GRANT REQUEST FORM (GRF)

New Agreement EPC-15-057 (To be completed by CGL Office)

Division	Agreement Manager:	MS-	Phone
ERDD	Jackson Thach	51	916-327-1625

Recipient's Legal Name	Federal ID Number
The Regents of the University of California, on behalf of the California Institute for Energy and Environment	94-6002123

Title of Project
Customer-controlled, Price-mediated, Automated Demand Response for Commercial Buildings

Term and Amount	Start Date	End Date	Amount
	6/30/2016	3/31/2019	$ 4,000,000

Business Meeting Information

☐ ARFVTP agreements under $75K delegated to Executive Director.

Proposed Business Meeting Date	5/17/2016	☐ Consent	☒ Discussion
Business Meeting Presenter	David Hungerford	Time Needed:	5 minutes

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

Agenda Item Subject and Description

UNIVERSITY OF CALIFORNIA, BERKELEY. Proposed resolution approving Agreement EPC-15-057 with the Regents of the University of California, on behalf of the California Institute for Energy and Environment at the Berkeley campus, for a $4,000,000 grant to improve small and large commercial customer participation in demand response by providing a cost-effective energy management system that allows a wide range of hardware and service offerings and automated price-based management.

California Environmental Quality Act (CEQA) Compliance

1. Is Agreement considered a "Project" under CEQA?
   ☐ Yes (skip to question 2) ☒ No (complete the following (PRC 21065 and 14 CCR 15378)):
   Explain why Agreement is not considered a "Project":
   Agreement will not cause direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because technical research activities will be confined to the internal environment of commercial buildings having no impact on the external environment. Therefore, it is not considered a "project" under CEQA.
2. If Agreement is considered a "Project" under CEQA:
   ☐ a) Agreement **IS** exempt. (Attach draft NOE)
   - ☐ Statutory Exemption. List PRC and/or CCR section number: ______
   - ☐ Categorical Exemption. List CCR section number: ______
   - ☐ Common Sense Exemption. 14 CCR 15061 (b) (3)

   Explain reason why Agreement is exempt under the above section:

   ☐ b) Agreement **IS NOT** exempt. (Consult with the legal office to determine next steps.)
   Check all that apply
   - ☐ Initial Study
   - ☐ Negative Declaration
   - ☐ Mitigated Negative Declaration
   - ☐ Environmental Impact Report
   - ☐ Statement of Overriding Considerations

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

Legal Company Name:	Budget
Siemens Corporation	$ 900,000
Quantum Energy Services and Technologies, Inc	$ 610,000
Carnegie Mellon University, Silicon Valley	$ 500,000
TBD	$ 90,000
	$

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

Legal Company Name:

STATE OF CALIFORNIA

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 10/2015)

CALIFORNIA ENERGY COMMISSION

Budget Information			
Funding Source	**Funding Year of Appropriation**	**Budget List No.**	**Amount**
EPIC	14-15	301.001B	$4,000,000
			$
			$
R&D Program Area: EERO: Buildings		TOTAL:	$4,000,000
Explanation for "Other" selection			
Reimbursement Contract #:		Federal Agreement #:	

Recipient's Administrator/ Officer		**Recipient's Project Manager**	
Name:	Eric Lee	Name:	Therese Peffer
Address:	2087 Addison St	Address:	2087 Addison St
City, State, Zip:	Berkeley, CA 94704-1268	City, State, Zip:	Berkeley, CA 94704-1268
Phone:	510-643-1449 / Fax: - -	Phone:	510-289-4278 / Fax: - -
E-Mail:	eric.lee@uc-ciee.org	E-Mail:	therese.peffer@uc-ciee.org

Selection Process Used	
☒ Competitive Solicitation	Solicitation #: GFO-15-311
☐ First Come First Served Solicitation	

The following items should be attached to this GRF		
1. Exhibit A, Scope of Work		☒ Attached
2. Exhibit B, Budget Detail		☒ Attached
3. CEC 105, Questionnaire for Identifying Conflicts		☒ Attached
4. Recipient Resolution	☒ N/A	☐ Attached
5. CEQA Documentation	☒ N/A	☐ Attached

Agreement Manager	Date	Office Manager	Date	Deputy Director	Date

EXHIBIT A
Scope of Work

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR[1]	Task Name
1		General Project Tasks
2		Develop Customer Value
3		Develop System Architecture
4		Develop, Harden and Scale XBOS/DR
5	X	Pilot Testing in Small and Large Commercial Buildings
6		Evaluation of Project Benefits
7		Technology/Knowledge Transfer Activities
8		Product and Market Readiness Plan

B. Acronym/Term List

Acronym/Term	Meaning
BMS	Building Management System
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CPR	Critical Project Review
TAC	Technical Advisory Committee
TSS	Transactive Signal Server
XBOS	eXtensible Building Operating System platform
XBOS/DR	Demand Response management system using XBOS as its foundation

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

A. Purpose of Agreement

The purpose of this Agreement is to improve small- and large-commercial customer participation in demand response by providing a cost-effective energy management system that allows a wide range of hardware and service offerings and effective automated price-based management.

B. Problem/ Solution Statement

<u>Problem</u>
The services demanded of commercial building customers—heating, cooling, ventilating, lighting, computing, and so on—require significant energy and contribute to peak energy demand. In fact, while demand response solutions abound for residential customers—communicating thermostats, for example—few solutions address the complexity and heterogeneity of the needs of commercial customers. Large commercial customers (≥1 MW, >50,000 sf) typically have a Building Management System (BMS) that can control heating,

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

ventilation, and air-conditioning equipment and often lighting in order to respond to price signals, although this requires some communication and controls infrastructure. Small commercial customers (< 100 kW, <50,000 sf), however, typically do not have a BMS, and thus cannot easily participate in demand response.

This problem has not been addressed because an open source and open architecture enabling platform runs counter to the business model of many companies, who want to maintain a single vendor, proprietary solution. The proposed open source and open architecture platform, a Demand Response manager based on the eXtensible Building Operating System (XBOS/DR), can interface with multiple hardware devices from different vendors as well as include software applications from various vendors. With its ability to create a virtual BMS for small commercial buildings by networking thermostats and other controllers, XBOS/DR can provide large and small commercial customers with a variety of choices for demand response capability.

Solution

This Agreement provides a holistic solution in addressing nine key requirements that a customer-controlled, price mediated, automated demand response manager should:

1. Receive pricing signals, evaluate energy demand, and respond with managed demand requirements, while complying with regulatory requirements,
2. Enable heterogeneous customers to adapt demand response with individual preferences for each commercial building,
3. Track, evaluate, and control multiple heterogeneous devices,
4. Interoperate with various building systems, such as BMS in large commercial and networked thermostats in small commercial to enable coordination of building management with the operation of other building systems and to take advantage of sensors connected to the BMS, enhanced by the use of emerging smart grid standards,
5. Retain the electrical usage history of connected devices. An electrical energy data historian, or means of storing energy data, provides the basis for understanding usage patterns, which is essential for effective demand optimization and management,
6. Provide pricing-based load management algorithms based on a variety of metrics including load type, existing schedules, service prioritization, and historical demand,
7. Coordinate to maintain load diversity. Coordination can be achieved through price signals but if many consumers automatically and simultaneously respond to the same price (e.g., a Time of Use price), loads may become synchronized—switching on and off simultaneously in ways that destabilize the system.
8. Provide security. The system must be secure from disruptive intrusions or theft of confidential information, and
9. Provide customer value. Because demand-response is implemented at a relatively small scale in many commercial buildings, software must be inexpensive (preferably free) and easy to install and maintain. To enhance this value the software should also provide other services such as management of demand charges and turning off equipment during non-business hours.

The project will develop the customer value: define, design and develop the system architecture, modules, and applications; make the software robust through testing; and then pilot test in small and large commercial buildings.

C. Goals and Objectives of the Agreement

Agreement Goals

The goal of this Agreement is to improve commercial customer participation in demand response by providing customer value: engaging service choices such as lowered demand charges and improved comfort and convenience and an easy-to-use interface at a low cost.

Ratepayer Benefits:[2] This Agreement will result in the ratepayer benefits of greater electricity reliability, lower costs, and increased safety. The project technology is anticipated to lower energy costs for California businesses by providing convenient means to reduce electrical energy and demand use. This project is expected to reduce peak electric load through both energy efficiency and demand response applications, thus providing greater electric grid reliability. Safety surrounding energy end-use equipment will be improved through increased capability for remote monitoring and potential integration with alarm services.

Technological Advancement and Breakthroughs:[3] This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals. This project provides a cost-effective solution towards both AB 758 and SB 350, which govern energy efficiency in existing buildings. The high cost of technological upgrades—such as replacing equipment with energy efficient products—represent a major barrier to these goals; a software solution is a much more nimble and cost-effective approach to achieve energy goals. Another major barrier is single-vendor, single communication protocol integrated solutions. The open architecture of XBOS/DR, augmented by the information exchanger allowing interoperability with other standards, will foster technical innovation by third-party vendors and HVAC, lighting, and other manufacturers in providing energy services.

Agreement Objectives

The objectives of this Agreement are to:

- Design and develop customer value, with user surveys and use cases to develop applications and the user interface.
- Define, design, and develop all components of the system architecture:
    - A negotiation mediator that coordinates among several building sites.
    - A messaging system to convey pricing schedules to the BMS and the BMS demand requirements to the rate supplier,
    - An information exchange module to manage disparate message content,
    - Developments within the XBOS context to support a variety of networked devices, and
    - Applications such as optimization to manage demand based on pricing schedules.

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

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

- Test the alpha version at the laboratory scale in order to develop a beta version that is robust and secure.
- Pilot test XBOS/DR in commercial buildings in California in order to measure and verify energy savings.
- Evaluate project benefits and technology,
- Develop knowledge transfer activities and
- Produce a product and market readiness plan.

III. TASK 1 GENERAL PROJECT TASKS

PRODUCTS

Subtask 1.1 Products

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

The Recipient shall:

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

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

For products that require a final version only

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

For all products

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

Instructions for Submitting Electronic Files and Developing Software:

- **Electronic File Format**

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

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

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

- **Software Application Development**
  Use the following standard Application Architecture components in compatible versions for any software application development required by this Agreement (e.g., databases, models, modeling tools), unless the CAM approves other software applications such as open source programs:
  - Microsoft ASP.NET framework (version 3.5 and up). Recommend 4.0.
  - Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5.
  - Visual Studio.NET (version 2008 and up). Recommend 2010.
  - C# Programming Language with Presentation (UI), Business Object and Data Layers.
  - SQL (Structured Query Language).
  - Microsoft SQL Server 2008, Stored Procedures. Recommend 2008 R2.
  - Microsoft SQL Reporting Services. Recommend 2008 R2.
  - XML (external interfaces).

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

MEETINGS

Subtask 1.2 Kick-off Meeting

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

The Recipient shall:

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

  The administrative portion of the meeting will include discussion of the following:
  - Terms and conditions of the Agreement;
  - Administrative products (subtask 1.1);
  - CPR meetings (subtask 1.3);
  - Match fund documentation (subtask 1.7);
  - Permit documentation (subtask 1.8);
  - Subcontracts (subtask 1.9); and
  - Any other relevant topics.

  The technical portion of the meeting will include discussion of the following:
  - The CAM's expectations for accomplishing tasks described in the Scope of Work;
  - An updated Project Schedule;
  - Technical products (subtask 1.1);
  - Progress reports and invoices (subtask 1.5);
  - Final Report (subtask 1.6);
  - Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
  - Any other relevant topics.

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

The CAM shall:

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

Recipient Products:

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

CAM Product:

- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings

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

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

The Recipient shall:

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

The CAM shall:

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

Recipient Products:

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

CAM Products:

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

Subtask 1.4 Final Meeting
The goal of this subtask is to complete the closeout of this Agreement.

The Recipient shall:

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

  The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be divided into two separate meetings at the CAM's discretion.
  - The technical portion of the meeting will involve the presentation of findings, conclusions, and recommended next steps (if any) for the Agreement. The CAM will determine the appropriate meeting participants.
  - The administrative portion of the meeting will involve a discussion with the CAM and the CAO of the following Agreement closeout items:
    - Disposition of any state-owned equipment.
    - Need to file a Uniform Commercial Code Financing Statement (Form UCC-1) regarding the Energy Commission's interest in patented technology.
    - The Energy Commission's request for specific "generated" data (not already provided in Agreement products).
    - Need to document the Recipient's disclosure of "subject inventions" developed under the Agreement.
    - "Surviving" Agreement provisions such as repayment provisions and confidential products.
    - Final invoicing and release of retention.

- Prepare a *Final Meeting Agreement Summary* that documents any agreement made between the Recipient and Commission staff during the meeting.
- Prepare a *Schedule for Completing Agreement Closeout Activities*.
- Provide *All Draft and Final Written Products* on a CD-ROM or USB memory stick, organized by the tasks in the Agreement.

Products:

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

REPORTS AND INVOICES

Subtask 1.5 Progress Reports and Invoices
The goals of this subtask are to: (1) periodically verify that satisfactory and continued progress is made towards achieving the project objectives of this Agreement; and (2) ensure that invoices contain all required information and are submitted in the appropriate format.

The Recipient shall:

- Submit a monthly *Progress Report* to the CAM. Each progress report must:
  - Summarize progress made on all Agreement activities as specified in the scope of

work for the preceding month, including accomplishments, problems, milestones, products, schedule, fiscal status, and an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. See the Progress Report Format Attachment for the recommended specifications.

- Submit a monthly or quarterly *Invoice* that follows the instructions in the “Payment of Funds” section of the terms and conditions, including a financial report on Match Fund and in-state expenditures.

Products:
- Progress Reports
- Invoices

Subtask 1.6 Final Report

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

Subtask 1.6.1 Final Report Outline

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

Recipient Products:
- Final Report Outline (draft and final)

CAM Product:
- Style Manual
- Comments on Draft Final Report Outline
- Acceptance of Final Report Outline

Subtask 1.6.2 Final Report

The Recipient shall:
- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline, Style Manual, and Final Report Template provided by the CAM with the following considerations:
  - Ensure that the report includes the following items, in the following order:
    - Cover page (**required**)
    - Credits page on the reverse side of cover with legal disclaimer (**required**)
    - Acknowledgements page (optional)
    - Preface (**required**)
    - Abstract, keywords, and citation page (**required**)
    - Table of Contents (**required**, followed by List of Figures and List of Tables, if needed)
    - Executive summary (**required**)

        - Body of the report (**required**)
        - References (if applicable)
        - Glossary/Acronyms (If more than 10 acronyms or abbreviations are used, it is required.)
        - Bibliography (if applicable)
        - Appendices (if applicable) (Create a separate volume if very large.)
        - Attachments (if applicable)
    - Ensure that the document is written in the third person.
    - Ensure that the Executive Summary is understandable to the lay public.
        - Briefly summarize the completed work. Succinctly describe the project results and whether or not the project goals were accomplished.
        - Identify which specific ratepayers can benefit from the project results and how they can achieve the benefits.
        - If it's necessary to use a technical term in the Executive Summary, provide a brief definition or explanation when the technical term is first used.
    - Follow the Style Guide format requirements for headings, figures/tables, citations, and acronyms/abbreviations.
    - Ensure that the document omits subjective comments and opinions. However, recommendations in the conclusion of the report are allowed.
    - Include a brief description of the project results in the Abstract.

- Submit a draft of the report to the CAM for review and comment. The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt
- Consider incorporating all CAM comments into the Final Report. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product
- Submit the revised Final Report and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period or approves a request for additional time.
- Submit one bound copy of the *Final Report* to the CAM along with *Written Responses to Comments on the Draft Final Report*.

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

CAM Product:
- Written Comments on the Draft Final Report

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds
The goal of this subtask is to ensure that the Recipient obtains any match funds planned for this Agreement and applies them to the Agreement during the Agreement term.

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

The Recipient shall:

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

  If match funds were a part of the proposal that led to the Energy Commission awarding this Agreement, then provide in the letter:
  - A list of the match funds that identifies:
    - The amount of cash match funds, their source(s) (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied.
    - The amount of each in-kind contribution, a description of the contribution type (e.g., property, services), the documented market or book value, the source (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied. If the in-kind contribution is equipment or other tangible or real property, the Recipient must identify its

      owner and provide a contact name, address, telephone number, and the address where the property is located.
  - A copy of a letter of commitment from an authorized representative of each source of match funding that the funds or contributions have been secured.
- At the Kick-off meeting, discuss match funds and the impact on the project if they are significantly reduced or not obtained as committed. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide a *Supplemental Match Funds Notification Letter* to the CAM of receipt of additional match funds.
- Provide a *Match Funds Reduction Notification Letter* to the CAM if existing match funds are reduced during the course of the Agreement. Reduction of match funds may trigger a CPR meeting.

Products:

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

Subtask 1.8 Permits

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

The Recipient shall:

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

  The list of permits and the schedule for obtaining them will be discussed at the Kick-off meeting (subtask 1.2), and a timetable for submitting the updated list, schedule, and copies of the permits will be developed. The impact on the project if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in progress reports and will be a topic at CPR meetings.
- If during the course of the Agreement additional permits become necessary, then provide the CAM with an *Updated List of Permits* (including the appropriate information on each permit) and an *Updated Schedule for Acquiring Permits*.
- Send the CAM a *Copy of Each Approved Permit*.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the CAM within 5 days. Either of these events may trigger a CPR meeting.

Products:

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

Subtask 1.9 Subcontracts

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

The Recipient shall:

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

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.

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

IV. TECHNICAL TASKS

*Products that require a draft version are indicated by marking **"(draft and final)"** after the product name in the "Products" section of the task/subtask. If "(draft and final)" does not appear after the product name, only a final version of the product is required. **Subtask 1.1 (Products)** describes the procedure for submitting products to the CAM.*

TASK 2: DEVELOP CUSTOMER VALUE
The goals of this task are to ascertain, through surveys and lab studies, the needs and preferences of various commercial customers to develop the software tools and interfaces necessary to provide customer value in managing energy demand.

The Recipient shall:
- Conduct surveys, and interviews of large commercial building facilities managers and small commercial building stakeholders.
  - Implement online surveys and interviews of key stakeholders
  - Prepare and provide *Customer Value Needs and Preferences Memo,* which will summarize the results of the surveys and interviews, outlining key needs and preferences of commercial customers.

- Develop use cases that maximize the daily operating value to the owner of the project
  - Develop criteria for suitable devices and applications to be demonstrated on the energy management platform

- Select devices and applications for incorporation into the platform
- Prepare and provide a *Customer Value Use Case Report:* written from the customer's perspective of how the project will provide value and benefits.

- Conduct lab testing of prototype user interface
  - Develop prototype user interface
  - Test the user interface with potential customers
  - Prepare and provide a *User Interface Testing Report,* which will describe the design fundamentals of the user interface and summarize the results of testing.

Products:
- Customer Value Needs and Preferences Memo
- Customer Value Use Case Report
- User Interface Testing Report

TASK 3: DEVELOP SYSTEM ARCHITECTURE
The goals of this task are to define, design, and develop the components of the system architecture: the mediator, the price messaging system, the information and compliance transparency module, developments within XBOS to support a variety of networked devices, and applications.

The Recipient shall:
- Develop a negotiation mediator that receives tariff signals from the utility and passes on to the building sites, in turn receiving building demand and passing on to the utility; the mediator coordinates among several building sites.

- Develop the price messaging system
  - Outline applicable compliance regulations
  - Develop the price messaging software module
  - Integrate with other modules
  - Work with the Group 3 recipient from GFO-15-311 to:
    - Understand all the interfaces to and from the Transactive Signal Server (TSS) developed by the Group 3 recipient
    - Document end-to-end use cases and sequence diagrams for interactions with the TSS
  - Develop mechanisms to receive the transactive signal made available by the TSS
  - Process/incorporate the transactive signal
    - Test the communication mechanisms with the TSS in real time in a staging environment
    - Move to production and repeat test
  - Given the timely and compete TSS from the Group 3 recipient, run a demonstration of signal receipt for the Energy Commission in a dispatch demonstration.

- Develop the information exchange module
  - Develop the criteria for suitable information models
  - Locate, modify, and integrate suitable models
  - Integrate with existing XBOS data model

  - Prepare an *Information Exchange Memo,* which summarizes the criteria for suitable information models, and outline the process for integration with the XBOS data model.

- Develop the Demand Response module for XBOS
  - Develop interfaces to hardware devices (e.g., smart thermostats)
  - Implement security
  - Develop user interface
  - Prepare *Software Architecture Memo,* which outlines the various interfaces, security measures, and user interface for XBOS/DR.

- Develop applications
  - Based on the use cases, develop applications and tools required to enable customer value
  - Develop price-based optimization for demand loads

Products:
- Information Exchange Memo
- Software Architecture Memo

TASK 4: DEVELOP, HARDEN AND SCALE XBOS/DR
The goal of this task is to make the XBOS/DR robust and secure.

The Recipient shall:
- Conduct overall security audit and verification of SSL management
- Develop tools for integration with existing building IT infrastructure.
- Provide more complete documentation, including *Tutorials* (which include example exercises to demonstrate how to use the XBOS/DR software system) and *User's Manual* (which outlines how to navigate through and use various elements of XBOS/DR).
- Package system for distribution with an open-source license, including configuration tools, resulting in the delivery of *Packaging, Configuration, and Distribution Scripts* (which describe how to download and configure the software).

Products:
- Tutorials
- User's Manual
- Packaging, Configuration and Distribution Scripts

TASK 5: PILOT TESTING IN SMALL AND LARGE COMMERCIAL BUILDINGS
The goal of this task is to test the ability of the system to control the operation of the devices, to save energy, and to engage customers.

The Contractor/Subcontractor shall:
- Conduct laboratory testing of the Customer-Controlled Price-Mediated Automated Demand Response System in a number of laboratory and living laboratory settings, several of which may include but are not limited to (activities will be reported in the monthly progress reports per subtask 1.5):
  - Room 410 Soda Hall at UC Berkeley

  - Sutardja Dai Hall at UC Berkeley (141,000 square foot building with Siemens Building Management System, and environmental sensors)
  - 2087 Addison Street 2nd floor office in Berkeley (7,500 sf small commercial building with networked thermostats, lighting controls and plugload controllers).
  - The NASA Sustainability Base in Moffett Field (50,000 sf commercial building with Siemens BMS, photovoltaics, fuel cells)
  - Transportation Sustainability Research Center's EV charging station at the Berkeley Global Campus at Richmond Bay
  - Other sites deemed appropriate by CAM

- Recruit pilot test buildings through existing Quantum Energy Services & Technologies, Inc. clients
- Prepare a *Pilot Test Plan for Small-Medium Commercial Buildings*, including the test of hardware (sensors) and applications and an identification of barriers and solutions to deployment.
- Develop a *Pilot Test Plan for Large Commercial Buildings*, for integrating with existing BAS, including an identification of barriers and solutions to deployment.
- Conduct pilot testing of XBOS/DR platform and devices in small-medium commercial building in accordance with the Pilot test plans. These activities will be reported in the Progress Reports.
- Conduct pilot testing XBOS/DR platform as overlay to existing BAS in large commercial building in accordance with the Pilot test plans. These activities will be reported in the Progress Reports.
- Prepare a *Test Report* that includes the quantitative and qualitative results of the pilot tests
  - At least 12 months of technical and economic data collection, including documentation of installation issues, operational constraints, and operational performance
  - Documentation of success, measured in accordance with parameters approved by the Energy Commission.
  - A report on lessons learned and best practices, including a design configuration that provides the highest value to customers, ratepayers, and utilities.
- Participate in CPR per subtask 1.3

Products:
- Pilot Test Plan for Small-Medium Commercial Buildings.
- Pilot Test Plan for Large Commercial Buildings
- Test Report
- CPR Report

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:

- <u>For Product Development Projects and Project Demonstrations:</u>
  - Published documents, including date, title, and periodical name.
  - Estimated or actual energy and cost savings, and estimated statewide energy savings once market potential has been realized. Identify all assumptions used in the estimates.
  - Greenhouse gas and criteria emissions reductions.
  - Other non-energy benefits such as reliability, public safety, lower operational cost, environmental improvement, indoor environmental quality, and societal benefits.
  - Data on potential job creation, market potential, economic development, and increased state revenue as a result of the project.
  - 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.
  - <u>Additional Information for Product Development Projects</u>:
    - 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.
  - <u>Additional Information for Product Demonstrations</u>:
    - Outcome of demonstrations and status of technology.
    - Number of similar installations.
    - Jobs created/retained as a result of the Agreement.

- <u>For Information/Tools and Other Research Studies:</u>
  - Outcome of project.
  - Published documents, including date, title, and periodical name.
  - A discussion of policy development. State if the project has been cited in government policy publications or technical journals, or has been used to inform regulatory bodies.
  - The number of website downloads.
  - An estimate of how the project information has affected energy use and cost, or have resulted in other non-energy benefits.
  - An estimate of energy and non-energy benefits.
  - Data on potential job creation, market potential, economic development, and increased state revenue as a result of project.

  - A discussion of project product downloads from websites, and publications in technical journals.
  - A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
- Respond to CAM questions regarding responses to the questionnaires.

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

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

TASK 7: TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES
The goal of this task is to develop a plan to make the knowledge gained, experimental results, and lessons learned available to the public and key decision makers.

The Recipient shall:
- Prepare an *Initial Fact Sheet* at start of the project that describes the project. Use the format provided by the CAM.
- Prepare a *Final Project Fact Sheet* at the project's conclusion that discusses results. Use the format provided by the CAM.
- Prepare a *Technology/Knowledge Transfer Plan* that includes:
  - An explanation of how the knowledge gained from the project will be made available to the public, including the targeted market sector and potential outreach to end users, utilities, regulatory agencies, and others.
  - A description of the intended use(s) for and users of the project results.
  - Published documents, including date, title, and periodical name.
  - Copies of documents, fact sheets, journal articles, press releases, and other documents prepared for public dissemination. These documents must include the Legal Notice required in the terms and conditions. Indicate where and when the documents were disseminated.
  - A discussion of policy development. State if project has been or will be cited in government policy publications, or used to inform regulatory bodies.
  - The number of website downloads or public requests for project results.
  - Additional areas as determined by the CAM.
- Conduct technology transfer activities in accordance with the Technology/Knowledge Transfer Plan. These activities will be reported in the Progress Reports.
- When directed by the CAM, develop *Presentation Materials* for an Energy Commission-sponsored conference/workshop(s) on the project.
- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the California Energy Commission.
- Provide at least (6) six *High Quality Digital Photographs* (minimum resolution of 1300x500 pixels in landscape ratio) of pre and post technology installation at the project sites or related project photographs.
- 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)
- Presentation Materials (draft and final)
- High Quality Digital Photographs
- Technology/Knowledge Transfer Plan (draft and final)
- Technology/Knowledge Transfer Report (draft and final)

TASK 8: PRODUCT AND MARKET READINESS PLAN

The goal of this task is to determine the steps that will lead to the market readiness and commercialization of the project's results.

The Recipient shall:

- Prepare a *Product and Market Readiness Plan*. The degree of detail in the plan should be proportional to the complexity of producing or commercializing the proposed product, and to its state of development. As appropriate, the plan will discuss the following:
  - Identifying Stakeholders (vendors, service provides, manufacturers)
  - Critical production processes, personnel resources, and support systems needed to support the commercial community of third party vendors.
  - The outcome of product development efforts, such as open license agreements.
  - Other areas as determined by the CAM.

Products:

- Product and Market Readiness Plan (draft and final)

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

RESOLUTION NO: 16-0517-17e

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: UNIVERSITY OF CALIFORNIA, BERKELEY

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

RESOLVED, that the Energy Commission approves Agreement EPC-15-057 from GFO-15-311 with the Regents of the University of California, on behalf of the California Institute for Energy and Environment at the Berkeley campus, for a $4,000,000 grant to improve small and large commercial customer participation in demand response by providing a cost-effective energy management system that allows a wide range of hardware and service offerings and automated price-based management; 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 May 17, 2016.

AYE: [List of Commissioners]
NAY: [List of Commissioners]
ABSENT: [List of Commissioners]
ABSTAIN: [List of Commissioners]

Cody Goldthrite,
Secretariat