

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 02/13)

CALIFORNIA ENERGY COMMISSION

New Agreement EPC-14-036 (To be completed by CGL Office)

Division	Agreement Manager:	MS-	Phone
ERDD	Hassan Mohammed	43	916-327-1442

Recipient's Legal Name	Federal ID Number
SunSpec Alliance	27-0996957

Title of Project
Smart Inverter Interoperability Standards and Open Testing Framework to Support High-Penetration Distributed Photovoltaics and Storage

Term and Amount	Start Date	End Date	Amount
	5/15/2015	3/29/2019	\$ 2,000,000

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

Proposed Business Meeting Date	4/8/2015	<input type="checkbox"/> Consent	<input checked="" type="checkbox"/> Discussion
Business Meeting Presenter	Hassan Mohammed	Time Needed:	5 minutes

Please select one list serve. Select

Agenda Item Subject and Description

SUNSPEC ALLIANCE. Proposed resolution approving Agreement EPC-14-036 with SunSpec Alliance for a \$2,000,000.00 grant to develop a complete smart inverter data communication standardization and go-to-market solution to enable Photovoltaic (PV) penetration beyond the 15% Institute of Electrical and Electronics Engineers (IEEE) guideline, incorporate energy storage as a standard building block of PV systems, and evaluate the market-expansion potential of a standardized communication interface.

California Environmental Quality Act (CEQA) Compliance

- 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
- 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:
The activities of this project involve: a) installation of equipment and testing of electrical equipment in a controlled environment on the UCSD campus and b) installing or retrofitting commercially available smart inverters, storage, and EV chargers on primarily residential structures and some commercial structures. The process of installing smart commercially available inverters, storage, and EV chargers is well known to city and county building permit departments throughout the state of California. No earth moving and no additional construction is required, and the lithium ion battery systems are fully contained and factory certified. All installation of the inverters, storage, and EV charger, and planning to be completed by SolarCity including acquisition of building permits and approvals from various jurisdictions. The activity is covered by the general rule that CEQA applies only to projects which have the potential for causing a significant effect on the environment. Where it can be seen with certainty that there is no possibility that the activity in question may have a significant effect on the environment, the activity is not subject to CEQA.
 - b) Agreement **IS NOT** exempt. (Consult with the legal office to determine next steps.)
Check all that apply

<input type="checkbox"/> Initial Study	<input type="checkbox"/> Environmental Impact Report
<input type="checkbox"/> Negative Declaration	<input type="checkbox"/> Statement of Overriding Considerations
<input type="checkbox"/> Mitigated Negative Declaration	

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

Legal Company Name:	Budget
UCSD: Bob Caldwell	\$ 5,000
SunSpec: SolarCity	\$ 500,000
SunSpec: Olivine	\$ 134,500
SunSpec: Strategen	\$ 97,000
SunSpec: Underwriters Laboratory	\$ 58,500
SunSpec: OSISoft	\$ 95,000
SunSpec: SolarEdge	\$ 0
SunSpec: SMA	\$ 0
SunSpec: SCE	\$ 0
SunSpec: Outback	\$ 0
SunSpec: Kaco	\$ 0
SunSpec: Ideal Power	\$ 0
SunSpec: Enphase	\$ 0
SunSpec: Advanced Energy	\$ 0

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

Legal Company Name:	NONE
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Budget Information

Funding Source	Funding Year of Appropriation	Budget List No.	Amount
EPIC	13-14	301.001A	\$2,000,000
			\$
R&D Program Area: EGRO: Renewables		TOTAL:	\$2,000,000
Explanation for "Other" selection			
Reimbursement Contract #:		Federal Agreement #:	

Recipient's Administrator/ Officer **Recipient's Project Manager**

Name:	Anil Pochiraju	Name:	Anil Pochiraju
Address:	4030 MOORPARK AVE STE 109	Address:	4030 MOORPARK AVE STE 109
City, State, Zip:	SAN JOSE, CA 95117-1848	City, State, Zip:	SAN JOSE, CA 95117-1848
Phone:	408-421-2711 / Fax: - -	Phone:	408-421-2711 / Fax: - -
E-Mail:	anil@sunspec.org	E-Mail:	anil@sunspec.org

Selection Process Used

<input checked="" type="checkbox"/> Competitive Solicitation	Solicitation #: PON-14-303
<input type="checkbox"/> First Come First Served Solicitation	

The following items should be attached to this GRF

1. Exhibit A, Scope of Work	<input checked="" type="checkbox"/> Attached
2. Exhibit B, Budget Detail	<input checked="" type="checkbox"/> Attached
3. CEC 105, Questionnaire for Identifying Conflicts	<input checked="" type="checkbox"/> Attached
4. Recipient Resolution	<input checked="" type="checkbox"/> N/A <input type="checkbox"/> Attached
5. CEQA Documentation	<input type="checkbox"/> N/A <input checked="" type="checkbox"/> Attached

Agreement Manager _____ Date _____ Office Manager _____ Date _____ Deputy Director _____ Date _____

Exhibit A Scope of Work

A. Task List

Task #	CPR ¹	Task Name
1		General Project Tasks
2	X	Develop California CA Rule 21 Compliance Test Framework and Evaluate Smart Inverters for CA Rule 21 Compliance
3		Demonstrate and Evaluate Impact of High PV Penetration using Smart Inverter with Energy Storage on SCE Grid
4		Demonstrate and Evaluate Impact of Coordinated DER Asset Participation in Demand Response Markets
5		Analysis and Validation of Value Propositions
6		Outreach Activities
7		Evaluation of Project Benefits
8		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
CAISO	California Independent System Operator
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CPR	Critical Project Review
CPUC	California Public Utilities Commission
DER	Distributed Energy Resources
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
MatDyn	Matlab-based toolbox for power system analysis
OpenADR	Open Automated Demand Response
OpenDSS	Open Distribution System Simulator
PDR	Proxy Demand Resource
PV	Photovoltaic
RQMD	Revenue Quality Meter Data
SB X1-2	Senate Bill requiring California's electric utilities to increase their renewable generation to 33% by 2020
SCE	Southern California Edison
SDG&E	San Diego Gas & Electric
SQMD	Settlement Quality Meter Data
SVP	SunSpec System Validation platform
TAC	Technical Advisory Committee

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.

Exhibit A Scope of Work

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

A. Purpose of Agreement

The purpose of this agreement is to develop, demonstrate and evaluate a complete solar photovoltaic (PV) with distributed energy resources (DER) system, solar PV-based DER system, that will address key barriers impeding the progress toward high penetration of solar PV and DER, while improving grid stability and increasing cost effectiveness. The system which includes a standardized communication interface harmonized with the future International Electrotechnical Commission (IEC) (IEC 61850-90-7), will monitor and control inverter operating functions including participation in ancillary service for diverse DER assets. The work includes development of a CA Rule 21 test framework and test scripts, compliance testing of smart inverters with functionality as described in the California Public Utility Commission (CPUC) CA Rule 21 Smart Inverter Working Group (SIWG) recommendations², deployment of integrated PV and energy storage systems participating in ancillary service markets, and a market impact report to estimate potential impacts of this solution on California distributed generation market development. The project will demonstrate the benefits to all stakeholders including ratepayers, utilities, manufacturers, investors and system operators.

B. Problem/ Solution Statement

Problem

High PV penetration using legacy inverters on California grid feeder circuits can exacerbate problems associated with grid instability. It is currently both expensive and risky for grid operators to monitor and control diverse DER assets, including participation in ancillary service. While inverter power technology exists, a standard and cost-effective communication interface to monitor and control inverter operating functions and address grid operating variability is not available.

Solution

The vision of this agreement is to enable high penetration of solar PV and DER beyond current Institute of Electrical and Electronics Engineers (IEEE) limits (15% total circuit penetration) while improving grid stability and increasing cost effectiveness. Key barriers impeding the achievement of this vision include: 1) availability of cost-effective communication-capable smart inverters; 2) sufficient empirical data to objectively evaluate the impact of DER installations on sub-stations and feeder circuits; and 3) a detailed understanding of the economic and environmental benefits of solar PV-based DER systems.

The agreement addresses these critical gaps impeding progress toward creating cost-effective and mass-produced smart inverters that can be integrated into diverse grid systems through standard communications. It also provides concrete, real-world and actionable data, demonstrating that a standards-based approach will deliver significant benefits to all of California ratepayers, utilities, DER providers and equipment manufacturers. This agreement will deliver a smart inverter test framework and open source software tools to enable rapid product development and safety testing.

To estimate grid impacts, power flow models will be created to emulate target conditions. To validate the power flow models, and to prove interoperability with wholesale electricity markets,

² http://www.energy.ca.gov/electricity_analysis/rule21/

Exhibit A Scope of Work

a 50 unit pilot test will be deployed and circuit data will be collected. Finally, the project team will assimilate and analyze the data collected during the lab tests and field pilot to demonstrate the validity of the predicted benefits as specified in the project primary goals.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this agreement are:

- Demonstrate that a common communication standard, that leverages inherent capabilities of existing inverter product offerings (e.g. Modbus, Ethernet, Wi-Fi, TCP/IP, HTTP, XML) and combines them with international standards (e.g. IEC 61850), can establish a common language for Smart Inverters, thus increasing plug and play interoperability and improving economics for all stakeholders.
- Demonstrate that Smart Inverters equipped with a common communication interface can drive down system integration and supply chain costs.
- Deliver a Smart Inverter test framework that can be used by relevant parties to reduce test expenses, increase quality through repeatability, and increase uniformity of grid behavior of compliant solutions.
- Demonstrate that a standards-based Test & Certification Framework can increase multi-vendor interoperability and improve economics through lower integration costs.
- Demonstrate technical capabilities and identify new revenue models for DER asset owners and operators by enabling standards-compliant systems to participate in ancillary grid service markets to accelerate the achievement of Senate Bill X1-2 goals.

Ratepayer Benefits:³

This Agreement will result in the ratepayer benefits of greater reliability, lower cost, and increased safety. The agreement will deliver these benefits by: 1) measuring the value of eliminating vendor-specific communication interfaces in favor of a single standard communication interface for all inverters; 2) measuring the time saved installing PV-based DER system containing smart inverters with standard communication interface networks versus systems with vendor-specific communication interfaces; 3) performing a field demonstration of solar PV-based DER systems with smart inverters on feeder circuits that are at or above 15% penetration, monitoring these systems and circuits, and measuring their reliability and safety impacts; and 4) using these field demonstration systems to demonstrate participation in ancillary service markets thus evaluating benefits of utility cost avoidance.

Technological Advancement and Breakthroughs:⁴

³ 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).

⁴ 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.

Exhibit A Scope of Work

This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals, including the goals of Senate Bill X1-2, by: 1) setting an open standard for inverter communication that provides a low-cost and scalable communication platform for DER resources of all sizes and types, 2) demonstrating that DER resources can provide reliable ancillary grid support service as a central function of their operation; and 3) putting the state on a path to support international standards as and when these standards mature in the next five to 10 years.

Agreement Objectives

The objectives of this Agreement are to:

- Provide a standards-ready Test & Certification Framework that allows for timely implementation to support CA Rule 21 updates.
- Provide enumeration tools for inverter (and energy storage) vendor compliance with the revised CA Rule 21 solar PV-based DER system control and advanced inverter control requirements.
- Demonstrate a standards-compliant test harness that allows PV equipment suppliers and energy storage providers to deliver tested and standards-based solutions.
- Demonstrate interoperability between solar PV-based DER systems, energy storage, EV charging systems and communications systems.
- Demonstrate high grid penetration of solar PV-based DER systems beyond current IEEE limits (15% total circuit penetration).
- Demonstrate the technical capabilities of DER portfolios to provide high-value ancillary grid services that benefit the local electric grid. Validate current baseline of solar PV systems without DER technical capabilities engineering, installation estimates and determine achievement of cost savings targeted at 10%.
- Demonstrate mitigation of the impact of increased PV penetration on feeder circuits operating at or above the IEEE-mandated 15% penetration level limit.
- Identify new revenue models for DER investors and operators and accelerate the achievement of SB X1-2 goals.
- Evaluate the potential market size and stakeholder impacts of smart inverters in California.

II. TASK 1 GENERAL PROJECT TASKS

PRODUCTS

Subtask 1.1 Products

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

Exhibit A Scope of Work

The Recipient shall:

For products that require a draft version

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

For products that require a final version only

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

For all products

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

- **Electronic File Format**

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

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

- Data sets will be in MS Access or MS Excel file format (version 2007 or later), or any other format approved by the CAM.
- 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)

Exhibit A Scope of Work

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.

Exhibit A Scope of Work

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.

Exhibit A Scope of Work

- 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*)

Exhibit A Scope of Work

- Schedule for Completing Agreement Closeout Activities
- All Draft and Final Written Products

REPORTS AND INVOICES

Subtask 1.5 Progress Reports and Invoices

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

The Recipient shall:

- Submit a monthly *Progress Report* to the CAM. Each progress report must:
 - Summarize all Agreement activities conducted by the Recipient for the preceding month, including an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. See the Progress Report Format Attachment for the recommended specifications.
 - Provide a synopsis of the project progress, including accomplishments, problems, milestones, products, schedule, fiscal status, and any evidence of progress such as photographs.
- Submit a monthly or quarterly *Invoice* that follows the instructions in the “Payment of Funds” section of the terms and conditions. In addition, each invoice must document and verify:
 - Energy Commission funds received by California-based entities;
 - Energy Commission funds spent in California (*if applicable*); and
 - Match fund expenditures.

Products:

- Progress Reports
- Invoices

Subtask 1.6 Final Report

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

Subtask 1.6.1 Final Report Outline

The Recipient shall:

- Prepare a *Final Report Outline* in accordance with the *Style Manual* provided by the CAM.
- Submit a draft of the outline to the CAM for review and comment.
- Once agreement has been reached on the draft, submit the final outline to the CAM. The CAM will provide written approval of the final outline within 10 days of receipt.

Recipient Products:

- Final Report Outline (draft and final)

CAM Product:

- Style Manual

Subtask 1.6.2 Final Report

Exhibit A Scope of Work

The Recipient shall:

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

Products:

- Final Report (draft and final)

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds

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

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

The Recipient shall:

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

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

- A list of the match funds that identifies:
 - The amount of cash match funds, their source(s) (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied.
 - The amount of each in-kind contribution, a description of the contribution type (e.g., property, services), the documented market or 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.

Exhibit A Scope of Work

- 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.

Exhibit A Scope of Work

- 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

Exhibit A Scope of Work

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

III. TECHNICAL TASKS

TASK 2 DEVELOP CALIFORNIA CA RULE 21 COMPLIANCE TEST FRAMEWORK AND EVALUATE SMART INVERTERS FOR CA RULE 21 COMPLIANCE

The goals of this task are to (1) provide a standards-ready Test & Certification Framework for CA Rule 21 smart inverter updates; and (2) test multiple smart inverters for compliance and conformance to CA Rule 21 updates.

Subtask 2.1 Create Test Plan & Develop Test Scripts

The goals of this subtask are to (1) create a comprehensive CA Rule 21 compliance and conformance test plan; and (2) develop necessary software to automate the testing.

The Recipient shall:

Exhibit A Scope of Work

- Develop, prepare and publish a detailed CA Rule 21 Functional Test Plan to evaluate the communications and power functionality of smart inverters with storage, specifying interactions and measurements.
- The *CA Rule 21 Functional Test Plan* includes but is not limited to the following:
 - A description of test objectives outlining CA Rule 21 functional and communication requirements;
 - A description of each test procedure explaining the functional test, interactions and measurements;
 - A description of test harness required to perform the test including necessary equipment, wiring and connections; and
 - A description of test results outlining “Pass” and “Fail” conditions.
- Develop open source *SunSpec System Validation Platform (SVP) Extension Scripts* to the open source SunSpec System Validation Platform (SVP) software that encodes the functional test plan in test scripts to automate the testing and evaluation of smart inverters with and without storage.
- Prepare and publish a *User Guide For SunSpec System Validation Platform Extension Scripts* that includes but is not limited to the following:
 - A description of SunSpec Inverter Models;
 - A description of software and hardware requirements to run the test tool;
 - A description of the installation procedures;
 - A description of test scripts;
 - A description of using the test tool including running the scripts and UI; and
 - A description of the reports that the test tool provides.
- Participate in a CPR meeting and prepare a CPR Report consistent with Task 1.3.

Products:

- CA Rule 21 Functional Test Plan (draft and final)
- CPR Report #1 (draft and final)
- SunSpec System Validation Platform Extension Scripts
- User Guide For SunSpec System Validation Platform Extension Scripts

Subtask 2.2 Evaluate Smart Inverters in Test Lab

The goal of this subtask is to test multiple smart inverters for CA Rule 21 compliance and conformance. To perform these tests:

The Recipient shall:

- Install a test harness at UCSD that includes:
 - A Grid Simulator to adjust AC power voltage, frequency and loads;
 - A PV Simulator to adjust DC power levels;
 - Relevant communication equipment to use for monitoring and reporting; and
 - A computer running the SunSpec SVP software to adjust settings of inverter under test, monitoring and reporting.
- Submit and install smart inverters from multiple manufacturers for testing in the test harness.
- Conduct functional testing in the UCSD lab using the test harness to evaluate capabilities of each smart inverter submitted.
- Prepare a *Smart Inverter Evaluation Report* that includes but is not limited to the following:

Exhibit A Scope of Work

- A description of the test objectives;
- A discussion on the evaluation requirements;
- A description of the tests performed;
- A discussion on how to reproduce the results; and
- The actual test results for each inverter and a discussion on the results for each.

Products:

Smart Inverter Evaluation Report (draft and final)

TASK 3 DEMONSTRATE AND EVALUATE IMPACT OF HIGH PV PENETRATION USING SMART INVERTER WITH ENERGY STORAGE ON THE SOUTHERN CALIFORNIA EDISON (SCE) GRID

The goals of this task are to (1) model smart inverter impacts in simulated real-world conditions on San Diego Gas & Electric (SDG&E) feeders that have been developed and validated at UCSD; (2) install and operate smart inverters with energy storage in real-world conditions on SCE grid; (3) demonstrate safe enablement of high PV penetration beyond 15% using CA Rule 21 and IEEE 1547a-2014 compliant smart inverters; and (4) gather data for analysis and insights.

Subtask 3.1 Simulate High PV Penetrations in Lab

The goals of this subtask are to (1) simulate feeder circuits in lab to understand impact of high PV penetration (2) develop control strategies for smart inverters to safely operate in real-world conditions; and (3) gather data for analysis and insights.

- Simulate the modeled feeders without a smart inverter to understand the impact of high PV penetration on a distribution system under current conditions.
 - Study the impact of different high PV penetration levels on:
 - Overvoltage,
 - Voltage fluctuations,
 - Tap operations, and
 - Losses.
- Develop a simulation of the smart inverter operations under 15% and higher PV penetration levels to study the impact of high PV penetration on five representative SDG&E distribution feeders using OpenDSS for quasi-steady state and MatDyn for transient analysis.
 - Develop model and control logic for the smart inverter using the SolarCity hardware specifications.
 - Implement smart inverter model for all PV systems on the investigated SDG&E feeders.
 - Generate realistic distributed PV power output using on-site measured SolarCity data from over 200 systems and sky imager cloud overlays from solar forecasting technology developed at UCSD.
- Repeat the above simulations with smart inverter operation under 15% and higher PV penetration levels to study the capability of smart inverters to mitigate high PV penetration impacts.
 - Run the simulation of the smart inverters on SDG&E representative feeders at different PV penetration levels.
 - Perform quasi-steady-state and transient analysis (including fault study and connecting/ disconnecting of PV systems and smart inverters from the grid) of SDG&E feeder models with and without smart inverters.

Exhibit A Scope of Work

- Demonstrate the feasibility of operating smart inverters in higher PV penetration levels beyond the IEEE 15% level.
 - Define the requirements for the smart inverters for operations in PV penetration levels beyond the 15% level for a distribution system.
 - Design smart inverter control strategies to enable higher PV penetration and mitigate the adverse impact of solar variability.
 - Run quasi-steady-state and dynamic simulations with the designed control strategies using the modeled SDG&E feeders.
- Prepare a *Smart Inverters For High PV Penetration Report* that includes but is not limited to the following:
 - A description of the report objectives;
 - A discussion on the initial assumptions;
 - A discussion on the requirements for the smart inverters and control strategies for operations in high PV penetration levels beyond the 15% level for a distribution system.
 - An analysis of the simulation on the modeled SDG&E feeders with and without smart inverters that are CA Rule 21 and IEEE 1547a-2014 compliant;
 - A tabulated result of the data collected; and
 - A discussion on the conclusions on the ability of smart inverters to safely enable higher PV penetration levels beyond the 15% level for a distribution system.

Products:

- Smart Inverters for High PV Penetration Report (draft and final)

Subtask 3.2 Demonstrate High PV Penetrations on SCE Grid

The goals of this subtask are to (1) install and operate smart inverters with energy storage in real-world conditions; (2) demonstrate safe enablement of high PV penetration using CA Rule 21 compliant smart inverters; and (3) gather data for analysis and insights.

The Recipient shall:

- Install 50 solar PV-based DER systems on 2-5 feeders with 5-20 residential and commercial customers per feeder, on the SCE grid:
 - Enroll new and existing customers to the project by building new solar PV-based DER systems or retrofitting existing solar PV systems.
 - Educate customers on the project and its potential benefits.
 - Install PV (or connect/modify existing PV), Smart Inverter, Energy Storage and Load Management Systems.
 - Setup DER assets, communications, monitoring equipment and control equipment on customer premises.
- Integrate the complete DER ecosystem and confirm interoperability:
 - Configure the DER systems and confirm ecosystem integration.
 - Test communications, data backhaul and interface with SolarCity communications and control system.
 - Log data and ensure end-to-end data flow.
- Confirm compatibility with the grid:
 - Confirm ability to operate DER assets without violating utility operating procedures.
 - Confirm DER asset operations in grid operating and environmental conditions.
 - Identify any safety or compliance issues and mitigation approaches.
- Configure and test monitoring and control interface systems:

Exhibit A Scope of Work

- Configure monitoring tools:
 - Monitor voltage data, at the solar PV-based DER system's site and at feeder, via Supervisory Control and Data Acquisition devices, Smart Meters, smart inverters and customer sub-metering.
 - Model feeders and customer DER assets in distribution modeling tool.
 - Characterize baseline circuit characteristics like power flow, voltage profile, fault analysis and time series steady-state profile.
 - Log all data for post processing and analysis.
- Configure control interfaces of individual DER systems.
- Test control capabilities of DER assets including but not limited to:
 - Dynamic output ramping and curtailment of PV.
 - Dynamic charge and discharge of Energy Storage.
 - Dynamic charge of EV.
 - Dynamic load shifting and shedding through Load Management.
 - Log all data for post processing and analysis.
- Demonstrate that aggregated DER systems respond correctly to CA Rule 21 mode changes by testing for the following grid support use cases and logging all data for post processing and analysis:
 - Voltage regulation support.
 - High voltage real-power ramping and curtailment.
 - Net load reduction.
 - Autonomous frequency response and frequency regulation.
 - Curtailment based on circuit reverse power flow conditions.
- Survey site host occupants regarding their experiences with the aggregated DER asset portfolio of smart inverters, storage and EV charging solutions
- Collect data over the course of the task for post-processing and analysis:
 - Log all data to historian.
 - Data collected includes, but not limited to:
 - Operational data;
 - Circuit characteristics like power flow, voltage data; and
 - Faults.
- Prepare a *PV Penetration Impact Report* that includes but is not limited to the following:
 - A description of the report objectives;
 - A discussion on the initial assumptions;
 - A description of the simulation and forecast model developed;
 - An analysis of the simulation on the modeled SDG&E feeders with and without smart inverters that are CA Rule 21 and IEEE 1547a-2014 compliant;
 - An analysis of the SCE feeder data collected by SolarCity with smart inverters that are CA Rule 21 and IEEE 1547a-2014 compliant;
 - A comparative analysis of simulated versus field data to demonstrate and validate the capabilities and limitations of smart inverters in enabling higher PV penetration beyond 15% on a distribution feeder;
 - A discussion on the requirements for the smart inverters and control strategies for operations in high PV penetration levels beyond the 15% level for a distribution system.
 - A tabulated result of the data collected; and
 - A discussion on the conclusions on the ability of smart inverters to increase the PV penetration levels for a distribution system, contribute to grid stability, and enable raising the limit requiring a Supplemental Review Process under CA Rule 21.

Exhibit A Scope of Work

Products:

- PV Penetration Impact Report (draft and final)

TASK 4 DEMONSTRATE AND EVALUATE IMPACT OF COORDINATED DER ASSET PARTICIPATION IN DEMAND RESPONSE MARKETS

The goals of this task are to (1) demonstrate connectivity and direct participation of aggregated solar PV-based DER system solutions installed by SolarCity on SCE grid in demand response markets; (2) simulate solar PV-based DER system's asset participation in other potential direct wholesale market service areas; and (3) gather data for analysis and insights.

The Recipient shall:

- Validate that the project assets installed in Task 3 will meet baseline requirements for market participation and overall design parameters for successful market simulation.
- Develop a plan for the market service participation phase and simulation phase, to cover the available opportunities in energy, reserves, and frequency regulation ancillary service, as well as distribution-only service, as applicable. The plan includes but is not limited to the following:
 - Physical design of one or more Proxy Demand Resources (PDR) resource(s), including resource sizing, locations, and possible bidding strategies.
 - Pseudo resources made up of physical assets to be used in operational market simulations.⁵
 - A schedule for testing project assets for readiness, market participation phase, and simulation phase.
 - Detailed scopes for both market participation phase and simulation phase.
- Configure and test dispatch and telemetry interfaces between resource and market systems, utilizing OpenADR 2.0b to interface between Olivine market systems and SolarCity, with other standards used as interfaces if necessary.
- Implement market participation phase
 - Support the PDR resource(s) integration into the California Independent System Operator (CAISO) market, including:
 - Meet retail / wholesale customer enrollment requirements (in parallel with customer project enrollment from Task 3).
 - PDR registration, resource definition, resource management, outage reporting.
 - Develop and support bid strategy and management.
 - Configure and support award and dispatch management.
 - Manage customer revenue quality meter data (RQMD) to support CAISO meter data requirements.
 - Configure and prepare settlement management, invoicing, and financial reporting.
- Implement simulation phase:
 - Define additional pseudo-resources, if necessary, for simulation.
 - Develop and support bid strategy and management.

⁵ The (50) PV systems installed under this sub-task, are logically grouped to create a single pseudo resource. The logical grouping is done via software configuration. Action can then be taken on the pseudo resource, which would then trigger additional local actions on each physical PV system.

Exhibit A Scope of Work

- Configure and support award and dispatch management, both “forced” as well as run off of live market clearing prices.
- Manage customer revenue quality meter data (RQMD) to settlement quality meter data to support out of market settlement calculations.
- Configure and prepare financial reporting.
- Prepare a *Field Demonstration Analysis Report* that includes but is not limited to the following:
 - An assessment of the technical impact of coordinated DER asset control comparing baseline voltage profile without DER coordination with the DER portfolio performance in grid support conditions;
 - A quantitative modeling of DER asset availability and capacity for grid support use cases through time series plots under various grid conditions;
 - A discussion on lessons learned about the operational and functional challenges and performance limitations with communication system latencies and throughput in the field;
 - A discussion on impediments to the broad use of DER asset coordination for providing grid support including technical and economic challenges; and
 - A conclusion with recommendations on operating standards, protocols, policy changes and optimal installation methods for utilization of PV, energy storage, EV and load management assets for grid support.

Products:

- Field Demonstration Analysis Report (draft and final)

TASK 5 ANALYSIS AND VALIDATION OF VALUE PROPOSITIONS

The goals of this task are to (1) demonstrate a 10% cost savings of distributed energy resources (DER) system engineering from current baseline estimates for California ratepayers and other stakeholders⁶ (2) identify new revenue models for DER investors and operators; and (3) conduct a value proposition analysis including an assessment of ratepayer impacts.

The Recipient shall:

- Assimilate, aggregate and analyze data collected from the lab and field trials.
- Prepare a *Cost Reduction Forecast Report* that includes but is not limited to the following:
 - A description of the report objectives;
 - A discussion on the cost reduction opportunities in product development and network integration;
 - A description of the forecast model developed;
 - Tabulated results of data quantifying the cost reduction opportunities; and
 - A discussion on how the forecast model is validated, along with a description of assumptions associated with the data used by the model.
- Prepare a *Coordinated DER Assets Market Assessment Report* that includes but is not limited to the following:
 - A description of the report objectives in relation to achievement of Senate Bill SB X1-2 goals;
 - A discussion on the analysis of Total Available Market and Served Available Market for interactive DER solutions;

⁶ Stakeholders include: utilities, electric grid-operators, investors and equipment manufacturers.

Exhibit A Scope of Work

- A discussion evaluating the commercial opportunities for DER in (grid support) ancillary service and demand response markets;
- A discussion on the impediments to the broad use of DER coordination technologies;
- A tabulated result of data collected during the project;
- A discussion on the recommendations to support greater use of interactive DER solutions; and
- A discussion on the new revenue models available to DER investors and operators and accelerated achievement of Senate Bill SB X1-2 goals as a result of greater use of interactive DER solutions.
- Prepare a *Value Proposition Report* that includes a detailed summary of the following activities:
 - Identify the potential benefit streams, including benefits to the end customers, utilities, and local and system-wide benefits to the grid/ratepayers.
 - Isolate key regulatory and market barriers and recommend mitigation alternatives for the potential benefit streams.
 - Categorize the operational modes of the system components to provide the potential benefits.
 - List the required data inputs and outputs for the value proposition analysis.
 - Prioritize the primary benefits for the detailed value proposition analysis outlined below and list secondary, intrinsic benefits for future study.
 - Summarized data inputs identified in the value proposition framework.
 - Setup the uses cases and corresponding data inputs in the appropriate models, which will include Strategen's proprietary customer-sited optimization model and Electric Power Research Institute's Energy Storage Evaluation Tool.
 - Summarize modeling runs for the use cases based on the categories of operational modes identified in the framework above.
 - Collect key output data from the model(s), including key metrics to understand the value proposition from the perspectives of the host, end customers, investors, utilities, and the grid.
 - Apply cost effectiveness tests, using the modeling output data above, including but not limited to Total Resource Cost (TRC).
 - Utilize the value proposition modeling and cost effectiveness testing to validate the impacts and benefits for California ratepayers.

Products:

- Cost Reduction Forecast Report
- Coordinated DER Assets Market Assessment Report
- Value Proposition Report

TASK 6 OUTREACH ACTIVITIES

The goals of this task are to (1) disseminate information to all stakeholders throughout the duration of the project; and (2) publicize the results of the project to facilitate the incorporation of the project learning into ongoing research programs and industry product rollouts.

The Recipient shall:

- Publish all reports, documents and papers on project participants' websites.
- Publish a *Project Case Study* about the project that includes but is not limited to the following:
 - A description of the project's purpose, objectives and benefits;

Exhibit A Scope of Work

- A description of the project strategy, participants and roles;
- A narrative on the data collection, data selection and data analysis methods;
- A discussion about the project findings; and
- A conclusion outlining the project outcomes and recommendations.
- Publish a *Project Showcase Presentation* that includes but is not limited to the following:
 - An overview of the project's vision and goals;
 - An overview of the project strategy, participants and tasks;
 - An overview of the project findings; and
 - A conclusion outlining the project outcomes and recommendations.
- Publish and feature the project whitepapers and project related articles in Greentech Media (www.greentechmedia.com) and Solar Power World (www.solarpowerworldonline.com).
- Host a public showcase event targeting utilities, independent power producers and financiers at Intersolar North America.
- Host three public educational webinars with project partners targeting all California renewable energy stakeholders including ratepayers, utilities, operators, investors and equipment manufacturers, to inform of the findings and progress of this project.
- Conduct a workshop with the six Nationally Recognized Testing Laboratories (NRTLs) to introduce them and train them on the Smart Inverter functional test procedures developed by this project.
- Conduct a workshop with the Solar Energy Finance Association (SEFA) in order to explain the economic benefits and facilitate risk assessment of the solutions resulting from this project.

Products:

- Project Case Study
- Project Showcase Presentation

TASK 7 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.

Exhibit A Scope of Work

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

Exhibit A Scope of Work

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

TASK 8 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 on the results of the project.
- 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)
- Technology/Knowledge Transfer Plan (draft and final)
- Technology/Knowledge Transfer Report (draft and final)

IV. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: SUNSPEC ALLIANCE

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

RESOLVED, that the Energy Commission approves Agreement EPC-14-036 from PON-14-303 with **SunSpec Alliance** for a **\$2,000,000** grant to develop a complete solution for smart systems that enhances reliability of the California grid, increases photovoltaic penetration and evaluates the market potential of a standardized communication interface; and

FURTHER BE IT RESOLVED, that the Executive Director or his/her designee shall execute the same on behalf of the Energy Commission.

CERTIFICATION

The undersigned Secretariat to the Commission does hereby certify that the foregoing is a full, true, and correct copy of a Resolution duly and regularly adopted at a meeting of the California Energy Commission held on April 8, 2015.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

Harriet Kallemeyn,
Secretariat