Exhibit A

SCOPE OF WORK

TECHNICAL TASK LIST

Task #	CPR	Task Name
1	N/A	Administration
2		Project Activation
3		Site Selection
4		Network Evaluation
5		Microgrid Design
6	X	Phase 2 Smart Grid Demonstration Plan
7	X	Phase 2 Scoping Study
8		Establish Baseline
9		Integrate Resources
10		Operational Testing
11		Prepare Results

KEY NAME LIST

Task #	Key Personnel	Key Subcontractor(s)	Key Partner(s)
1	Tom Bialek – SDG&E Terry Mohn – SDG&E Steve Pullins – HEG		
2	Tom Bialek – SDG&E Terry Mohn – SDG&E Steve Pullins – HEG	Horizon Energy Group GridPoint	University of San Diego
3	Tom Bialek – SDG&E Terry Mohn – SDG&E Steve Pullins – HEG	Horizon Energy Group Xanthus	
4	Tom Bialek – SDG&E Terry Mohn – SDG&E Steve Pullins – HEG	Horizon Energy Group GridPoint Xanthus	University of San Diego
5	Tom Bialek – SDG&E Terry Mohn – SDG&E Steve Pullins – HEG	Horizon Energy Group GridPoint Xanthus	University of San Diego
6	Tom Bialek – SDG&E Terry Mohn – SDG&E Steve Pullins – HEG		

Task #	Key Personnel	Key Subcontractor(s)	Key Partner(s)
7	Tom Bialek – SDG&E Terry Mohn – SDG&E Steve Pullins – HEG		
8	Tom Bialek – SDG&E Terry Mohn – SDG&E Steve Pullins – HEG	Horizon Energy Group GridPoint	Xanthus
9	Tom Bialek – SDG&E Terry Mohn – SDG&E Steve Pullins – HEG	Horizon Energy Group GridPoint	Xanthus
10	Tom Bialek – SDG&E Terry Mohn – SDG&E Steve Pullins – HEG	Horizon Energy Group GridPoint	
11	Tom Bialek – SDG&E Terry Mohn – SDG&E Steve Pullins – HEG	Horizon Energy Group	Xanthus

GLOSSARY

Specific terms and acronyms used throughout this work statement are defined as follows:

Acronym	Definition
AMI	Advanced Meter Infrastructure
CAIDI	Customer Average Interruption Duration Index
CHP	Combined Heat and Power
CIM	Common Information Model
CPR	Critical Project Review
CPUC	California Public Utilities Commission
DER	Distributed Energy Resources (Storage, DG, Microgrid)
DG	Distributed Generation
DR	Distributed Resources
EPRI	Electric Power Research Institute
kW	Kilowatt
MAIFI	Momentary Average Interruption Frequency Index
MS	Microsoft
PIER	Public Interest Energy Research
PQ	Power Quality
PV	Photovoltaic
R&D	Research and Development
SAIDI	System Average Interruption Duration Index

Acronym	Definition
SAIFI	System Average Interruption Frequency Index
SCADA	Supervisory Control and Data Acquisition
T&D	Transmission and Distribution
TAC	Technical Advisory Committee
TES	Thermal Energy Storage
UCC.1	Uniform Commercial Code
VAr	Volt-Amps-Reactive

Problem Statement

The foundation of existing electric utility systems is based on delivering power from central station generation units to their diverse end users. Market, technological, and regulatory forces have created a nexus of opportunity as utilities increasingly focus on providing commercial, industrial, and residential customers with uniform electric reliability and power quality resources via a cost effective and integrated electric delivery system. Customers are also concurrently investigating and investing in energy assets and distribution systems, ranging from backup power systems to on-site generation and renewable resources. While some progress has been made on the development of interconnected loads and distributed energy resources there has been scant attention to the development of an integrated energy system that can operate in parallel with the grid or in an intentional island model. Hence, there is an immediate and critical need to understand how microgrids consisting of interconnected loads and distributed energy resources can be operationally optimized and developed in a cost effective manner. Concurrently, there is an increasing need to assess the role, impact, and contributions of sustainable communities in integrated microgrid designs and their potential to contribute to demand response objectives and programs.

Microgrids are viewed as part of a larger smart grid strategy. Although the focus of this research centers on grid design and distributed generation, the results impact the larger understanding of smart grid efforts. Smart grid defines a series of characteristics and technologies, and is more appropriately described as a strategy, rather than a result. This research, during Phase 1 - design, clarifies the strategy; and during Phase 2 - demonstration, tests the strategy for both technological capabilities and cost effectiveness.

This demonstration project will help determine how innovative microgrid designs can be developed and supported by an electric utility with the smart grid goals of optimizing assets, managing costs, achieving demand response goals, integrating renewable resources and advanced technologies, and increasing reliability of the power grid. This demonstration project will also lay the framework for assessing the impact and viability of smart grids on energy costs and price volatility, environmental sustainability, including the extent of energy system carbon foot printing, and the management of intermittent renewable resources.

The SDG&E smart grid project is setup as two phases. Phase 1 will establish the design for addressing four fundamental and interrelated goals:

- Integrating utility and customer based energy resources, including carbon and non-carbon based energy sources and applications

- Enhancing the management of intermittent renewable resources, including the impact of resources from sustainable communities
- Identifying and evaluating the key technical and operational issues with designing, implementing, and managing an integrated energy portfolio of utility and non-utility interconnected resources
- Improving power reliability and quality via utility asset optimization

Phase 2 will apply the lessons learned and designs developed in Phase 1. Phase 2 literally follows Phase 1. During Phase 1, a demonstration plan is developed, followed by site selection, preparing for engineering development and all engineering aspects of the Phase 2.

Goals of the Agreement

This project will focus on developing a demonstration project that will answer the following key questions necessary to move smart grid focused technology, and integration thereof, from the R&D and "bench test" environment to the actual operating environment:

- How do microgrids perform at utility scale regarding reliability and economics?
- How do microgrids conduct normal operations while optimizing performance in peak and non-peak periods?
- How do microgrids handle transients, outages, and emergency conditions?
- What information and communications are necessary between microgrid and utility operations to ensure operational coordination and effective information sharing?
- How do the incorporation of feeder-level storage and DG affect system performance?
- How effective are new advances in storage and DG for smart grid?
- How do utility-scale circuits and associated resources transition into and out of microgrid operations?
- How do utilities optimize the design of circuit operations for microgrid capabilities given consumer DG, demand response, automated response, and other advanced tools?

The demonstration project developed for this contract brings circuit and customer realities to the picture. While a few smart grid trials have taken place in the US, they have been small scale and not directly applicable to the real operating environment. This project differs from previous trials and will extend the knowledge base as follows:

- The demonstration project will include real customers with real operating environments
- The demonstration project will not only examine normal operations in and out of microgrid operations, but also examine outage and event conditions
- The demonstration project is at significant scale; several megawatts as opposed to 100 kW test scale
- The demonstration project integrates not only reliability-oriented operations, but also economic-oriented operations

The fact that the project will be designed to operate at the real world scale, including the application of outage, transient, and event conditions, the project will provide knowledge about the design, operational, and economic considerations of an integrated microgrid model that includes both carbon and non-carbon based energy sources..

The successful and optimized integration of distributed energy technologies not only rests with their functionality and ability to address outages and event conditions, but also the economics of microgrids. The demonstration project will also include the future development and, outside the scope of this agreement and Energy Commission funding, filing of tariffs with California Public Utilities Commission (CPUC). The project optimization goals start with the following premises:

- Examining outage and event conditions
- Addressing power quality (PQ) locally leads to reduced dollars spent by the utility and consumer
- Engaging consumer-owned DER to address the peak may require less capital overall

Aggregation of data taken throughout the project (multiple Phase 2 stage testing), with the testing at the conclusion of the project will enable the San Diego smart grid team to provide the nation with real data on smart grid operational and economic performance.

Objectives of the Agreement

The objectives of this Agreement are to develop a demonstration plan that will:

1. Assess the ability to achieve at least a fifteen percent reduction in feeder peak load through the integration of multiple, integrated DER – distributed generation (DG), electric energy storage, and price driven load management - on a San Diego Gas and Electric Company feeder;
2. Demonstrate capability of Volt-Amps-Reactive (VAr) electric power management - coordinating the DER with existing VAr management/compensation tools;
3. Develop a strategy and demonstration of information integration focused on both security and overall system architecture. Areas include Gridwise Architecture Interoperability Framework, EPRI's Intelligrid reference design, IEC Common information model (CIM) and other industry interoperability standards applied to smart grid operations;
4. Develop a strategy and demonstrate the integration of AMI into smart grid operations;
5. Demonstrate the capability to use automated distribution control to intentionally island customers in response to system problems; and
6. Develop information/tools addressing the impact of multiple DER technologies including:
    - control algorithms for autonomous DER operations/automation that address multiple DER interactions and stability issues
    - coordination and interoperability of multiple DER technologies with multiple applications/customers.
7. Demonstrate Programmable and Controllable Thermostats to achieve Demand Response goals within the smart grid.

TASK 1.0 ADMINISTRATION

MEETINGS

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 Contractor shall:

- Attend a "kick-off" meeting with the Commission Contract Manager, the Contracts Officer, and a representative of the Accounting Office. The Contractor Team will bring their Project Manager, Contracts Administrator, Accounting Officer, and any other individuals requested by the Commission Contract Manager to this meeting. The administrative and technical aspects of this Agreement will be discussed at the meeting. One week prior to the kick-off meeting, the Commission Contract 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:

  - Terms and Conditions of the Agreement
  - CPRs (Task 1.2)
  - Match fund documentation (Task 1.7)
  - Permit documentation (Task 1.8)
  - Development of TAC (Task 1.10)

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

  - The Commission Contract Manager's expectations for accomplishing tasks described in the Scope of Work;
  - An updated Schedule of Deliverables
  - An updated Gantt Chart
  - Progress Reports (Task 1.4)
  - Technical Deliverables (Task 1.5)
  - TAC Meeting Support (1.11)
  - Final Report (Task 1.6)

The Commission Contract Manager shall designate the date and location of this meeting.

Contractor Deliverables:

- An Updated Schedule of Deliverables
- An Updated Gantt Chart
- An Updated List of Match Funds
- An Updated List of Permits

Commission Contract Manager Deliverables:

- Final Report Instructions

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 if it should, are there any modifications that need to be made to the tasks, deliverables, schedule or budget.

CPRs provide the opportunity for frank discussions between the Energy Commission and the Contractor. CPRs generally take place at key, predetermined points in the Agreement, as determined by the Commission Contract Manager and as shown in the Technical Task List above and in the Schedule of Deliverables. However, the Commission Contract Manager may schedule additional CPRs as necessary, and any additional costs will be borne by the Contractor.

Participants include the Commission Contract Manager and the Contractor, and may include the Commission Contracts Officer, the PIER Program Team Lead, other Energy Commission staff and Management as well as other individuals selected by the Commission Contract Manager to provide support to the Energy Commission.

The Commission Contract Manager shall:

- Determine the location, date and time of each CPR meeting with the Contractor. These meetings generally take place at the Energy Commission, but they may take place at another location.
- Send the Contractor 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 to modify the tasks, schedule, deliverables and budget for the remainder of the Agreement, including not proceeding with one or more tasks. If the Commission Contract Manager concludes that satisfactory progress is not being made, this conclusion will be referred to the Energy Commission's Research, Development and Demonstration Policy Committee for its concurrence.
- Provide the Contractor with a written determination in accordance with the schedule. The written response may include a requirement for the Contractor to revise one or more deliverable(s) that were included in the CPR.

The Contractor 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 deliverables identified in this Scope of Work. Submit these documents to the Commission Contract 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.

Contractor Deliverables:

- CPR Report(s)
- CPR deliverables identified in the Scope of Work

Commission Contract Manager Deliverables:

- Agenda and a List of Expected Participants
- Schedule for Written Determination
    - Written Determination

Task 1.3 Final Meeting

The goal of this task is to closeout this Agreement.

The Contractor shall:

- Meet with the Energy Commission 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 Contractor, the Commission Contracts Officer, and the Commission Contract 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 Contract Manager.
- The technical portion of the meeting shall present findings, conclusions, and recommended next steps (if any) for the Agreement. The Commission Contract Manager will determine the appropriate meeting participants.
- The administrative portion of the meeting shall be a discussion with the Commission Contract Manager and the Contracts Officer about the following Agreement closeout items:
    - What to do with any state-owned equipment (Options)
    - Need to file UCC.1 form re: Energy Commission's interest in patented technology
    - Energy Commission's request for specific "generated" data (not already provided in Agreement deliverables)
    - Need to document Contractor's disclosure of "subject inventions" developed under the Agreement
    - "Surviving" Agreement provisions, such as repayment provisions and confidential deliverables
    - Final invoicing and release of retention
- Prepare a schedule for completing the closeout activities for this Agreement.

Deliverables:

- Written documentation of meeting agreements and all pertinent information
- Schedule for completing closeout activities

REPORTING

See Exhibit D, Reports/Deliverables/Records.

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.

The Contractor shall:

- Prepare progress reports which summarize all Agreement activities conducted by the Contractor 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 Contract Manager within 10 working days after the end of the reporting period. Attachment A-2, Progress Report Format, provides the recommended specifications.

Deliverables:

- Monthly Progress Reports

Task 1.5 Test Plans, Technical Reports and Interim Deliverables

The goal of this task is to set forth the general requirements for submitting test plans, technical reports and other interim deliverables, unless described differently in the Technical Tasks. When creating these deliverables, the Contractor shall use and follow, unless otherwise instructed in writing by the Commission Contract Manager, the latest version of the PIER Style Manual published on the Energy Commission's web site:

http://www.energy.ca.gov/contracts/pier/contractors/index.html

The Contractor shall:

- Submit a draft of each deliverable listed in the Technical Tasks to the Commission Contract Manager for review and comment in accordance with the approved Schedule of Deliverables. The Commission Contract Manager will provide written comments back to the Contractor on the draft deliverable within 10 working days of receipt. Once agreement has been reached on the draft, the Contractor shall submit the final deliverable to the Commission Contract Manager. The Commission Contract Manager shall provide written approval of the final deliverable within 5 working days of receipt. Key elements from this deliverable shall be included in the Final Report for this project.

Task 1.6 Final Report

The goal of this task is to prepare a comprehensive written Final Report that describes the original purpose, approach, results and conclusions of the work done under this Agreement. The Commission Contract Manager will review and approve the Final Report. The Final Report must be completed on or before the termination date of the Agreement. When creating these deliverables, the Contractor shall use and follow, unless otherwise instructed in writing by the Commission Contract Manager, the latest version of the PIER Style Manual published on the Energy Commission's web site:

http://www.energy.ca.gov/contracts/pier/contractors/index.html

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

Task 1.6.1 Final Report Outline

The Contractor shall:

- Prepare a draft outline of the Final Report.
- Submit the draft outline of Final Report to the Commission Contract Manager for review and approval. The Commission Contract Manager will provide written comments back to the Contractor on the draft outline within 10 working days of receipt. Once agreement has been reached on the draft, the Contractor shall submit the final outline to the Commission Contract Manager. The Commission Contract Manager shall provide written approval of the final outline within 5 working days of receipt.

Deliverables:

- Draft Outline of the Final Report
- Final Outline of the Final Report

Task 1.6.2 Final Report

The Contractor shall:

- Prepare the draft Final Report for this Agreement in accordance with the approved outline.
- Submit the draft Final Report to the Commission Contract Manager for review and comment. The Commission Contract Manager will provide written comments within 10 working days of receipt.

  Once agreement on the draft Final Report has been reached, the Commission Contract Manager shall forward the electronic version of this report to the PIER Technology Transfer Group for final editing. Once final editing is completed, the Commission Contract Manager shall provide written approval to the Contractor within 5 working days.
- Submit one bound copy of the Final Report with the final invoice.

Deliverables:

- Draft Final Report
- Final Report

MATCH FUNDS, PERMITS, AND ELECTRONIC FILE FORMAT

Task 1.7 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. While the PIER budget for this task will be zero dollars, the Contractor may utilize match funds for this task. Match funds shall be spent concurrently or in advance of PIER funds during the term of this Agreement. Match funds must be identified in writing, and the associated commitments obtained before the Contractor can incur any costs for which the Contractor will request reimbursement.

The Contractor shall:

- Prepare a letter documenting the match funding committed to this Agreement and submit it to the Commission Contract Manager at least 2 working days prior to the kick-off meeting:
  1. 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.
  2. 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 Contractor shall identify its owner and provide a contact name, address and telephone number, and the address where the property is located.
     - 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 significantly 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 Contract Manager if during the course of the Agreement additional match funds are received.
     - Notify the Commission Contract Manager within 10 working days if during the course of the Agreement existing match funds are reduced. Reduction in match funds may trigger an additional CPR.

Deliverables:

- A letter regarding Match Funds or stating that no Match Funds are provided
- Letter(s) for New Match Funds
- A copy of each Match Fund commitment letter
- Letter that Match Funds were Reduced (if applicable)

Task 1.8 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 not reimbursable under this Agreement. While the PIER budget for this task will be zero dollars, the Contractor shall show match funds for this task. Permits must be identified in writing and obtained before the Contractor can incur any costs related to the use of the permits for which the Contractor will request reimbursement.

The Contractor shall:

- Prepare a letter documenting the permits required to conduct this Agreement and submit it to the Commission Contract Manager at least 2 working days prior to the kick-off meeting:
  1. If there are no permits required at the start of this Agreement, then state such in the letter.
  2. 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
     - Schedule the Contractor will follow in applying for and obtaining these permits.
- The list of permits and the schedule for obtaining them will be discussed at the kick-off meeting, and a timetable for submitting the updated list, schedule and the copies of the permits will be developed. 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, then provide the appropriate information on each permit and an updated schedule to the Commission Contract Manager.
- As permits are obtained, send a copy of each approved permit to the Commission Contract Manager.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the Commission Contract Manager within 5 working days. Either of these events may trigger an additional CPR.

Deliverables:

- A letter documenting the Permits or stating that no Permits are required
- Updated list of Permits as they change during the Term of the Agreement
- Updated schedule for acquiring Permits as it changes during the Term of the Agreement
- A copy of each approved Permit

Task 1.9 Electronic File Format

The goal of this task is to unify the formats of electronic data and documents provided to the Energy Commission as contract deliverables. Another goal is to establish the computer platforms, operating systems and software that will be required to review and approve all software deliverables.

The Contractor shall:

- Deliver documents to the Commission Contract Manager in the following formats:
  - Data sets shall be in Microsoft (MS) Access or MS Excel file format.
  - PC-based text documents shall be in MS Word file format.
  - Documents intended for public distribution shall be in PDF file format, with the native file format provided as well.
  - Project management documents shall be in MS Project file format.
- Request exemptions to the electronic file format in writing at least 90 days before the deliverable is submitted.

Deliverables:

- A letter requesting exemption from the Electronic File Format (if applicable)

TECHNICAL ADVISORY COMMITTEE

Task 1.10 Organize and Conduct Meetings of the Technical Advisory Committee (TAC)

The goal of this activity is to create a technical advisory committee for this Agreement.

The TAC should be composed of diverse professionals. The number can vary depending on potential interest and time availability. The Contractor's Project Manager and the Commission Contract Manager shall act as co-chairs of the TAC. The exact composition of the TAC may change as the need warrants. TAC members serve at the discretion of the Commission Contract Manager.

The TAC shall be composed of, but not limited to, qualified professionals spanning the following types of disciplines:

- Representatives of municipal, state and federal regulatory agencies;
- Relevant stakeholders;
- Utility Representatives;
- Members of relevant technical research organizations;
- Academic experts

The purpose of the TAC is to:

- Provide guidance in research direction. The guidance may include scope of research; research; appropriate technical applications; coordination with other research.
- Review deliverables. Provide specific suggestions and recommendations for needed adjustments, refinements, or enhancement of the deliverables.
- Evaluate tangible benefits to California of this research and provide recommendations, as needed, to enhance tangible benefits.

- Provide recommendations regarding information dissemination, market pathways or commercialization strategies relevant to the research strategies.

The Contractor shall:

- Prepare a draft list of potential TAC members that include name, organization, physical and electronic address, and phone number and submit it to the Commission Contract Manager at least 2 working days prior to the kick-off meeting. This list will be discussed at the kick-off meeting and a schedule for recruiting members and hold the first TAC meeting will be developed.
- Work with the Project Manager and the CEC Contract Manager to identify and recruit TAC members and ensure that each individual understands the member obligations described above, as well as the TAC Meeting Schedule outline in Task 1.11.

Deliverables:

- Draft list of TAC Members.
- Final List of TAC Members

Task 1.11 Support TAC Meetings

The goals of this task is for the TAC to provide strategic guidance to this project by participating in regular meetings or teleconferences.

The Contractor shall:

- Discuss the TAC meeting schedule at the kick-off meeting. The number of face-to-face meetings and teleconferences and the location of TAC meetings shall be determined in consultation with the Commission Contract Manager. This draft schedule shall be presented to the TAC members during recruiting and finalized at the first TAC meeting.
- Develop detailed objectives and a schedule of meetings with the TAC, the Project Manager and the Contract Manager.
- With the TAC, develop success criteria for evaluating the entire project.
- Support the organization of and participate in TAC meetings in accordance with the schedule. Changes to the schedule must be pre-approved in writing by the Commission Contract Manager.
- Provide input to the preparation of TAC meeting agenda(s) with back-up materials for agenda items.
- Provide input to the preparation of TAC meeting summaries, including recommended resolution of major TAC issues.

Deliverables:

- Draft TAC Meeting Schedule.
- TAC Meeting Agenda(s) with Back-up Materials for Agenda Items.
- Written TAC meeting summaries, including recommended resolution of major TAC issues.

TECHNICAL TASKS

Unless otherwise provided in the individual Task, the Contractor shall prepare all deliverables in accordance with the requirements in Task 1.5.

The proposed technical tasks are broken down into the following four major tasks:

- Project Activation
- Site Selection
- Network Evaluation
- System Design
- Phase 2 Smart Grid Demonstration Plan
- Phase 2 Site Secure And Preparation

The scope of work and deliverables for each task is presented in this section.

Task 2 Project Activation

The goal of this task is to organize the accounting, requisition personnel and facilities and to verify project plans and contractors. This is necessary because some time has passed since the project proposal date and the approval to proceed. The administration of a project this complex requires support from many internal resources and requires careful attention to ensure they are now ready to begin the project.

The Contractor shall:

- Ensure all sub-contractor contracts are executed and enforceable. Ensure that the sub-contractors resource commitments are verified for the duration of Phase I. Ensure that sub-contractor deliverables and budgets are consistent with the overall contractor's contract.
- Develop and maintain an online resource for project management that includes the project schedule, project participant contact information, project documents by task and project deliverables.
- Submit an Updated Project Plan. This plan shall include, but not be limited to, change in resources, change in dates, change in timing, change in dependencies.
- Submit a Functional Online Project Management Tool. This Tool shall include, but not be limited to the project schedule, project participant contact information, project documents by task and project deliverables.

Task 2 Deliverables:

- Updated Project plan with personnel assignments
- Functional Online Project Management Tool

Task 3 Site Selection

The goal of this task is to select a project site from a number of candidate substations. The process of site selection for a candidate location identified as the basis of design and eventually an implemented system for demonstration of a microgrid in the SDG&E service territory will be based on the characteristics of the local substation, the feeder(s), and the customers. Due to the interactive nature of the grid with the microgrid, the utility-side resource requirements, and the customer-side resources available (several megawatts as opposed to 100 kW test scale), the selection process must identify potential locations where favorable conditions exist (circuit options, existing renewables and DG, reliability options, etc) and then identify which one of the candidate locations will provide the most benefits in the most cost effective manner.

The analysis and selection of candidate sites will be an iterative process, which may start at the substation analysis and then proceed to consideration of the customer or could start at known favorable customer locations and work back through the feeders and substations to determine the best candidate site. An overview of the issues and selection criteria that will be considered during the site selection process for substations, feeders and customers are outlined below.

The Contractor shall:

- Conduct an analysis of substations with a focus on implementing a microgrid on one or more feeders. The selection criteria will address the following areas:
  - Loading Factors
    - Historical (one year)
    - Planned (five years)
  - Configuration
  - Existing Advanced Technology Devices (e.g. capacitors, advanced communications)
  - Existing Measurement Devices
  - Existing Control Capabilities
  - Upgrade Potential as Required
- Conduct an assessment of the communications and protocol capabilities of equipment in substations being analyzed. This will include assessing the use of wireless communications media, and determining whether International Electrical Code (IEC) 61850 standards for distribution substation equipment could or should be used. (IEC 61850 is a standard for the design of electrical substation automation.) The data models defined in IEC61850 can be mapped to protocols that can run over TCP/IP networks and/or substation LANs using high speed switched Ethernet.
- Analyze baseline feeder characteristics from the candidate substations for use in future selection process.

- Determine which feeders could best benefit from a microgrid application. Benefits that will be considered include reducing load on a high demand feeder, the physical attributes of the feeder, the customer installed resources on the feeder, such as photovoltaics, cogeneration units or other resources. The selection criteria for the feeder analysis will address the following areas:
  - Loading
    - Historical (one year)
    - Planned (five years)
  - Configuration
  - Existing Advanced Technology Devices
  - Existing Measurement Devices
  - Existing Control Capabilities
  - Upgrade and Reconfiguration Potential as Required
  - Customer Characteristics (residential, commercial, industrial, government)
- Conduct assessment on the communications and protocol capabilities of equipment on feeders being analyzed, including possible upgrades. This will include determining whether IEC 61850 standards for Distribution Automation (DA) (currently under development in the IEC) could or should be implemented on these feeders. In addition, different communications media will be assessed to determine the most practical and/or cost-effective media to use for accessing the feeder equipment.
- Identify potential customer clusters with installed resources that are favorable to a microgrid in terms of generation and consumptions loads.
- Identify areas where proactive developers or owners have implemented zero energy homes, sustainable communities and/or commercial power parks. An example of a possible candidate community is Mission Viejo Ranch that is a sustainable community with characteristics that could be favorable to a microgrid. This is an example of just one area that will be considered during this site selection task.
- Screen customer account information on the feeder to identify customers participating in California Solar Initiative, Self Generation Incentive Program, demand response programs, or have energy storage devices (thermal energy storage or batteries).
- In the case that the analysis indicates that there are insufficient customer resources in terms of generation, storage and load control, investigate the potential for the installation of new resources (customer-side and/or utility-side) to be implemented or scaling the number of participants down to a workable group that will meet the load balance requirements of the smart grid operation when it operates in an islanding mode.

  The selection criteria for the customer analysis will address the following areas:
  - Potential Developers
    - Zero Energy Homes
    - Sustainable Communities
    - Power Parks

    - Existing Resources
        - On-site Generation
        - Demand Response Participants
        - Load Shifting and Storage Capabilities
    - Acceptance of New Technologies
    - Willingness to Participate
- Conduct an assessment of the communications and protocol capabilities and requirements for customer equipment, including generation and storage, as well as AMI. This will include determining whether the IEC 61850-7-420 DER protocol standard could or should be implemented for the customer DER systems. In addition, different communications media will be assessed to determine the most practical and/or cost-effective media to use for accessing the customer equipment, including an AMI system or a non-AMI communications network.
- Prepare a Substation Analysis Report, a Feeder Analysis Report, and a Customer Analysis Report summarizing the work performed in this Task.
- Prepare a draft Task 3 TAC Report, containing at a minimum an overview of the results of this Task.
- Participate in the TAC.
- Based on feedback from the TAC, submit the final Task 3 TAC Report.

Task 3 Deliverables:

- Substation Analysis Report
- Feeder Analysis Report
- Customer Analysis Report
- Task 3 TAC Report

Task 4 Network Evaluation

The goal of this task is to conduct the system engineering necessary to carry out a successful demonstration. The network evaluation task will be conducted on one or more feeders or candidate locations. During the evaluation process, the detailed analysis of the microgrid specifics will be conducted. This evaluation will focus on the areas of system resources, the microgrid operational requirements, and the system controls for both the conventional grid and the microgrid.

The Contractor shall:

- Evaluate Customer-side of the meter standard technologies for generation, demand response and load shifting technologies as well as advanced technologies such as fuel cells, microturbines, battery storage, plug-in hybrid vehicles, grid friendly appliances, and remotely controlled demand response technologies. Typical classifications of resources to be evaluated include the following:
    - Generation
    - Load Shedding and Demand Response
    - Load Shifting

  - Storage
  - Plug-in Hybrid Vehicles
- Evaluate the existing Utility-side of the meter resources and technologies that can be used to leverage the microgrid operation.
- Identify system modifications required at the substation that will allow the smart grid to operate in the desired modes of operation in the following areas:
  - Communications
  - Metering and Measurement
  - Network Configuration
  - Substation Controls
  - Generation (if existing or needed)
  - Storage (if existing or needed)
- Focus on applying as much technology at the customer-side of the meter, but also consider best technical and cost-effective approaches to implement technologies at the utility's systems such as devices to maintain reliability and power quality within the microgrid during periods of transition into and out of islanding mode.
- Evaluate system resources by identifying the information system modifications needed for the required information exchanges between the customer site, the feeder equipment, and the substation equipment. Upon prior approval with the CCM, use cases will be developed to identify the necessary information exchanges, performance requirements, and security requirements.
- Develop and evaluate system operational requirements.
- Estimate the load profile of the microgrid and then evaluate the extent to which the resources can operate in a balanced manner. The balancing will look at capacity offsets in terms of generation and storage and then energy offsets in terms of load shedding and load shifting.
- Evaluate various modes of operation that will be defined for the microgrid. At a minimum, include a grid-connected mode, island mode and transitions into and out of the island mode.
- Evaluate the safety devices required to allow the microgrid to operate in the desired modes of operation. Address the ability to maintain the required safety and operational aspects of the conventional grid. Types of systems that will be addressed include the following:
  - Capacitors
  - Reclosers and Switches
  - Revised Relay and Protection
  - Revised Sequencing

- Determine the desired control approach for the microgrid control. Evaluate a centralized control system approach, an autonomous control system approach or a combined system approach that has aspects of both central and autonomous control. The core issues to be addressed for microgrid operation include load management, power quality and power factor. The control system design for the microgrid will address the following areas:
  - Centralized (semi-autonomous) vs. Autonomous Control
  - Power Quality
  - Power Factor
  - Load Management
  - Sequencing for Various Modes of Operation
  - Synchronization
- Determine the information exchanges needed between the customer site, the feeder equipment, the substation equipment, and the operations SCADA system to disconnect a microgrid from the main grid, operate the microgrid over normal and emergency conditions, and reconnect the microgrid to the main grid. Use Cases will be developed to identify the necessary information exchanges, performance requirements, network management, and security requirements. These Use Cases will also address the different possible control configurations, so that the impact of these configurations can be better assessed.
- Characterize the field monitoring and control requirements, the additional integration requirements of the control center systems and the back office systems will also require evaluation. Depending upon the control configurations, the following systems could be impacted:
  - Operations SCADA system
  - Outage Management System
  - AMI system
  - MDM system
  - CIS system
  - Work Management System
  - Distribution Planning systems
  - Distribution maintenance systems
  - Asset management systems
- Prepare a System Resources Evaluation Report and an Operational Requirements Report summarizing the work performed in this Task.

Task 4 Deliverables:

- System Resources Evaluation Report
- Operational Requirements Report

Task 5 Microgrid Design

The goal of this task is to compile the information gathered in the prior engineering tasks and create a detailed implementation design. This task consists of taking the results of the evaluation developed in Task 4 and constructing a detailed design for the microgrid system to be implemented at the selected site. Included in the microgrid designs will be a focus on retrofitting the existing utility system to accommodate this new design.

The Contractor shall:

- Engage various vendors through a series of meetings and workshops to ensure that installation, functional and control requirements for the microgrid are incorporated into the design. The major activities to be conducted under this task are as follows:
  - Identify Equipment Specifications and Vendors
  - Coordinate with Vendors on Equipment Requirements
  - Develop Design Requirements
- Prepare a Preliminary Design Report on design and equipment requirements for the Microgrid.
- Develop methods and interfaces into customer-owned equipment to allow control of operation in conjunction with the microgrid controller. There are several current operating technologies that have control interfaces for various modes of operation such as generation and storage systems. The categories of systems that will have interface and control systems designed are as follows:
  - Generation Interface and Controls
  - Load Shedding and Demand Response Controls
  - Load Shifting Controls
  - Storage Interface and Controls
  - Plug-in Hybrid Vehicle Controls
- Evaluate design modifications to the distribution system so that it has some of the attributes of a Smart Grid.
- Evaluate the need for modifications associated with the need for additional metering and control devices at the substation and the feeder network.
- Analyze the actual or equivalent AMI meter interface to determine if the communications and data transfer rates need to be modified to supply the required information to the control system. The areas to be addressed in this task are as follows:
  - AMI modifications
  - New Metering Devices
  - Network Modifications
  - Substation and Feeder Control Modifications

- Design specific control systems and control interfaces. At this stage of the project, the controllable components, data transfer rates, and sequence of operation for the microgrid will have been defined. The design will specify the utility and microgrid systems that will be incorporated into the design and delineate the communication protocols, control algorithms, detailed sequences of operations, checks and balances for safety, load control, load factor and power factor.
- Include in the design an interface aspect for the tasks of system monitoring, alarms, pricing signals, bill presentment and customer interfaces, addressing the following:
  - Communication Systems
  - Interfaces
    - Between the microgrid and the grid
    - Between the microgrid and customer resources within the microgrid
    - Between the microgrid and utility resources within the microgrid
    - Presentment/Pricing signals/Customer Interface
  - Modes of Operation
    - Grid Connected Normal Operation
    - Grid Support Mode of Operation
      - Capacity
      - Energy
      - Network Reconfiguration
    - Islanding Mode
      - Transition into Island Mode
      - Island Mode Operation
      - Transition out of Island Mode
  - Power Quality Control
  - Synchronization
- The control system design will include a focus on the communication interfaces, in particular the protocols such as IEC 61850 and IEC 61968, as well AMI and DNP3, the security issues, and the performance requirements.
- Prepare a Microgrid Design Report. The Microgrid Design Report shall include without limitation the information provided in the Preliminary Microgrid Design Report, as well as the following:
  - The Customer-owned assets and how they will be used in the demonstration study.
  - Design and equipment requirements for the Microgrid.
  - The control systems and interfaces needed to complete a demonstration project.

Task 5 Deliverables:

- Preliminary Microgrid Design Report (Final)
- Microgrid Design Report

Task 6 Phase 2 Smart Grid Demonstration Plan

The goal of this task is to produce a demonstration plan based on the findings from the design tasks, above. Task 6 presents the project plan for a demonstration of the designed microgrid based on lessons learned and the design developed in Task 5. This will lay the groundwork for Phase 2 of this project. The plan will present the demonstration phase Statement of Work, Project Team, Project Budget and Schedule. The Phase 2 Demonstration is anticipated to include four major tasks that consist of establishing the baseline, integration of resources, operational testing and reporting of results.

The Contractor shall:

- Prepare a draft Microgrid Plan that identifies where resources on both the customer-side and utility side of the meter (circuit options, existing renewables and distributed generation, reliability options, etc.) are available to demonstrate and assess innovative microgrid designs that will optimize assets, manage costs, increase reliability, achieve demand response goals, integrate renewable resources and advanced technologies while increasing reliability of the power grid. The plan will include a detailed budget and a schedule that includes the timing and durations of the demonstration phase tasks and milestones. The Microgrid Plan shall include the following:
  - Prepare the system for the demonstration project, including establishment of a performance baseline for later comparison of results from the pilot-scale testing.
  - Develop a list of key feeder metrics supporting the project objectives that can be used for test comparisons and results evaluations.
  - Conduct feeder configuration and parametric analysis of the pre-existing network before the physical changes are applied in later tasks,
  - Determine baseline feeder performance measurements including standard industry metrics (CAIDI, SAIDI, SAIFI, MAIFI)
  - Develop test scenarios with defined objectives and metrics
    - Install, integrate, test and validate all resources to enable the operation of a complete, real-time distribution network operating in a real-time environment. Key activities include:
      1) Installing the AMI or equivalent interface at the selected points of interest in the real distribution network. (This work will not be paid for by the Energy Commission.)
      2) Installing communication infrastructure as needed.
      3) Installing new equipment, metering, sensors, and other infrastructure equipment per the system design of both utility and customer systems. (This work will not be paid for by the Energy Commission.)
      4) Development, installation, testing and validation of the microgrid control system
      5) Conducting basic system tests for functionality and safety (load management coordination).
      6) Functional testing of control algorithms for load management.
      7) Integration testing of the load management points of interest with the control devices.

- Perform simulations of the distribution network by:
  - Developing strategic test scenarios on the real distribution network of the integrated resources.
  - Developing test plans for various modes of operation for the microgrid
  - Executing the prescribed tests
  - Analyzing data from the tests
- Evaluate results against program objectives and metrics
- Make modifications and adjustments to microgrid system components and re-test as necessary

- Prepare the CPR Report.
- Participate in the CPR.
- Modify the Microgrid Plan based upon feedback received during the CPR. Submit the final Microgrid Plan.

Task 6 Deliverables:

- CPR Report
- Migrogrid Plan

Tasks 7, 8, 9 and 10 shall be performed in accordance with the Microgrid Plan developed in Task 6.

Task 7 Phase 2 Scoping Study

The goal of this task is to create a scoping report that outlines all the parameters for a successful demonstration project. Task 7 prepares for the development phase (Phase 2) to ensure all the parameters needed for a successful microgrid operation are in place. Careful planning for the next phase will ease the transition. This task will include preparing all electrical operation parameters such as power quality, VAR control, load-following capability, black start, and other ancillary services. The electric operational requirements help define equipment requirements, which may incur lengthy procurement process. Regarding the communication component of the project; this study will report how, what and which loads/devices will be controlled. The customer interface and tariff components require planning; including determination what is needed to encourage customers to participate and what is needed to obtain CPUC tariff approval. Finally, the communications component requires planning on the current state of AMI deployment, particularly identifying which circuits will be active during the project.

The Contractor shall:

- Prepare a Preliminary Phase 2 Scoping Report. This Preliminary Report will include, but not be limited to,
  - Identification of the required electric system parameters.
  - A plan to address CPUC regulations that will impact the ability to interact and compensate customers who participate in the project. Develop a strategy to address these issues.

- Prepare a list of Potential Project Sites, which will include information such as customer mix, demographics and current DER penetration and submit it to the Commission Contract Manager.
- In consultation with the Commission Contract Manager, review and prioritize the list of potential project sites.
- , After project-site selection has been finalized, develop agreements between the utility and customers who will participate in the project.
- Prepare a Phase 2 Scoping Report. The Phase 2 Scoping Report will contain without limitation the information provided in the Preliminary Phase 2 Scoping Report, as well as the following:
    - The communications systems required for the project including the current state of AMI deployment to maximize asset benefits, integration of new monitoring and control points into the SCADA system, two-way communications to customer-owned resources, and processes to trend microgrid system operation.
    - An integration plan to coordinate the microgrid controller(s) with the conventional grid operations including load control, outage management, and crew dispatch.

Task 7 Deliverables:

- Preliminary Phase 2 Scoping Report
- List of Potential Project Sites
- Phase 2 Scoping Report

Task 8 (Start of Phase 2) Establish Baseline

The goal of this task is to baseline the operating conditions and key metrics that will be tracked later in the demonstration. Task 8 establishes a performance baseline for later comparison of the results obtained from this project. This task results in a list of key feeder metrics supporting the project objectives that can be used for test comparisons and results evaluations. Key activities include: 1) conducting feeder configuration and parametric analysis of the pre-existing network before the physical changes are applied in later tasks, 2) determining baseline feeder performance measurements including standard industry metrics (CAIDI, SAIDI, SAIFI, MAIFI), 3) developing, fundamental microgrid operating scenarios for testing, and 4) installing an industry-standard integration tool suite (distribution system modeling software which provides analysis of the integrated resources)

The Contractor shall:

- Prepare the system for the demonstration project, including establishment of a performance baseline for later comparison of results from the pilot-scale testing.
- Develop a list of key feeder metrics supporting the project objectives that can be used for test comparisons and results evaluations.
- Determine baseline feeder performance measurements including standard industry metrics (CAIDI, SAIDI, SAIFI, MAIFI)
- Prepare a Feeder Configuration Baseline Report summarizing the work performed in this task.

Task 8 Deliverables:

- Feeder Configuration and Baseline Report

Task 9 Integrate Resources

The goal of this task is to install and integrate the resources that will be used in the demonstration tasks. Task 9 focuses on the integration and deployment of key building blocks as defined by earlier tasks, which are necessary for the integrated operations of an advanced distribution control system. This task will iterate through various strategies of autonomous control algorithms and the AMI interface specific to the project.

This task begins the operational strategy testing based on integration of installed consumer-owned DG and may require utility / CEC supplied DG and storage. This task results in the integration of the DG and storage units such that monitoring and control can take place under real distribution network operating conditions. In addition, this task will integrate the functionality of the control algorithms in a controlled environment with known distribution devices prior to adding the additional points of interest Key activities include: 1) configuring the integration tool suite for DG and storage units, 2) integrate the basic system testing for functionality and safety (DG and storage coordination), and 3) integrate functional testing systems of control algorithms.

The Contractor shall:

- Conduct feeder configuration and parametric analysis of the pre-existing network before the physical changes are applied in later tasks,
- Develop test scenarios with defined objectives and metrics

  Install, integrate, test and validate all resources to enable the operation of a complete, real-time distribution network operating in a real-time environment. Key activities include:
  1) Installing the AMI or equivalent interface at the selected points of interest in the real distribution network;
  2) Installing communication infrastructure as needed;
  3) Installing new equipment, metering, sensors, and other infrastructure equipment per the system design of both utility and customer systems;
  4) Development, installation, testing and validation of the microgrid control system;
  5) Conducting basic system tests for functionality and safety (load management coordination);
  6) Functional testing of control algorithms for load management; and
  7) Integration testing of the load management points of interest with the control devices.
- Develop and update strategic test scenarios on the real distribution network of the integrated resources.
- Prepare an Algorithms, Integration Results and Revised Execution Test Plan Report summarizing the work performed in this task.

Task 9 Deliverables:

- Algorithms, Integration Results and Revised Execution Test Plan Report

Task 10 Operational Testing

The goal of this task is to perform the tests outlined in prior tasks. Task 10 conducts testing on the strategies defined in early tasks upon a real distribution network of integrated DG and storage. The results are compared to the baseline to determine relative improvements consistent with the objectives of the program. Testing of the pilot-scale network that shows the incremental improvement in feeder reliability, satisfactorily demonstrates intentional islanding, and improved DG management under different configurations / scenarios.

The Contractor shall:

- Conduct the following tests:
  - Develop distribution operations (DO) test procedures and Switching Schedules,
  - Test feeder reliability improvements from integration of existing DG or storage,
  - Test DG management under defined scenarios,
  - Conduct intentional islanding test with DG and/or storage functioning on the same circuit,
  - DG penetration limit testing,
  - Conduct tests on autonomous DG control algorithms,
  - Interoperability tests across the integration tool suite, and
  - Compare test results with the baseline established earlier.
- Make modifications and adjustments to microgrid system components and re-test as necessary.
- Prepare a Test Results Report on the results of this testing.

Task 10 Deliverables:

- Test Results Report

Task 11 Prepare Results

The goal of this task is to analyze, organize and deliver detailed results of the development of the pilot-scale network, optimum DG and storage strategies, testing conducted, results, cost / benefit for deployment, deployment implementation plans, conclusions, recommendations, and lessons learned. In addition, this task will supply empirical test data to be included in the final project documentation package

The Contractor shall:

- Gather project data set, analyses, test evaluations, plans, and interim reports.
- Prepare preliminary findings on test results.
- Organize materials in preparation for final documentation package.

Task 11 Deliverables:

- None. The data gathering, review and analysis performed in this task will feed into the Final Report.