

**GRANT REQUEST FORM (GRF)**

CEC-270 (Revised 10/2015)

CALIFORNIA ENERGY COMMISSION

New Agreement EPC-15-083 (To be completed by CGL Office)

Division	Agreement Manager:	MS-	Phone
ERDD	David Hungerford	51	916-327-2341

Recipient's Legal Name	Federal ID Number
Ohmconnect, Inc.	46-4395720

Title of Project
Empowering Proactive Consumers to Participate in Demand Response Programs

Term and Amount	Start Date	End Date	Amount
	5/18/2016	6/28/2019	\$ 3,995,028

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

Proposed Business Meeting Date	5/17/2016	<input type="checkbox"/> Consent	<input checked="" type="checkbox"/> Discussion
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Business Meeting Presenter	David Hungerford	Time Needed:	5 minutes
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Please select one list serve. Select

**Agenda Item Subject and Description**

OHMCONNECT, INC.. Proposed resolution approving agreement EPC-15-083 with Ohmconnect, Inc. for a \$3,995,028 grant to develop and conduct experiments evaluating methods of encouraging proactive consumer participation in DR programs. The project will develop, test and refine information communication and automation techniques that maximize customer engagement in DR events and low-cost telemetry solutions that facilitate participation in California Independent System Operator markets.


**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

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: Cal. Code Regs., tit 14, § 15301 -- Cal. Code Regs., tit 14, § 15306  
 Common Sense Exemption. 14 CCR 15061 (b) (3)  
 Explain reason why Agreement is exempt under the above section:  
 Cal. Code Regs., tit. 14, sec. 15301 provides that projects which consist of the operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, and which involve negligible or no expansion of use beyond that existing at the time of the lead agency's determination, are categorically exempt from the provisions of the California Environmental Quality Act. This project will distribute "smart" thermostats and power strips to existing residential homes. Between 3000-5000 electric utility customers will be eligible to receive one of the two following types of equipment: 1) a wifi-enabled "smart" thermostat or 2) a wifi-enabled "smart" power strip. The "smart" thermostats will be installed either by a professional or by the homeowner, following the same protocols required by "regular" thermostats with the addition of a WiFi communication step, which involves enabling settings and entering passwords—like setting up a wifi link for a mobile phone or computer. The "smart" power strips are "plug-and-play" and will be installed by the homeowner, which simply requires plugging in the device and connecting the device to the recipient's web-based energy management platform. The smart thermostats are approximately the size of a deck of cards and will be wall-mounted. The smart power strips are the size of a conventional power strip and are plugged in to a standard wall outlet. Therefore, the project will not have a significant effect on the environment and falls within section 15301.  
  
 Cal. Code Regs., tit. 14, sec. 15306 provides that projects which consist of basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource. In this project, electricity consumption data will be collected from the small smart thermostats and power strips described in the paragraph above. All devices will be controlled through a web portal. During energy-reduction events, the recipient will reduce electricity usage as controlled by these devices. Therefore, the project will not have a significant effect on the environment and falls within section 15306.  
 b) Agreement **IS NOT** exempt. (Consult with the legal office to determine next steps.)  
 Check all that apply  
 Initial Study  Environmental Impact Report  
 Negative Declaration  Statement of Overriding Considerations  
 Mitigated Negative Declaration

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

Legal Company Name:	Budget
Schneider Electric USA Inc.	\$ 300,000
Electric Power Research Institute, Inc.	\$ 336,000
Honeywell, Inc.	\$ 300,000
The Regents of the University of California	\$ 226,841
Customized Energy Solutions	\$ 95,000
TBD SCADA Provider	\$ 44,000
TBD Professional Services	\$ 50,000
TBD - Technical Writer	\$ 30,000
TBD - Survey Research Contractor	\$ 23,159



## I. TASK ACRONYM/TERM LISTS

### A. Task List

Task #	CPR <sup>1</sup>	Task Name
1		General Project Tasks
2	X	Project Setup and R&D on User Acquisition
3		Experimental Evaluation of Automation and DR Dispatch
4		R&D: Solutions for Residential Telemetry
5		Reports and Recommendations
6		Evaluation of Project Benefits
7		Technology/Knowledge Transfer Activities

### B. Acronym/Term List

Acronym/Term	Meaning
API	Application Program Interface
AS	Ancillary Services
CAISO	California Independent System Operator
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CES	Customized Energy Solutions
CISR	Customer Information Service Request
CPR	Critical Project Review
DPG	Digital Processing Gateway
DR	Demand Response
DRP	Demand Response Provider
IoT	Internet of Things
IOU	Investor-Owned Utility
OC	OhmConnect, Inc.
PG&E	Pacific Gas & Electric
Recipient	OhmConnect, Inc.
RIG	Remote Intelligent Gateway
SCE	Southern California Edison
SDG&E	San Diego Gas & Electric
TAC	Technical Advisory Committee

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

### A. Purpose of Agreement

The purpose of this Agreement is to fund applied research and development to better understand the three largest barriers for residential, third-party demand response (DR)

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<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.

programs: (1) user acquisition, (2) user yield, and (3) affordable telemetry. This project will develop data and analysis to inform policymakers on how to overcome the institutional, technological, and regulatory barriers that prevent large-scale participation of residential homeowners in aggregation programs managed by demand response providers (DRPs) for participation in wholesale energy markets, and create a solution to enable residential telemetry that provides sufficient information to meet participation requirements for wholesale energy products. This project is intended to develop market-based grid management solutions that increase the flexibility and resiliency of grid infrastructure by developing a pathway to create a novel, crowd-sourced energy resource; that enables small consumers to interact with wholesale markets by leveraging two major trends: energy awareness and the Internet of Things (IoT)..

## **B. Problem/ Solution Statement**

### **Problem**

Currently, the market for third-party DR is constrained by market barriers, which limits this enormous resource from contributing to the grid. To resolve this problem, the electrical system must transform from its current unidirectional grid into a transactive energy network that enables consumers to provide intelligent management of their loads and distributed energy resources to not only draw electricity from the grid, but to contribute as well..

### **Solution**

By using control signals to interact with both distribution and wholesale-level resources, the grid's capacity to incorporate and engage innovative grid resources can be increased. This project will develop and conduct experiments that test residential homeowners' level of interest in participating in direct market services and identify improved telemetry approaches. The project will develop technologies and strategies to test user acquisition (e.g., enrollment of energy consumers into a DR program/platform) and user yield (e.g., user responsiveness to DR event signaling). In addition, it will provide data on the reliability and accuracy of lower-cost telemetry approaches in residential applications, with the goal of enabling aggregated small customer provision of ancillary services.

## **C. Goals and Objectives of the Agreement**

This project will be split into three activities: (1) *Task 2: Project Setup and R&D on User Acquisition* (e.g., User Acquisition), (2) *Task 3: Experimental Evaluation of Automation and DR Dispatch* (e.g., User Yield), and (3) *Task 4: R&D: Solutions for Residential Telemetry*. Task 2 will enroll a user base to be studied and collect information on which user acquisition and yield methodologies are most successful. Task 3 will include evaluation of DR programs to empirically measure the amount of energy reduced during event calls relative to an experimental counterfactual. Task 4 will develop a low-cost software solution to provide telemetry for residential users and solicit feedback on its approach, development, and potential viability from key stakeholders such as the CAISO.

**Agreement Goals:** The goals of this Agreement are to:

- Design technological and behavioral experiments (the "Experiments"), the results of which will inform DR providers and utilities about how to design DR programs and policies that effectively engage users and result in significant improvement to grid stability and performance. The experiments will be designed to answer the following specific research questions (see Tasks 2 and 3):

- Which methods of customer acquisition are most effective?
- What is the effect of up-front subsidies and information on remote automation technology adoption?
- What is the return in yield and compliance for a given incentive level?
- How do various engagement strategies compare with respect to DR event compliance, yield, and retention? Specifically, what is the causal effect of varying message targeting, incentives, education, and message content?
- Develop the ability to process and distribute a transactive signal to be provided by the Group 3 awardee under GFO 15-311 (see Task 2);
- Recipient will enroll a minimum of 12,500 users in order to implement automated and behavioral experiments (see Task 2);
- Create “shadow curves” to quantify the average level of a user’s demand reduction under various price incentives (see Task 3);
- Propose and validate a software solution to provide low-cost telemetry and communication that meet requirements for supply-side services (see Task 4); and
- Compile a set of institutional and policy recommendations to enable these new resources to expand outside this grant.

**Ratepayer Benefits:** This Agreement will result in savings for ratepayers. The software platform developed by this Agreement and DR program implemented by it will help stabilize the grid by more effectively coordinating demand and all supply resources (including grid-edge resources), thereby immediately reducing peak demand on the state’s energy generation facilities and creating statewide savings for all ratepayers in the short term. This project will facilitate integration of additional renewable generation and storage at the consumer level into two-way grid operations by providing a mechanism by which the costs of communicating system need and enabling operation of demand response is lowered, making utilization of smaller, distributed resources more cost-effective, effectively enabling renewables to become a grid-edge resource. Increasing the availability and usability of grid-edge resources will reduce the need for central energy generation plant expansion, creating savings for all ratepayers over the long term. This increased innovation will both speed the development of higher-efficiency, lower-cost grid-edge technologies and incentivize solutions that streamline both the temporal and locational operations of the grid, thus increasing their contribution to electricity reliability.

This Agreement will result in increased reliability by reducing the complexity necessary to engage grid-edge resources as grid assets, thereby increasing the pool of accessible grid resources. Valuing grid-edge assets for the services that they can provide on the wholesale markets will create value for participants that can provide changing loads. Residential participants cannot access the energy markets alone, as they do not have a sufficient amount of reductions to be considered by the CAISO individually. As the minimum threshold is 100 kilowatts (kW), aggregations of various residences to reduce electricity would empower grid-edge technologies. This new market would enable innovation in the terms of business opportunities, as determined by the size and scope of the market.

Grid-edge and wholesale energy technologies complement each other. By having both operate under the same markets and control standards, the overhead historically associated with interfacing with new grid-edge technologies will be permanently reduced. Having the option to crowd-source grid services increases the grid’s options, enabling it to gain a novel; versatile; and reliable service while decreasing its reliance on carbon-intensive peaker plants.

**Technological Advancement and Breakthroughs:** This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's energy goals by engaging grid-edge technologies to respond to supply-side product signals.

This agreement will result in technology being created to overcome the formidable barrier of providing real-time data for telemetry purposes. The recipient has already evaluated methods to overcome this barrier by using substitutes for traditional telemetry solutions. This Agreement will implement those methods, to test their viability as breakthrough technology. The recipient will use a Data Processing Gateway (DPG) as a conduit for submeters, greatly lowering the barrier to entry for residential homes. The recipient will work closely with industry leaders, policymakers, and experts in developing the proposed solution.

**Agreement Objectives:** The objectives of this Agreement are to:

- Design and develop project-specific enhancements to the OhmConnect Platform, to enable experimentation for Task 2 and Task 3;
- Acquire a minimum user base of 12,500 users to the OC Platform to enable statistically significant measurements and data analysis (See Task 2, Subtask 2.3);
- Determine the most effective methods of recruiting and retaining users of the OC Platform ("Users") (See Subtask 2.4);
- Design and implement randomized, controlled experiments that will determine the most effective methods of obtaining user responses to DR event signaling from both automation and behavioral responses (See Task 3);
- Design and implement randomized controlled experiments to estimate a Shadow Curve quantifying the average level of load reduction at different price points (See Task 3);
- Design, implement, and build a software solution to transport telemetry data from residential homeowners to wholesale energy markets in real-time (See Task 4);
- Interface with regulators, policymakers, and industry leaders including the CAISO to arrive at a feasible telemetry solution for residential homes (See Task 4.1);
- Produce a report on the telemetry solution framework and recommendations (See Subtask 4.6);
- Produce Reports and Recommendations (Task 5) on Customer Feedback, Policy Recommendations, State of the Market, and API (application program interface) Standards Best Practices.

### 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 towards 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
- 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, 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 Project Setup and R&D on User Acquisition**

The goals of this task are to recruit project participants or “users” (see Task 3). The total user enrollment goal will incorporate a minimum of 2,000 existing users and recruit additional new participants to hit the minimum requirement of 12,500 users.

### **Subtask 2.1 Extension of the OC Platform**

The goal of this subtask is to modify the current OC Platform software to incorporate the experimental program needed for Tasks 3 and 4 and to enable users to visualize their participation in multiple energy products.

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

- Create and host *Project Landing Pages Presentation* on the OC Platform for the purposes of educating and attracting users to the program. The presentation will include:
  - A brief description and demonstration of the platform components; and
  - FAQs that provide details about the program.
- Develop an automated negotiation process (“handshake”) with the Green Button Data equivalent at PG&E, SCE, and SDG&E, to enable consumers to provide their utility data to this platform outside of the current Customer Information Service Request-Demand Response Provider CISR-DRP process, which is the primary mechanism for existing market products such as day-ahead energy.
  - Develop Green Button Negotiation Process Documentation that discusses the “handshake” process associated with gaining consumer utility data from each IOU.

#### **Products:**

- Project Landing Pages Presentation
- Green Button Negotiation Process Documentation

### **Subtask 2.2 Creation of Dispatch Signal Platform for Multiple Energy Products**

The goal of this subtask is to modify the existing OC Platform to enable user participation in multiple energy products beyond the single energy product (day-ahead energy) currently offered.

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

- Diagram various market signals that will be used, in order of importance, and incorporation of user preferences in a *User Dispatch Diagram*, which includes but is not limited to the following:
  - Modify the existing dispatch mechanism on the OC Platform to accommodate multiple dispatch parameters. The existing dispatch mechanism currently relies on a single data stream from the CAISO; project-specific modifications to this mechanism will include:
    - Intelligently process and prioritize market and transactive signals based on a standard set of variables, including customer preferences, frequency of events, length of event, value of event in dollars per kilowatt-hour, and timing of the event.
    - Incorporate the market and transactive signals into the development of automated dispatches for devices.
- Incorporate user preferences and user devices into the dispatch mechanism.

- Enable specific device control tailored for the user, the user preferences, the type of dispatch occurring, and the type of device.
- Produce a *User Dispatch Diagram* that documents the multiple dispatch mechanism functionality created under this task.

**Products:**

- User Dispatch Diagram

**Subtask 2.3 Transactive Signal Processing**

The goal of this subtask is to create a means for the OC Platform to incorporate transactive signals developed by EPRI, the Group 3 awardee under GFO 15-311. These signals will be used in a dispatch algorithm communicated to end users for the experiments in Task 3.

**The Recipient shall:**

- Incorporate the transactive signal into the Dispatch Signal Platform developed in Subtask 2.2.
- Process the transactive signal into the design of multiple energy products.
  - Incorporate the signals into the development of automated dispatches for multiple devices, including but not limited to communicating thermostats and other communicating devices capable of controlling customer loads
- Run a demonstration of the dispatch for the CAM and prepare a *Dispatch Demonstration Presentation* that includes, but is not limited to, a discussion of the development of automated dispatches for multiple devices.

**Products:**

- Dispatch Demonstration Presentation

**Subtask 2.4 Project-wide User Acquisition**

The goal of this subtask is to acquire users for the project experiments in Task 3. For operational efficiency and to eliminate duplication of the activity description across multiple subtasks, this task aggregates the User Acquisition activities for each experiment in Task 3. This project-wide user acquisition subtask will acquire, at minimum, 12,500 total OC Platform users to respond to DR events in California.

**Subtask 2.4.1 User Acquisition Tactics**

The goal of this subtask is to create a user acquisition strategy and create a tactical implementation timeline.

**The Recipient shall:**

- Identify a minimum of 2,000 participants to be solicited from the existing OhmConnect customer base.
- Create a tactical timeline for task completion over two 6-month periods in *Project Schedule – User Acquisition 2016* and *Project Schedule – User Acquisition 2017*.
- Detail the planned User Acquisition strategies, tactics, and timeline in the *User Acquisition Summary Memo*.

**Products:**

- User Acquisition Summary Memo
- Tactical Implementation Timeline – User Acquisition 2016
- Tactical Implementation Timeline – User Acquisition 2017

**Subtask 2.4.2 Platform Development to Iterate on User Acquisition**

The goal of this subtask is to build the required hooks for the OC Platform to enable experimentation for both direct and indirect pathways.

**The Recipient shall:**

- Design and build landing pages tailored to each acquisition channel.
- Implement a tracking system to ensure that all users coming through each acquisition channel are tracked properly.
- Create analytic tools to understand the signup rates, registration rates, and overall acquisition rates of both new users signed up and new users visiting the site.
- Build real-time alerts to alert the Recipient when acquisition channels are performing well or performing poorly.
- Provide webinar to CAM in a *Platform Development Walkthrough Webinar* which will include discussion of the tracking system, analytic tools used to assess signup tactics and real-time alerts.

**Products:**

- Platform Development Walkthrough Webinar

**Subtask 2.4.3 Execute Direct User Acquisition Strategies**

The goal of this subtask is to execute the direct user acquisition strategies.

**The Recipient shall:**

- Enroll at least 1000 users via non-incentivized and incentivized direct user acquisition methods.
- Experiment with the following different variables on the splash page to see its effect on user acquisition, including four (4) different levels of depth in the messaging, four (4) calls to action, four (4) different images to encourage users to save, and four (4) different options of links exposed on the splash page.
- Create a set of at least twelve (12) one (1)-month-long experiments that test these different variables.
- Document results in a *Direct User Acquisition Results Memo*

**Products**

- Direct User Acquisition Results Memo

**Subtask 2.4.4 Execute Indirect User Acquisition Strategies**

The goal of this subtask is to execute the indirect user acquisition strategies.

**The Recipient shall:**

- Enroll at least 1000 users via referral-based mechanisms detailed in Subtask 2.4.1.
- Experiment with the following different incentive mechanisms to analyze their user acquisition effectiveness: three (3) different referral incentives for direct referrals, three (3) different group incentives, and three (3) different incentives for different treatments

- Conduct six (6) two-month-long experiments to test performance of different incentive mechanisms.
- Document results in an *Indirect User Acquisition Results Memo*.

**Products:**

- Indirect User Acquisition Results Memo

**Subtask 2.4.5 Report on User Acquisition Strategies**

The goal of this subtask is to report on the results of direct and indirect user acquisition.

**The Recipient shall:**

- Present the results of user acquisition efforts from Subtasks 2.4.3 and 2.4.4
- Document results of project-wide user acquisition efforts in a *User Acquisition Results Report*. The *User Acquisition Report* will include, but not be limited to, the following information:
  - Overall cost of customer acquisition;
  - Timeline of user acquisition;
  - Breakdown of customer acquisition across direct vs. indirect channels; and
  - Documentation of the comparative cost-effectiveness of different user acquisition strategies.
  - Prepare a *CPR Report* in accordance with subtask 1.3 (CPR Meetings).
  - Participate in a CPR meeting.

**Products:**

- User Acquisition Results Report
- CPR Report

**TASK 3 Experimental Evaluation of Automation and DR Dispatch**

The goal of this subtask is to assign the enrollees to various price and behavioral interventions described below.

**The Recipient shall:**

- Assign participants to differing levels of encouragement to adopt remote automation technologies, conditional on their existing technology profile. This will be achieved by randomly encouraging 40% of participants determined by Subtask 3.1 to adopt a specified automation technology and participate in remote compliance. These participants will receive messages for the Phase I (the first three months of enrollment). The remaining 60% will not receive additional encouragement and will be divided so that 40% of the sample will be sent messages during Phase I and 20% will be pure controls.
- Assign participants to differing *price interventions* to estimate the demand curve (or Shadow Curve) for DR dispatch. This will be achieved by randomly assigning 80% of participants upon enrollment to at least two different price levels where the wholesale market revenue is shared at varying rates. The remaining 20% of participants will be assigned to the control group. This assignment will hold for Phase I and II (the first six months of enrollment) (see Figure 2, above). Participants will be reassigned to different price levels in Phase III (the duration of the study).
- Assign participants to differing levels of *targeted interventions* to estimate potential for improvement of dispatch efficiency. Randomly assign 80% of users in any of the treatment arms from Phase I to a “Targeted” or a “Generic” group in equal proportions

for Phase II. There will be no pure control group. Instead, the control will be continuing messaging as conducted in Phase I.

- Assign participants to differing *information and behavioral interventions* to estimate the effect of price salience and social comparison within message content and attention/messaging frequency on participant yield and compliance.
  - Information Interventions – After completion of Phase I and (if applicable) Phase II, 50% will be randomly assigned to an information treatment, which will educate participants on the nature of the wholesale market for electricity and the potential economic and environmental value of DR compliance. The other 50% will not receive information treatments.
  - Behavioral Interventions – After completion of Phase I and (if applicable) Phase II, at each event called, participants will randomly be assigned to one of two of the behavioral interventions below or a control group in equal proportions. Specifically, 67% will be assigned to one of two interventions in equal proportions and 33% will not receive messages and serve as controls. The potential interventions are detailed below:
    - Price Salience – Treatment groups will receive messages that display the level of DR incentive in the message content or a message with no price information and a simple call to reduce. Controls will receive no message.
    - Social Comparison – Treated groups will receive a message with social comparisons to peers in message content or a message with no social comparison content. Controls will receive no message.
    - Attention – Treated groups will receive more messages within a week or less messages within a week. Controls will receive no message.
- Document full implementation of assignment in a *User Assignment Paper*.

### **Subtask 3.1 Conduct Preliminary Participant and Automation Technology Study**

The goal of this subtask is to fully characterize each household's automation potential (type and number of automation technologies).

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

- Identify the most popular products to be integrated for users from each category based on total number of units sold from each category.
- Build device integration into each product included in the study to enable remote automation participation.
- Conduct a voluntary survey to obtain more information about the sample participants (household demographics, building characteristics, etc.).
- Prepare an *Automation Yield Study: Baseline Report* which 1) identifies the technologies to be tested, 2) summarizes the penetration of automation technologies in the participant sample, 3) summarizes survey results, and 4) informs the assignment of users to treatment and control groups in Subtask 3.2.

#### **Products:**

- Automation Yield Study: Baseline Report

### **Subtask 3.2 Assignment of Program Participants to Treatment and Control Groups**

The goal of this subtask is to assign the 12,500 enrollees to various price and behavioral interventions.

**The Recipient shall:**

- Assign participants to differing *encouragement interventions* for remote automation technology adoption, based on their existing technology profile.
- Assign participants to differing *price interventions* to estimate the demand curve (or Shadow Curve) for DR dispatch.
- Assign participants to differing levels of *targeted interventions* to estimate potential for improvement of dispatch efficiency.
- Assign participants to differing *information and behavioral interventions* to estimate the effect of price salience and social comparison within message content and attention/messaging frequency on participant yield and compliance.
- Document full implementation of assignment in a *User Assignment Paper* that describes and documents participant assignment to the different interventions.

**Products:**

- User Assignment Paper

**Subtask 3.3 Implementation of the Experiments**

The goal of this subtask is to assign participants to treatment and control groups, collect relevant data, validate treatment assignment at the beginning and during the course of the experiment, and develop an Adaptive Targeting algorithm. These activities will be documented and summarized in an *Experimental Design Paper*. This paper will summarize all results associated with Subtasks 3.3.1, 3.3.2, 3.3.3, and 3.3.4.

**Products:**

- Experimental Design Paper

**Subtask 3.3.1 Assign Participants to Different Automation Incentive Treatments**

The goal of this subtask is to assign participants to different incentive treatments for adopting home automation technology as defined in Subtask 3.2 to estimate the causal effect of the different incentive levels on both adoption of home automation technology and demand response performance.

**The Recipient shall:**

- Provide participants with devices, including but not limited to WiFi-enabled thermostats, “Smart Plugs”—power strips with communication capability into which customers can plug devices they wish to control remotely, and electric vehicle charging stations with communications capability, to serve as incentives to adopt home automation technology according to their assignment in Task 3.2.
- Collect data for analysis in Subtask 3.4.1.

**Subtask 3.3.2 Assign Participants to Different DR Price Incentive Treatments**

The goal of this subtask is to provide different price incentives to program participants over the course of the experiment in order to document participant price response to DR different incentive levels, from which a proxy DR demand curve can be estimated.

**The Recipient shall:**

- Provide treatment groups with different levels of price incentives
- Collect data for analysis in Subtask 3.4.2.

### **Subtask 3.3.3 Assign Participants to Different Information and Behavioral Intervention Treatments**

The goal of this subtask is to provide different information and behavioral treatments to program participants in order to document participant response to those treatments, from which the relative effectiveness of different treatments can be estimated.

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

- Provide participants different information treatments and behavioral interventions depending on assignment in Subtask 3.2.
- After receiving information treatment (if applicable), send behavioral treatment signals to the different treatment groups as defined in Subtask 3.2.
- Collect data relevant to estimating the causal effects of information and behavioral interventions on user load reductions for analysis in Subtask 3.4.3.

### **Subtask 3.3.4 Assignment Validation and Implementation of the Adaptive Targeting Algorithm**

The goal of this subtask is to validate the random assignment mechanisms at the beginning and during the course of this experiment, and to develop and implement the Adaptive Targeting Algorithm.

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

- Validate the random assignment mechanism by performing statistical analysis of the composition of the different treatment and control groups.
- Develop and implement the Adaptive Targeting Algorithm:
  - At the end of Phase I of the experiment, determine the level of responsiveness of individual users in the “Targeted” group.
  - During Phase II, resume DR messaging for the “Generic” group the same way as during Phase I. Within the “Targeted” group, increase the frequency of sending DR messages to users which have shown high responsiveness during Phase I.
- Collect data for analysis in Subtask 3.4.4.

### **Subtask 3.4 Evaluation of the Experiments**

The goal of this subtask is to utilize the data collected in Subtask 3.3.1, 3.3.2, 3.3.3, and 3.3.4 to estimate (1) the effect of adopting automation technologies, (2) the effect of price on observed load reductions and its dependency on the automation level, (3) the effects of price salience and social comparisons on energy reduction behavior, and (4) the accuracy and validity of previously developed non-experimental estimators and the causal effect of adaptive targeting. All implementation steps and results in Subtasks 3.4.1 to 3.4.4 will be summarized in an *Experimental Evaluation Paper*.

#### **Products:**

- Experimental Evaluation Paper

### **Subtask 3.4.1 Estimation of the Effect of Automated Remote Compliance Adoption**

The goal of this subtask is to use data collected in Subtask 3.3.1 to analyze the effect of different automation technologies on participants’ responses to events.

**The Recipient shall:**

- Estimate the causal effect of adopting different automation technologies on participants' responses during event and non-event periods by comparing response rates among enrollees who marginally adopt.

**Subtask 3.4.2 Estimate the Effect of Price on Load Reduction**

The goal of this subtask is to use the data collected in Subtask 3.3.2 to estimate demand response demand curve.

**The Recipient shall:**

- Estimate the demand curve due to demand response.

**Subtask 3.4.3 Estimation of the Effects of Behavioral Interventions**

The goal of this subtask is to use the data collected in Subtask 3.3.3 to estimate the effect of behavioral interventions on participants' responses to events.

**The Recipient shall:**

- Estimate the causal effect of providing participants with information about the functioning of the wholesale market on user response and engagement by comparing the average treatment effects of the information treatment groups as defined in Subtask 3.3.3.
- Estimate the causal effects of Price Salience, Social Comparisons, and messaging frequency as described in Task 3 on user responses by comparing the outcomes of those receiving different treatments.

**Subtask 3.4.4 Estimation of the Effect of Adaptive Targeting**

The goal of this subtask is to use the data collected in Subtask 3.3.4 to validate non-experimental estimates of the Adaptive Targeting algorithm and to estimate the causal effect of adaptively targeting participants in Subtask 3.3.4.

**The Recipient shall:**

- Evaluate the performance of the estimation component of the adaptive targeting algorithm by benchmarking its non-experimental estimates of individual treatment effects against the experimental estimates obtained in the shadow curve estimation.
- Estimate the causal effect of adaptive targeting on the measured energy use reduction per call by comparing the treatment effects for usage response and engagement between the "Targeted" and "Generic" groups as defined under Task 3.

**Subtask 3.5 Verification of Reductions**

The goal of this Subtask is to ensure that the energy reductions as calculated by the OC Platform meet CAISO requirements.

**The Recipient shall:**

- Evaluate the data integrity with respect to CAISO reporting standards.
- Ensure compliance with all requirements to sell market products to the CAISO.
- Take best practices from other balancing authorities for advanced market products, like ancillary services, to form a temporary set of requirements for data integrity. Discuss these requirements directly with CAISO.
- Document verification of energy reductions and conformance with CAISO requirements in a *Reduction Verification Memo*.

## Products

- Reduction Verification Memo

### **Subtask 3.6 Conduct Survey of Stated Preference for Interventions**

The goal of this subtask is to solicit stated preferences for various interventions and compare with observed compliance decisions from the experimental evaluation. These data will be used to complement the existing evaluation strategy and perform a welfare analysis.

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

- Conduct voluntary follow-up surveys via email with participants, and if required, mailers and phone calls. The surveys shall gather data necessary to trace out “willingness to pay” (WTP) curves using contemporary techniques, as demonstrated in Allcott & Taubinsky (2015) and Allcott & Kessler (2015), to understand stated preference.<sup>2,3</sup> The sample for the survey will be a 75% random selection of the enrolled at the end of Phase I/II. The surveys will solicit WTP for:
  - Automated Remote Compliance technology; and
  - Behavioral Interventions.
- Trace out WTP curves based on data obtained from surveys.
- Conduct a welfare analysis
- Compile follow-up survey results in a *Survey Results Memo*

## Products

- Survey Results Memo

### **TASK 4 R&D: Solutions for Residential Telemetry**

The goal of this task is to design and implement a low-cost telemetry solution that can facilitate participation by residential demand response resources in the CAISO’s Real-Time Market (RTM) and Ancillary Services (AS) Market.

#### **Subtask 4.1 Identify Existing Requirements**

The goal of this subtask is to determine the scope of solutions that can be implemented at the CAISO to make participation requirements for market products such as ancillary services less burdensome for participants.

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

- Coordinate with the CAISO to establish a revised set of requirements for ancillary services and options for telemetry, including review of the following documents:
  - CAISO Business Practice Manual (BPM) for Direct Telemetry
  - CAISO New Resource Implementation Guide
  - CAISO Remote Intelligent Gateway (RIG)/Data Processing Gateway (DPG) Validation Procedure
  - California Public Utilities Commission (CPUC) Supply Resource DR Integration Working Group telemetry recommendations

- Determine the requirements needed, including local regulatory authority approval, CAISO approval and NERC approval, and WECC approval, as applicable; and data provision.
- Identify a minimum of three (3) IoT devices from the *Automation Yield Study: Baseline Report* product of Subtask 3.1 from which to collect customer-level data for residential telemetry.
- Document solution requirements in the *Market Products Study: Telemetry Requirements Outline*, including the devices to be studied and the key personnel to approve telemetry solutions for use in the CAISO's Ancillary Services Market.

**Products:**

- Market Products Study: Telemetry Requirements Outline

**Subtask 4.2 Telemetry Options Compatible with Mass Market Cost Points and Grid Operator Rationale**

The goals of this subtask are to identify acceptably robust and cost-compatible telemetry options for aggregation of residential demand response resources, and to vet options with grid operators like the CAISO to assess acceptability.

**The Recipient shall:**

- Interview grid operators to identify differences between regional telemetry requirements and acceptable alternative options that may lower costs.
- Develop an architectural diagram to describe a lower-cost telemetry solution proposal.
- Summarize findings in a *Market Products Study: Initial Solution Proposal* on providing telemetry to the CAISO for residential aggregation and include results of meetings with key personnel (including CAISO) to refine and finalize the Proposal based on comments by CAISO.

**Products:**

- Market Products Study: Initial Solution Proposal

**Subtask 4.3 Technical Development of Low-cost Telemetry System**

The goal of this subtask is to procure, install, configure, and write necessary software for interfacing with balancing authorities such as the CAISO and Load Serving Entities such as the IOUs and providing a lower-cost DPG solution, which is acceptable to the CAISO, for providing telemetry for aggregations of residential customer DR assets.

**The Recipient shall:**

- Implement a (DPG) system with adequate communication transfer (and optional control) capabilities to demonstrate telemetry capabilities.
- Implement a software interface to support data exchange with the residential customer data aggregation system.
- Specify a data aggregation system API required to support exchange of aggregated residential customer data.
- Procure equipment necessary for the DPG.
- Install the equipment at a facility for hosting and pilot testing (e.g., OhmConnect office).
- Create APIs capable of transferring data between different software systems and hardware platforms in order to conduct Subtask 4.4.2

- Document the system architecture of the DPG in a System Architecture Diagram for Demonstration of a RIG-like Solution for Mass Markets Memo.

**Products:**

- System Architecture Diagram for Demonstration of a RIG-like Solution for Mass Markets Memo

**Subtask 4.4 Overall System Implementation, Integration and Demonstration**

The goal of this subtask is to implement telemetry options compatible with mass market cost points and grid operator rationale, as described in Subtask 4.2.

**The Recipient shall:**

- Implement a pilot of the initial solution as detailed in the *Market Products Study: Initial Solution Proposal* in Subtask 4.2.
- Test the aggregation of grid-edge resources for provision of ancillary services using the parameters in subtasks 4.4.1 through 4.4.5.
- Create a *Market Products Study: Interim Review Memo* to inform the Energy Commission on the solution implementation process and identify any major implementation barriers and approaches to overcome these barriers.

**Products:**

- Market Products Study: Interim Review Memo

**Subtask 4.4.1 Customer-specific Data Collection**

The goal of this subtask is to collect customer data via grid-connected devices.

**The Recipient shall:**

- Coordinate with device manufacturers and participating customers to enable real-time communication (via ZigBee) between customers' devices and utility smart meters.
- Verify that connected devices are communicating customers' consumption data to OhmConnect, via the Internet, at sufficiently high frequency (e.g., every 10 seconds) and with high reliability (e.g., missing or unavailable data in no more than 5% of intervals).
- Work with EPRI to ensure device-level data is of sufficient quality so that, upon aggregation, it will meet the requirements for data input to the DPG.
- Document status of integration in *Customer Data Collection Memo* that summarizes the activities of this Subtask, but which shall not include any personal information.

**Products**

- Customer Data Collection Memo

**Subtask 4.4.2 Aggregation of Data Across Customers**

The goal of this subtask is to perform the data aggregation, data transformation, and data transfer necessary to successfully communicate with the DPG developed in Subtask 4.3.

**The Recipient shall:**

- Extract, transform, and load (ETL) data from customer-specific data streams.
- Verify that timestamps align for customer-specific data streams, such that the aggregated data stream represents a well-defined time interval (e.g., 30 seconds).
- Implement logic for estimating missing or erroneous customer-specific interval data (e.g., replace missing interval(s) with value from last valid interval).

- Aggregate all data collected after the initial ETL.
- Run additional ETL on the aggregated data.
- Engage in data de-duplication.
- Look for outliers, including negatives.
- Build in error-handling functionality on the ETL data.
- Work with EPRI to build communication protocols to the DPG developed in Subtask 4.3.
- Document data aggregation status in *Data Aggregation Memo*.

**Products**

- Data Aggregation Memo

**Subtask 4.4.3 DPG Implementation Demonstration**

The goal of this subtask is to demonstrate that the DPG developed in Subtask 4.3 is functional for data transfer. This subtask will demonstrate transfer of aggregated resource-level data from OhmConnect to CAISO per the requirements established in Subtask 4.2.

**The Recipient shall:**

- Demonstrate that data collection inbound from OhmConnect is transferrable to the CAISO system, verifying that the telemetry transferred meets requirements under different iterations of data streams.
- If calculated relative error measures exceed thresholds acceptable to CAISO, identify actions to improve precision of proposed telemetry solution (e.g., refine process for estimating missing customer-specific submetered device data).
- Summarize transferability of collected data to assess effectiveness of tested telemetry solutions in a *Presentation: Telemetry Solution Implementation*.

**Products:**

- Presentation: Telemetry Solution Implementation

**Subtask 4.4.4 Test Plan for Solution Demonstration**

The goal of this subtask is to create a data transfer plan with the CAISO for a minimum of three (3) events to test the DPG’s bi-directional communication capabilities and the ability of the residential demand response resource(s) to provide ancillary services to the CAISO.

**The Recipient shall:**

- Prepare a test plan for the DPG solution implemented in Subtask 4.4.3.
- Develop a map for transfer of aggregated customer load data.
- Develop a plan for error handling that includes actions to accelerate collection, aggregation, and communication of data.
- Collect feedback from CAISO on the test plan, considering the ability of CAISO’s energy management system (EMS) to assume control, via DPG, over OhmConnect’s DR dispatch engine.
- Develop a test plan to measure the effectiveness of telemetry solutions
- Summarize the telemetry solution test plan and describe its ability to meet meeting CAISO requirements in a *Presentation: Telemetry Solution Test Plan*.

**Products:**

- Presentation: Telemetry Solution Test Plan

#### **Subtask 4.4.5 Assess Effectiveness of Telemetry Solution Implementation**

The goal of this subtask is to review the results of aggregating data from residential customers to assess effectiveness of the implemented telemetry solution in passing the data to the CAISO.

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

- Perform ex post data validation for the proposed telemetry solution.
- Compare different time frames (e.g., hour, day, week, month) of aggregated interval data from submetered devices to aggregated interval data from utility smart meters to calculate relative error of the proposed telemetry solution.
- Verify that the aggregated data is communicated to CAISO at its required frequency and within CAISO-established frequency and latency requirements (per Subtask 4.1).
- Create a *Market Products Study: Review Memo* on the solution to the implementation process, including identification of any major barriers and potential solutions, and identification of interactions with key personnel identified in Subtask 4.1 to overcome these barriers.

##### **Products:**

- Market Products Study: Review Memo

#### **Subtask 4.5 Consolidated Data Analysis**

The goal of this subtask is to consolidate and analyze the data from the implementation of the DPG to determine if the implementation produced enough relevant and high-quality data upon which to draw conclusions.

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

- Consolidate all implementation data collected in Tasks 3 and 4 for analysis.
- Analyze the data for the purposes of validating statistical significance and data integrity.
- Determine if additional data collection is needed in order to draw valid conclusions.
- Document data collected under Tasks 3 and 4, and the analysis done on and integrity of that data, in a *Market Products Study: Raw Data Report*.

##### **Products:**

- Market Products Study: Raw Data Report

#### **Subtask 4.6 Connected Devices Telemetry Framework Recommendations**

The goals of this subtask are to codify trends observed in the data analysis conducted in Subtask 4.5 and arrive at a series of recommendations for the CAISO on solutions for grid-edge resource participation in the ancillary services market.

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

- Produce a *Market Products Study: Final Report* on lessons learned from developing and testing ancillary services for residential demand response resources. This report will also include a Report on participating in CAISO Ancillary Service markets that: discusses the process for identifying ancillary services participation requirements of; discusses the mechanics and monetary impact of ancillary services provided by grid-edge resources; and includes comments from the CAISO on the implications of participation by residential demand response resources in its Ancillary Services Market.
- Solicit Comments from the CAISO on a draft version of the *Market Products Study: Final Report*

- Create and present the *Market Product Study: Final Report Presentation Slides*.

**Products:**

- Market Products Study: Final Report
- Market Products Study: Final Report Presentation Slides

**TASK 5 Reports and Recommendations**

The goal of this task is to develop a set of reports and recommendations to overcome entry barriers for residential aggregation of demand response from a technical, regulatory, and institutional perspective.

**Subtask 5.1 Project-specific Feedback and Publications**

The goal of this subtask is to consolidate quantitative and qualitative feedback on customer participation during this project's research and development tasks.

**The Recipient shall:**

- Interview a minimum of twenty (20) project users by phone or in-person interviews.
- Run a minimum of three (3) qualitative surveys across a sample of five hundred (500) users to better understand the user experience. These surveys may include the surveys from Subtask 3.1 and 3.6
- Compile results of both interviews and surveys in a *Report on User Feedback*.
- Consolidate and process data on customer web and mobile interactions, customer signals regarding their devices such as overrides, and notification preferences. Produce a quantitative *Customer Event Participation Dataset* detailing this information.
- Report on customers' feedback to the program via one online presentation. Document quantitative and qualitative information on customer interactions as required by this subtask in the *Customer Event Participation Presentation Slides*.

**Products:**

- Report on User Feedback
- Customer Event Participation Dataset
- Customer Event Participation Presentation Slides

**Subtask 5.2 Policy Recommendations**

The goal of this subtask is to document policy requirements from the CAISO, IOUs, and the CPUC; requirements from device manufacturers and their APIs; and barriers to data utilization and access to IOU customers.

**Subtask 5.2.1 State of the Market Report**

The goal of this subtask is to summarize the regulatory barriers to entry in wholesale energy markets for residential aggregators of various products.

**The Recipient shall:**

- Compile a list of recent regulatory changes and barriers to entry to wholesale energy markets.
- Rank order the barriers to entry based on impact on the market and value of the product.
- Review the regulatory development historical record; and identify and interview key organizations and individuals to better understand the context in which barriers developed.

- Prepare a *Summary Report on Current Regulatory Barriers to Entry* that discusses the findings from activities conducted under this subtask.

**Products:**

- Summary Report on Current Regulatory Barriers to Entry

**Subtask 5.2.2 Identification of Potential Solutions**

The goal of this subtask is to identify the optimal pathways to overcome regulatory barriers.

**The Recipient shall:**

- Meet with key individuals interviewed in Subtask 5.2.1 to discuss potential solutions to overcome policy barriers.
- Prepare a *List of Potential Solutions to Overcome Policy Barriers*.

**Products:**

- List of Potential Solutions to Overcome Policy Barriers

**Subtask 5.2.3 Report on Policy Recommendations**

The goal of this subtask is to compile the list of solutions from Subtask 5.2.2 and rank order them by (1) impact on the overall marketplace, (2) implementation barriers and timing, and (3) uniqueness of solution.

**The Recipient shall:**

- Create a *Draft Summary Report on Policy Recommendations* to present to stakeholders.
- Circulate the *Draft Summary Report on Policy Recommendations* with leading policy groups and advocates, including the Environmental Defense Fund (EDF) and others.
- Request feedback from advocacy groups such as the Dynamic Grid Council (DGC).
- Modify *Draft Summary Report on Policy Recommendations* based on advocacy group feedback.
- Prepare a *Final Summary Report on Policy Recommendations* based on the findings and feedback resulting from this subtask.
- Prepare a *Policy Recommendation Presentation* and present recommendations in two (2) online webinars.

**Products:**

- Draft Summary Report on Policy Recommendations
- Final Summary Report on Policy Recommendations
- Policy Recommendation Presentation

**TASK 6 Evaluation of Project Benefits**

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

**The Recipient shall:**

- Complete three Project Benefits Questionnaires that correspond to three main intervals in the Agreement: (1) Kick-off Meeting Benefits Questionnaire; (2) Mid-term Benefits Questionnaire; and (3) Final Meeting Benefits Questionnaire.
- Provide all key assumptions used to estimate projected benefits, including targeted market sector (e.g., population and geographic location), projected market penetration, baseline and projected energy use and cost, operating conditions, and emission

reduction calculations. Examples of information that may be requested in the questionnaires include:

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

- A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
- Respond to CAM questions regarding responses to the questionnaires.

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

**Products:**

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

**TASK 7: TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES**

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

**The Recipient shall:**

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

## **I. PROJECT SCHEDULE**

Please see the attached Excel spreadsheet.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES  
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: OHMCONNECT, INC.

**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-15-083 from GFO-15-311 with Ohmconnect, Inc. for a \$3,995,028 grant to develop and conduct experiments evaluating methods of encouraging proactive consumer participation in demand response programs. The project will develop, test, and refine information communication and automation techniques that maximize customer engagement in demand response events and low-cost telemetry solutions that facilitate participation in California Independent System Operator markets; 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]

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Cody Goldthrite,  
Secretariat