CEC Staff Workshop on Microgrids

SDGE

A Sempra Energy utility®

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September 6, 2016

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

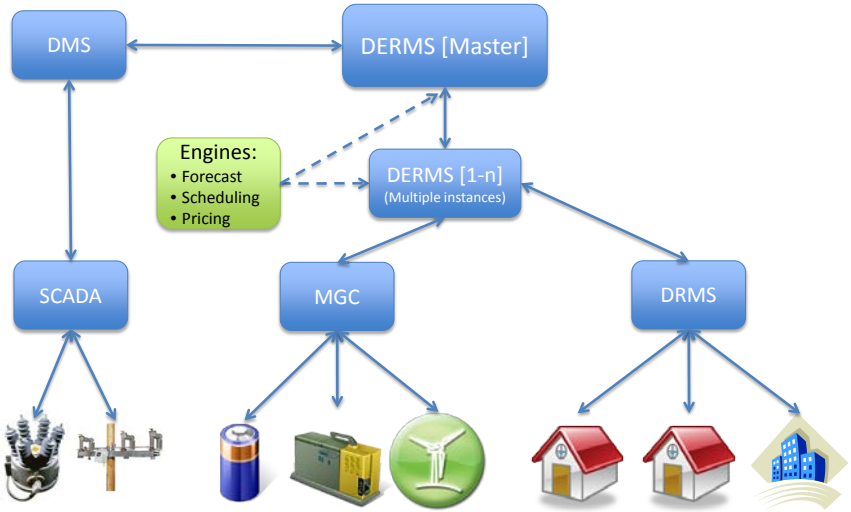
- Enhance Emergency Readiness
- Increase Operational Flexibility
- Decrease Outage Response Times
- Increase Grid Resiliency
- Demonstrate New Microgrid Technologies
- Increase Microgrid Load Capacity

Project Metrics

- Develop microgrid technologies including a commercially available controller
- Island the entire community of Borrego Springs during the day and to drop non-critical loads during the night
  - Coordinate generation and loads and maintaining grid characteristics consistent with SDG&E's standards
- Develop a microgrid that meets or exceed the U.S. Department of Energy's 2020 goals of commercial-scale microgrid systems
  - Reduce outage time of required loads by >98% at lowest cost while reducing emissions by >20% compared to a diesel backup generator set
- Enable the "smart inverter" functionality that meets the requirements of IEEE 1547a or IEEE 1547.8 for the 26 MW_{ac} PV array inverters
- Utilize renewable resources to supply 100% of the community's load
- Reduce energy use by using energy efficiency and demand response where appropriate
- Include engineering and interconnection infrastructure for additional energy storage devices

Project Values

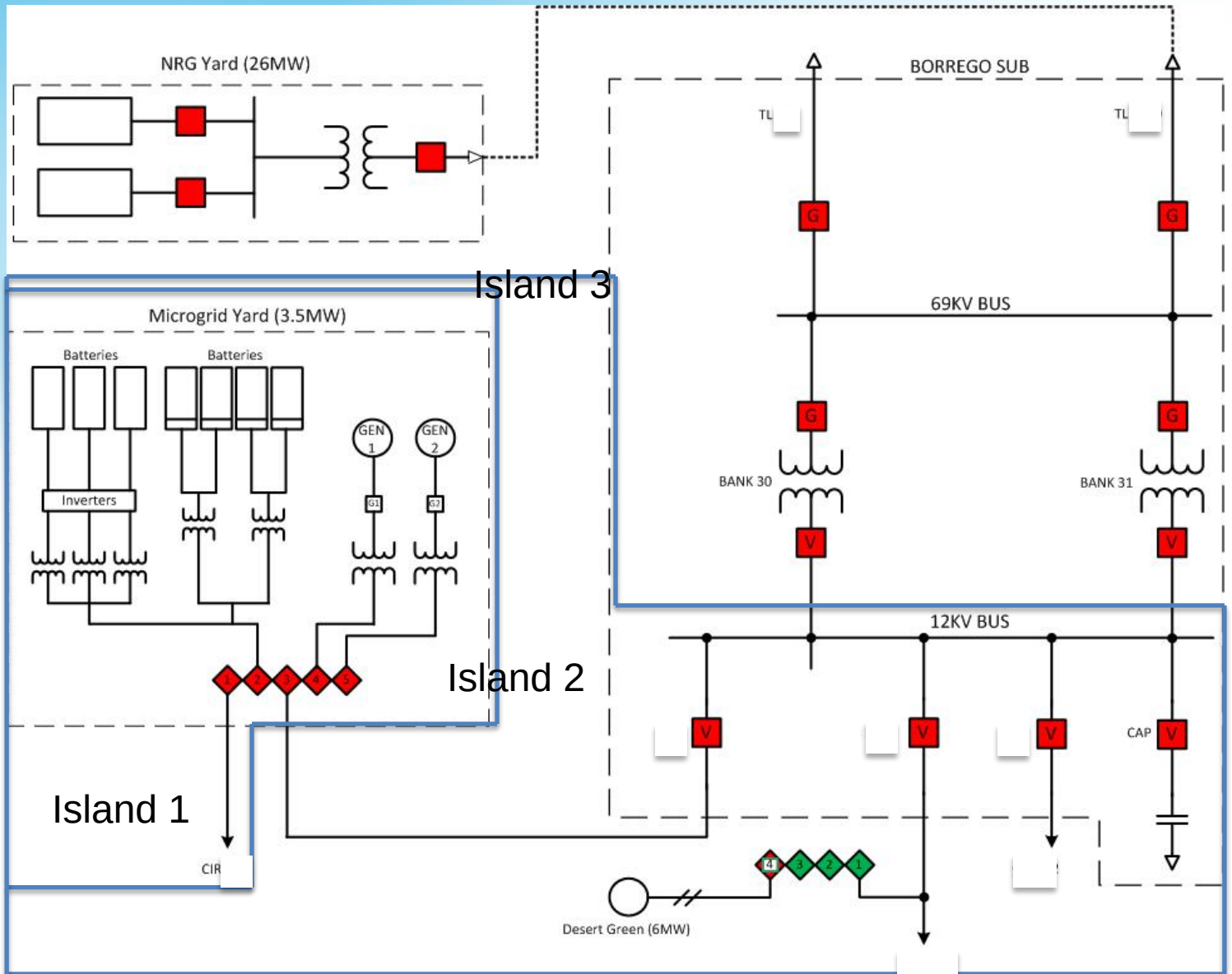
- Demonstrate that microgrids can provide value to customers and the grid:
  - Improved grid resiliency
  - Enable higher penetrations of renewable energy
  - Avoid adverse grid impacts through the use of a microgrid controller
    - Utilize DERMS product system wide
- Identify barriers to deployment of high-penetration, renewable-based microgrids and potential solutions
- Create a replicable microgrid model



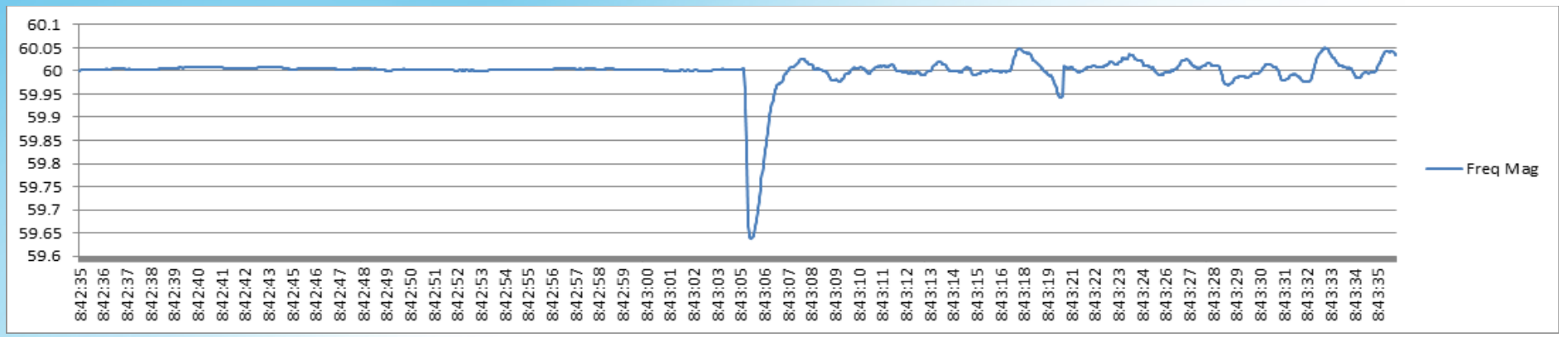
Increased Grid Resilience – 5/21/15 Operation of Borrego Springs Microgrid

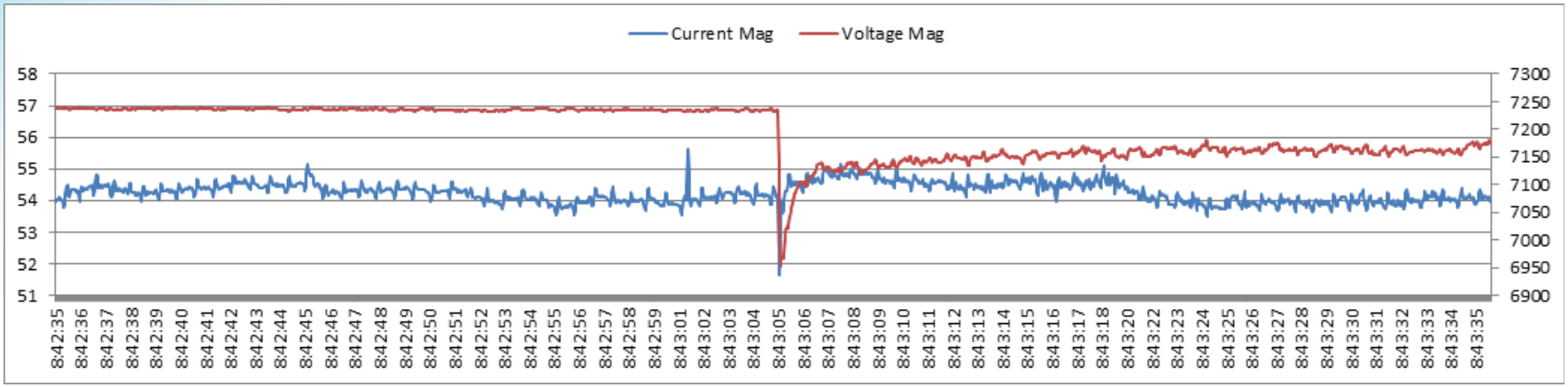
- 10 hour outage to entire community required to perform compliance-driven transmission maintenance and to replace 2 suspect transmission poles
- Utilized Borrego Springs Microgrid to keep all 2800 customers energized during transmission outage
- Base load was fed by the solar facility, using the batteries and distributed generation to “follow the load”
- Customers experienced a brief 10 minute planned outage to reconnect to the transmission grid

Normal Operations

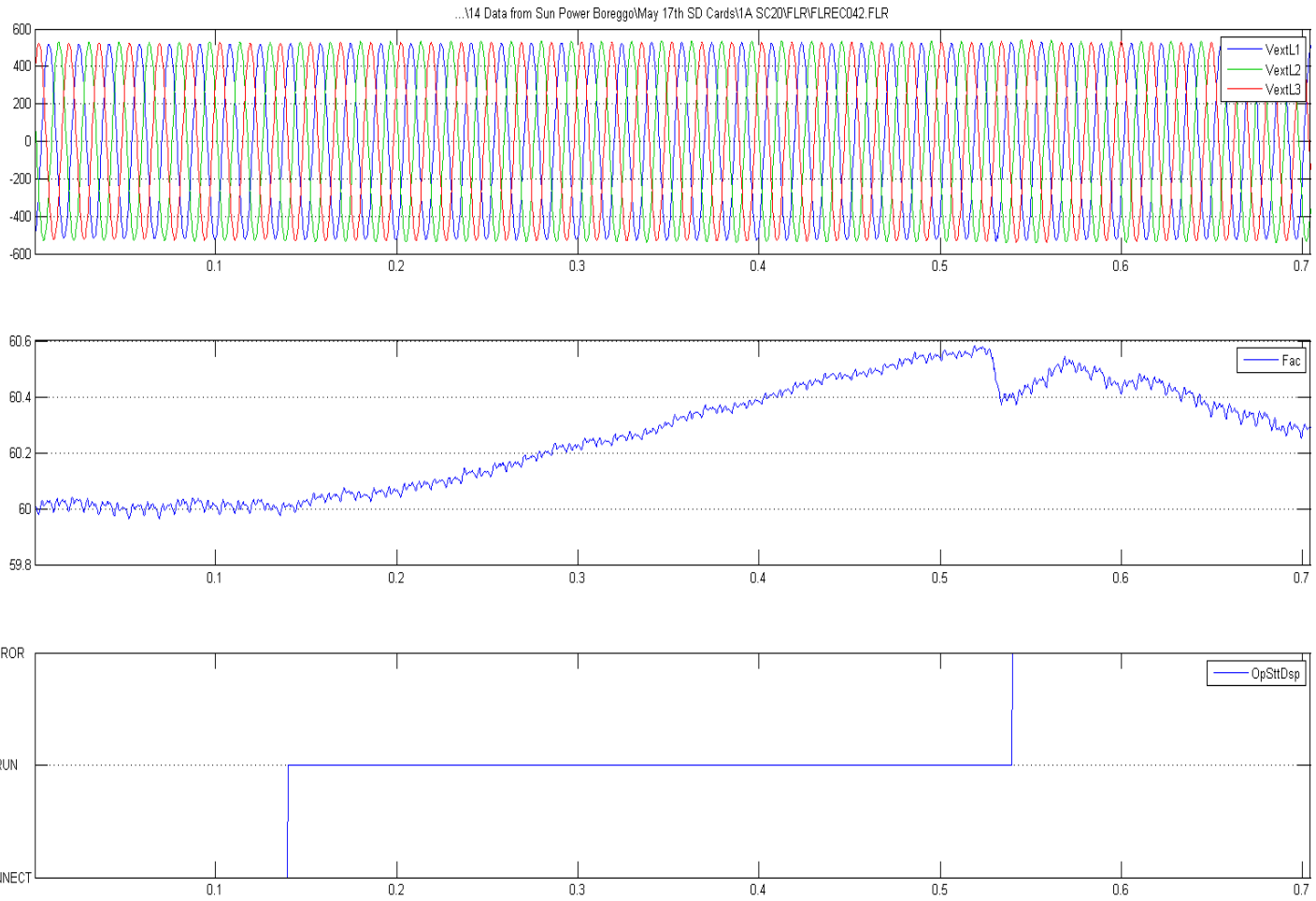


May 21, 2015 Islanding Event - Transition to Island





May 17, 2016 Islanding Event - NRG Trips on Over Frequency



Key Lessons Learned

- New requirements and procedures needed
  - Controls need to be place
  - Adaptive protection scheme
  - Forecasts needed
    - Load and generation
- Loss of microgrid inertia issues
  - Step change in frequency and voltage variability
  - RAS scheme for Islands 2 & 3
  - Control time step?
- Requirements for the NRG PV facility
  - Extend frequency and voltage ride through
  - Dynamic Volt/VAr capabilities
  - Generation master
  - Isosynchronous mode?
  - Communications/control
- Role of rooftop solar

Significance and Impact

- First large scale utility microgrid
- Actually island real customers
- Alternative service delivery model
- Prove advanced technologies for future applications
- Significant lessons learned in operating a low inertia environment
- Establish model to be used by other utilities
- Operation in a 100% renewable environment

Borrego Microgrid 3.0 – Overview

Enhance the Borrego Springs Microgrid to displace the diesel generators and run entirely on renewable resources. Demonstrate a 100% renewable environment islanded and 300% renewable capacity when grid connected.

Goals

- Install 12 MWac PV System
- Install 10 MW, 150 MWh Energy Storage System
- Reduce Storage Cost with ITC
- Increase Grid Resiliency for the Entire Community
- Demonstrate Low Inertia Microgrid Control Technologies
- Create a 100% Renewable Microgrid Environment

Acknowledgements

Acknowledgement: "This material is based upon work supported by the Department of Energy [National Nuclear Security Administration] under Award DE-FC26-08NT02870 and DE-FC26-08NT01904.

Questions?

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