



Energy Solutions

CERTS Microgrid Demonstration with Large scale Energy Storage & Renewable Generation November 5, 2010

Presented By:

Craig Gee, Project Manager

(for Mr. Eduardo Alegria – Principal Investigator)

Agenda

- Introduction – Who we are
- Project Team & Site
- Project Purpose & Objectives
- Project Impacts
- System Elements
- Project Status
- Research Elements
- Recent Developments in California
- Questions & Comments

Chevron Energy Solutions

Designed & Implemented over 900 Projects in the U.S.



- Chevron ES, a division of Chevron USA, Inc. is committed to delivering economically & environmentally advantageous green energy programs to the institutions & businesses.
 - One-stop shop from project conception to commissioning, Chevron ES provides:
 - ▶ Innovative Design + Demonstration
 - ▶ Engineering + design
 - ▶ Project + construction management
 - ▶ Incentive + rebate assistance
 - ▶ Project financing – minimize capital investment, leverage bond dollars and develop paid through savings programs
 - ▶ Monitoring + verification
 - Comprehensive solution-based energy programs
 - ▶ Clean onsite power generation
 - ▶ Energy management systems/controls and retro-commissioning
 - ▶ Lighting retrofits and redesign
 - ▶ Heating Ventilation and Air Conditioning (HVAC) upgrade/retrofits
 - ▶ Central Plant, Utility Infrastructure, Power Reliability

Project Partners

- **Chevron Energy Solutions (Principal)**
- **Alameda County, California - Santa Rita Jail (Host)**

And...



Project Team

■ Chevron Energy Solutions

- Eduardo Alegria, Principal Investigator
- Dave Potter, Senior Project Director
- Craig Gee, Project Manager
- Timothy Moriarty, Project Administrator

■ Alameda County, California

- Matt Muniz, Energy Program Manager

■ Design, Development, Equipment, and Construction Subcontractor Partners

Advisors

- **Eduardo Alegria, Senior Power Systems Engineer and PI**
 - **Chevron Energy Solutions**
- **Dr. Robert Lasseter, Professor, Electrical Engineering**
 - **University of Wisconsin**
- **Joe Eto, Staff Scientist, EETD**
 - **Lawrence Berkeley National Laboratory**
- **Janice Lin, Managing Partner**
 - **Strategen Consulting**

Project Site

■ Alameda County, Santa Rita Jail

Needs:

- Reduce peak electricity demand/demand response
- Improve the security and reliability of power supply
- Environmental Leadership
- Clean backup power source for jail

Solutions:

- 1 MW fuel cell power plant
- Heat recovery cogeneration: hot water and space heating inside jail
- Support existing 1.2 MW solar on rooftops (see picture)

Process:

- CES worked with FuelCell Energy to engineer applications, integrate components, and install systems
- Seamless project management to ensure health and safety of inmates

Benefits:

- Fuel Cells provide among the cleanest, most reliable sources of power generation
- High quality power 24 hours a day
- Ultra-low emissions and quiet operation
- **CES Captured Incentives:**
 - \$1.4 million - PG&E
 - \$1 million - DOD Climate Change Fuel Cell Program
 - \$2.8 million - energy savings
 - \$900K - energy incentives



Project Objectives

- ***Demonstrate the commercial implementation*** of a CERTS microgrid combined with large-scale energy storage, photovoltaics, wind, a fuel cell and back-up diesel generators to enable future applications
- ***Reduce peak load*** of utility distribution feeder by increasing the utilization of significant and diverse distributed energy resources (DER) to intelligently supply peak power.

Project Objectives (continued)

- ***Improve grid reliability*** by providing dispatchable renewable energy and other ancillary services to support electric distribution systems
- ***Increase grid efficiency and security*** through the development of monitoring, diagnostic, and automation capabilities and research of communications and control technologies, including identification of SCADA requirements
- ***Meet customer quality and reliability requirements*** to ensure secure operation and reduce costs

Modern Grid Project Characteristics and Impacts



Modern Grid Characteristic	Proposed Project Impact
Self-healing	The CERTS microgrid automatically detects and responds to actual and emerging transmission and distribution problems. By reducing peak load, problems can be prevented
Motivates and Includes the Consumer	The consumer is actively involved in microgrid deployment and control of distributed energy resources. Significant demand response capabilities supports the grid
Resists Attack	Autonomous microgrid operation resists attack and reduces burden on the grid during restoration
Provides Power Quality for 21st Century Needs	Uninterrupted power is reliably delivered to the consumer to consistently meet total consumer load
Accommodates all Generation and Storage Options	Microgrid “plug and play” convenience allows easy addition of diverse DER; this project accommodates a large-scale battery, photovoltaics, wind, a CHP fuel cell, and diesel generators
Enables Markets	Project potential to sell wholesale power back to the grid; enables PV, fuel cell and storage markets
Optimizes Assets and Operates Efficiently	Monitoring and control system developed to utilize DER assets, and provide remote monitoring capability, and a platform for potential asset dispatch ability.

System Elements

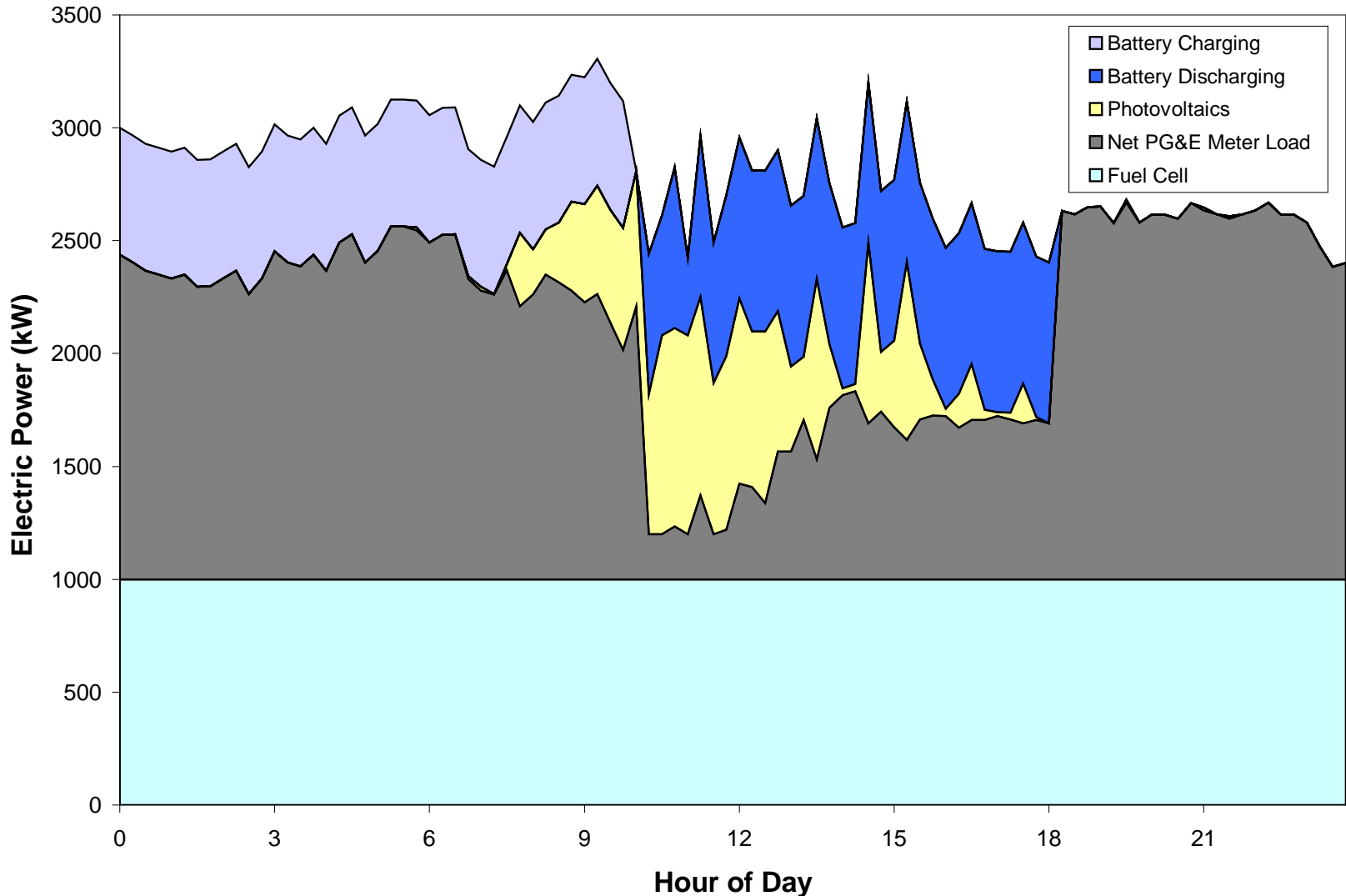
- ***Existing 1 MW Fuel Cell + 1.2MW Solar PV with Backup Diesel Generators***
- ***Add 2 MW (12 MWH) Battery***
- ***Plus CERTS Microgrid-enabled control logic***
- ***Plus Fast Static Disconnect Switch to enable islanded operation during periods of grid instability or outage***
- ***During short term outages, battery picks up the extra load***
- ***During extended outages, diesel generators fire-up to recharge battery or provide power as needed***

Host Site Layout



System Design – Load Impacts

Cloudy Spring Day – Solar Output Uneven

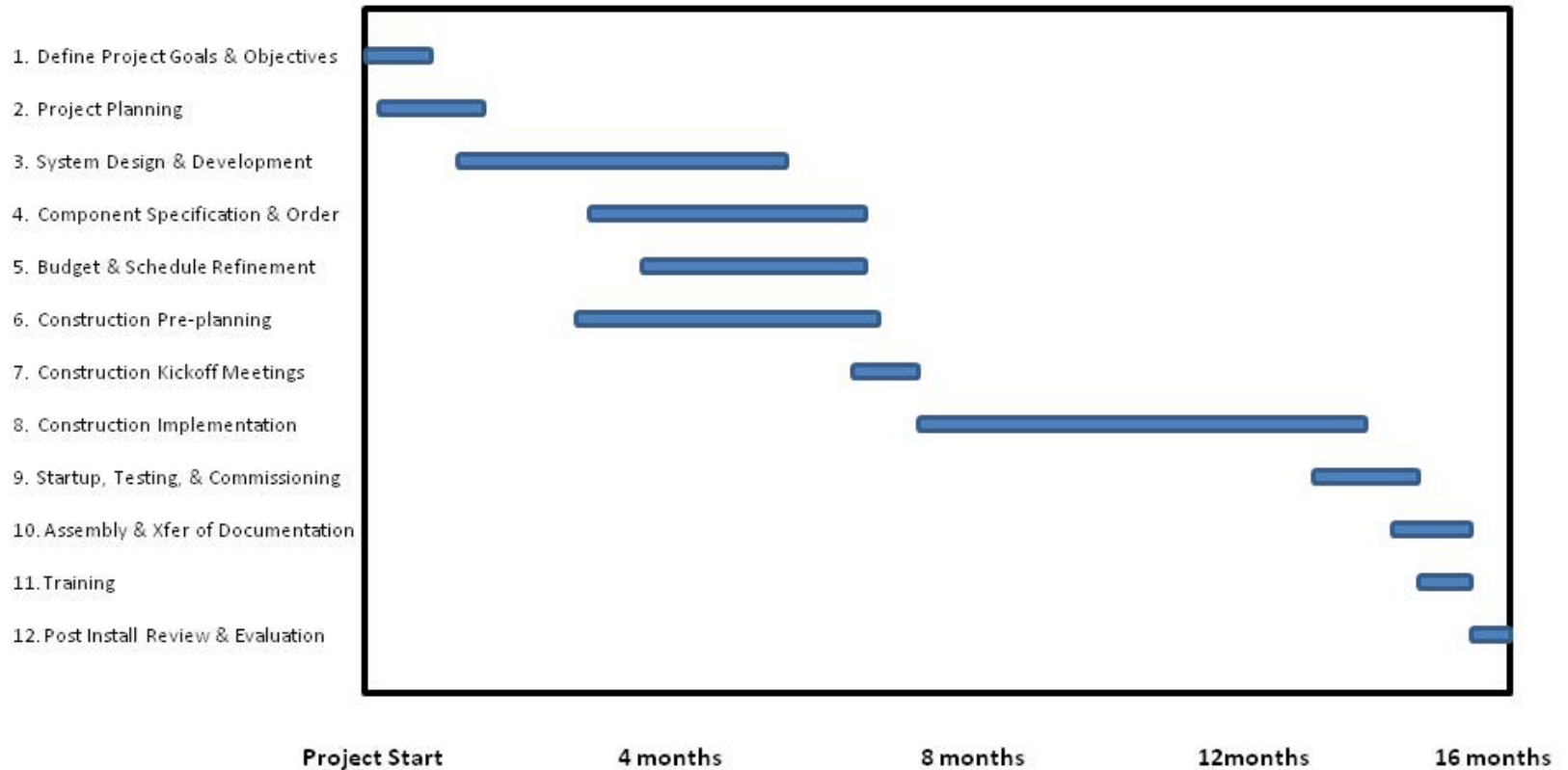


Project Expected Milestones

- **Project Kickoff**
- **Planning**
- **Continued Team and Subteam Formation**
- **System Design and Development**
- **Component Specification**
- **Budget and Schedule Refinement**
- **Equipment Procurement**
- **Construction Pre-planning and Kickoff Meetings**
- **Construction Implementation by Zones & Phases**
- **Startup, Testing, and Commissioning**
- **Training and Transfer of Documentation**
- **Post Installation Review and Evaluation**

Project General Timeline

SRJ Microgrid Advanced Energy Storage – Development and Construction High Level Timeline



Research Elements

■ ***Metering, Monitoring, and Design Approach***

- ***Power Quality metering at all significant power sources: Fuel Cell, Diesel Generators, Battery, Utility PCC***
- ***Energy metering at all four feeder locations.***
- ***National Renewable Energy Laboratory input and evaluation***

■ ***Economic and User Benefits***

- ***Lawrence Berkeley National Laboratory input and evaluation***
- ***StrateGen to evaluate from an "Energy Program Manager" perspective.***

■ ***Organizational Strengths***

- ***Integration of Renewable Energy Resources.***
- ***Power Electronic Systems Design Approach and Design Elements***

■ ***Research Contribution***

- ***System design review***
- ***Team with CES and LBNL to gather and analyze utility feeder load data, and upstream utility distribution feeder configuration and characteristic***
- ***Development of an Electrical Simulation Model***
- ***Post-system startup use of collected data to validate and/or show discrepancies with the developed model.***

Lawrence Berkeley National Laboratory

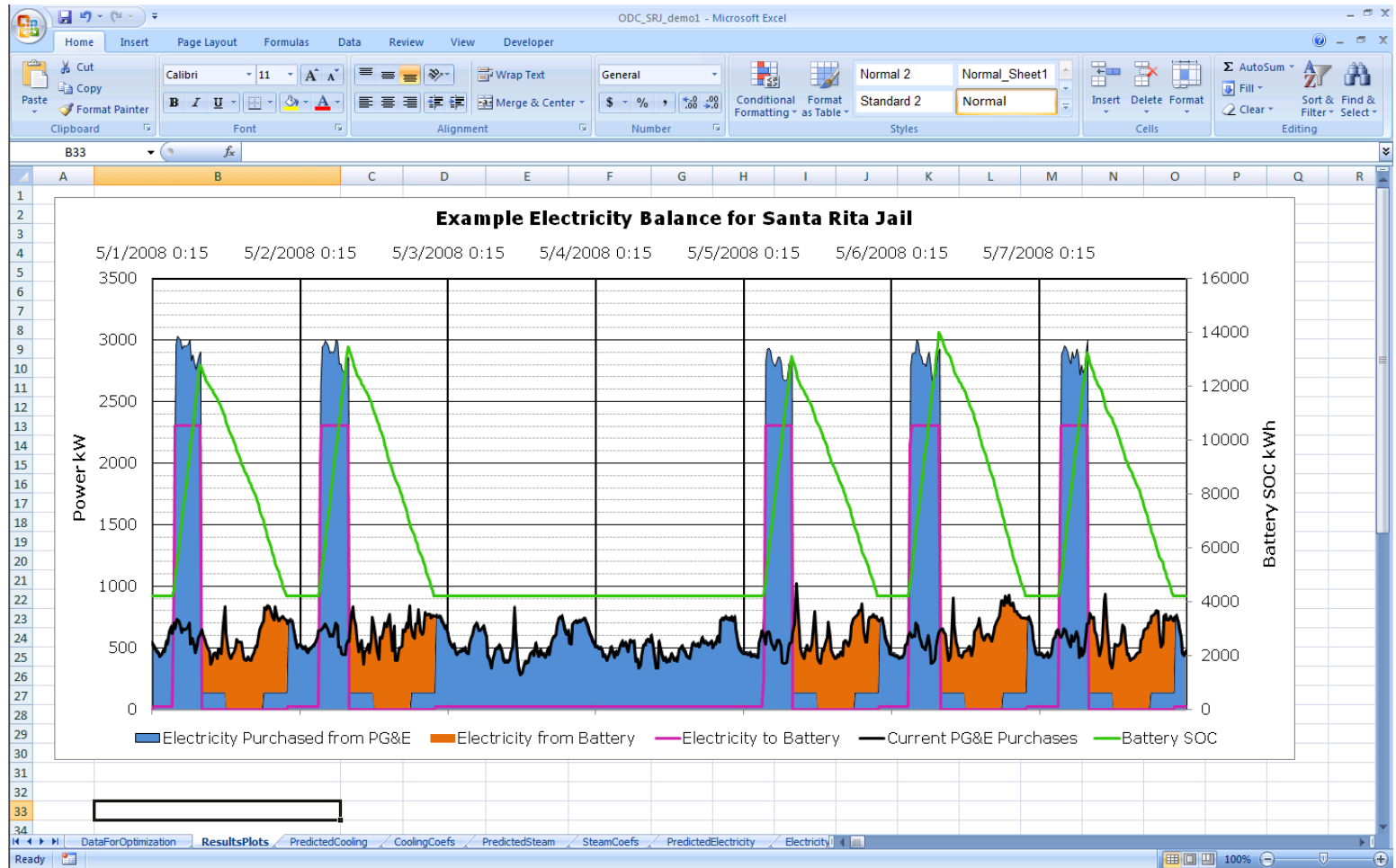
■ ***Organizational Strengths***

- *Microgrid Economic Benefits*

■ ***Research Contribution***

- *Collection and analysis of utility distribution feeder data as relates to Microgrid peak feeder load reduction approach and impact*
- *Analysis regarding future approaches to increase peak feeder load reduction impact*
- *Incorporate rate tariffs into analysis*
- *Facility analysis with California ISO involvement relating to their focus relating to renewable energy penetration, demand response, and ancillary services*
- *Seasonally based charge / discharge schedule, and potential “week-ahead” energy storage scheduling*

Charge / Discharge Profiles



StrateGen

- ***Organizational Strengths***
 - ***Energy Industry and Policy Analysis***

- ***Research Contribution***
 - ***Project Economic Analysis useful to other communities or projects considering implementation of similar systems***
 - ***Project Case Study with an “end-user” perspective, quantifiable benefits, and subjective benefits***

Recent Regulatory History in California

- ***CPUC Approves Big Bold Action Plan (May 2008)***
 - *New Residential developments must be “net zero energy” by 2020*
 - *New Commercial developments must be “net zero energy” by 2030*

- ***CPUC Proposed Decision (Peevey on 10/22/2008)***
 - *New Incentive of \$2/Watt of Installed capacity for Advanced Energy Storage when coupled with behind the meter Wind or Fuel Cell systems (up to 3 MW)*

Thank You!

