

## Exhibit A WORK STATEMENT

### TECHNICAL TASK LIST

Task #	CPR	Task Name
1	N/A	Administration
2		Advanced Power Analytics for Steady State and Dynamic PV Models
3	X	Solar Forecasting Integrated with Energy Storage and PV Performance
4	X	Command, Control and Communications for Power Flow Management
5		Field Testing and Validation of the Suite of Models
6		Raise Distribution and RTO/ISO's Situational Awareness of Virtual Power Plants and Microgrids

### KEY NAME LIST

Task #	Key Personnel	Key Subcontractor(s)	Key Partner(s)
1	Washom/Project Manager	EDSA	
2	Washom/Kleissl/Darie	EDSA	Direct Power Technologies
3	Washom/Kleissl/Darie		Direct Power Technologies
4	Washom /Darie	EDSA	Direct Power Technologies
5	Washom /Darie		Direct Power Technologies
6	Washom /Darie	EDSA	Direct Power Technologies

### GLOSSARY

*Specific terms and acronyms used throughout this scope of work are defined as follows:*

Acronym	Term
Energy Commission	California Energy Commission
CPM	Commission Project Manager
CPR	Critical Project Review
DERs	Distributed Energy Resources
Energy Commission	California Energy Commission
EDSA	EDSA Micro Corporation
ISO	Independent System Operator
PIER	Public Interest Energy Research
PV	Photovoltaic
RTO	Regional Transmission Operator
RD&D	Research, Development and Demonstration
UCSD	University of California San Diego

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Acronym	Term
VAr	Volt-Amps-Reactive
VPPs	Virtual Power Plants

### **Problem Statement:**

Both state and federal governments are pursuing greater deployment of renewable energy technologies, in particular dispersed photovoltaics (PV). Complications occur with this new, unplanned source of electricity supply on the distribution grid. One of the future grid designs is microgrids, nearly self-sufficient energy infrastructures built to provide superior power quality and reliability at a lesser cost than the utility system, and with a larger fraction of renewable energy resources.

Although examples of high-penetration PV on a distribution system exist, there are far too few occurrences and even fewer representative case studies to have a clear and documented understanding of the impacts that are available to the stakeholder community. There is a need to better understand the effects of PV penetration levels on grid operations with respect to different distribution circuit characteristics (circuit designs, load and generation mixes, etc.) for broad acceptance of high-penetration PV levels in distribution systems throughout the country.

### **Goals of the Agreement:**

The goals of this Agreement are to:

- a) Integrate for the first time a highly sophisticated power analytics software from the “mission critical” industry with a network of sixteen densely-spaced microclimate monitoring systems (greater than 1 per 100 acres), a hemispherical sky imager, and a ceilometer;
- b) Produce one-hour ahead output forecasts for 1 MegaWatt (MW) of dispersed PV; and
- c) Make supply, storage and load adjustments on a microgrid, based on dynamic market price signals.

Each one of these three elements above represents the leading edge of the current state of the art, but the assemblage of all within a single microgrid without any additional capital investment is globally unique. The overall goal is to significantly advance the needed modeling tools and validated databases of experience from field experiments with high penetration scenarios of PV on a Smart Microgrid and Smart Grid utility distribution system.

### **Objectives of the Agreement:**

The objectives of this Agreement include, but are not limited to, the following:

1. Achievement of greater than 20% reduction in feeder peak load through the integration of multiple, integrated PV, other distributed generation, electric energy storage, and price-driven load management on a feeder within the UCSD-owned microgrid;

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2. Demonstration of the capability of Volt-Amps-Reactive (VAr) electric power management, coordinating the Distributed Energy Resource (DER) with existing VAr management/ compensation tools;
3. Development of a strategy for, and demonstration of, information integration focused on both security and overall system architecture;
4. Development of a strategy for, and demonstration of, “self-healing” networks through the integration of Feeder Automation System Technologies into microgrid operations;
5. Demonstration of the capability to use automated distribution control to intentionally island customers in response to system problems; and
6. Development of information/tools addressing the impact of multiple DER technologies including:
  - a. Control algorithms for autonomous DER operations/automation that address multiple DER interactions and stability issues
  - b. Penetration limits of PV on the substation/feeder
  - c. Coordination and interoperability of multiple DER technologies with multiple applications/customers.

### **Product Guidelines:**

For complete product guidelines, refer to Section 5 in the Terms and Conditions.

### **TASK 1 ADMINISTRATION**

#### **Task 1.1 Attend Kick-off Meeting**

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

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

- Attend a “Kick-Off” meeting with the Commission Project Manager, the Grants Officer, and a representative of the Accounting Office. The Recipient shall bring its Project Manager, Agreement Administrator, Accounting Officer, and others designated by the Commission Project Manager to this meeting. The administrative and technical aspects of this Agreement will be discussed at the meeting. Prior to the kick-off meeting, the Commission Project Manager will provide an agenda to all potential meeting participants.

The administrative portion of the meeting shall include, but not be limited to, the following:

- Discussion of the terms and conditions of the Agreement
- Discussion of Critical Project Review (Task 1.2)
- Match fund documentation (Task 1.6)
- Permit documentation (Task 1.7)

The technical portion of the meeting shall include, but not be limited to, the

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following:

- The Commission Project Manager's expectations for accomplishing tasks described in the Scope of Work
- An updated Schedule of Products
- Discussion of Progress Reports (Task 1.4)
- Discussion of Technical Products (Product Guidelines located in Section 5 of the Terms and Conditions)
- Discussion of the Final Report (Task 1.5)

### **The Commission Project Manager shall:**

- Designate the date and location of this meeting.

### **Recipient Products:**

- Updated Schedule of Products (no draft)
- Updated List of Match Funds (no draft)
- Updated List of Permits (no draft)

### **Commission Project Manager Product:**

- Kick-Off Meeting Agenda (no draft)

### **Task 1.2 Critical Project Review (CPR) Meetings**

The goal of this task is to determine if the project should continue to receive Energy Commission funding to complete this Agreement and to identify any needed modifications to the tasks, products, schedule or budget.

CPRs provide the opportunity for frank discussions between the Energy Commission and the Recipient. CPRs generally take place at key, predetermined points in the Agreement, as determined by the Commission Project Manager and as shown in the Technical Task List above. However, the Commission Project Manager may schedule additional CPRs as necessary, and if necessary, the budget will be reallocated to cover the additional costs borne by the Recipient, but the overall grant amount will not increase.

Participants include the Commission Project Manager and the Recipient and may include the Commission Grants Officer, the Public Interest Energy Research (PIER) Program Team Lead, other Energy Commission staff and Management as well as other individuals selected by the Commission Project Manager to provide support to the Energy Commission.

If DOE is conducting similar meetings, the Recipient shall notify and invite the Commission project manager to participate, either by teleconference or by actual meeting attendance. The DOE required meetings can be used in place of the Commission's CPR meetings, at the discretion of the Commission project manager.

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### **The Commission Project Manager shall:**

- Determine the location, date, and time of each CPR meeting with the Recipient. These meetings generally take place at the Energy Commission, but they may take place at another location.
- Send the Recipient the agenda and a list of expected participants in advance of each CPR. If applicable, the agenda shall include a discussion on both match funding and permits.
- Conduct and make a record of each CPR meeting. One of the outcomes of this meeting will be a schedule for providing the written determination described below.
- Determine whether to continue the project, and if continuing, whether or not modifications are needed to the tasks, schedule, products, and/or budget for the remainder of the Agreement. Modifications to the Agreement may require a formal amendment (please see the Terms and Conditions). If the Commission Project Manager concludes that satisfactory progress is not being made, this conclusion will be referred to the Energy Commission's Research, Development and Demonstration (RD&D) Policy Committee for its concurrence.
- Provide the Recipient with a written determination in accordance with the schedule. The written response may include a requirement for the Recipient to revise one or more product(s) that were included in the CPR.

### **The Recipient shall:**

- Prepare a CPR Report for each CPR that discusses the progress of the Agreement toward achieving its goals and objectives. This report shall include recommendations and conclusions regarding continued work of the projects. This report shall be submitted along with any other products identified in this scope of work. The Recipient shall submit these documents to the Commission Project Manager and any other designated reviewers at least 15 working days in advance of each CPR meeting.
- Present the required information at each CPR meeting and participate in a discussion about the Agreement.
- Recipient will provide copies of any DOE correspondence (emails, reports, letters, etc.) that relate to the project status. This includes copies of project performance reviews on Recipient work and summaries and results of project review meetings with DOE.

### **Commission Project Manager Products:**

- Agenda and a list of expected participants (no draft)
- Schedule for written determination (no draft)
- Written determination (no draft)

### **Recipient Product:**

- CPR Report(s) (no draft)
- DOE correspondence and reporting (no draft)

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### **Task 1.3 Final Meeting**

The goal of this task is to closeout this Agreement.

If DOE is conducting a similar final meeting, the Recipient shall notify and invite the Commission project manager to participate, either by teleconference or by actual meeting attendance. The DOE required meeting can be used in place of the Commission's final meeting, at the discretion of the Commission project manager. However, all items listed in this task will need to be covered in the meeting.

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

- Meet with Energy Commission staff to present the findings, conclusions, and recommendations. The final meeting must be completed during the closeout of this Agreement.

This meeting will be attended by, at a minimum, the Recipient, the Commission Grants Office Officer, and the Commission Project Manager. The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be two separate meetings at the discretion of the Commission Project Manager.

The technical portion of the meeting shall present an assessment of the degree to which project and task goals and objectives were achieved, findings, conclusions, recommended next steps (if any) for the Agreement, and recommendations for improvements. The Commission Project Manager will determine the appropriate meeting participants.

The administrative portion of the meeting shall be a discussion with the Commission Project Manager and the Grants Officer about the following Agreement closeout items:

- What to do with any equipment purchased with Energy Commission funds (Options)
- Energy Commission's request for specific "generated" data (not already provided in Agreement products)
- Need to document 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 schedule for completing the closeout activities for this Agreement
- Copies of all correspondence and reports discussing DOE's findings on the project, and future disposition of the project, if applicable. When directed by the Commission project manager, recipient will provide copies of any DOE correspondence (emails, reports, letters, etc.) that relate to project performance.

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### **Products:**

- Written documentation of meeting agreements (no draft)
- Schedule for completing closeout activities (no draft)
- DOE correspondence on project findings and results (no draft)

### **Task 1.4 Monthly Progress Reports**

The goal of this task is to periodically verify that satisfactory and continued progress is made towards achieving the research objectives of this Agreement on time and within budget.

The objectives of this task are to summarize activities performed during the reporting period, to identify activities planned for the next reporting period, to identify issues that may affect performance and expenditures, and to form the basis for determining whether invoices are consistent with work performed.

With Commission project manager approval, the Recipient can submit a DOE Progress Report in lieu of the required Commission report if contains the information listed in Attachment 1 of the Terms and Conditions.

### **The Recipient shall:**

- Prepare a Monthly Progress Report which summarizes all Agreement activities conducted by the Recipient for the reporting period, including an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. Each progress report is due to the Commission Project Manager within 10 days of the end of the reporting period. The recommended specifications for each progress report are contained in Exhibit A, Attachment A-2.
- Unless otherwise directed by the Commission project manager, each Progress Report must contain any reports made to DOE, including summaries of meetings with DOE, as it that relates to the project outcome and performance. Include names and contacts of DOE representatives.

### **Product:**

- Monthly Progress Reports (no draft)
- Copies of DOE reporting and meeting summaries (no draft)

### **Task 1.5 Final Report**

The goal of the Final Report is to assess the project's success in achieving its goals and objectives, advancing science and technology, and providing energy-related and other benefits to California.

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The objectives of the Final Report are to clearly and completely describe the project's purpose, approach, activities performed, results, and advancements in science and technology; to present a public assessment of the success of the project as measured by the degree to which goals and objectives were achieved; to make insightful observations based on results obtained; to draw conclusions; and to make recommendations for further RD&D projects and improvements to the PIER project management processes.

If a final report is required by DOE, the Recipient will include a copy of it along with the Energy Commission's final report requirements. In addition, the Recipient shall submit the draft final DOE report to the Energy Commission for review at the same time it submits it to DOE.

The Final Report shall be a public document. If the Recipient has obtained confidential status from the Energy Commission and will be preparing a confidential version of the Final Report as well, the Recipient shall perform the following activities for both the public and confidential versions of the Final Report.

### **The Recipient shall:**

- Prepare an Outline of the Final Report.
- Prepare a Final Report following the approved outline and the latest version of the PIER Final Report guidelines published on the Energy Commission's website at <http://www.energy.ca.gov/contracts/pier/contractors/index.html> at the time the Recipient begins performing this task, unless otherwise instructed in writing by the Commission Project Manager. Instead of the timeframe listed in the Product Guidelines located in Section 5 of the Terms and Conditions, the Commission Project Manager shall provide written comments on the Draft Final Report within fifteen (15) working days of receipt. The Final Report must be completed on or before the end of the Agreement Term.
- Submit one bound copy of the Final Report with the final invoice.
- Provide a draft copy of the Final Report including a copy of the draft submitted to the U.S. DOE in response to the American Recovery and Reinvestment Act Funding Opportunity Notice for which an award was received. The Final Report must be completed on or before the end of the Agreement Term.
- Submit written correspondence from DOE regarding acceptance of the final report.

### **Products:**

- Draft Outline of the Final Report, including a copy of the draft report submitted to DOE
- Final Outline of the Final Report, including a copy of the final report submitted to DOE
- Draft Final Report

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- Final Report
- Written correspondence from DOE regarding acceptance of final report (no draft)

### **Task 1.6 Identify and Obtain Matching Funds**

The goal of this task is to ensure that the match funds planned for this Agreement are obtained for and applied to this Agreement during the term of this Agreement.

The costs to obtain and document match fund commitments are not reimbursable through this Agreement. Although the PIER budget for this task will be zero dollars, the Recipient may utilize match funds for this task. Match funds shall be spent concurrently or in advance of PIER funds for each task during the term of this Agreement. Match funds must be identified in writing and the associated commitments obtained before the Recipient can incur any costs for which the Recipient will request reimbursement.

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

- Prepare a letter documenting the match funding committed to this Agreement and submit it to the Commission Project Manager at least 2 working days prior to the kick-off meeting. 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 such 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 each cash match fund, its source, including a contact name, address and telephone number and the task(s) to which the match funds will be applied
  - Amount of each in-kind contribution, a description, documented market or book value, and its 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 shall identify its owner and provide a contact name, address and telephone number, and the address where the property is located
- Provide a copy of the letter of commitment from an authorized representative of each source of cash match funding or in-kind contributions that these funds or contributions have been secured.
- Discuss match funds and the implications to the Agreement if they are reduced or not obtained as committed, at the kick-off meeting. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide the appropriate information to the Commission Project Manager if during the course of the Agreement additional match funds are received.
- Notify the Commission Project Manager within 10 days if during the

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course of the Agreement existing match funds are reduced. Reduction in match funds must be approved through a formal amendment to the Agreement and may trigger an additional CPR.

### **Products:**

- A letter regarding match funds or stating that no match funds are provided (no draft)
- Copy(ies) of each match fund commitment letter(s) (if applicable) (no draft)
- Letter(s) for new match funds (if applicable) (no draft)
- Letter that match funds were reduced (if applicable) (no draft)

### **Task 1.7 Identify and Obtain Required Permits**

The goal of this task 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 reimbursable under this Agreement. Permits must be identified in writing before the Recipient can incur any costs related to the use of the permit(s) for which the Recipient will request reimbursement.

### **The Recipient shall:**

- Prepare a letter documenting the permits required to conduct this Agreement and submit it to the Commission Project Manager at least 2 working days prior to the kick-off meeting. If there are no permits required at the start of this Agreement, then state such in the letter. If it is known at the beginning of the Agreement that permits will be required during the course of the Agreement, provide in the letter:
  - A list of the permits that identifies the:
    - Type of permit
    - Name, address and telephone number of the permitting jurisdictions or lead agencies
- The schedule the Recipient will follow in applying for and obtaining these permits.
- Discuss the list of permits and the schedule for obtaining them at the kick-off meeting and develop a timetable for submitting the updated list, schedule and the copies of the permits. The implications to the Agreement 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 the Progress Reports and will be a topic at CPR meetings.
- If during the course of the Agreement additional permits become necessary, provide the appropriate information on each permit and an updated schedule to the Commission Project Manager.
- As permits are obtained, send a copy of each approved permit to the

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Commission Project Manager.

- If during the course of the Agreement permits are not obtained on time or are denied, notify the Commission Project Manager within 10 days. Either of these events may trigger an additional CPR.

### **Products:**

- Letter documenting the permits or stating that no permits are required (no draft)
- A copy of each approved permit (if applicable) (no draft)
- Updated list of permits as they change during the term of the Agreement (if applicable) (no draft)
- Updated schedule for acquiring permits as changes occur during the term of the Agreement (if applicable) (no draft)

### **TASK 2 ADVANCED POWER ANALYTICS FOR STEADY STATE AND DYNAMIC PV MODELS**

The goal of this task is to examine performance of a PV system within a realistic power system. The project team will develop the dynamic model of a PV system, the protection control of the PV module, inverter, control equipment and controlling EDSA Power Analytics' Universal Control Logic. The developed steady state and dynamic PV models will not require recompilation and re-linking of object modules, thereby greatly reducing validation and testing efforts.

### **The Recipient shall:**

- Develop a Power Flow (steady-state) model of the PV system.
- Develop a Short Circuit (steady-state) model of the PV system.
- Develop a Transient Stability (time domain) model of the PV system.
- Perform an Integration Study, develop a Planning Guideline, and determine an acceptable level of penetration of the PV system.
- Develop Open Source Application Programming Interface.
- Provide an enhancements report to the Commission Project Manager (CPM) detailing the modeling, simulation and reporting enhancements made to the PV system in this task.
- Participate in a CPR as per Task 1.2.

### **Products:**

- Enhancements Report (no draft)

### **TASK 3 SOLAR FORECASTING INTEGRATED WITH ENERGY STORAGE AND PV PERFORMANCE**

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The goals of this task are to estimate the benefits of energy storage systems, provide different probabilistic scenarios for input into the PV system model developed in Task 2, and develop a three-dimensional Cloud Tracking and Insolation forecast model.

### **The Recipient shall:**

- Derive a historical Probabilistic Ramp Rate Model from 1 second Global Horizontal Irradiance data.
- Develop a three-dimensional Cloud Tracking and Insolation Forecast Model.
- Provide a report on cloud location algorithms to the CPM.
- Publish an article in journal "Solar Energy on the measured extreme ramp rates of solar insolation and one hour solar forecasting." Provide the article to the CPM.
- Participate in a CPR as per Task 1.2.

### **Products:**

- Cloud Location Algorithms Report (no draft)
- "Solar Energy" Journal Publication (no draft)

## **TASK 4 COMMAND, CONTROL AND COMMUNICATIONS FOR POWER FLOW MANAGEMENT**

The goal of this task is to establish a common interface for bi-directional communications between the system controller and the electrical power service provider, or utility. The Utility Command/Control Interface will also incorporate other modes of operation depending on local and external conditions.

### **The Recipient shall:**

- Comply with the Open Systems Interconnection seven layer model.
- Incorporate into the Utility Command/Control Interface net metering with SDG&E single point of interface, utility dispatch sources in the case of Auto Demand Response, utility dispatch sink in the case of purchases surplus renewable energy, dynamic price signals based upon Locational Marginal Pricing and Demand Response, and manual/operator override of controls.
- Provide a report summarizing the bi-directional communication established during this task.
- Participate in a CPR as per Task 1.2.

### **Products:**

- Bi-Directional Communications Report (no draft)

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### **TASK 5 FIELD TESTING AND VALIDATION OF THE SUITE OF MODELS**

The goal of this task is to perform field testing and validation of the performance for the suite of models developed in Tasks 2, 3 and 4.

**The Recipient shall:**

- Field test and validate performance of the models at the existing 1 MW of PV at seven sites.
- Provide a report summarizing the results of the field tests and validation to the CPM.
- Participate in a CPR as per Task 1.2.

**Products:**

- Field Testing and Validation Report (no draft)

### **TASK 6 RAISE DISTRIBUTION AND RTO/ISO'S SITUATIONAL AWARENESS OF VIRTUAL POWER PLANTS AND MICROGRIDS**

The goal of this task is to raise the distribution of, and the Regional Transmission Operator (RTO)/ Independent System Operators' (ISO) understanding of, Virtual Power Plants (VPPs) and microgrids to a level that will permit these resources to become competitive operational assets for power generation, demand response and ancillary services responding to dynamic price signals.

**The Recipient shall:**

- Perform real-world simulations of dynamic price signals for SDG&E and CAISO, demand response events, islanding, frequency regulation, energy storage dispatch, utility load sink and peak load shaving.
- Evaluate and verify microgrid renewable integration operations in the controlled and well-instrumented environment on UC San Diego's microgrid.
- Provide a report on the real-world simulations, microgrid renewable integration operations, and VPPs to the CPM.

**Products:**

- Report on simulations, microgrids, and VPP (no draft)