

Current and Future Role of Microgrids



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Types of microgrids

- Utility
 - Borrego Springs
- Military Bases
- Campus Environment
 - UCSD
- Greenfield Development
 - Third World Applications
- Homes

Requirements

- Define microgrid boundary
 - Industrial customer, campus, substation, circuit
- Match load and generation
 - Voltage, frequency and power factor within tolerances
- Define reliability requirements
 - SAIDI, SAIFI, MAIFI and power quality
- Determine seamless transition
 - How long to restore power in island
- Define loads
 - Critical, demand response, peak load
- Determine island duration
 - Typical outage or extreme event
- Define generation needs
 - Renewables, energy storage, fossil generation

Background - Microgrid Opportunities

- Support the integration of renewable resources
- Improve reliability and power quality
- Support emergency operations
- Ability to “ride through” outages
- Optimize energy usage
- Enable participation in new markets for demand response and ancillary services



Microgrid 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 consumer DG, demand response, automated response, and other advanced tools

Borrego Springs Microgrid



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

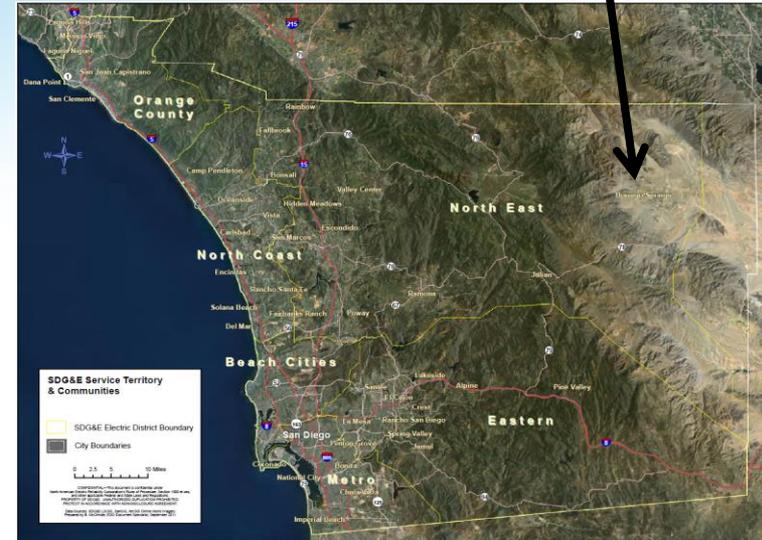
Project strategies

- Design and demonstrate a smart electrical 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.

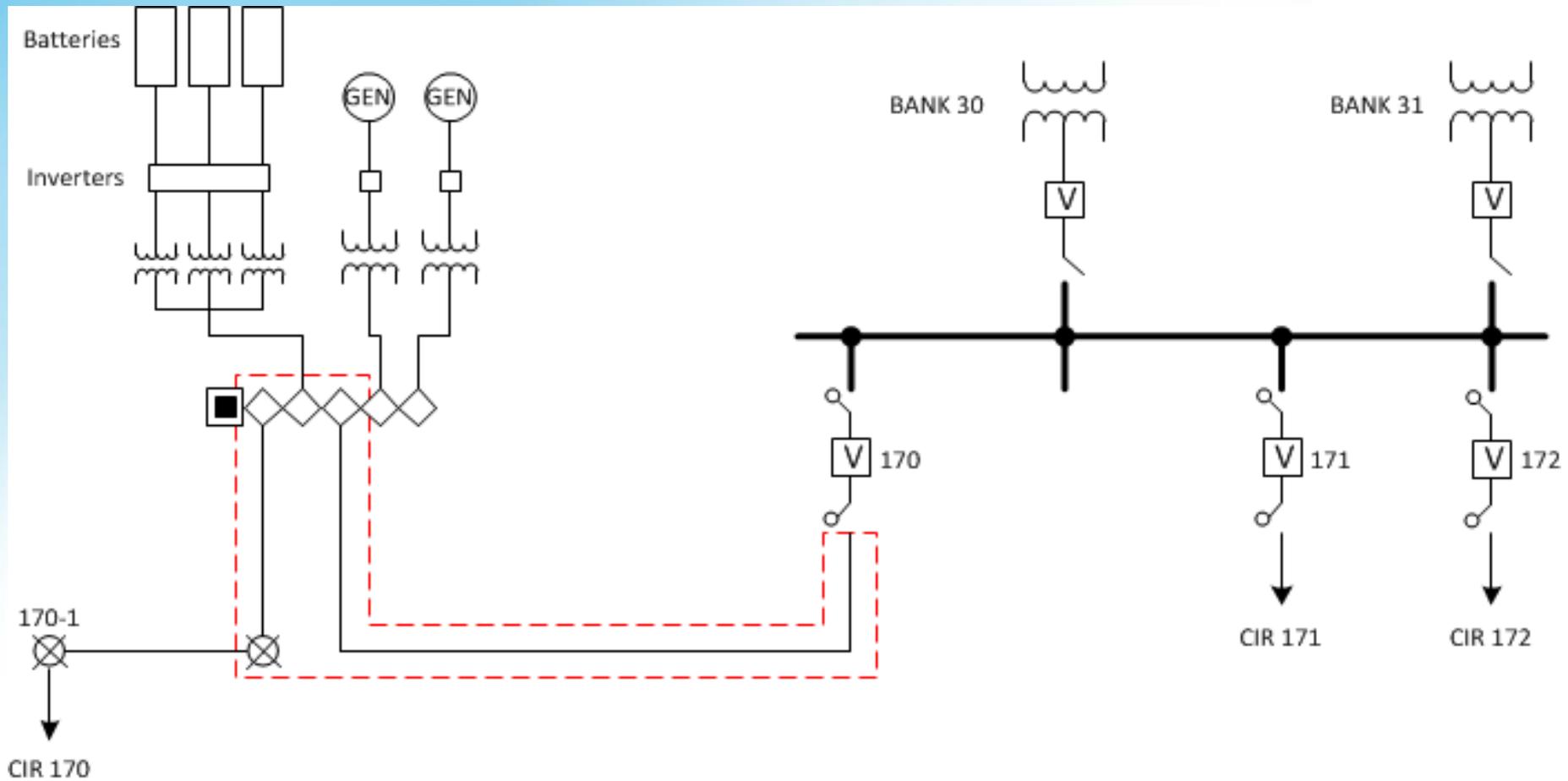
Site Selection – Borrego Springs, CA

- **Key Strengths:**
- Progressive-minded community
- High concentration of customer-owned solar generation
- Potential for reliability enhancements
- Opportunity to balance supply and demand to be more self-sufficient
- Extendable to service territory

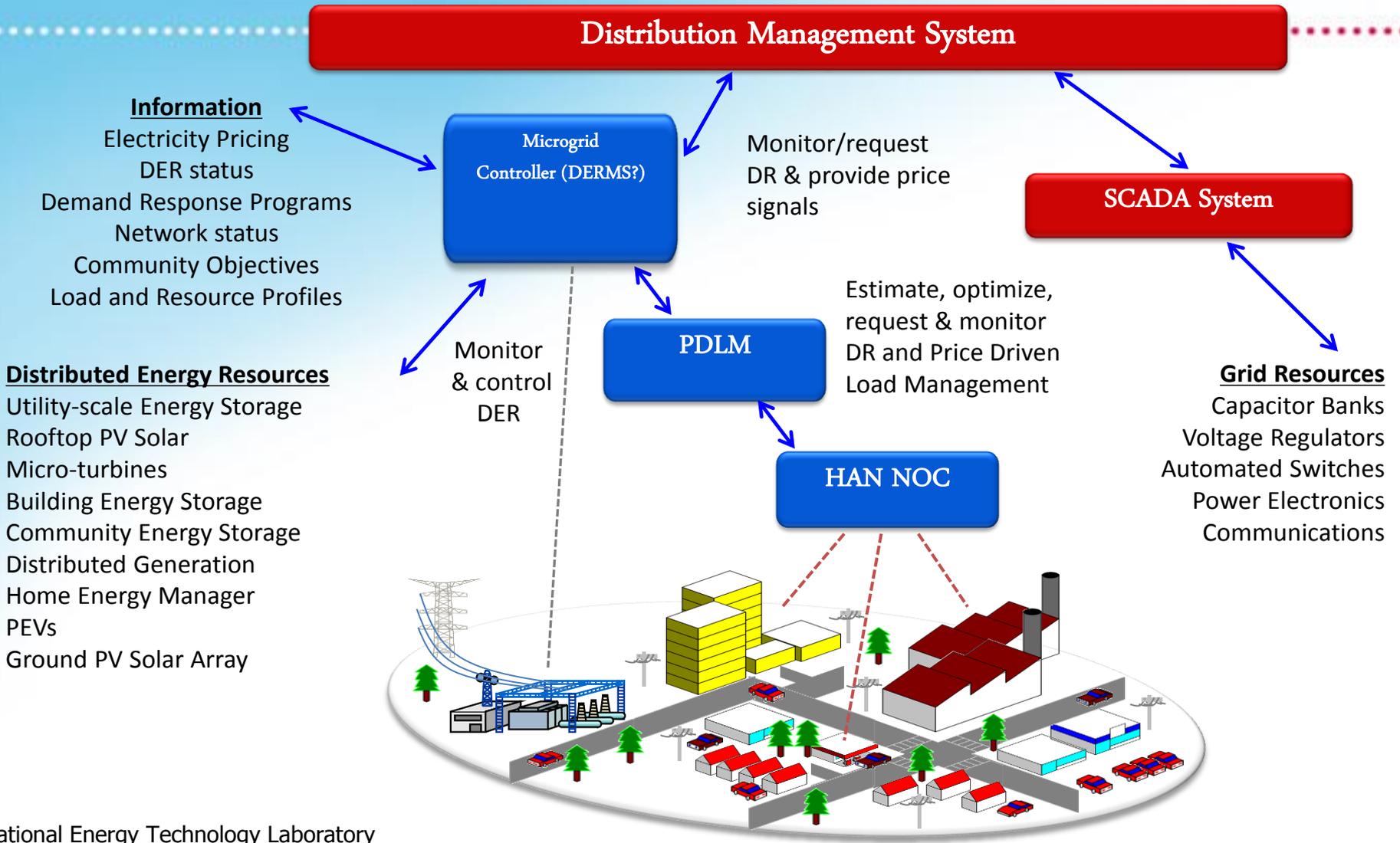
Borrego Springs



Reconfigure of C170/Borrego - Loop into Yard

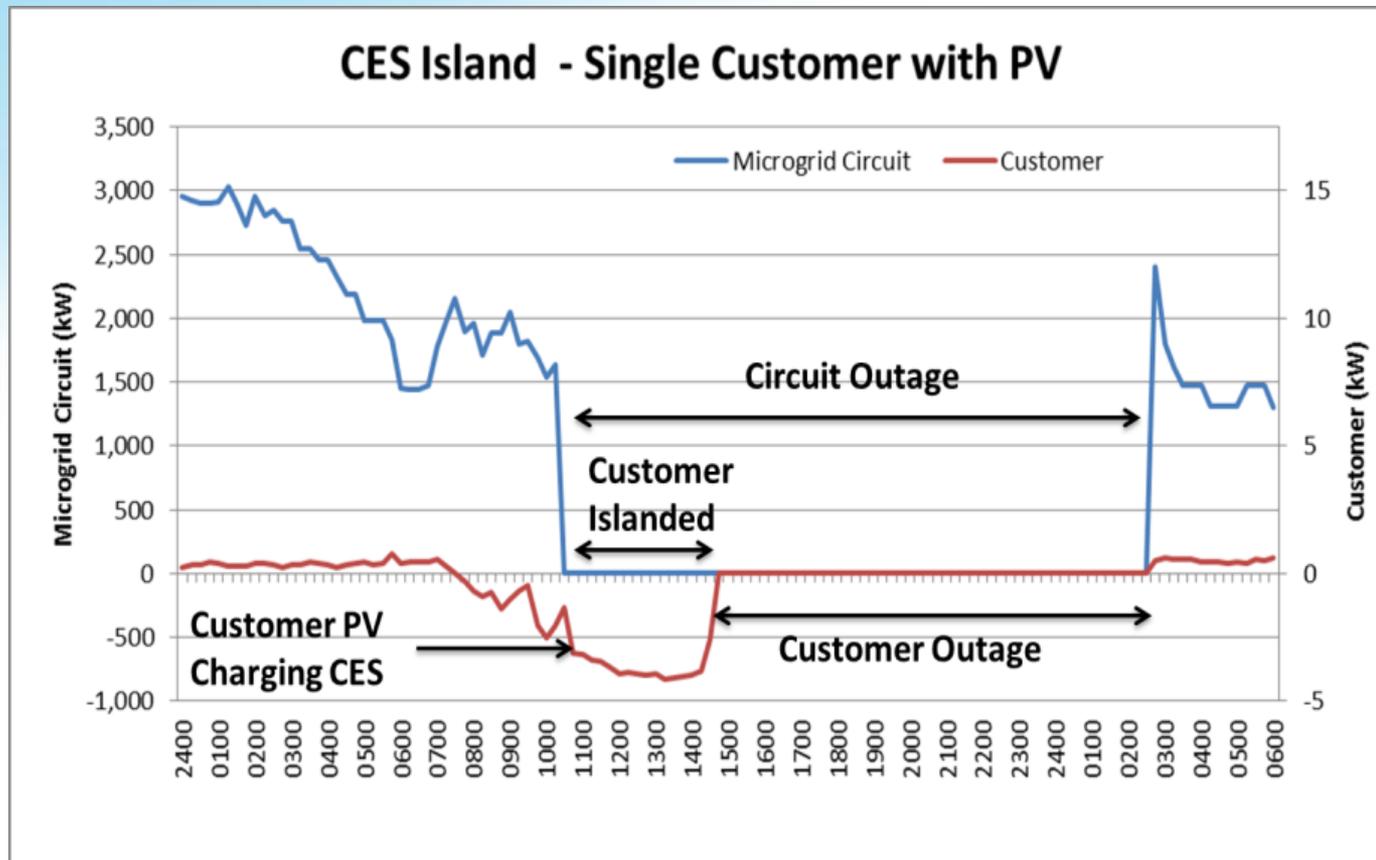


Managing a Microgrid



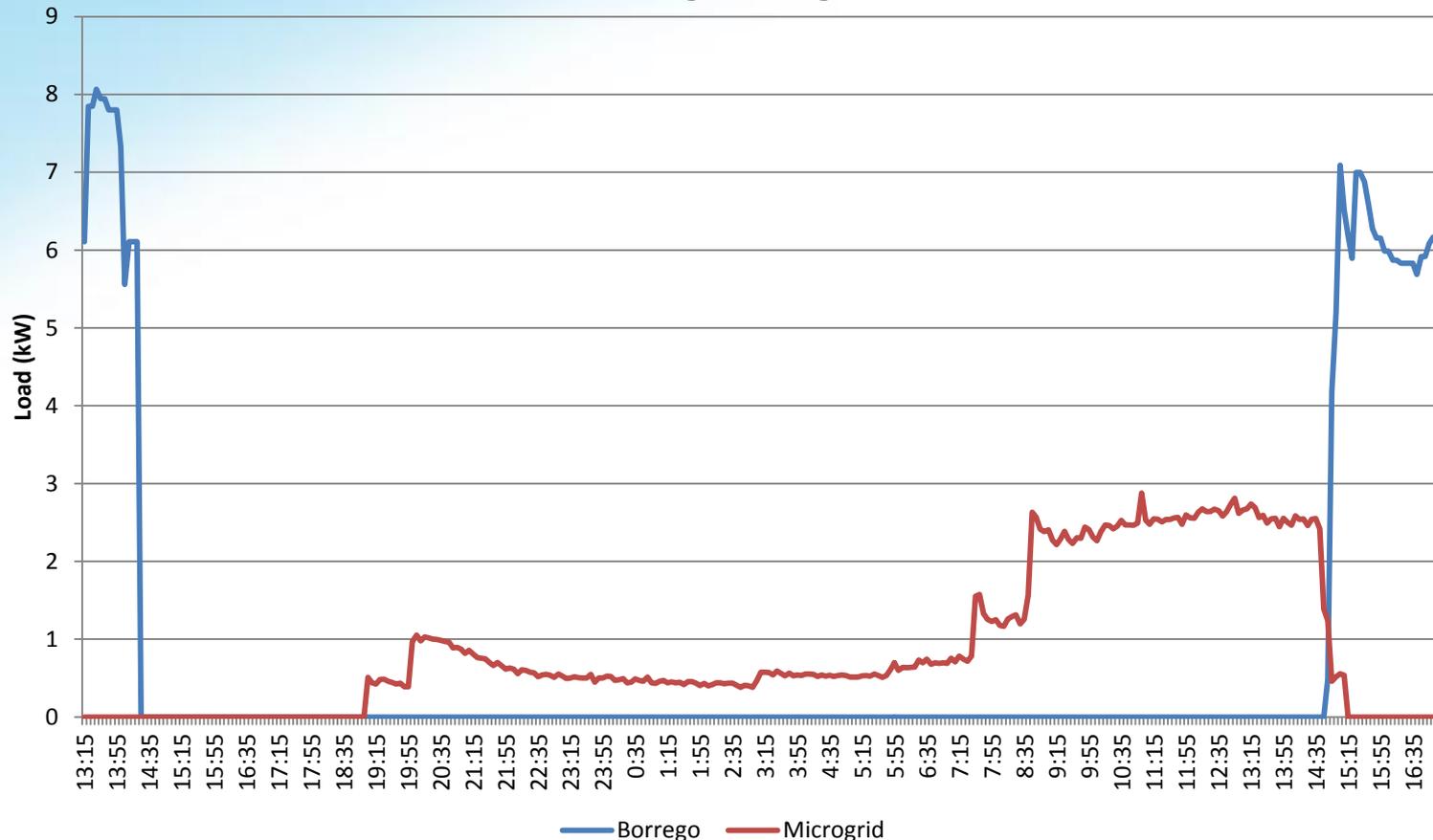
CES Islanding Event 4/8

- Residential customer islanded after grid outage
- Customer remained with power for approximately 5 hours after outage occurred



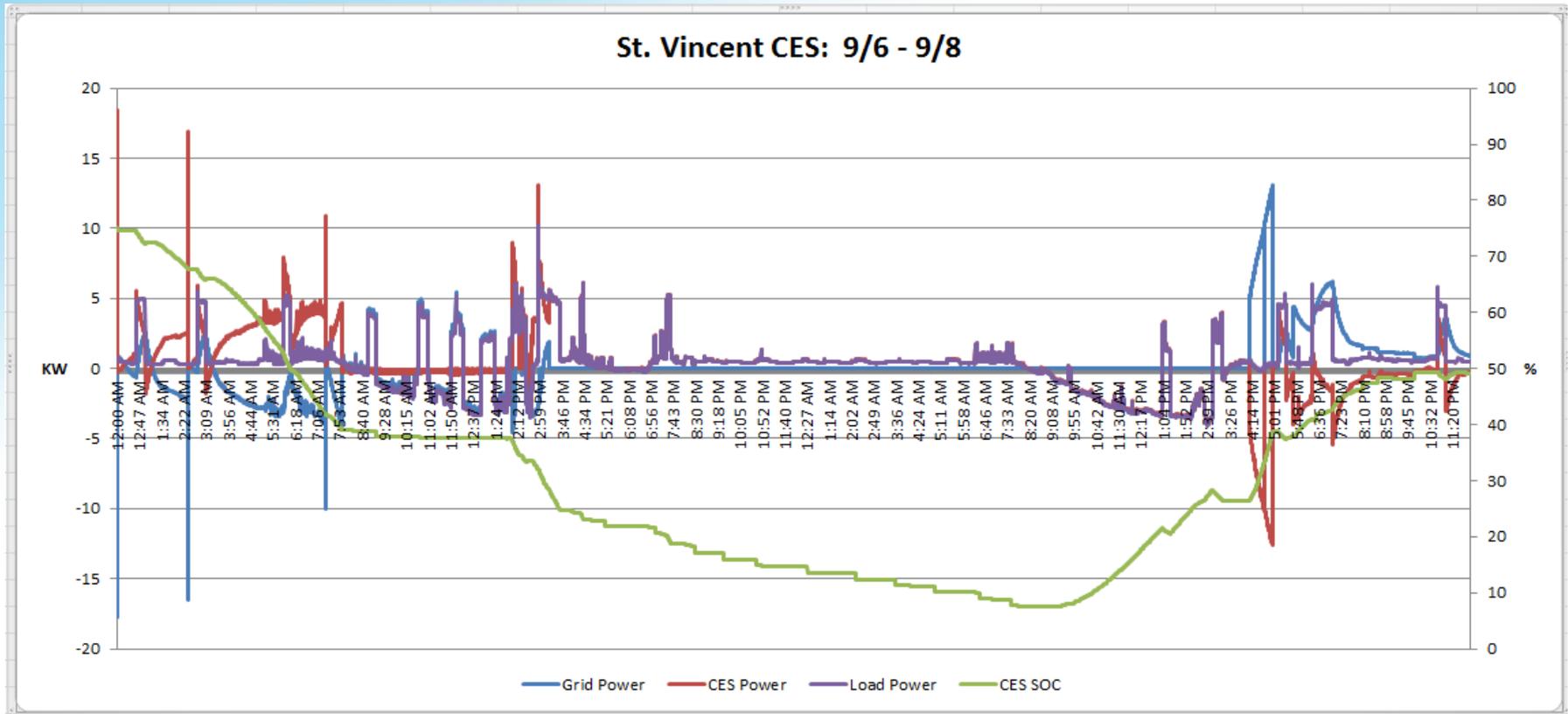
Borrego Outage 9/6-7

- At 1420, single transmission line to Borrego trips out
- 9 Transmission and 11 Distribution poles reported down
- 1056 total customers restored during outage



CES - Borrego Outage 9/6-7

- No outage seen at St. Vincent CES unit site



Significance and Impact

- First large scale utility microgrid
- Actually island real customers
- Alternative service delivery model
- Prove advanced technologies for future applications
- Establish model to be used by other utilities



Key Takeaways

- Microgrids can be utilized for grid resiliency
- Microgrids are cost effective in some applications
- Technology cost reductions will drive new applications
- Regulatory framework evolving



General Lessons Learned

- Nascent technology
- Likely points of failure and troubleshooting issues
- SES specifications
- Standards
- Operational coordination
- Security – cyber and physical



Borrego Microgrid 2.0 – Overview

Enhance the Borrego Springs Microgrid to be more flexible and automated in responding to a variety of potential outage situations, and leverage various new technologies and Distributed Energy Resources for increased Microgrid capabilities.

Goals

Enhance Emergency Readiness

Increase Operational Flexibility

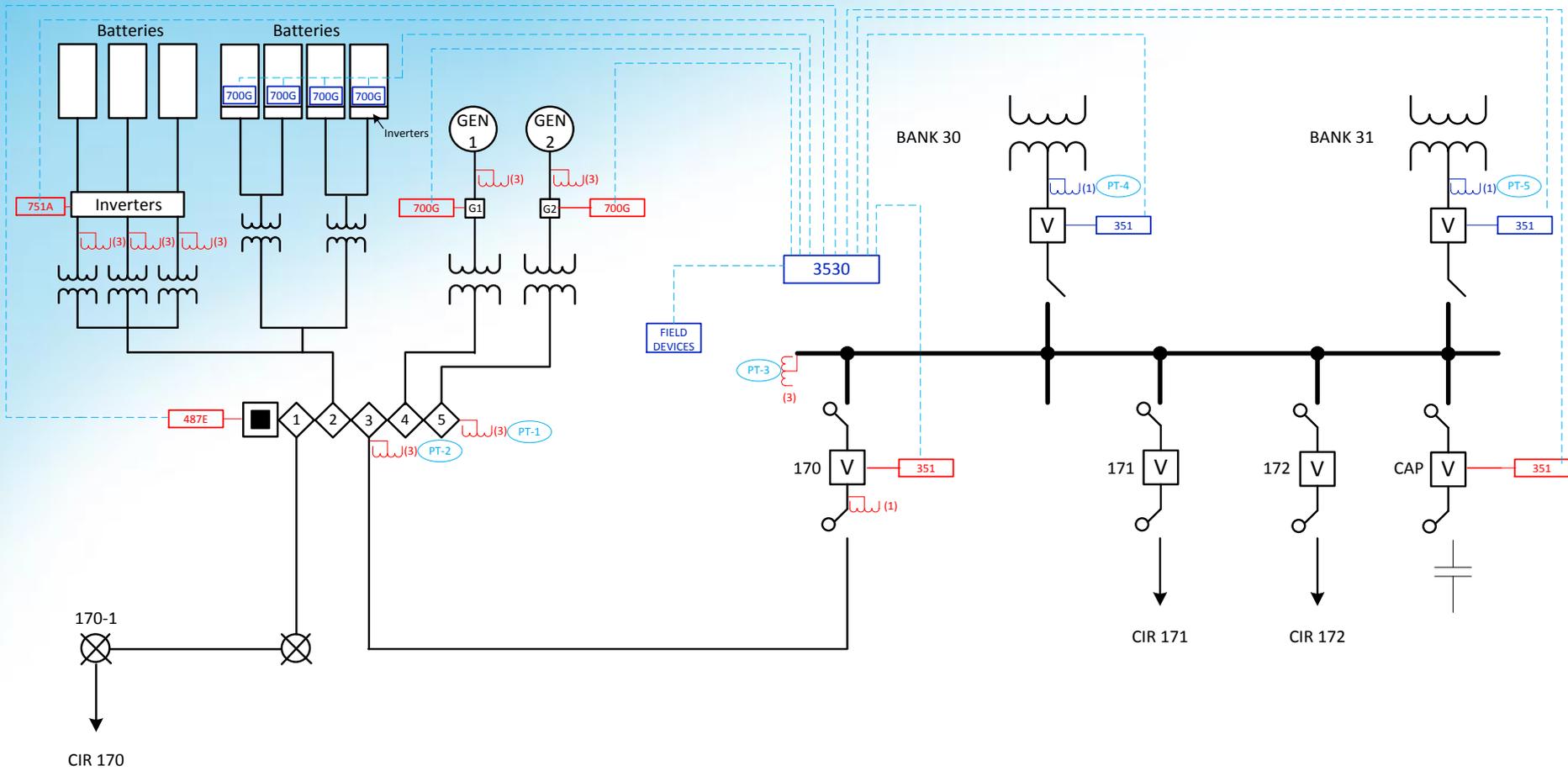
Decrease Outage Response Times

Increase Grid Resiliency

Demonstrate New Microgrid Technologies

Increase Microgrid Load Capacity

Upgrade Protection and Permissions - New Protection Layout



Borrego Microgrid 2.0 – Local PV Integration

- Solar facilities can provide additional generation source
- Potential of islanding all of Borrego Springs during the daytime



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Questions ?

Thank you.

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