 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:
  - **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.

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- 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 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);

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- Permit documentation (subtask 1.8);
- Subcontracts (subtask 1.9); and
- Any other relevant topics.

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

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

### **The CAM shall:**

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

### **Recipient Products:**

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

### **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.

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### **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

### **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.

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- 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 project objectives of this Agreement; and (2) ensure that invoices contain all required information and are submitted in the appropriate format.

### The Recipient shall:

- Submit a monthly *Progress Report* to the CAM. Each progress report must:
  - Summarize 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 "Payment of Funds" section of 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.

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### Products:

- Progress Reports
- Invoices

### Subtask 1.6 Final Report

The goal of this subtask is to prepare a comprehensive Final Report that describes the original purpose, approach, results, and conclusions of the work performed under this Agreement. 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
- Comments on Draft Final Report Outline
- Approval of Final Report Outline

#### Subtask 1.6.2 Final Report

##### The Recipient shall:

- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline 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.

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

### **The Recipient shall:**

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

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

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

### **Products:**

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

### **Subtask 1.8 Permits**

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

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### The Recipient shall:

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

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

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

### Products:

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

### Subtask 1.9 Subcontracts

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

### The Recipient shall:

- Manage and coordinate subcontractor activities in accordance with the requirements of this Agreement.
- Incorporate this Agreement by reference into each subcontract.
- Include any required Energy Commission flow-down provisions in each subcontract, in addition to a statement that the terms of this Agreement will prevail if they conflict with the subcontract terms.
- If required by the CAM, submit a draft of each *Subcontract* required to conduct the work under this Agreement.
- 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 project direction. The guidance may include scope and methodologies, timing, and coordination with other projects. The guidance may be based on:
  - Technical area expertise;
  - Knowledge of market applications; or
  - Linkages between the agreement work and other past, present, or future projects (both public and private sectors) that TAC members are aware of in a particular area.
- Review products and provide recommendations for needed product adjustments, refinements, or enhancements.
- Evaluate the tangible benefits of the project to the state of California, and provide recommendations as needed to enhance the benefits.
- Provide recommendations regarding information dissemination, market pathways, or commercialization strategies relevant to the project products.

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

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

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

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

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### **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.*

The technical tasks are divided into two phases: Task 2 (Phase I) and Task 3 (Phase II). In Task 2, the next-generation space-conditioning system will be evaluated at three laboratories. The prototype system will incorporate several energy efficiency enhancing technologies. In Task 3, a new prototype—integrating the technologies in Task 2 with additional energy efficiency enhancing technologies—will be evaluated in the same three laboratories. In Task 4, the prototype will be tested in the field at three California locations. The results of all laboratory and field research will inform a recommendations document (Subtask 4.2).

#### **TASK 2 Integration of Enhancing Technologies and Laboratory Evaluation of the Phase I Next-Generation Residential Space-Conditioning System for California**

The goal of this task is to conduct laboratory evaluations of the performance of a prototype next-generation space-conditioning system for applicability in California. The initial work in the first phase of the project will integrate several of the best available HVAC technologies into a state-of-the-art HVAC system, such as: variable-capacity compressor, variable-speed blower, integrated ventilation controls, demand-response (DR) capability, and dual-fuel (intelligent heating). The systems will be designed and evaluated for conditions that include typical residential building sizes and construction, location/climate, and utility rates.

#### **Subtask 2.1 Obtain a Prototype of the Phase I Next-Generation Space-Conditioning System**

The goal of this subtask is to obtain a prototype of the next-generation space- (quantity of three) for laboratory investigation of a) the enhancing technologies described below and b) the system as a whole, which integrates the enhancing technologies.

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

- Obtain three identical Phase I Next-Generation Space-Conditioning Systems, which will include several enhancing technologies, such as, but not limited to:
  - Variable-capacity compressor
  - Variable speed fan/blower
  - Integrated ventilation controls
  - Demand response capabilities
  - Dual-fuel heat pump systems (intelligent heating)
- Provide a Confirmation Receipt of the Prototypes that identifies the enhancing technologies included in the Phase I prototype

#### **Product:**

- Confirmation Receipt of the Prototypes that shows equipment shipped and received.

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### **Subtask 2.2 Evaluation of One Next-Generation Space-Conditioning System at the EPRI Thermal Laboratory**

The goal of this subtask is to assess the variable-capacity functionality of the next-generation space-conditioning system and to assess integrated ventilation of the prototype unit during cooling operation only. The laboratory evaluation will be conducted using multiple thermal chambers and indoor ductwork setup, which will simulate an indoor space, outdoor conditions for the California climate, and the ductwork infrastructure of a California residence.

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

- Prepare and conduct Next-Generation Space-Conditioning Test Plan Phase I, that includes, but is not limited to:
  - Thermal chamber testing that would be capable of simulating an indoor zone and California outdoor conditions.
  - Analysis of the cooling capacity, performance and efficiency (COP) of the next-generation space-conditioning system under various testing conditions.
  - Measurements to be recorded during laboratory experiments include: indoor temperature and humidity, outdoor temperature and humidity, temperature and humidity of the unit supply air, unit airflow, power consumption of the indoor unit, outdoor unit power consumption, refrigerant line pressures and temperatures, and exhaust air temperature.
- Prepare Summary Report on Findings that examines the functionality of the next-generation space-conditioning system within a laboratory setting under a simulated California climate. The Summary Report on Findings will also include discussions on, but be not limited to:
  - Thermal test results from simulated California outdoor conditions.
  - Cooling capacity, performance and efficiency test results under various test conditions.
  - Assessment of the variable-capacity space-conditioning system in both steady-state and dynamic operation.
  - Assessment of the integrated ventilation controls of the space-conditioning system.

#### **Product:**

- Next-Generation Space-Conditioning Test Plan
- Summary Report on Findings

### **Subtask 2.3 Evaluation of One Next-Generation Space-Conditioning System**

The goal of this subtask is to assess the performance of the next-generation space-conditioning system under California climates with particular emphasis on hot-dry climates and the interactions between variable-capacity equipment and typical duct systems.

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

- Prepare and conduct Next-Generation Space-Conditioning Test Plan, that includes, but is not limited to:
  - Testing different compressor speeds and fan speeds for the same outdoor conditions to measure the impact of variable-speed operation on efficiency and Sensible Heat Ratio (SHR).
  - Measure performance of the duct system by configuring the test chamber to simulate attic conditions.

## **Exhibit A Scope of Work**

- Prepare and conduct a Summary Report on Test Findings that includes discussions including, but not limited to:
  - Assessment of the next-generation space-conditioning system over a range of simulated California climate conditions within a laboratory setting, with a particular focus on hot-dry applications.
  - Assessment of duct losses associated with the space-conditioning system operating in a mocked-up ducted application, with a focus on the effects of variable cooling capacity and air flow on duct thermal losses and delivered capacity.
  - Examination of the SHR of the system, and seeking practical combinations of fan and compressor speed to optimize performance in California climate conditions.
  - All recorded measurements and observations for subsequent evaluation and reporting.
  - Development and validation (using laboratory data) of a computer model for predicting the efficiency of typical attic duct system (and therefore overall system efficiency) as a function of equipment capacity and fan flow. Prepare Summary Report on the Computer Model for the Interactions Between Variable-capacity Equipment and Typical Single-zone Duct Systems.

### **Product:**

- Next-Generation Space Conditioning Test Plan (WCEC)
- Summary Report on Test Findings (WCEC).
- Summary Report on the Computer Model for the Interactions between Variable-capacity Equipment and Typical Single-zone Duct Systems.

### **Subtask 2.4 Evaluation of One Next-Generation Space-Conditioning System**

The goal of this subtask is to assess the performance of the next-generation space-conditioning system under dual-fuel operation and to examine the DR capabilities of the system.

### **The Recipient shall:**

- Prepare and conduct Next-Generation Space-Conditioning Test Plan (PG&E), that includes, but is not limited to:
  - Measure indoor, outdoor, and cooling coil capacity.
  - The capacity, power, and efficiency (capacity divided by power) mapping against the conditions of the variable outdoor air and return air such that a computer model of the performance can be developed.
  - Test conditions for the HVAC system performance during dual-fuel operation.
  - DR test procedures and protocols for full load testing in several outside temperatures.
- Prepare Summary Report on Findings (PG&E) that includes a discussion on the following, but not limited to:
  - Assessment of the next-generation space-conditioning system in a simulated California climate within a laboratory setting.
  - Assessment of the space-conditioning system with dual-fuel operation for California conditions. This activity includes a) researching the range of design climate conditions for heating in California and also those used for rating (AHRI Standard 210/240) and b) refining these test conditions into a workable set of tests.
  - Assessment of the DR performance of the space-conditioning system.
  - Evaluation of all recorded measurements and observations for reporting.

## **Exhibit A Scope of Work**

### **Product:**

- Next-Generation Space Conditioning Test Plan (PG&E)
- Summary Report on Findings (PG&E).

### **Subtask 2.5 Provide Feedback to the Manufacturer During and After Laboratory Assessments**

The goal of this subtask is to provide feedback to the next-generation space-conditioning manufacturer during and after Phase I testing so that the manufacturer can develop a new prototype for Phase II testing.

### **The Recipient shall:**

- Provide results and feedback from laboratory results of the Next-Generation Residential Space-Conditioning System for California to the manufacturer
- Prepare Guiding Specifications for Phase II including, but not limited to, recommendations for the Phase II system based on the laboratory assessment from Phase I testing.
- Participate in CPR for Task 2 per Task 1.3 and prepare CPR Report #1

### **Product:**

- Guiding Specifications for Phase II: Next-Generation Residential Space-Conditioning System for California
- CPR Report #1

### **TASK 3 Integration of Enhancing Technologies and Laboratory Evaluation of Phase II Next-Generation Residential Space-Conditioning System for California Application**

The goal of this task is to conduct a laboratory evaluation of the performance of a Phase II next-generation space-conditioning system for applicability in California and designed for American-style ducting. The laboratory assessment of the Phase I system will inform the development and evaluation of the Phase II system. The initial work in the second phase of this project will integrate several additional HVAC technologies into the state-of-the-art HVAC systems found to be most promising in Phase I. These technologies may include zonal control, alternative refrigerants, and advanced FDD. Additionally, the Recipient will conduct a technical review of thermal storage, which will consist of reviewing the feasibility of using thermal energy storage into the next-generation space-conditioning system and what type of thermal energy storage is the most appropriate one to be tested.

### **Subtask 3.1 Obtain Prototypes of Phase II Next-Generation Space-Conditioning System**

The goal of this subtask is to obtain a next-phase prototype of the next-generation space-conditioning (quantity of three) for laboratory investigation of a) the enhancing technologies described below and b) the system as a whole, which integrates the enhancing technologies.

### **The Recipient shall:**

- Obtain three identical Phase II Next-Generation Space-Conditioning Systems. In consultation with the CAM, the Phase II system may include several new enhancing technologies in addition to the technologies tested in Phase I, such as, but not limited to:
  - Alternative refrigerants
  - Advanced FDD
  - Zonal control
  - Thermal storage (subject to passing of technical review)

## **Exhibit A**

### **Scope of Work**

- Provide a Confirmation Receipt of the Prototypes that identifies the enhancing technologies included in the Phase II prototypes, including the results of the technical review of thermal energy storage and the feasibility of using this technology in the prototype

#### **Product:**

- Confirmation Receipt of the Prototypes that shows equipment shipped and received.

#### **Subtask 3.2 Evaluation of One Phase II Next-Generation Space-Conditioning System at the EPRI Thermal Laboratory**

The goal of this subtask is to examine the variable-capacity functionality of an alternative refrigerant and explore the operation of the unit in both a steady-state and dynamic nature. The zonal operation of the variable capacity system will also be examined.

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

- Prepare and conduct Next-Generation Space-Conditioning Test Plan Phase II, that includes, but is not limited to:
  - Similar testing procedures and a similar test setup as used for the evaluation of the Phase I system. The Phase II system will be examined in both steady-state and dynamic operation within the laboratory setup, similar to the Phase I system. Testing procedures and set up may include, but are not limited to:
    - Thermal chamber testing that would be capable of simulating an indoor zone and California outdoor conditions.
    - Analysis of the cooling capacity, performance and efficiency (COP) of the next-generation space-conditioning system under various testing conditions.
    - Measurements to be recorded during laboratory experiments include: indoor temperature and humidity, outdoor temperature and humidity, temperature and humidity of the unit supply air, unit airflow, power consumption of the indoor unit, outdoor unit power consumption, refrigerant line pressures and temperatures, and exhaust air temperature.
  - 
  - Examine any performance differences between the Phase I (R410a refrigerant) and Phase II (alternative refrigerant) systems.
  - Assess the zonal operation of the Phase II prototype HVAC system. The laboratory setup for the zonal evaluation will be similar in nature to Phase I and Phase II steady-state and dynamic assessment setup with slight modification being that a second indoor airflow duct will allow for zoning to be examined in the laboratory assessment.
- Prepare Phase II Summary Report on Findings that includes discussions of the following, but not limited to:
  - Assessment of the performance of the Phase II next-generation space-conditioning system.
  - Performance differences between the Phase I (R410a refrigerant) and Phase II (alternative refrigerant) systems.
  - Zonal operation of the Phase II prototype HVAC system.

#### **Product:**

- Phase II Next-Generation Space Conditioning Test Plan Phase II
- Phase II Summary Report on Findings.

## **Exhibit A Scope of Work**

### **Subtask 3.3 Evaluation of One Phase II Next-Generation Space-Conditioning System**

The goal of this subtask is to assess the performance of the Phase II next-generation space-conditioning system under California climates, including an assessment of multi-zone capabilities incorporated into this equipment (as well as verifying the multi-zone computer model of the performance of the complete ducted system) and a technical review of the potential for thermal storage to cost-effectively increase efficiency.

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

- Prepare and conduct Next-Generation Space-Conditioning Test Plan Phase II, that includes, but is not limited to:
  - Test protocols and procedures to simulate a range of California climate conditions.
- Prepare Summary Report on Phase II Laboratory Test Findings that includes, but is not limited to:
  - Evaluation of all recorded measurements and observations for subsequent reporting.
  - Assessment of next-generation space-conditioning system over a range of simulated California climate conditions within a laboratory setting, with a particular focus on hot-dry applications.
  - Summary of thermal storage technical review, including its impact on SHR and the performance of the duct system and potential for Next Generation Space Conditioning.
- Prepare Summary Report on the Computer Model for the Interactions Between Variable-capacity Equipment and Typical Multi-zone Duct Systems.
  - Assess duct losses associated with the space-conditioning system operating in a simulated multi-zone ducted application, with a focus on the effects of variable capacity and airflow on duct thermal losses and delivered capacity in multi-zone operation.

#### **Product:**

- Next-Generation Space Conditioning Test Plan Phase II (WCEC)
- Summary Report on Phase II Laboratory Test Findings.
- Summary Report on the Computer Model for the Interactions Between Variable-capacity Equipment and Typical Multi-zone Duct Systems.

### **Subtask 3.4 Evaluation of One Phase II Next-Generation Space-Conditioning System**

The goal of this subtask is to assess the FDD capabilities of the Phase II next-generation space-conditioning system

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

- Prepare and conduct Next-Generation Space-Conditioning Test Plan Phase II, that includes, but is not limited to:
  - Test protocols and procedures to simulate a range of California climate conditions.
  - Procedures that are compliant with the preliminary draft of the American Society of Heating, Refrigerating, and Air-conditioning Engineers (ASHRAE) Standard 207.
- Prepare Phase II Summary Report on Findings (PG&E) that includes, but is not limited to:
  - Assess the next-generation space-conditioning system in a simulated California climate within a laboratory setting.
  - Determine what faults or other situations that the system is designed to identify and report on or diagnose.

## **Exhibit A Scope of Work**

- Establish conditions to create these fault situations to assess the response to the fault and whether the fault condition is correctly identified.
- Other fault situations applied to observe the system response, if any.

### **Product:**

- Next-Generation Space-Conditioning Test Plan Phase II (PG&E)
- Phase II Summary Report on Findings (PG&E).

### **Subtask 3.5 Provide Feedback to the Manufacturer during and after Laboratory Assessments**

The goal of this subtask is to provide feedback to the next-generation space-conditioning manufacturer during and after Phase II testing so that the manufacturer can refine its integrated HVAC system for testing in the field.

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

- Provide results and feedback from laboratory results of the Phase II Next-Generation Residential Space-Conditioning System for California to the manufacturer
- Prepare Guiding Specifications for Field Testing: Next-Generation Residential Space-Conditioning System for California.
- Participate in CPR for Task 3 per Task 1.3 and prepare CPR Report #2

### **Product:**

- Guiding Specifications for Field Testing: Next-Generation Residential Space-Conditioning System for California
- CPR Report #2

### **TASK 4 Field Evaluation of Next-Generation Residential Space-Conditioning System for California (with Approved Technologies from Phases I and II) and Final Report**

The goal of this task is to evaluate the Phase II prototype next-generation residential space-conditioning system at three occupied residential buildings. All enhancing technologies and the system as a whole will be evaluated for a period of about one year. After the three evaluations, the Recipient will provide the results of all laboratory and field evaluations and technology recommendations to relevant California stakeholders and manufacturers.

#### **Subtask 4.1 Field Evaluation of Phase II Next-Generation Space-Conditioning System for California Application**

The goal of this subtask is to assess the performance of the next-generation space-conditioning system in a field setting installed at residences with American-style ducting. The field study will consist of installing one Phase II system within the utility service territories of Southern California Edison (SCE), Pacific Gas and Electric (PG&E), and San Diego Gas and Electric (SDG&E). The baseline equipment—the HVAC systems currently operating at the three selected locations—would be monitored for one year, and then the next-generation HVAC System would be retrofitted and monitored the following year. Data collected will enable the Recipient and its subcontractors to determine improvements in energy efficiency conferred by the new system.

## **Exhibit A Scope of Work**

### **The Recipient shall:**

- Prepare and conduct a Field Evaluation Test Plan that includes, but is not limited to:
  - One year of baseline and one year of prototype HVAC performance monitoring.
  - The monitoring at each of the field sites will include unit power consumption, indoor air temperature and humidity, outdoor air temperature and humidity, return and supply conditions of the indoor unit, natural gas consumption (if applicable), and indoor unit airflow.
  - Power consumption of any of the electrical components (indoor unit, outdoor unit, electric heat) of the installed equipment will be monitored using WattNode power meters.
  - Retrofit the next-generation space-conditioning systems into the selected field sites. The three identical prototype systems will be divided equally between the three field sites, such that each system can be sufficiently examined and monitored.
- Work with the equipment manufacturer to specify and size appropriate heat pumps for the site.
- Arrange for delivery of the systems in coordination with the utility whose region in which the site resides and any construction operations already existing at the site.
- Design, construct, and install a data-acquisition and monitoring system appropriate to the sites and the installed equipment.
- Prepare Field Evaluation Summary Report that includes, but is not limited to:
  - Analysis of the monitored baseline performance for the three selected residential field sites in an electric investor-owned utility service territory for approximately one year which may include, but is not limited to: study of peak operation, study of changes in operation based on time of day, week, month or season; comparison of system modes.
  - Analysis of the monitored prototype HVAC system operation for approximately one year. The monitoring package and collected data of the system will be similar to the aforementioned monitoring of baseline equipment.
  - Performance assessment of the prototype system based on the collected baseline and test data.
  - Provide feedback to the research team on the performance of the next-generation space-conditioning system.

### **Product:**

- Field Evaluation Test Plan
- Field Evaluation Summary Report

### **Subtask 4.2 Technology Recommendations Provided to California Stakeholders and Manufacturers for Appropriate Commercialization of Equipment**

The goal of this subtask is to provide the results of the laboratory and field evaluations and technology recommendations to relevant California stakeholders and manufacturers in order to commercialize equipment appropriate for the California climate.

### **The Recipient shall:**

- Analyze the gains in cost, cost effectiveness, efficiency, demand reduction, comfort, and safety imparted by the technologies in the Phase 1, Phase 2 and Field Tests of the Next-Generation Residential Space-Conditioning System, to determine the gross potential of a future Next-Generation Residential Space-Conditioning System that incorporates the most promising technologies for optimal performance.

## **Exhibit A Scope of Work**

- Conduct at least one Workshops/Meetings with all stakeholders, including but not limited to the Energy Commission, the IOUs, manufacturers, and technology developers, and provide a copy of the presentation materials
- Prepare Workshop Findings, which may include, but are not limited to, lessons learned and next steps.
- Provide Public Summary Report of Research to public stakeholders, as a conference paper or equivalent.
- Prepare Final Report on Results of Laboratory and Field Testing of Prototype System which includes all of the items listed in the first bullet of the Recipient shall section of this subtask.

### **Product:**

- Workshop presentation materials
- Workshop Findings
- Public Summary Report of Research to Public Stakeholders
- Final Report on Results of Laboratory and Field Testing of Prototype System

### **TASK 5 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*.
- Compare the new systems developed and tested in this project to both commonly used existing systems and best-available existing systems. These new systems shall be defined in Tasks 2 and 3 and will include all elements of the next-generation residential space-conditioning product for California, including zonal control, environmentally friendly refrigerants (zero ozone depletion potential and low Global Warming Potential (GWP)), integrated ventilation control, use of variable-speed compressors and indoor fans, dual-fuel capability, DR readiness, FDD, and perhaps thermal storage. The comparisons will identify the combinations of attributes that provide the most benefits compared to the baselines. Comparisons shall include operating cost (energy use, peak demand, and maintenance), first cost, assessments of comfort and fresh air delivery, reliability, and cost/benefit or life cycle costs. The comparisons shall be made by building type and size, climate, and whether the application is new construction, retrofit, or a major remodel.
- 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.

## **Exhibit A Scope of Work**

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

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

## **Exhibit A Scope of Work**

### **Products:**

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

### **TASK 6 Technology/Knowledge Transfer Activities**

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

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

- Prepare a Technology/Knowledge Transfer Plan using this approach:
  - Identify key market participants, their role in the market, and product attributes they value in performing their role. (Key market participants could include users, utilities, building owners, specifiers, dealers, manufacturers, facility managers, construction managers, and federal and state government officials.)
  - Compare the anticipated attributes of the new product being developed to the attributes valued by key market participants. Focus technology-transfer efforts on overlapping attributes (those valued by participants and those expected to be part of the new product).
  - Identify market barriers that might impede adoption of the new technology for each key market participant and corresponding interventions needed to overcome these barriers. For example, users need information about the product (such as cost, comfort, and complexity) and need to be sure that an HVAC system works properly and reliably. Utilities and government program administrators also need cost-effectiveness and performance information to be sure that the product meets qualification criteria for programs (such as rebate and assistance programs).
  - For each key market participant, identify contacts, organizations, and mechanisms (such as meetings, publications, web sites, newsletters, and newspapers) that could be technology-transfer conduits to these participants. It is anticipated that users, utilities, property owners, and low-income program officials will be among key market participants targeted.
  - The plan will include an assessment of codes and standards that could potentially be utilized to affect the adoption of the next-generation residential space-conditioning system developed in this project. These should include ENERGY STAR, LEED, ASHRAE standards, utility incentive programs, and Title 24. Actions and white papers to inform and influence these organizations will be included in this technology-transfer plan.
  - The plan will describe development of technology-transfer products that will include preparation of an initial and final project fact sheet, tech briefs, white papers, brochures, newspaper articles, blogs and web site entries, journal articles, presentations, and “word of mouth” contacts. The technology-transfer products to be developed shall be tabulated in a time-phased document, including date, title, delivery site (periodical, web site, and meeting location), participants of the targeted market, host organization, and other relevant information.

## **Exhibit A Scope of Work**

- Technology transfer activities shall be conducted in accordance with the Technology/Knowledge Transfer Plan. Execution of the technology transfer plan will include preparation of the materials outlined in the plan, making contacts to facilitate timely, effective presentation of results at key meetings and publication in appropriate journals, web sites, and trade periodicals. These activities shall be reported in the progress reports and in the Technology/Knowledge Transfer Report.
- When directed by the CAM, the Contractor shall develop presentation materials for an Energy Commission- sponsored conference/workshop on the results of the project as well as other items required by the CAM.
- A Technology/Knowledge Transfer Report on technology transfer activities conducted during the project shall be prepared. Copies of all documents prepared for public dissemination shall be provided in conjunction with this report. The Contractor shall report the number of website downloads or public requests for project results.

### **Products:**

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

### **TASK 7 Production Readiness Plan**

The goal of this task is to determine the steps that will lead to the manufacturing of technologies developed in this project or to the commercialization of the project's results.

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

- Prepare a *Production Readiness Plan*. The next generation space conditioner for California will be a sophisticated product; yet very simple to use and maintain. For such a product to be ready, the Production Readiness Plan will discuss the following:
  - Critical equipment, facilities, personnel resources, and support systems needed to produce a commercially viable product.
  - Internal manufacturing facilities, supplier technologies (especially from overseas), capacity constraints, design-critical elements, and the use of hazardous or non-recyclable materials.
  - The estimated cost of production.
  - The expected investment threshold needed to launch the commercial product.
  - A preliminary implementation plan to ramp up to full production.
  - The outcome of product development efforts, such as copyrights and license agreements.
  - Intellectual property information, along with dates and brief descriptions. Licensing opportunities for background and foreground patents, and other IP
  - Other areas as determined by the CAM.

#### **Products:**

- Draft Production Readiness Plan
- Final Production Readiness Plan

## **Exhibit A Scope of Work**

### **IV. PROJECT SCHEDULE**

Please see the attached Excel spreadsheet, for delivery dates of specific products.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES  
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: ELECTRIC POWER RESEARCH INSTITUTE, INC.

**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 EPC-14-021 from PON-13-301 with **Electric Power Research Institute** for a **\$2,993,005** grant to develop and test the next generation residential space conditioning system by combining and integrating several advanced technologies into a single space conditioning system that cost-effectively fits California's climate conditions; 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 April 8, 2015.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

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Harriet Kallemeyn,  
Secretariat

STATE OF CALIFORNIA

STATE ENERGY RESOURCES  
CONSERVATION AND DEVELOPMENT COMMISSION

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Harriet Kallemeyn,  
Secretariat