SDG&E RDSI Project Overview

SDG&E Borrego Springs
Microgrid Demonstration Project

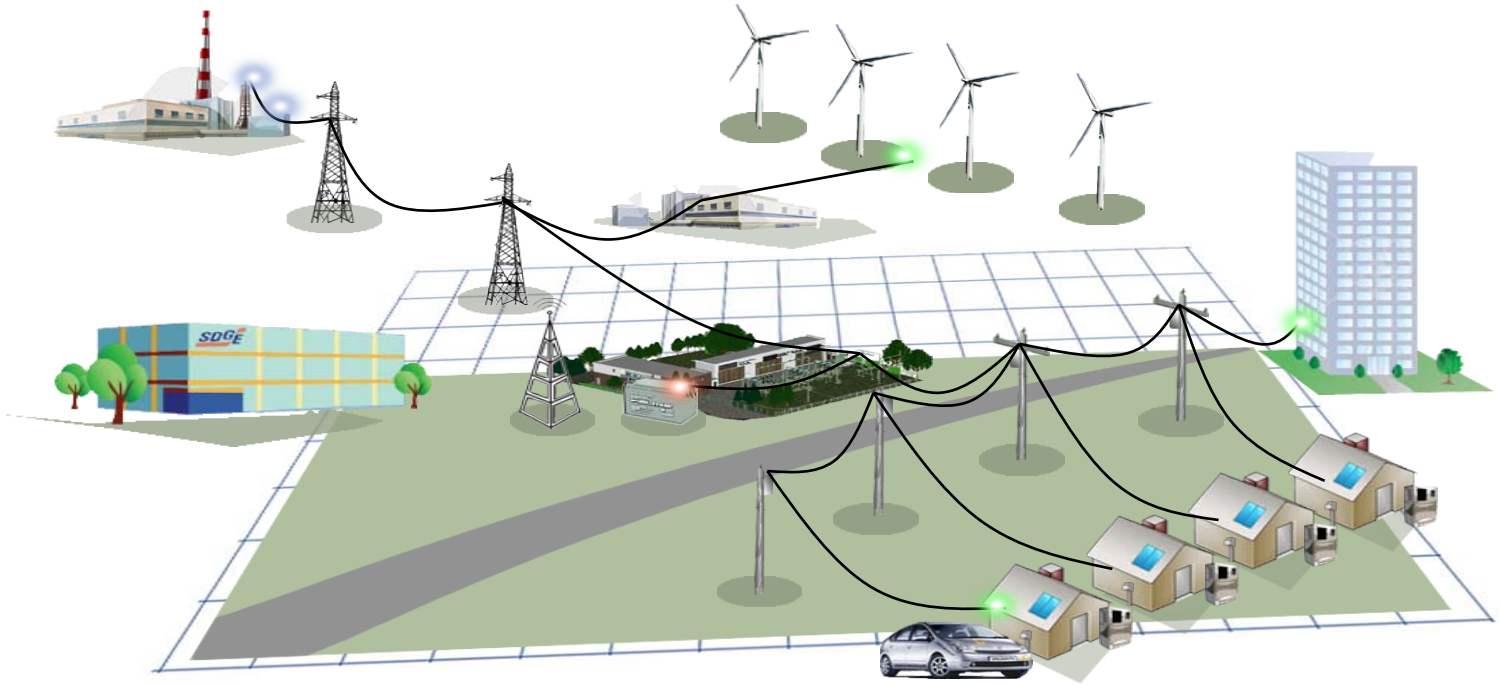
DOE Peer Review

November 3, 2010

SDG&E Borrego Springs Microgrid Project Summary

Utilize advanced technologies to integrate and manage distributed resources within the Smart Grid

Budget:	$15.2M ($4.1M SDG&E, $7.5M DOE, $2.8M CEC, and $0.8M partners)
Benefits:	• Reduce the peak load of feeders and enhance system reliability • Accommodate various generation and storage configurations
2010 Goal:	Successfully resolve DOE audit, negotiate contracts for remaining partners, and engage/inform Borrego Springs community



SDGE
A Sempra Energy utility

Department of Energy

Project Overview

Project Benefits

- Allow more power to be delivered through existing infrastructure and reduce the need to build more in the future
- Increase in the reliability and security of the grid by adding elements that make the grid more stable and reconfigurable.
- Allow Utility to utilize and control customer-owned resources
- Optimize the design of circuit operations for microgrid capabilities given DG, demand response, automated response, and other advanced tools

Project Objectives

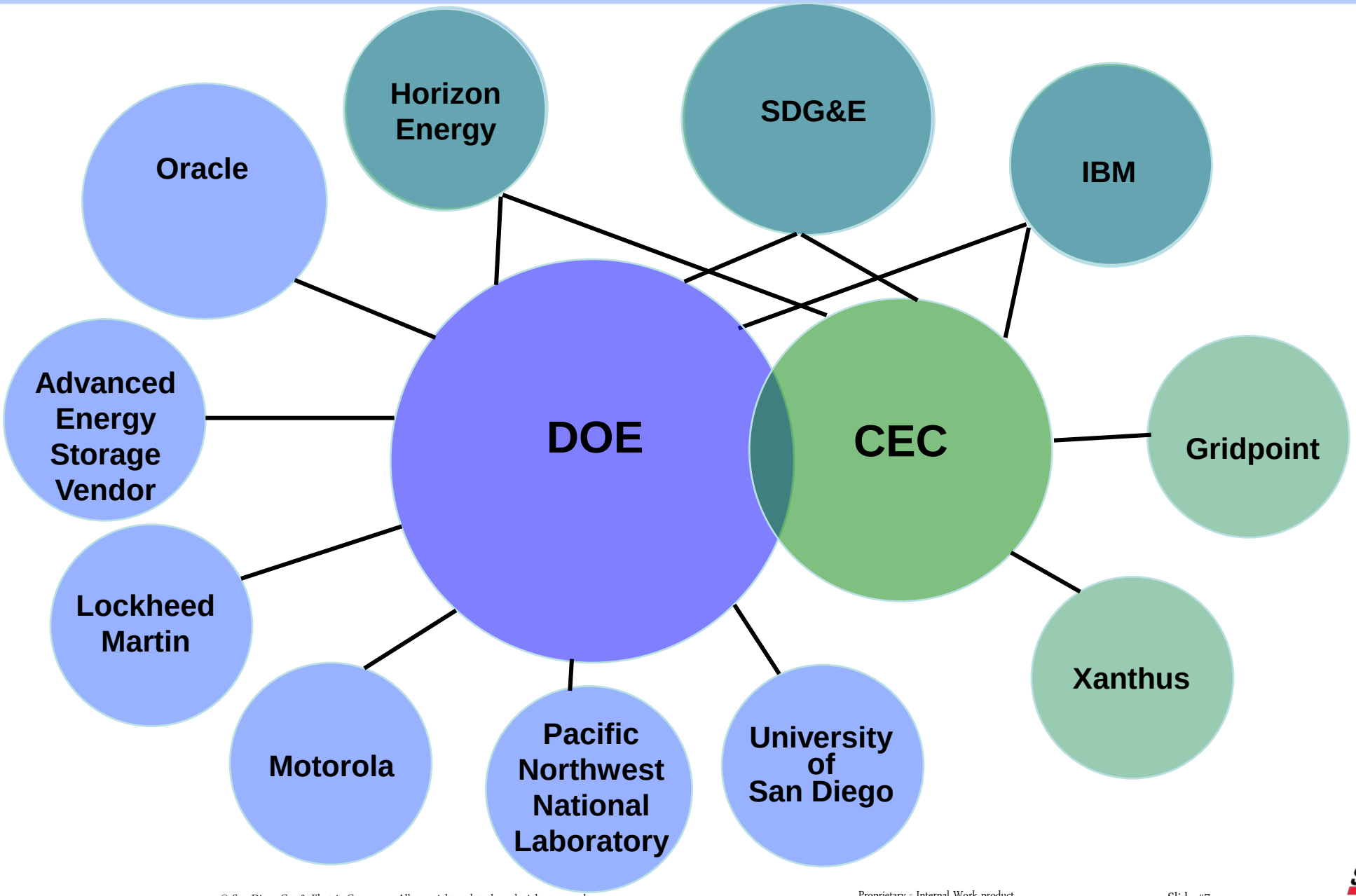
- Achieve > 15% reduction in feeder peak load
- Demonstrate capability of Volt-Amps-Reactive (VAr) management
- Develop a strategy and demonstrate:
  - Integration of AMI into Microgrid operations
  - Self-healing networks through the integration of Feeder Automation System Technologies (FAST)
  - Integration of an Outage Management System/Distribution Management System (OMS/DMS) into Microgrid operations
  - Intentionally island customers in response to system problems
  - Information/tools addressing the impact of multiple DER technologies

Project strategies

- Design and demonstrate a smart grid that incorporates sophisticated sensors, communications, and controls in the following ways:
  - Intelligently incorporate solar power generators on homes and businesses into the electrical delivery system.
  - Enable coordinated Demand Response (DR) programs whereby heavy electrical use during peak demand periods can be moderated to prevent electrical supply emergencies.
  - Integrate and control multiple distributed generation and electrical energy storage devices to operate the grid in a more cost-effective and reliable manner, benefiting customers and electrical rates.

- This project will proactively identify and apply leading-edge technologies to improve the security and reliability of electricity supply and to lower costs to consumers.

Project Partners



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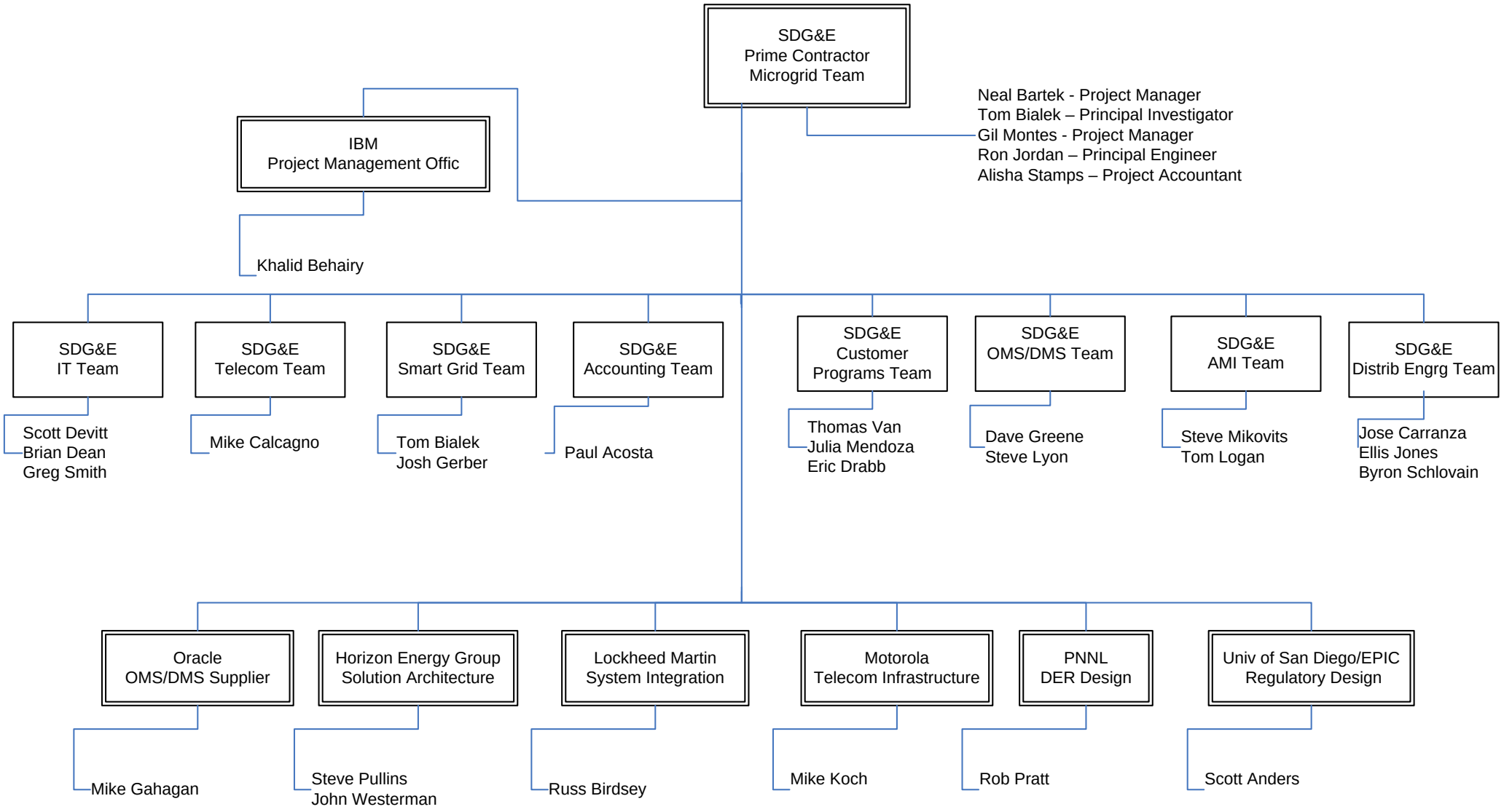
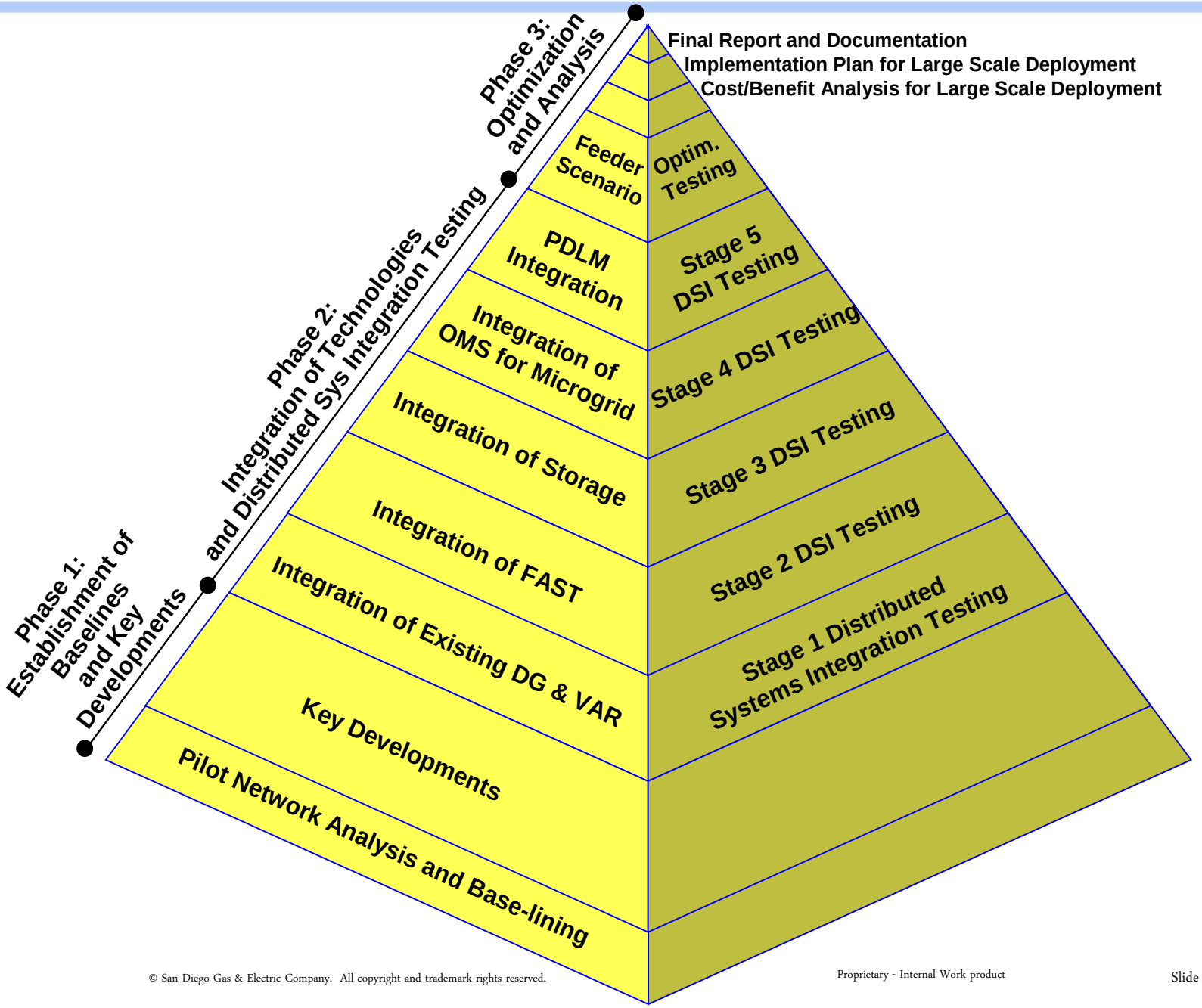
Project Management



Microgrid Project Overview



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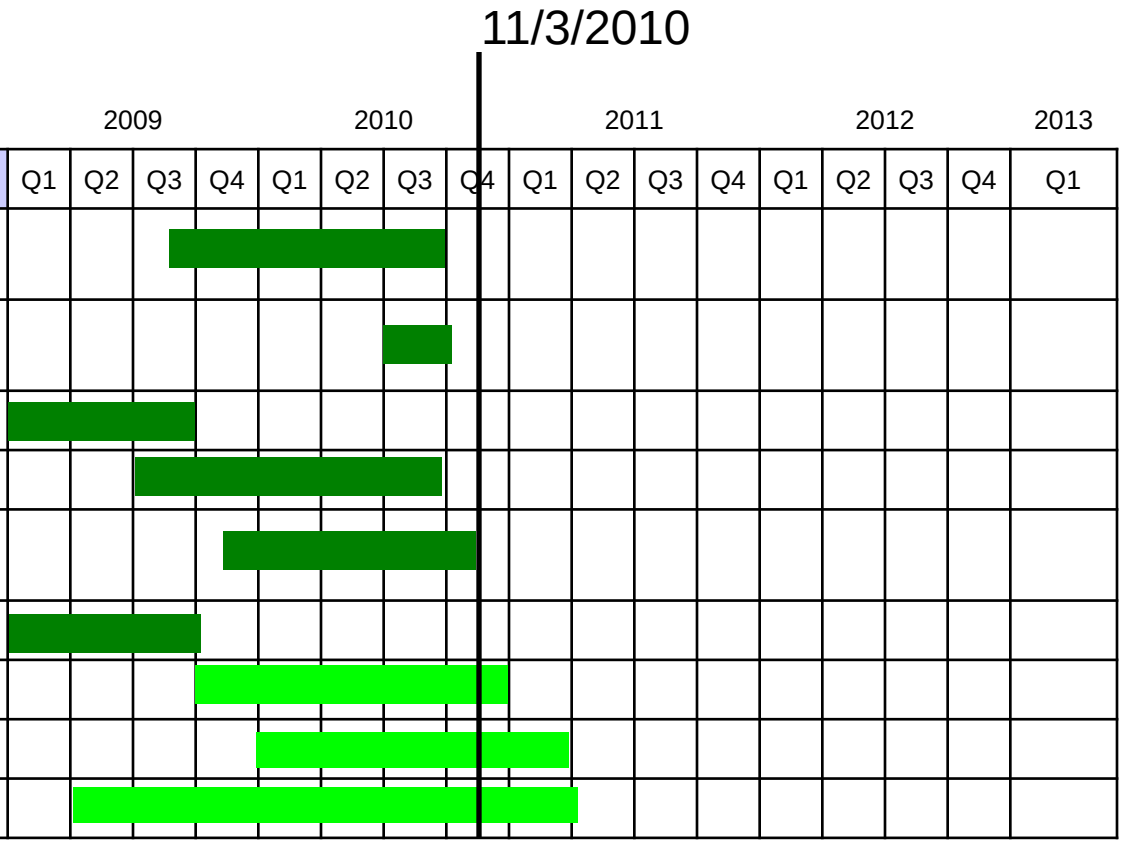
Project Status

Phase I: Establishment of Baselines & Key Developments

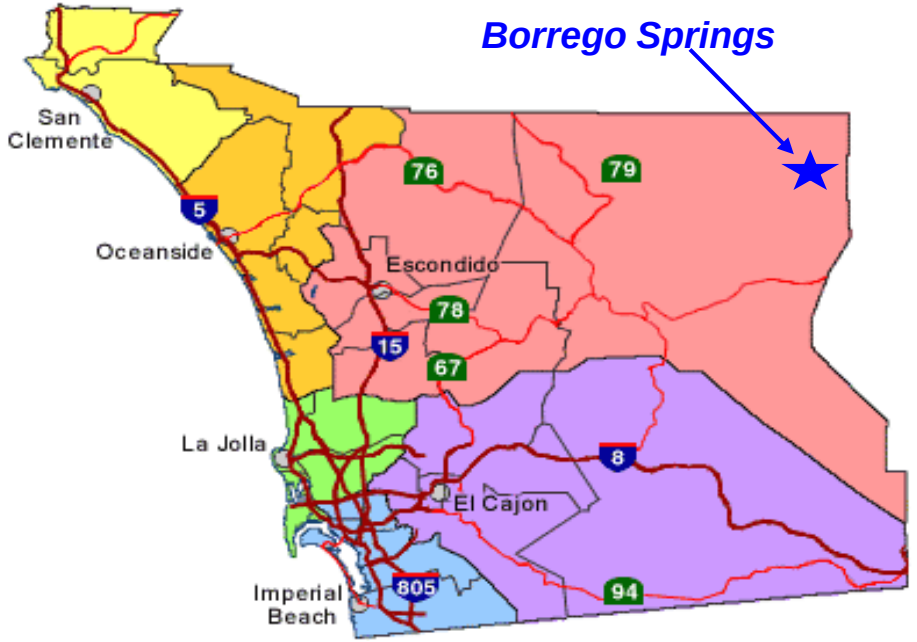


Task	Description	Status
1.0	Demonstration of Compliance with DCAA Audit Recommendations	Complete
1a	Revise the SOPO and Develop a Project Management Plan (PMP)	Complete
1b	Site Selection	Complete
1c	Analyze AES Solutions	Complete
1d	Negotiate AES Pricing and Obtain Cost Quotes	Complete
1e	Install Initial Field Hardware	Complete
2.0	Define Baseline and Measure Performance	In Process
2.1	Pilot Network Analysis and Baselining	In Process
2.2	Key Developments	In Process

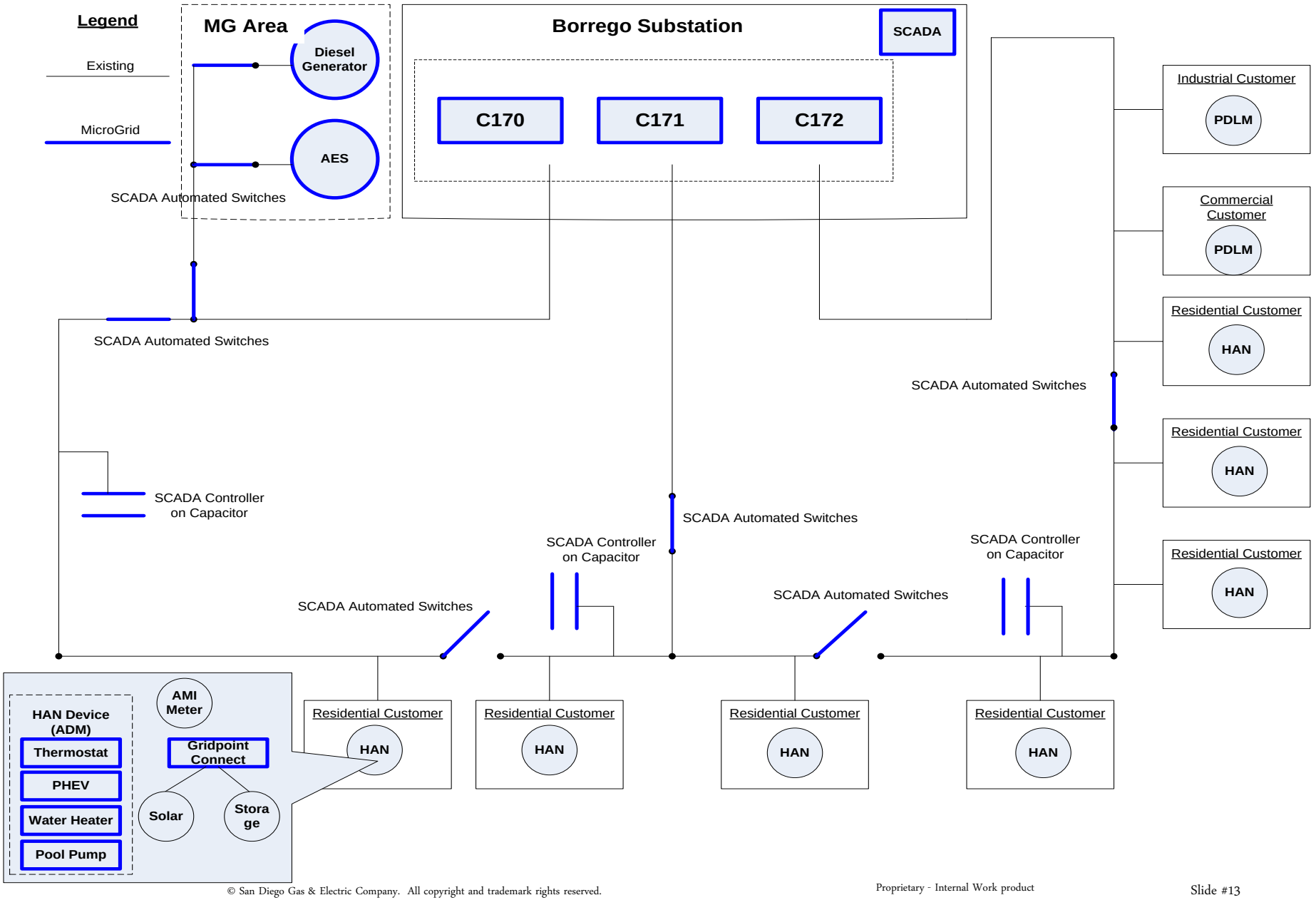
Site Selection – Borrego Springs, CA

Key Strengths:

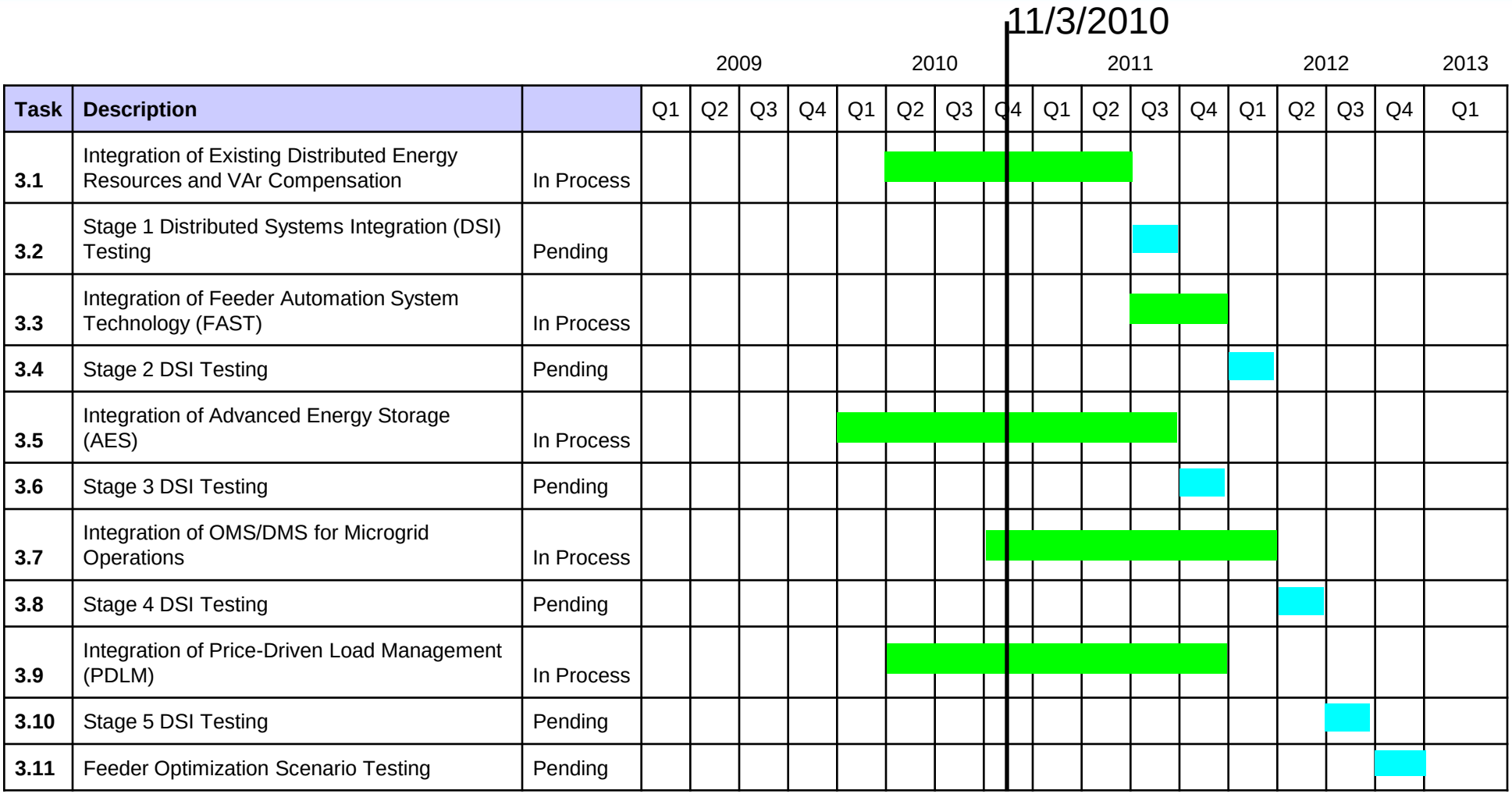
- High concentration of customer-owned solar generation
- Potential to realize advanced reliability enhancements
- Opportunity to demonstrate self-sufficient circuit
- Extendable to service territory



Borrego Substation Conceptual Circuit Illustration



Phase II – Integration of Technologies and Operational Testing



Task	Description		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
3.1	Integration of Existing Distributed Energy Resources and VAr Compensation	In Process																	
3.2	Stage 1 Distributed Systems Integration (DSI) Testing	Pending																	
3.3	Integration of Feeder Automation System Technology (FAST)	In Process																	
3.4	Stage 2 DSI Testing	Pending																	
3.5	Integration of Advanced Energy Storage (AES)	In Process																	
3.6	Stage 3 DSI Testing	Pending																	
3.7	Integration of OMS/DMS for Microgrid Operations	In Process																	
3.8	Stage 4 DSI Testing	Pending																	
3.9	Integration of Price-Driven Load Management (PDLM)	In Process																	
3.10	Stage 5 DSI Testing	Pending																	
3.11	Feeder Optimization Scenario Testing	Pending																	

Distributed Energy Resource (DER)

Utility-owned distributed generation will simulate customer-owned renewable generation

- Identified DER requirements
  - two 1.8 MW Tier 1 Caterpillar 3516DITA diesel generators owned by SDG&E
  - 200 hours per generator per year
- Filed application with Air Pollution Control District of San Diego County (APCD) for a Stationary Source Permit
  - Negotiating contract to retrofit generators with advanced emissions control to meet required Tier 4 standards
- Filed application with County of San Diego for Variance from County Noise Ordinance
  - To likely require a wall to be built to help reduce noise
- Developed requirements for remote control capabilities
  - Negotiating contract to retrofit generators with advanced controls

Advanced Energy Storage (AES)

Advanced Energy Storage will supplement Distributed Energy Resources

- Identified AES System requirements in conjunction with EPRI & Sandia
  - 1.0 MW Power Output
  - 6.0 MW-Hr of Energy
  - Potential future applications
- Developed RFP and issued to nine (9) vendors
- Received six (6) proposals
- Conducted best & final review with two (2) vendors
- Negotiating Terms and Conditions with preferred vendor
- Conducting RFI to assess state of battery technology
  - 25-50kW, 1-3 hours of storage (120/240v single phase)
  - 100-300kW, 3 hours of storage (120/208v or 277/480v 3-phase)

Feeder Automation System Technologies (FAST)

Automated switching technology will improve reliability by enabling circuit operations without human intervention

- Identified objectives of FAST
  - Programmed switch operation on Cir 170 (including tie switches) will automatically isolate faulted segments and restore service
  - All operations will be done based on real-time loads
- Borrego circuits modified for FAST Installation

Microgrid Controller & OMS/DMS

Microgrid Controller technology will integrate with the Distribution Management System while balancing the distributed energy resources and energy demand in the Microgrid control area

- Modeled use cases & business processes
  - Presented Use Cases at Microgrid Symposium in Vancouver, BC
  - Shared Use Cases with Xanthus Consulting for work on IEC 61850
- Mapped detailed requirements to functional requirements
- Received approval from Information Security
- Investigating vendor options for Design/Build
- OMS/DMS system testing
- Discussions with other RDSI projects
- Literature review

Microgrid Controller

Distribution Management System

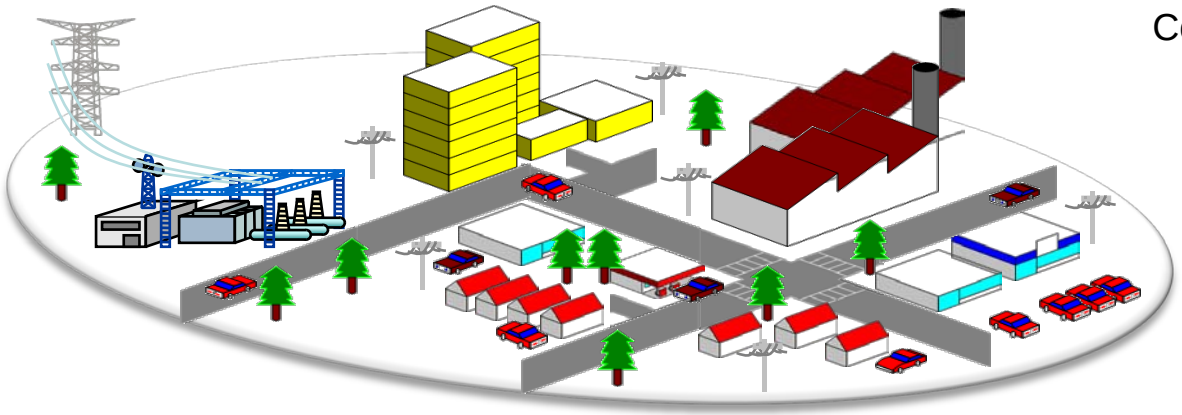
Microgrid Master Controller

SCADA System

Information
Electricity Pricing
DER status
Demand Response Programs
Network status
Community Objectives
Load and Resource Profiles

Grid Resources
Capacitor Banks
Voltage Regulators
Automated Switches
Power Electronics
Communications

Distributed Energy Resources
Utility-scale Energy Storage
Rooftop PV Solar
Micro-turbines
Building Energy Storage
Community Energy Storage
Distributed Generation
Home Energy Manager
PEVs
Ground PV Solar Array



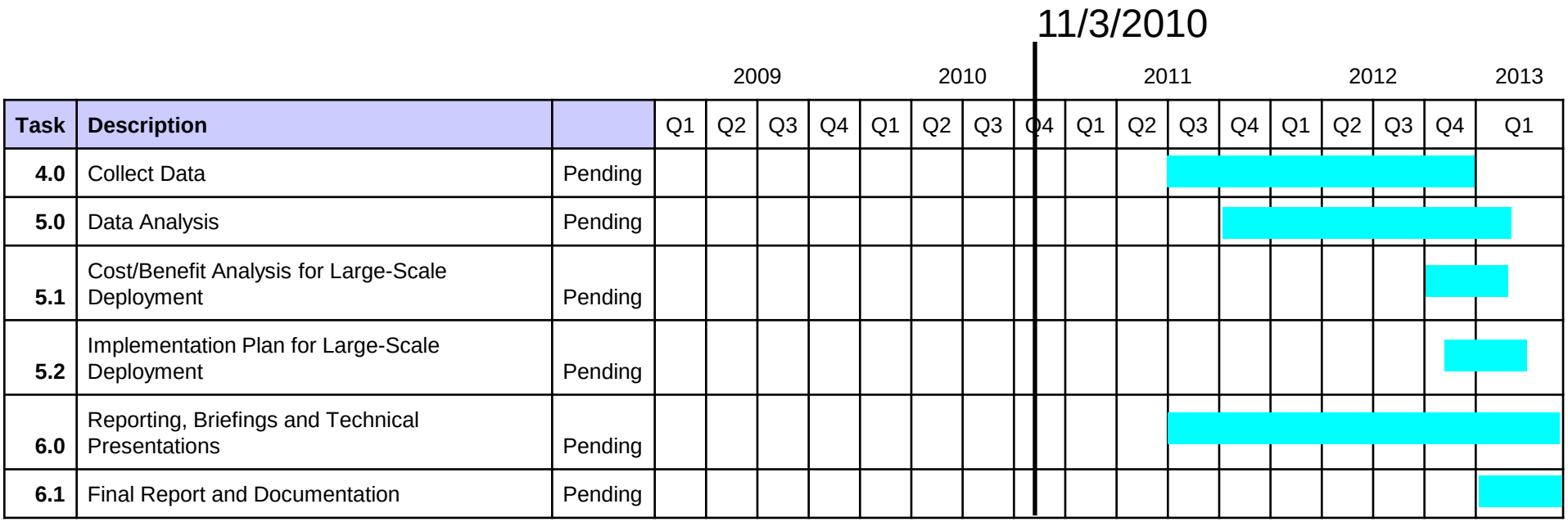
National Energy Technology Laboratory

Price-Driven Load Management

Leveraging Advanced Metering Infrastructure (AMI) and Home Area Network (HAN) devices, we will be able to influence/manage customer loads. Pricing signals will alter customer usage, Demand Response will be used during "Reliability Events" .

- Completed contracts with Gridpoint
- Collaborating with internal SDG&E departments to develop plan to present "one-face" to customers
- Developing customer participation plan
- Developing Timeline for Customer Communications
- AMI rollout complete

Phase III – Data Collection and Analysis



Task	Description		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
4.0	Collect Data	Pending																	
5.0	Data Analysis	Pending																	
5.1	Cost/Benefit Analysis for Large-Scale Deployment	Pending																	
5.2	Implementation Plan for Large-Scale Deployment	Pending																	
6.0	Reporting, Briefings and Technical Presentations	Pending																	
6.1	Final Report and Documentation	Pending																	

California Energy Commission

Project Overview

Smart Grid Project (CEC)

Participants:

SDG&E, Horizon Energy Group (HEG), Xanthus, GridPoint

Project Goals

- Integrate utility and customer-based energy resources, including carbon and non-carbon-based energy sources
- Enhance the management of intermittent renewable resources, including the impact of resources from sustainable communities
- Identify and evaluate the key technical and operational issues with designing, implementing, and managing an integrated energy portfolio of utility and non-utility interconnected resources
- Improve power reliability and quality via utility asset optimization

Smart Grid Project (CEC)

Project Objectives

- Assess the ability to achieve at least a fifteen percent reduction in feeder peak load through the integration of multiple, integrated DER on a SDG&E feeder
- Demonstrate capability of Volt-Amps-Reactive (VAr) electric power management
- Develop a strategy and demonstration of information integration focused on both security and overall system architecture.
- Develop a strategy and demonstrate the integration of AMI into smart grid operations;
- Demonstrate the capability to use automated distribution control to intentionally island customers in response to system problems
- 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.
- Demonstrate Programmable and Controllable Thermostats to achieve Demand Response goals within the smart grid.

Issues and Challenges

- Contract Management
- Security – Cyber and Physical
- Network Communications Infrastructure
- Internal/External Communications
- Customer Participation
- Regulatory and Tariff Impacts
- Permitting
- Synchronization with other SDG&E projects (AMI, OMS/DMS)
- Development of Microgrid Controller

Q & A