

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 10/2015)

CALIFORNIA ENERGY COMMISSION

New Agreement EPC-16-070 (To be completed by CGL Office)

ERDD	Ostap Loredo-Contreras	43	916-327-1552
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Electric Power Research Institute, Inc.	23-7175375
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Integrating Front-of-the-Meter Energy Storage with Smart PV Inverters and Solar Forecasting			
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6/30/2017	12/31/2020	\$ 1,832,770
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ARFVTP agreements under \$75K delegated to Executive Director.

Proposed Business Meeting Date 6/14/2017 Consent Discussion

Business Meeting Presenter Angela Gould Time Needed: 5 minutes

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

Agenda Item Subject and Description

ELECTRIC POWER RESEARCH INSTITUTE, Inc. (EPRI). Proposed resolution approving Agreement EPC-16-070 with Electric Power Research Institute, Inc. for a \$1,832,770 grant to fund a demonstration of an integrated, interoperable, cost-effective, and scalable solution that integrates distributed front-of-meter energy storage with smart PV inverters and solar forecasting. This solution will address grid readiness limitations and enable multi-tiered value stacking for distributed energy resources, particularly in areas with high penetrations of existing rooftop PV.

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 -- Cal. Code Regs., tit 14, § 15311

Common Sense Exemption. 14 CCR 15061 (b) (3)

Explain reason why Agreement is exempt under the above section:

The installation of the battery energy storage and communication equipment are classified as exempt from the provisions of CEQA based on article 19, sec. 15301(a) existing facilities, 15314 Accessory Structures, 15311 Minor Additions to Schools, and 15306 class 6 basic data collection. The proposed project consists of minor alterations to an existing bus depot paved parking lot that is not subject to public use, and any construction traffic related to the project will be both negligible and temporary. The primary work is electrical installation.

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

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Legal Company Name:	Budget
Clean Power Research, L.L.C.	\$ 30,000
Major League Electric, LLC	\$ 18,000
Quattrocchi Kwok Architects	\$ 8,000
Michael Devalle	\$ 9,750
Craig Wooster Engineering	\$ 791,538
Dersch Design & Engineering, Inc.	\$ 22,000
	\$
	\$
	\$

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

Legal Company Name:

Budget Information			
Funding Source	Funding Year of Appropriation	Budget List No.	Amount
EPIC	15-16	301.001C	\$302,962
EPIC	16-17	301.001D	\$1,529,808
			\$
			\$
			\$
			\$
R&D Program Area:	ESRO: ETSI	TOTAL:	\$1,832,770
Explanation for "Other" selection			
Reimbursement Contract #:		Federal Agreement #:	

Recipient's Administrator/ Officer		Recipient's Project Manager	
Name:	Cynthia Toth	Name:	Nick Tumilowicz
Address:	942 Corridor Park Blvd	Address:	3420 Hillview Ave PO Box 10412
City, State, Zip:	Knoxville, TN 37932-3723	City, State, Zip:	Palo Alto, CA 94304-1355
Phone:	865.218.8106 / Fax: - -	Phone:	650-855-8796 / Fax: - -
E-Mail:	ctoath@epri.com	E-Mail:	ntumilowicz@epri.com

Selection Process Used

Competitive Solicitation Solicitation #: GFO-16-309

First Come First Served Solicitation

The following items should be attached to this GRF

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

 Agreement Manager Date Office Manager Date Deputy Director Date

Exhibit A Scope of Work Electric Power Research Institute

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR ¹	Task Name
1		General Project Tasks
2		Project Preparation
3	X	Solution Development
4		Solution Deployment
5		Data Collection and Analysis
6		Storage Interconnection Recommendations
7		Evaluation of Project Benefits
8		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CAISO	California Independent System Operator
CPR	Critical Project Review
DER	Distributed Energy Resources
ES	Energy Storage
PV	Photovoltaic
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 demonstration and research of an integrated, interoperable, cost-effective, and scalable solution that integrates distributed front-of-the-meter energy storage with smart photovoltaic (PV) inverters and satellite-based solar forecasting to address grid readiness limitations and enable multi-tiered value stacking for distributed energy resources (DER).

B. Problem/ Solution Statement

Problem

Though it is becoming widely recognized that front-of-the-meter and community-scale storage projects could benefit the grid and provide greater value to customers, it is not yet clear what those values are or how they can be maximized (nor how the possible adverse impacts of high penetrations of PV can be minimized). In addition, current storage systems are deployed on an ad-hoc basis within distribution systems.

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

Electric Power Research Institute

Currently, distributed solar and storage projects are being deployed as pilots or on an ad-hoc basis. The proposed approach gives investor owned utilities and customers an ability to realize how an integrated solution would maximize the value of these assets and provide informed and rapid deployment decisions. Rather than one-off installs of solar or storage, beneficial integration of front-of-the meter storage and PV throughout California creates the potential for realizing a variety of benefits, both to the grid as well as to the customers.

Additional storage capacity in front of the meter has been mandated by AB 2868² and limited to 25 percent behind the meter. Storage in front of the meter is typically distributed in large scale projects connected near a substation and not necessarily near PV sources. Such projects are costly and time intensive due to the cost and environmental issues associated with new developments. Moreover, these ad-hoc installations do not result in maximizing the value of storage as a distribution asset. Long distances between the source and storage cause transmission losses by moving energy back and forth. Additionally, remote generation of reactive power causes increased transmission losses.

PV interconnection capacity is very frequently limited near the ends of individual feeders due to their distance from the substation. In many cases these locations are otherwise ideal for the installation of PV, but feasibility is limited by increased transmission losses in the feeder. Unmitigated high penetration PV will cause excess voltage instability and unsustainable ramp rates. Local PV generation will cause voltages to rise near the ends of feeders during peak solar hours. Increased voltage causes increased energy consumption of about 0.8 kWh for each percent of voltage rise.

Solution

By installing distributed storage in front of the meter, co-located with and in control of the PV source, we can (1) mitigate the impacts of high-penetration of distributed PV and other DER, (2) mitigate the local feeder conditions associated with high penetration PV, (3) provide additional reliability at the local level, and (4) streamline storage interconnection and reduce integration costs on the distribution grid. The addition of storage systems and satellite based solar forecasting on circuits with existing PV will prevent the uncontrolled mid-day export of large amounts of solar PV generation to the grid and reduce the evening net load peak and the associated need for fast-ramping generation. The storage system can absorb excess PV generation while providing local Volt/VAR³ support and smoothing of ramp rates. This enables additional PV interconnection equal to or greater than the power rating of the storage inverter used. Transmission losses from long distances between the PV and storage are eliminated. Using an already developed site with the right size storage solution resolves the developmental,

² AB 2868, Gatto. Energy storage.

Existing law requires the Public Utilities Commission (PUC) to determine appropriate targets, if any, for each load-serving entity to procure viable and cost-effective energy storage systems to be achieved by December 31, 2020.

This bill would require the PUC, in consultation with the State Air Resources Board and the State Energy Resources Conservation and Development Commission, to direct the state's 3 largest electrical corporations to file applications for programs and investments to accelerate widespread deployment of distributed energy storage systems, as defined.

³ Is a process of optimally managing voltage levels and reactive power to achieve more efficient grid operation by reducing system losses, peak demand or energy consumption or a combination of the three. During the process, voltage control devices at a substation and on the circuit can be used to shrink the voltage drop from the substation to the end of the line and reduce the service voltage to customers while maintaining the voltage within defined limits.

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environmental, and transmission related issues that occur with larger sites. Local reactive power generation can improve transmission efficiency as much as 5 percent.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Create and demonstrate an integrated, interoperable, cost-effective, and scalable solution combining in front of the meter battery storage with multiple smart PV inverters and satellite-based solar forecasting to enable higher penetration of distributed PV on existing distribution feeder sections with low integration capacity
- Through demonstrations, this project will enable PV as a grid asset through beneficial integration with storage, capacity management and communications. Specifically, a group of DER assets will be jointly managed to (1) increase PV hosting capacity, (2) mitigate adverse PV impacts on a distribution system, (3) reduce the risk of PV oversupply during the day, (4) maximize lifetime of the battery system, and (5) generate revenues from California Independent System Operator (CAISO) reserve markets with participation secured through a DER aggregator
- Develop and demonstrate best practices to enable additional PV generation in an easily replicable way to facilitate 50 percent Renewables Portfolio Standard goals

Ratepayer Benefits:⁴ This Agreement will result in the ratepayer benefits of (1) greater electricity reliability, by preventing PV overgeneration, regulating local voltage fluctuations, and reducing ramp rates, all of which reduce stress on the local utility infrastructure; (2) lower costs, by identifying the applications and designs that have the most economic benefits for customers and the operation of the grid, and (3) increased safety, by demonstrating a battery energy system that employs innovative active and passive safety strategies.

Technological Advancement and Breakthroughs:⁵ This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by demonstrating an integrated distributed storage system that can already meet the "work towards" goals. The proposed energy storage system is expected to operate at 90 percent efficiency with a lifespan of 15 years. The cell technology supplier has already achieved 38 percent in energy density in the last three years with the goal of achieving 76 percent in less than five years.

Agreement Objectives

The objectives of this Agreement are to:

- Quantify the effectiveness of front-of-meter storage for increasing PV hosting capacity

⁴ 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).

⁵ California Public Resources Code, Section 25711.5(a) also requires EPIC-funded projects to lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory and energy goals.

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- Publish lessons learned to facilitate accelerated development
- Validate recent advances in storage system efficiency
- Quantify actual capacity degradation over time
- Develop best practices around permitting and interconnection for utility acceptance of *battery storage systems*
 - Demonstrate and evaluate control systems capable of managing heterogeneous groups of DER assets as aggregates from multiple manufacturers, and interfacing with cloud-based energy services to support multi-tier control architectures
 - Develop control strategies enabling integrated control of DER groups to pursue multiple (and possibly conflicting) control objectives, and maximize locational benefits of these aggregate systems at the customer, distribution, and bulk levels
- Demonstrate the proposed solution package at a site with low hosting capacity and develop recommendations to facilitate future deployments of proposed solution across California

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:

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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.

Exhibit A Scope of Work Electric Power Research Institute

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

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Subtask 1.3: Critical Project Review (CPR) Meetings

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

CPR meetings generally take place at key, predetermined points in the Agreement, as determined by the CAM and as shown in the Task List on page 1 of this Exhibit. However, the CAM may schedule additional CPR meetings as necessary. The budget will be reallocated to cover the additional costs borne by the Recipient, but the overall Agreement amount will not increase.

CPR meetings generally take place at the Energy Commission, but they may take place at another location, or may be conducted via electronic conferencing (e.g., WebEx) as determined by the CAM.

The Recipient shall:

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

The CAM shall:

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

Recipient Products:

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

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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

Exhibit A Scope of Work Electric Power Research Institute

REPORTS AND INVOICES

Subtask 1.5: Progress Reports and Invoices

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

The Recipient shall:

- Submit a monthly *Progress Report* to the CAM. Each progress report must:
 - Summarize progress made on all Agreement activities as specified in the scope of work for the preceding month, including accomplishments, problems, milestones, products, schedule, fiscal status, and an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. See the Progress Report Format Attachment for the recommended specifications.
- Submit a monthly or quarterly *Invoice* that follows the instructions in the “Payment of Funds” section of the terms and conditions, including a financial report on Match Fund and in-state expenditures.

Products:

- Progress Reports
- Invoices

Subtask 1.6: Final Report

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

Subtask 1.6.1: Final Report Outline

The Recipient shall:

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

Recipient Products:

- Final Report Outline (draft and final)

CAM Product:

- Style Manual
- Comments on Draft Final Report Outline
- Acceptance of Final Report Outline

Subtask 1.6.2: Final Report

The Recipient shall:

- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline, Style Manual, and Final Report Template provided by the CAM with the following considerations:

Exhibit A Scope of Work Electric Power Research Institute

- 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

Exhibit A Scope of Work Electric Power Research Institute

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.
 - If different from the solicitation application, provide 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*)

Exhibit A

Scope of Work

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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.

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- 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

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discussed at the Kick-off meeting, and a schedule for recruiting members and holding the first TAC meeting will be developed.

- Recruit TAC members. Ensure that each individual understands member obligations and the TAC meeting schedule developed in subtask 1.11.
- Prepare a *List of TAC Members* once all TAC members have committed to serving on the TAC.
- Submit *Documentation of TAC Member Commitment* (such as Letters of Acceptance) from each TAC member.

Products:

- List of Potential TAC Members
- List of TAC Members
- Documentation of TAC Member Commitment

Subtask 1.11 TAC Meetings

The goal of this subtask is for the TAC to provide strategic guidance for the project by participating in regular meetings, which may be held via teleconference.

The Recipient shall:

- Discuss the TAC meeting schedule with the CAM at the Kick-off meeting. Determine the number and location of meetings (in-person and via teleconference) in consultation with the CAM.
- Prepare a *TAC Meeting Schedule* that will be presented to the TAC members during recruiting. Revise the schedule after the first TAC meeting to incorporate meeting comments.
- Prepare a *TAC Meeting Agenda* and *TAC Meeting Back-up Materials* for each TAC meeting.
- Organize and lead TAC meetings in accordance with the TAC Meeting Schedule. Changes to the schedule must be pre-approved in writing by the CAM.
- Prepare *TAC Meeting Summaries* that include any recommended resolutions of major TAC issues.

Products:

- TAC Meeting Schedule (draft and final)
- TAC Meeting Agendas (draft and final)
- TAC Meeting Back-up Materials
- TAC Meeting Summaries

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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 PREPARATION

The goal of this task is to secure the project site(s) and develop a detailed Measurement and Verification Plan.

Subtask 2: 1 Execute a Contract with the Selected Deployment Site

The goals of this task are to: confirm the availability of the project deployment site; and (2) execute any agreements necessary to secure the demonstration site.

The Recipient shall:

- Reach agreement with the manager(s) of the selected deployment site(s) regarding the project timeline, space reserved for the project, equipment installation, permit and insurance requirements, indemnity, and the Recipient’s use of any removal or support staff. The site identified as of the commencement date of this grant is 18751 Railroad Ave. Sonoma, CA 94304
- Site 1: The Demonstration Site
 - For any changes in site location, Recipient must check with their CAM or CAO who will provide guidance regarding the level of Commission approval required.
 - Prepare and provide *Site Readiness Verification Documents*, to include, but not be limited to a copy of Contract, Lease Agreement, and Memorandum of Understanding).

Products:

- Site Readiness Verification Documents

Subtask 2.2: Project Measurement and Verification

The goal of this subtask is to develop a detailed Measurement and Verification Plan for each site.

The Recipient shall:

- Develop a detailed *Measurement and Verification Plan* for each site to include but not be limited to:
 - A description of the monitoring equipment and instrumentation which will be used at each site.
 - A description of the key input parameters and output metrics which will be measured.
 - A description of the analysis methods to be employed.
 - Independent, third-party measurement and verification services to be employed, if applicable.

Products:

Measurement and Verification Plan (draft and final)

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TASK 3: SOLUTION DEVELOPMENT

The goals of this task are to: (1) Develop the control architecture, functional requirements, and performance metrics for the solution; (2) Develop and test the control strategies for the integrated management of PV and energy storage; (3) Assess the solution impact on PV hosting capacity.

Subtask 3.1: Conceptual Design, Requirements and Metrics

The goal of this task is to develop and document the control architecture, functional requirements, and performance metrics for the solution.

The Recipient shall:

- Develop a conceptual design for the control architecture, and performance metrics according to the operating requirements for the integrated solution
- Develop functional and communication requirements for all solution components including, but not limited to: (1) smart PV and storage inverters, (2) site controller (3) cloud-based DER aggregator, and (4) solar forecasting
- Map functional and communication requirements to common smart inverter functions, DER group-level functions, and communication standards
- Prepare a *Solution Design Report* that describes the control architecture, functional requirements, and performance metrics, and relevant standards identified.

Products:

- Solution Design Report (draft and final)

Subtask 3.2: Control Strategies for Integrated PV+Energy Storage (ES) Management

The goals of this task are to: (1) formulate the control objectives, and (2) develop and demonstrate the control strategies assigned to the site controller.

The Recipient shall:

- Formulate a complete set of control objectives assigned to the group of DER deployed and reflecting the local- and system-level goals considered
- Develop control strategies for integrated management of smart PV inverters, energy storage, and satellite-based solar forecasting data to optimize control objectives selected
- Demonstrate the control strategies developed through software simulations of five test cases representative of the five standard daily variability conditions (clear, overcast, mild, moderate, high)
- Prepare a *Control Strategies for Integrated PV+ES Management Report* that describes the control strategies developed and documents the simulation results obtained

Products:

- Control Strategies for Integrated PV+ES Management Report (draft and final)

Subtask 3.3: PV Hosting Capacity Assessment

The goals of this task are to: (1) Calculate the PV hosting capacity before and after the solution is deployed; (2) Compute the grid constraints limiting storage operations and calculate the optimal inverter setpoints to minimize adverse PV impacts and increase PV hosting capacity.

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The Recipient shall:

- Create detailed model of the host distribution feeder using the Recipient's Open Distribution System Simulator software tool
- Calculate the existing PV hosting capacity without storage and advanced controls using ERPI's existing hosting capacity calculation tool
- Compute the grid constraints limiting storage operations and calculate the optimal PV inverter setpoints for minimizing voltage violations and other adverse distribution impacts
- Assess the increase in PV hosting capacity and beneficial impacts on distribution system when PV+ES solution is fully deployed
- Prepare a *PV Hosting Capacity Assessment Report* that describes the change in the PV hosting capacity for the feeder zone where the demonstration site is located when the solution is deployed
- Prepare a *CPR Report* and participate in a CPR Meeting per task 1.3

Products:

- PV Hosting Capacity Assessment Report (draft and final)
- CPR Report

TASK 4: SOLUTION DEPLOYMENT

The goals of this task are to: (1) complete preparation of demonstration site, (2) complete implementation of site controller, and (3) deploy, test and commission all new field assets.

Subtask 4.1: Demonstration Site Preparation

The goals of this task are to: (1) select vendors, (2) secure all necessary permits, and (3) develop a hazard mitigation plan for front-of-the-meter storage.

The Recipient shall:

- Select all hardware and software vendors and execute contractual agreements
- Secure permits necessary to commence hardware deployment
- Prepare a *Safety Plan for Front-of-the-Meter Storage Report* that describes the hazard mitigation plan for front-of-the-meter storage that will be implemented to ensure public health and safety

Products:

- Safety Plan for Front-of-the-Meter Storage Report (draft and final)

Subtask 4.2 Site Controller Implementation

The goals of this task are to: (1) implement the control strategies into the site controller, and (2) demonstrate connectivity between the site controller and the relevant control architecture components.

The Recipient shall:

- Implement the control strategies developed as commercial-grade algorithms to enable the site controller to jointly manage the smart PV inverters and battery system
- Prepare a *Site Controller Test Plan* to evaluate performance of the site controller

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- Implement detailed test plan to evaluate performance of site controller and demonstrate connectivity between the site controller and: (1) smart PV inverters, (2) energy storage, (3) cloud-based DER aggregation platform, and (4) cloud-based solar forecasting platform

Products:

- Site Controller Test Plan (draft and final)

Subtask 4.3: Field Deployment and Commissioning

The goal of this task is to deploy and commission all new assets that are part of the solution.

The Recipient shall:

- Install and commission all new assets including, but not limited to battery storage, new PV system, and control and monitoring systems
- Prepare *Documentation of Safety, Maintenance, and Operation Guidelines*

Products:

- Documentation of Safety, Maintenance, and Operation Guidelines (draft and final)

TASK 5: DATA COLLECTION AND ANALYSIS

The goal of this task is to collect measured data and performance analysis from the demonstration site over a period of one year.

Subtask 5.1: Data Gathering and Analysis

The goal of this task will include all the experimental testing on the demonstration site and will include data analysis to assess the performance of the proposed system in accordance with the test plan and metrics developed in the previous task.

The Recipient shall:

- Execute the test procedure for the proposed solution
- Collect data, perform analysis
- Perform data analysis and verify against proposed solution requirements 1) Individual component performance, 2) Overall solution performance, 3) Communication and controls, 4) Interoperability
- Validate with models developed in Task 3 the impacts of operations to the local distribution system
- Prepare a *Data Collection and Analysis Report* that will document the collection process and results obtained.

Products:

- Data Collection and Analysis Report (draft and final)

Subtask 5.2: Performance Economic Assessment of the Proposed Solution

This goal of this task is to perform the economic assessment of the proposed end-to-end integrated solution including developing appropriate cost benefit analysis framework/methodology.

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The Recipient shall:

- Develop cost benefit analysis framework/methodology
- Performance economic analysis of the proposed solution to evaluate potential benefits, cost reduction of the proposed solution
- Prepare a *Performance Assessment Report* that documents the methodology, analysis conducted, validations using field data, and findings

Products:

- Performance Assessment Report (draft and final)

TASK 6: STORAGE INTERCONNECTION RECOMMENDATIONS

The goal of this task is to develop recommendations to ensure public health and safety, streamline interconnection, and inform the successor to the Rule 21.

The Recipient shall:

- Assemble results from the prior tasks and develop a *Distribution Interconnection Guide* for proposed system deployment and interconnection to the distribution system
- Evaluate Net Energy Metering 2.0 interconnection processes as they relate to the combination of existing and new PV and Battery Energy Storage. Determine how current impacts of Net Energy Metering queues relate to Net Energy Metering - Multiple Tariff transfer agreements.
- Assess process and requirements related to CAISO interconnection, scheduling, aggregation, and market participation.
- Develop a *Bulk System Interconnection Guide*, to include, but not be limited to:
 - Best practices to interconnect and aggregate customer-sited storage to participate in CAISO market services
 - Lessons learned specific to new market rules and processes required to connect and participate in the market
 - A user guide to inform streamlined market integration of future distributed storage assets

Products:

- Distribution Interconnection Guide (draft and final)
- Bulk System Interconnection Guide (draft and final)

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*.

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- 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.
 -

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- 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 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(s) on the project.
- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the California Energy Commission.

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- 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)

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: ELECTRIC POWER RESEARCH INSTITUTE, INC.

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

RESOLVED, that the Energy Commission approves Agreement EPC-16-070 from GFO-16-309 with Electric Power Research Institute, Inc. for a \$1,832,770 grant to fund a demonstration of an integrated, interoperable, cost-effective, and scalable solution that integrates distributed front-of-meter energy storage with smart PV inverters and solar forecasting. This solution will address grid readiness limitations and enable multi-tiered value stacking for distributed energy resources, particularly in areas with high penetrations of existing rooftop PV; 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 June 14, 2017.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

Cody Goldthrite,
Secretariat