STATE OF CALIFORNIA

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 10/2015) CALIFORNIA ENERGY COMMISSION

New Agreement EPC-17-038 (To be completed by CGL Office)

ERDD	Quenby Lum	43	916-327-1492

DOE- Lawrence Berkeley National Laboratory	94-2951741

Camp Parks Army Microgrid - A Blueprint for Nested, Modular Design

	4/23/2018	3/30/2023	$ 5,000,000

☐ ARFVTP agreements under $75K delegated to Executive Director.			
Proposed Business Meeting Date	3/21/2018	☐ Consent	☒ Discussion
Business Meeting Presenter	Mike Gravely	Time Needed:	5 minutes
Please select one list serve. EPIC (Electric Program Investment Charge)			

Agenda Item Subject and Description

LAWRENCE BERKELEY NATIONAL LABORATORY. Proposed resolution approving Agreement EPC-17-038 with the U.S. Department of Energy's Lawrence Berkeley National Laboratory for a $5,000,000 grant to demonstrate a microgrid project based at the U.S. Army Parks Reserve Forces Training Area that will make it easier for military bases to install and operate their own microgrids while maximizing renewable energy, increasing energy security and resiliency, reducing energy vulnerability and risks, and reducing GHG emissions. The Army and LBNL are providing $11,410,900 in match funding.

California Environmental Quality Act (CEQA) Compliance

1. Is Agreement considered a "Project" under CEQA?
   ☒ Yes (skip to question 2) ☐ No (complete the following (PRC 21065 and 14 CCR 15378)):
   Explain why Agreement is not considered a "Project":

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, 15303, 15306
   ☐ Common Sense Exemption. 14 CCR 15061 (b) (3)

   Explain reason why Agreement is exempt under the above section:

   This project will install and integrate a number of components in order to demonstrate a microgrid on the grounds of Parks Reserve Forces Training Area in Dublin, CA. All project activities, including installation, will take place within already disturbed areas. The microgrid components to be installed include a solar photovoltaic (PV) system, a battery energy storage system, electric vehicles and electric vehicle charging stations and an energy management system. The solar PV system will be a 100kW system and may be carport, rooftop or ground mounted and may include some trenching and an associated conduit run. If the solar PV system is installed on the ground, it will be installed in an already disturbed area. The battery energy storage system will be installed outside in an already disturbed area, will require slight modifications to existing electrical components, and will not require the alteration of an existing facility. The energy control system will be installed inside an existing building and will require slight modifications to existing electrical components within the building.

   Installation and operation of the microgrid components funded by this Agreement adds only zero-emission sources to the microgrid, will not create noise or odors, will not increase traffic to the project site in any significant way and will not expand any existing use of the Parks Reserve Forces Training Area facilities. This project is therefore categorically exempt under CEQA Guidelines sections 15301 as a minor alteration to an existing facility, categorically exempt under CEQA Guidelines section 15303 as construction of new, small structures and categorically exempt under CEQA Guidelines section 15306 as basic data collection and research activities which do not result in a serious or major disturbance to an environmental resource.

   ☐ b) Agreement **IS NOT** exempt. (Consult with the legal office to determine next steps.)

   Check all that apply
   ☐ Initial Study
   ☐ Negative Declaration
   ☐ Mitigated Negative Declaration
   ☐ Environmental Impact Report
   ☐ Statement of Overriding Considerations

Legal Company Name:	Budget
Microgrid Labs, Inc.	$ 600,000
Customized Energy Solutions	$ 350,000
Schneider Electric USA Inc.	$ 756,184
Spectrum Energy Development, Inc.	$ 567,105
Ultrasolar Technology	$ 150,000
The Urban Collaborative	$ 50,000
Cal Poly State University, San Luis Obispo	$ 95,000
DOE- Pacific Northwest National Laboratory	$ 90,000
Coal Fire	$ 92,182

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

Funding Source	Funding Year of Appropriation	Budget List No.	Amount
EPIC	17-18	301.001E	$5,000,000
			$
			$
			$
			$
			$
R&D Program Area: ESRO: ETSI			$5,000,000
Explanation for "Other" selection			
Reimbursement Contract #:		Federal Agreement #:	

Name:	Betsy Quayle	Name:	Reshma Singh
Address:	1 Cyclotron Rd MS 56A-0120	Address:	1 Cyclotron Rd, MS 90R400
City, State, Zip:	Berkeley, CA 94720-8130	City, State, Zip:	Berkeley, CA 94720-8099
Phone:	510-486-7391 / Fax: - -	Phone:	510-495-2167 / Fax: - -
E-Mail:	bequayle@lbl.gov	E-Mail:	reshmasingh@lbl.gov

☒ Competitive Solicitation — Solicitation #: GFO-17-302
☐ First Come First Served Solicitation

1. Exhibit A, Scope of Work		☒ Attached
2. Exhibit B, Budget Detail		☒ Attached
3. CEC 105, Questionnaire for Identifying Conflicts		☒ Attached
4. Recipient Resolution	☒ N/A	☐ Attached
5. CEQA Documentation	☐ N/A	☒ Attached

Agreement Manager	Date	Office Manager	Date	Deputy Director	Date

Exhibit A
Scope of Work
Lawrence Berkeley National Laboratory

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR	Task Name
1		General Project Tasks
2	X	Microgrid Planning and Design
3		Supervisory and Realtime Controller (DER-CAM.OS) Adaptation
4	X	Engineering, Procurement and Site Deployment
5		Testing, Commissioning, and Operation
6		Data Collection, Analysis, and Sharing
7		Evaluation of Project Benefits
8		Technology/Knowledge Transfer Activities
9		Production Readiness Plan (Commercialization)

B. Acronym/Term List

Acronym/Term	Meaning
CAISO	California Independent System Operator
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CES	Customized Energy Solutions
CPR	Critical Project Review
DER	Distributed Energy Resources
DER-CAM	Distributed Energy Resources Customer Adoption Model
DER-CAM.OS	Distributed Energy Resources Customer Adoption Model Operating System
DoD	U.S. Department of Defense
HMI	Human Machine Interface
IRN	Integrated Resilient Node
LBNL	Lawrence Berkeley National Laboratory
MODBUS	A communication protocol developed by Modicon systems for transmitting information over serial lines between electronic devices.
PG&E	Pacific Gas and Electric
PRFTA	Parks Reserve Forces Training Area
PV	Photovoltaic
R2M2	Resilient Replicable Modular Microgrid
RMF	Risk Management Framework
RPS	Renewables Portfolio Standard
RTU	Remote Terminal Unit
TAC	Technical Advisory Committee
VAR	Volt-amp Reactive

Exhibit A
Scope of Work
Lawrence Berkeley National Laboratory

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

A. Purpose of Agreement

The purpose of the project is for Lawrence Berkeley National Laboratory (LBNL or Recipient) to design, develop and demonstrate a commercially viable permanent Resilient Replicable Modular Microgrid (R2M2) at Parks Reserve Forces Training Area (PRFTA) in Dublin, CA, establish its business case and create a replicable design that can be implemented at other military bases. The project will demonstrate the viability of a microgrid to manage high amounts of intermittent renewable energy to meet the facility load while avoiding adverse grid impacts. The project, with five types of distributed resource elements, will focus on developing standardized, cost-effective, packaged solutions that are streamlined to comply with U.S. Department of Defense's (DoD) project approval and financing requirements to help commercialization.

B. Problem/ Solution Statement

Problem

Microgrids today suffer from lack of cost effectiveness and replicability due to barriers of business justification, absence of valuation of energy security, lack of performance data, long procurement lead times, lack of standardization, interconnectivity and operational hurdles with participating utility and California Independent System Operator (CAISO) interconnections.

Most of the demonstration projects so far have been focused on proving technology (distributed energy resources (DER), control systems or features like seamless islanding) and not on standardization, replicable designs, cost reductions or business case justification. Most of the microgrids that are in operation today are relatively unsophisticated with limited ability to integrate high levels of intermittent DERs or to extract multiple value streams (e.g. resiliency, demand management, demand response, provision of ancillary services, Volt/Volt-amp Reactive (VAR) support) to improve the return on investment.

One of the current barriers to reaching the state's Renewables Portfolio Standard (RPS) goals is the lack of understanding of how to cost-effectively integrate renewable energy sources on the distribution grid and the lack of positive business case in the absence of incentives and subsidies.

Solution

The proposed microgrid at PRFTA is a military base scale microgrid with high renewable DER penetration with the ability to create multiple value streams for the PRFTA and the utility (e.g. resiliency, demand management, energy cost reduction, revenues from market participation, GHG reductions etc.). The demonstrated microgrid will have five DER elements (photovoltaic with efficiency boosting Quantum Boost technology, Li-Ion battery energy storage, electric vehicles, base wide building energy management control system for energy efficiency, and an ability to participate in ancillary services and demand response activities).

Exhibit A
Scope of Work
Lawrence Berkeley National Laboratory

The R2M2 solution comprises two distinct products: 1) A cost-effective, commercially viable, triple-play (reduces utility charges, increases renewables, and enhances energy security) permanent microgrid; 2) A best practices design, configuration, criteria definition and component selection training document that is a blueprint to develop a cost-effective and commercially viable microgrid at DoD bases with cost metrics of replicable configuration, maintainability, flexibility, coverage and reliability.

This project will:

- Create a modular, scalable, cost effective and replicable design and a clear approach to establishing a business case for large energy users such as DoD bases, campuses and industrial parks.
- Improve the business case of microgrids by extracting multiple value streams, e.g., resiliency, demand management, energy cost reduction, revenues from market participation, GHG reductions, etc.
- Demonstrate the viability of microgrids to manage significant amounts of intermittent renewable energy, e.g., establish that a microgrid can be operated with up to 100% renewable penetration (as a % of average/peak demand).
- Provide utility distribution control systems adequate visibility of the microgrid DERs connected to the utility's network and, if needed, to influence the operation of the DERs to mitigate any adverse impact on the feeders.
- Enable utilities to use microgrids as "control variables" in the distribution system.
- Identify and reduce barriers to broader microgrid deployment throughout California.
- Help the state move closer to the energy goals of 100 percent RPS.

C. Goals and Objectives of the Agreement

Agreement Goals:

The goals of this Agreement are to:

- Deploy a microgrid to manage high amounts (up to 100% penetration as a % of average peak load) of intermittent type renewable energy at PRFTA.
- Demonstrate different microgrid use cases including nested operation, energy market participation and provision of grid support.
- Demonstrate the operation and efficacy of photovoltaic (PV) efficiency booster and solar micro forecasting technology.
- Demonstrate the ability of the microgrid to support critical facilities with minimum use of diesel during a long-term power outage.
- Demonstrate the financial benefits during grid connected operation – e.g. reduction in energy costs and GHG emissions.
- Establish microgrid value proposition by evaluating and quantifying the benefits that microgrids provide to different stakeholders – PRFTA, utility, ratepayer, and society at large.
- Provide ratepayer benefits from greater electricity reliability and lower costs, by better integration of renewable sources, reduced outage times and minimization of capital investment for distribution upgrades.
- Accelerate technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by enabling renewable intensive microgrids.

- Develop a commercializable approach to implement nested microgrids.

Agreement Objectives:
The objectives of this Agreement are to:

- Demonstrate key microgrid capabilities: grid-responsive integration of DER, islanded operation (including nested islanded operation), active demand management, integration with building energy management system, EVs as flexible loads, demand response and market participation.
- Demonstrate nested operation, and design of the integrated resilient node (IRN) to provide two layers of resiliency, i.e., an islanded operation of the entire base in the event of an outage and a resilient nodal building block that supports nesting in the event of an internal fault (e.g., transformer failure or cable fault).
- Demonstrate the functionalities of Distributed Energy Resources Customer Adoption Model Operating System (DER-CAM.OS) supervisory controller with a view to commercializing and rolling it out to other military bases.
- Secure DoD's cybersecurity risk management framework (RMF) certification for the microgrid control and communication systems.
- Sustain a 14-day outage and quantify reduction in diesel consumption and GHG emissions.
- Demonstrate and quantify early stage microgrid supporting technologies like solar irradiance micro forecasting, PV efficiency boosters, IRN, R2M2, and nested grid designs.
- Demonstrate ability to support utility with peak demand reduction, load shedding capability, Volt/VAR support, demand response and ancillary services.
- Establish a business-case for microgrids by quantifying benefits as listed below:
  - Economic: Reduction in capital costs, operation costs, total electricity costs, electricity demand charges, revenues from energy market participation and demand response schemes, payback period of investment, backup fuel costs, avoided losses from interruptions, and improved net-present value of investment.
  - Reliability: Reduction in number of interruptions and total annual outage time.
  - Environmental impact: GHG emissions during different operating conditions.
  - Non-quantifiable benefits: Enhanced reserve capacity and value of energy security, service to the distribution system operator for enabling increased DERs, and utility support.
- Create a blueprint for a microgrid capable of incorporating multiple DERs, a multi-layered, microgrid control system and architecture that is vendor neutral, a resilient nodal building block that supports nesting (grid within a grid), deployment business-case, bill of materials, engineering guidelines, and easy to adapt "how-to" case tool for accelerated adoption and commercialization.

Exhibit A
Scope of Work
Lawrence Berkeley National Laboratory

III. TASK 1 GENERAL PROJECT TASKS

PRODUCTS

Subtask 1.1 Products
The goal of this subtask is to establish the requirements for submitting project products (e.g., reports, summaries, plans, and presentation materials). Unless otherwise specified by the Commission Agreement Manager (CAM), the Recipient must deliver products as required below by the dates listed in the **Project Schedule (Part V).** Products that require a draft version are indicated by marking **"(draft and final)"** after the product name in the "Products" section of the task/subtask. If "(draft and final)" does not appear after the product name, only a final version of the product is required. With respect to due dates within this Scope of Work, **"days"** means working days.

The Recipient shall:

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

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

For products that require a final version only

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

For all products

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

Instructions for Submitting Electronic Files and Developing Software:

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

  The following describes the accepted formats for electronic data and documents provided to the Energy Commission as products under this Agreement, and

establishes the software versions that will be required to review and approve all software products:

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

- **Software Application Development**

  Use the following standard Application Architecture components in compatible versions for any software application development required by this Agreement (e.g., databases, models, modeling tools), unless the CAM approves other software applications such as open source programs:

  - Microsoft ASP.NET framework (version 3.5 and up). Recommend 4.0.
  - Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5.
  - Visual Studio.NET (version 2008 and up). Recommend 2010.
  - C# Programming Language with Presentation (UI), Business Object and Data Layers.
  - SQL (Structured Query Language).
  - Microsoft SQL Server 2008, Stored Procedures. Recommend 2008 R2.
  - Microsoft SQL Reporting Services. Recommend 2008 R2.
  - XML (external interfaces).

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

MEETINGS

Subtask 1.2 Kick-off Meeting

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

The Recipient shall:

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

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

- Terms and conditions of the Agreement;
- Administrative products (subtask 1.1);
- CPR meetings (subtask 1.3);
- Match fund documentation (subtask 1.7);
- Permit documentation (subtask 1.8);
- Subcontracts (subtask 1.9);
- Technology/Knowledge Transfer (Task 8); and
- Any other relevant topics.

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

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

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

The CAM shall:

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

Recipient Products:

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

CAM Product:

- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings

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

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

place at another location, or may be conducted via electronic conferencing (e.g., WebEx) as determined by the CAM.

The Recipient shall:

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

The CAM shall:

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

Recipient Products:

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

CAM Products:

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

Subtask 1.4 Final Meeting

The goal of this subtask is to complete the closeout of this Agreement.

The Recipient shall:

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

The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be divided into two separate meetings at the CAM's discretion.

- The technical portion of the meeting will involve the presentation of findings, conclusions, and recommended next steps (if any) for the Agreement. The CAM will determine the appropriate meeting participants.
- The administrative portion of the meeting will involve a discussion with the CAM and the CAO of the following Agreement closeout items:
    - Disposition of any state-owned equipment.
    - Need to file a Uniform Commercial Code Financing Statement (Form UCC-1) regarding the Energy Commission's interest in patented technology.
    - The Energy Commission's request for specific "generated" data (not already provided in Agreement products).
    - Need to document the Recipient's disclosure of "subject inventions" developed under the Agreement.
    - "Surviving" Agreement provisions such as repayment provisions and confidential products.
    - Final invoicing and release of retention.
- Prepare a *Final Meeting Agreement Summary* that documents any agreement made between the Recipient and Commission staff during the meeting.
- Prepare a *Schedule for Completing Agreement Closeout Activities*.
- Provide *All Draft and Final Written Products* on a CD-ROM or USB memory stick, organized by the tasks in the Agreement.

Products:

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

REPORTS AND INVOICES

Subtask 1.5 Progress Reports and Invoices

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

The Recipient shall:

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

Exhibit A
Scope of Work
Lawrence Berkeley National Laboratory

Products:
- Progress Reports
- Invoices

Subtask 1.6 Final Report
The goal of this subtask is to prepare a comprehensive Final Report that describes the original purpose, approach, results, and conclusions of the work performed under this Agreement. The CAM will review the Final Report, which will be due at least **two months** before the Agreement end date. When creating the Final Report Outline and the Final Report, the Recipient must use the Style Manual provided by the CAM.

Subtask 1.6.1 Final Report Outline

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

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

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

Subtask 1.6.2 Final Report

The Recipient shall:
- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline, Style Manual, and Final Report Template provided by the CAM with the following considerations:
  - Ensure that the report includes the following items, in the following order:
    - Cover page (**required**)
    - Credits page on the reverse side of cover with legal disclaimer (**required**)
    - Acknowledgements page (optional)
    - Preface (**required**)
    - Abstract, keywords, and citation page (**required**)
    - Table of Contents (**required**, followed by List of Figures and List of Tables, if needed)
    - Executive summary (**required**)
    - Body of the report (**required**)
    - References (if applicable)
    - Glossary/Acronyms (If more than 10 acronyms or abbreviations are used, it is required.)
    - Bibliography (if applicable)
    - Appendices (if applicable) (Create a separate volume if very large.)
    - Attachments (if applicable)
  - Ensure that the document is written in the third person.

- Ensure that the Executive Summary is understandable to the lay public.
    - Briefly summarize the completed work. Succinctly describe the project results and whether or not the project goals were accomplished.
    - Identify which specific ratepayers can benefit from the project results and how they can achieve the benefits.
    - If it's necessary to use a technical term in the Executive Summary, provide a brief definition or explanation when the technical term is first used.
- Follow the Style Guide format requirements for headings, figures/tables, citations, and acronyms/abbreviations.
- Ensure that the document omits subjective comments and opinions. However, recommendations in the conclusion of the report are allowed.
- Include a brief description of the project results in the Abstract.

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

Products:

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

CAM Product:

- Written Comments on the Draft Final Report

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds

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

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

The Recipient shall:

- Prepare a *Match Funds Status Letter* that documents the match funds committed to this Agreement. If no match funds were part of the proposal that led to the Energy

Commission awarding this Agreement and none have been identified at the time this Agreement starts, then state this in the letter.

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

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

Subtask 1.8 Permits

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

The Recipient shall:

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

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

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

Products:

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

Subtask 1.9 Subcontracts

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

The Recipient shall:

- Manage and coordinate subcontractor activities in accordance with the requirements of this Agreement.
- Incorporate this Agreement by reference into each subcontract.
- Include any required Energy Commission flow-down provisions in each subcontract, in addition to a statement that the terms of this Agreement will prevail if they conflict with the subcontract terms.
- If required by the CAM, submit a draft of each *Subcontract* required to conduct the work under this Agreement.
- Submit a final copy of the executed subcontract.
- Notify and receive written approval from the CAM prior to adding any new subcontractors (see the discussion of subcontractor additions in the terms and conditions).

Products:

- Subcontracts *(draft if required by the CAM)*

Exhibit A
Scope of Work
Lawrence Berkeley National Laboratory

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, phone numbers, summaries of relevant experience, and descriptions of potential value added to the project for each potential member. The list will be discussed at the Kick-off meeting, and a schedule for recruiting members and holding the first TAC meeting will be developed.
- Recruit TAC members. Ensure that each individual understands member obligations and the TAC meeting schedule developed in subtask 1.11.
- Prepare a *List of TAC Members* once all TAC members have committed to serving on the TAC.
- Submit *Documentation of TAC Member Commitment* (such as Letters of Acceptance) from each TAC member.

Products:

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

Subtask 1.11 TAC Meetings

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

The Recipient shall:

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

Products:

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

Exhibit A
Scope of Work
Lawrence Berkeley National Laboratory

IV. TECHNICAL TASKS

TASK 2 MICROGRID PLANNING AND DESIGN

The goals of this task are to: (1) Prepare conceptual and detailed design, (2) Prepare equipment and procurement specifications, (3) Start application process for interconnection and RMF certification, and (4) Identify and finalize market participation mechanism.

The Recipient shall:

- Finalize PRFTA and project requirements.
    - Finalize the overall conceptual microgrid design for PRFTA including concepts for special topics like nested microgrids, planned and unplanned islanding schemes.
- Specify the conceptual design.
    - Includes simplified one-line, high level use cases, rough equipment sizing, equipment locations, and preliminary DER-CAM modeling.
- Develop specific use cases.
    - Describe different use cases for the different operating scenarios.

  Integrate the above into a *Detailed Design Document with Use Cases.*
- Perform modeling and simulation and develop *System Modeling and Simulation Report,* which shall include, but not be limited to, a summary of the following activities:
    - Perform system configuration and constraints modeling using DER-CAM.
    - Perform simulation of the electrical network to understand its performance under steady state and dynamic conditions including energy storage provision and how storage will mitigate PV variability and ramp rate control during grid connected operation. Simulation will include determination of how network stability will be maintained during islanded operation.
    - Design the electrical infrastructure system based on the outcome of network modeling and simulation.
- Develop detailed design and integrate into a *Control System Architecture with Communication Interfaces Description Memo,* which shall include, but not be limited to, a summary of the following activities:
    - Specify controls operations for nested microgrids, Integrated Resiliency Node (IRN), nested schemes for load prioritization, unintentional islanding schemes, etc.
    - Finalize the design, and include software and hardware interfaces, control system architecture, functional requirements and communication interfaces between the different layers of the distributed control architecture for software engineering, interoperability and cyber security, and final sizing and selection of major equipment (e.g. photovoltaic, storage and IRN elements).
    - Detailed IRN design and element specifications including equipment sizing, electrical system design, control system design, software architecture, and detailed use cases.
- Develop *Procurement Specifications for Hardware and Software.*
- Develop *Market Participation/Revenue Analysis Report, a* blueprint for market participation opportunities.
    - Develop appropriate revenue stream plan enabled by the microgrid as a participant in utility or CAISO programs.

- Develop *Microgrid Interconnection Procedure Documentation*
    - Work with the PRFTA staff and Pacific Gas and Electric (PG&E) as an advisor, and document the interconnection process to streamline the process to save time and effort for other DoD facilities to follow.
- Apply for RMF certification.
- Participate in a CPR meeting.
- Prepare a *CPR Report* in accordance with Subtask 1.3 (CPR Meetings).

Products:

- Detailed Design Document with Use Cases
- System Modeling and Simulation Report
- Control System Architecture with Communication Interfaces Description Memo
- Procurement Specifications for Hardware and Software
- Market Participation/Revenue Analysis Report
- Microgrid Interconnection Procedure Documentation
- CPR Report #1

TASK 3 SUPERVISORY AND REALTIME CONTROLLER (DER-CAM.OS) ADAPTATION

Subtask 3.1 Supervisory Controller (DER-CAM.OS) Adaptation

The goal of this task is to customize Recipient's microgrid controller (DER-CAM.OS) for deployment at the demonstration site. For this purpose, several project-specific modules will be assembled, customized, integrated and tested.

The Recipient shall:

- Develop *Detailed Control System Architecture Report* that includes, but is not limited to:
    - Detailed breakdown of use cases for software development
    - HMI screen definitions
    - Communication and data exchange design
    - Integration of DER-CAM.OS modules
    - Microgrid Controller with modules and functionalities
    - Customization of communication interfaces for data exchange with other systems
    - Internal testing protocols and test results
    - Market participation and micro-forecasting interface
    - Solar micro-forecasting system architecture
- Develop *Detailed Use Cases for Software Development.*
    - A graphical Human Machine Interface (HMI) will be developed and deployed. This task will require programming and will be the main operator station that has screens.
- Adapt existing modular and scalable microgrid controller to be deployed at PRFTA. This microgrid controller is an optimization-based controller, which takes the future forecasted load and generation into consideration and determines the optimum operation schedule for the microgrid. This will include integration of the following modules:
    - Module 1, Forecasting Unit for Load, Generation and Storage.

  - Module 2, Micro-forecast Module. In this module, the controller will be interfacing with high precision infrared based high resolution forecasting technology for short-term solar forecasts (micro-forecasts).
  - Module 3, Day-ahead Scheduling (unit commitment). The unit commitment function calculates the optimized commitment and dispatch schedules for all controllable DERs.
  - Module 4, Re-optimizer (Economic Dispatch). The economic dispatch function determines the optimum generation / storage schedules for the next several hours. This optimization problem is solved for a rolling window every 15 minutes.
  - Module 5, Automatic Generation Control and Power Balancer. This module monitors the electrical power balance in the system on a minute-by-minute basis and generates correction signal where necessary. It takes into account the most up-to-date data from generators, storage devices and loads. It also integrates output from the solar micro-forecast system in order to provide the best possible power correction signals to generators, storage and loads.
  - Module 6, Generation, Load, and Storage Management. This module takes the dispatch schedules from economic dispatch and re-optimizer modules and assigns them to generators, storage, and loads, considering the most up-to-date status and constraints.
  - Module 7, Data Exchange Module. Data exchange module facilitates data interchange between the DER-CAM controller and the connected systems (e.g. real-time controller, market/utility interface, weather forecast systems, solar micro-forecasting units, etc.).
- Develop Interconnection Kickoff Protocol that includes specification, and interface development for DER-CAM.OS, the real time control layer, and the market interface.
- Provide customization and adaptation using market participation and micro forecasting controller use interface.

Products:

- Detailed Control System Architecture Report
- Detailed Use Cases for Software Development

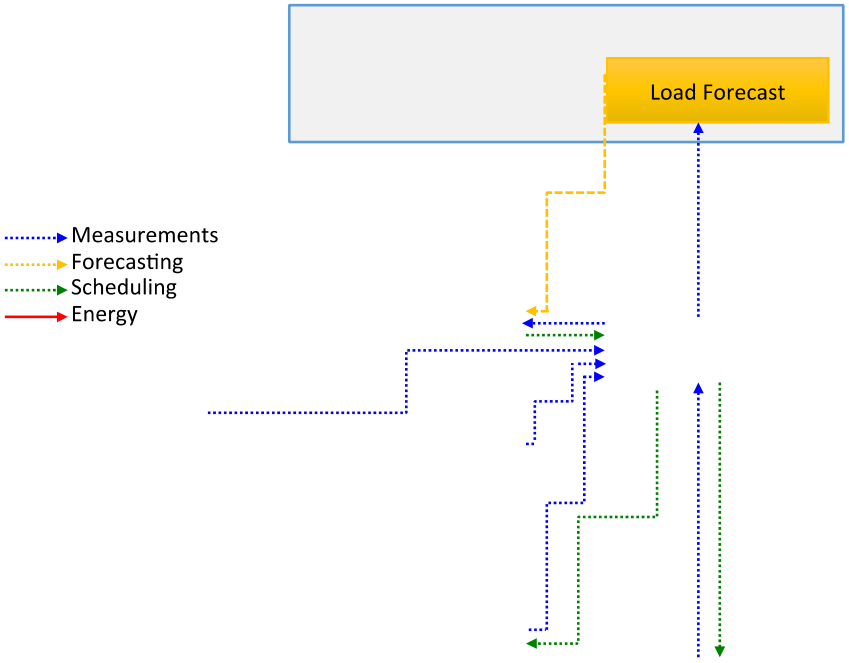

Figure 1: High level schematic of the microgrid controller based on DER-CAM

Subtask 3.2 Real-Time Controller Adaptation
The goal of this task is to customize the real-time controller.

The Recipient shall:

- Assemble, integrate and test several project specific modules/sub-systems.
- Integrate DER-CAM.OS with the real time controller over industry standard protocol, e.g. MODBUS, over TCP/IP interface. See high level conceptual schematic in Figure 1.
- Integrate and test real time controller for controlling and managing all the building loads via an interface, as well as the DERs and associated inverters.

Subtask 3.3 Market Interface Adaptation
The goal of this task is to design and implement the necessary equipment and communications paths for unit telemetry, revenue metering and dispatch signals to be transferred to/from the resource (DER-CAM.OS managed microgrid) and the CAISO. The intent is to provide connectivity to the CAISO using the CES SecureNet-RT system and a Business Class Internet connection or a Cellular Internet Connection solution. SecureNet-RT Remote Data Gateway (Includes the following internal capabilities): Remote Terminal Unit (RTU), Internal common 120VAC to 12VDC Power Supply, Data Encryption Device, and Unit Rack mount enclosure for all hardware.

The Recipient shall:

- Design necessary equipment and communications paths for unit telemetry, revenue metering and dispatch signals to be transferred to and from the resource (DER-CAM.OS managed microgrid) and the CAISO.
- Install and configure all hardware required for installation.
- Provide point check out (remote) of configuration once equipment is installed at site.

Integrate the above into a *SecureNet-RT Remote Data Gateway Specifications Memo.*

Products:

- SecureNet-RT Remote Data Gateway Specifications Memo

Subtask 3.4 Utility Interface Adaptation

The goal of this task is to implement the equipment used for CAISO interface. This can also be used for utility interface except when direct communication with the utility's distribution control center is needed for the utility to test, measure and possibly compensate for the distribution grid services that the PRFTA microgrid might want to provide to local substation/distribution grid. In that instance, if required, another communications portal that complies with the utility communication protocol will be installed.

The Recipient shall:

- Design and implement the utility interface unit.

Subtask 3.5 Solar Micro-Forecasting System Adaptation

The goal of this task is to design, supply and commission a solar micro-forecasting system.

The Recipient shall:

- Develop a *Solar Micro-Forecasting System Report* that includes, but is not limited to:
  - System architecture design drawings
  - Communication interface – to DER-CAM
  - Internal testing results
  - Commissioning results
- Provide internal testing, training the neural networks.
- Deliver the onsite testing and commissioning.

Products:

- Solar Micro-Forecasting System Report

Exhibit A
Scope of Work
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TASK 4 ENGINEERING, PROCUREMENT AND SITE DEPLOYMENT
The goal of this task is to complete preliminary and detailed engineering, procure project equipment and services, and install equipment at project site.

Subtask 4.1 Engineering
The goal of this task is to complete preliminary and detailed engineering design documents and specifications.

The Recipient shall:

- Prepare *Design Drawing Package* that will include, but not be limited to:
    - Electrical drawings
    - Civil drawings
    - Installation drawings
    - Cable routing diagrams
    - Approvals and permits
    - Power system modeling results
- Create one-line and three-line diagrams for the electrical network.
- Create electrical schematic, wiring and terminal diagrams.
- Validate the detailed power system model of the electrical distribution system prepared during the design phase. This model will be leveraged to ensure that the renewable resources can be effectively integrated and that the microgrid can maintain stability during all operating conditions.
- Perform protection and safety engineering studies.
- Specify engineering details for electrical/automation system upgrades.
- Perform system integration engineering studies - power, control and communication, including interfaces.
- Prepare interconnection cabling diagrams.
- Perform civil and installation engineering - equipment layout drawings, foundations, cable routing, and grounding.
- Perform software engineering and system integration programming.
- Secure approvals and permits.
- Continue with interconnection application/process.
- Continue RMF application/certification process.
- Participate in a CPR meeting.
- Prepare a *CPR Report* in accordance with Subtask 1.3 (CPR Meetings).

Products:

- Design Drawing Package
- CPR Report #2

Subtask 4.2 Procurement
The goal of this task is to complete procurement of equipment.

The Recipient shall:

- Procure equipment and services through *Purchase Orders* / *Contracts*: finalize items to be procured, finalize offers from vendors, evaluate offers, negotiate contracts, issue purchase orders, witness and approve equipment during factory testing, and issue shipping clearances. The major items to be procured include, but may not be limited to:
    - Carport PV unit
    - Battery energy storage system
    - Real-time controller and systems integration services
    - Solar micro forecasting units
    - PV Quantum Boost boosters
    - Integrated Resiliency Node (Medium voltage/low voltage switchgear/transformer) – vendor will be decided after completing the design
    - Support services for design, engineering and systems integration support
    - Support services for construction and installation engineering services
    - Supporting services for utility interfaces, interconnection, market interfaces
    - Supporting services from an external consultant for RMF certification

Products:

- Purchase Orders / Contracts

Subtask 4.3 Site Deployment
The goal of this task is to develop Site Deployment related specifications and procedures.

The Recipient shall:

- Develop interconnection handoff with PG&E.
    - evaluate and map interconnection process with utility
    - interconnection application and process, mapping with Rule 21 or WDAT tariff
- Deploy at site: Includes contracting, procurement and shipping of materials, and site preparation. Installation is the beginning of field activity. Organizing unloading of equipment at site, storing them, if needed, doing the civil works for the installation (e.g. foundations and excavations), positioning equipment on foundations, fixing and wiring them and keeping them ready for testing and commissioning. In accordance to the *Site Preparation and Installation Guide* the following items will be installed:
    - battery energy storage system including inverters
    - photovoltaic and inverters
    - optical fiber and active switches for communications
    - cables to map with existing conduits
    - integrated resilient node hardware (medium voltage, low voltage)
    - secure approvals and permits
    - supply of miscellaneous installation materials

- A *Memo for Completion of Installation* will be provided once the installation is completed.

Products:

- Site Preparation and Installation Guide
- Memo for Completion of Installation

TASK 5 TESTING, COMMISSIONING, AND OPERATION

The goal of this task is to commission and test system and equipment for proper operation at the PRFTA microgrid demonstration site, and provide operational training to the PRFTA. The microgrid will be operated and data will be collected for a period of approximately 12 months.

The Recipient shall:

- Develop testing protocols for product level testing at manufacturer works/facilities (covered under procurement).
- Recipient and one or more subcontractors will collaborate to prepare system testing and commissioning protocols.
- Testing with no load commissioning of major equipment and sub systems after installation at site to develop *System Testing and Commissioning Report*.
- Conduct system commissioning, testing the system as a whole for all use cases.
- Acquire RMF certification, a requirement for all equipment installed at military sites.
- Test provision of distribution services that may become available as revenue streams to microgrids, such as VAR services, flexible energy services, and emergency services, to develop *Potential Revenue Streams Report*.
- Description of a *Measurement and Verification Plan* that includes, but is not limited to:
    - Energy Efficiency (EE) to measure before and after EE for the quantification of actual kW/kWh saved.
    - Demand Response (DR) including, but not limited to:
        - kW/kWh provided when DR is used
        - Definition of how the DR is used, the services provided by the microgrid, and the proposed value provided for these microgrid load services
        - The values of integrated services and how the services can be verified, measured and valued
        - DR event performance information from the IOU or CAISO for any DR services provided
- Conduct measurement and verification for system and components such as connected buildings for energy efficiency, to develop a *Performance Measurement and Verification Report*.
- Provide *Systems Operating Manual* and operational training to PRFTA's personnel.

Exhibit A
Scope of Work
Lawrence Berkeley National Laboratory

Products:

- System Testing and Commissioning Report
- Potential Revenue Streams Report
- Measurement and Verification Plan
- Performance Measurement and Verification Report
- Systems Operating Manual

TASK 6 DATA COLLECTION, ANALYSIS, AND SHARING

The goal of this task is to collect performance data from the PRFTA microgrid. LBNL will provide a secure repository for data collection, analysis, and sharing with DoD and CEC. Data will be collected and analyzed to identify and verify operational performance, proactively address any performance issues, measure progress, create and validate the business case, and calculate other metrics critical to replication and scaling of the microgrid design to other sites.

The Recipient shall:

- Develop a *Data Collection Plan*, to include plans for documentation of technical, environmental and economic data, including, but not limited to:
    - Installation issues
    - Operational constraints
    - Operational performance, including duration of islanded mode capability
    - Response to grid emergencies
    - Parameters that will measure and document successes, lessons learned, and best practices for the above
- Document and describe all data that will be collected (technical and economic) and produce a *Data Description Report* that describes data fields, data file formats, and file naming conventions.
- Compare project expectations and performance. Validation of assumptions and metrics, such as outage, monetization, and grid interaction. Analyze actual microgrid performance compared to expected performance. Develop an *Operating Performance Data Analysis Report* summarizing all of these measurements.
- Work with both the CEC and the microgrid operator to negotiate the delivery of the following to the CEC annually for 3 years beyond the term end date of this Agreement:
    - A confirmation that the microgrid system is operating
    - Any available summary performance data, benefits, or other relevant summary data reports that can be easily provided based on the data collecting systems installed

Products:

- Data Collection Plan
- Data Description Report
- Operating Performance Data Analysis Report

Exhibit A
Scope of Work
Lawrence Berkeley National Laboratory

TASK 7 EVALUATION OF PROJECT BENEFITS

The goal of this task is to report the benefits resulting from this project. The benefits evaluation will cover reliability improvement, operational cost reduction, environmental improvement, emissions reduction, and societal benefits. Project expectations and performance will also be compared.

The Recipient shall:

- Develop a *Benefits Framework*.
    - Review utility bills and calculate revenue streams
- Complete Project Benefits Questionnaires
    - Kick-off Meeting Benefits Questionnaire
    - Mid-term Benefits Questionnaire
    - 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, but are not limited to:
    - Reliability, resiliency and sustainability improvements as provide by the microgrid.
    - Net impacts on the larger grid's load and load shape as provide by the microgrid.
    - GHG reductions as provided by the microgrid, compared to using the utility grid for the electricity and also GHG reductions as provided by any new energy efficiency capabilities of the microgrid project.
    - The dollar value of energy savings as provided by the microgrid, each year.
    - The dollar value of any co-benefits that may accrue to the project, each year.
    - Cost savings or increments compared to business as usual, as provided by the microgrid, including but not limited to technology and installation costs, operations and maintenance, and energy use.
    - Benefit metrics for each of the different DERs separated by the specific DER element (e.g. the value energy storage provides to the microgrid owner/operator, the value renewables provide to the microgrid owner/operator, the value demand response services provide to the microgrid owner/operator).
    - Benefit of services as provided by the microgrid to the utility grid.

    - o <u>For Product Development Projects and Project Demonstrations:</u>

        - Published documents, including date, title, and periodical name.
        - Estimated or actual energy and cost savings, and estimated statewide energy savings once market potential has been realized. Identify all assumptions used in the estimates.
        - Greenhouse gas and criteria emissions reductions.

- Other non-energy benefits such as reliability, public safety, lower operational cost, environmental improvement, indoor environmental quality, and societal benefits.
- Data on potential job creation, market potential, economic development, and increased state revenue as a result of the project.
- A discussion of project product downloads from websites, and publications in technical journals.
- A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.

o Additional information for Product Development Projects:

- Outcome of product development efforts, such as 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.

o 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.

o For Information/Tools and Other Research Studies:

  - Outcome of project.
  - Published documents, including date, title, and periodical name.
  - A discussion of policy development. State if the project has been cited in government policy publications or technical journals, or has been used to inform regulatory bodies.
  - The number of website downloads.
  - An estimate of how the project information has affected energy use and cost, or have resulted in other non-energy benefits.
  - An estimate of energy and non-energy benefits.
  - Data on potential job creation, market potential, economic development, and increased state revenue as a result of project.
  - A discussion of project product downloads from websites, and publications in technical journals.
  - A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.

- Respond to CAM questions regarding responses to the questionnaires.

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

- Prepare a *Business Case Report*. As appropriate, the report will discuss the following:
  - How the microgrid system meets the critical needs of the intended end user/operator.
  - Cost/benefit analysis of the microgrid.
  - Define why the specific configuration has a high probability of being replicated in the future without EPIC funds.
  - Other areas as determined by the CAM.

Products:

- Benefits Framework
- Kick-off Meeting Benefits Questionnaire
- Mid-term Benefits Questionnaire
- Final Meeting Benefits Questionnaire
- Business Case Report (draft and final)

TASK 8 TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES

The goal of this task is to make the project successes, knowledge gained, experimental results, and lessons learned available to the public and key decision makers, and to commercialization partners, via publication in peer-reviewed journals and presentation at relevant technical conferences. The project will also leverage contributions from CAISO, PG&E, and one or more subcontractors to disseminate information and promote the project's findings and microgrid concept. The team will also engage with utilities to build stakeholder support and help remove regulatory barriers.

Exhibit A
Scope of Work
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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 throughout the project and at the end, with the expectation of identifying targets for replicability, 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. Presentation materials must be approved by the CAM in writing prior to the conference/workshop(s).
- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the California Energy Commission.
- Provide at least (6) six High Quality Digital Photographs (minimum resolution of 1300x500 pixels in landscape ratio) of pre and post technology installation at the project sites or related project photographs.
- Prepare a Technology/Knowledge Transfer Report on technology transfer activities conducted during the project.
- Conduct an Invite Only Site Tour and Workshop for California Base Commanders, Energy Teams and other Key Stakeholders
- Develop Microgrid Handbook for Master Plan, as a compilation of best practices, experience, business case, know-how for resiliency, reliability, and standard/typical designs
    - Microgrid Contracting How To
    - Microgrid Business Case
    - Microgrid Costing/Status Quo Comparison Tool

- Develop *Policy Acceleration and Adoption Strategy* by mobilizing the ecosystem through:
    - forming a working group for microgrid standards for fast permitting
    - forming a working group to codify standards and protocols needed to meet California utility and CAISO microgrid requirements, with an aim toward reduction in cost barriers for microgrid interconnection requirements
    - form working group for cybersecurity requirements

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)
- Microgrid Handbook for Master Plan
- Policy Acceleration and Adoption Strategy
- Invite Only Site Tour and Workshop

TASK 9 PRODUCTION READINESS PLAN

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

LBNL and team members will collaborate to commercialize the microgrid concept, i.e., prepare a robust industrial grade supervisory controller, and make it available for commercial use, together with manuals and engineering handbooks. Finally, LBNL and team members will pursue commercialization of the following products through bundling and packaging, as outlined in the project Scope of Work: Microgrid Investment Planner, Microgrid Supervisory Controller, Solar Microforecasting System, PV Efficiency Booster, Microgrid Business Case Application Suite and Bill of Materials.

The Recipient shall:

- Prepare a *Production Readiness Plan*. The degree of detail in the plan should be proportional to the complexity of producing or commercializing the proposed product, and to its state of development. As appropriate, the plan will discuss the following:
    - Critical production processes, equipment, facilities, personnel resources, and support systems needed to produce a commercially viable product.
    - Internal manufacturing facilities, supplier technologies, capacity constraints imposed by the design under consideration, design-critical elements, and the use of hazardous or non-recyclable materials. The product manufacturing effort may include "proof of production processes."
    - The estimated cost of production.
    - The expected investment threshold needed to launch the commercial product.
    - An implementation plan to ramp up to full production.
    - The outcome of product development efforts, such as copyrights and license agreements.
    - Patent numbers and applications, along with dates and brief descriptions.
    - Other areas as determined by the CAM.

Products:

- Production Readiness Plan (draft and final)

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

RESOLUTION NO: 18-0321-3c

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: LAWRENCE BERKELEY NATIONAL LABORATORY

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-17-038 from GFO-17-302 with the U.S. Department of Energy's Lawrence Berkeley National Laboratory for a $5,000,000 grant to demonstrate a microgrid project based at the U.S. Army Parks Reserve Forces Training Area that will make it easier for military bases to install and operate their own microgrids while maximizing renewable energy, increasing energy security and resiliency, reducing energy vulnerability and risks, and reducing GHG emissions. The Army and LBNL are providing $11,410,900 in match funding; 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 March 21, 2018.

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

Cody Goldthrite,
Secretariat