

CEC Staff Workshop on Microgrids

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Thomas Bialek PhD, PE
Chief Engineer

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

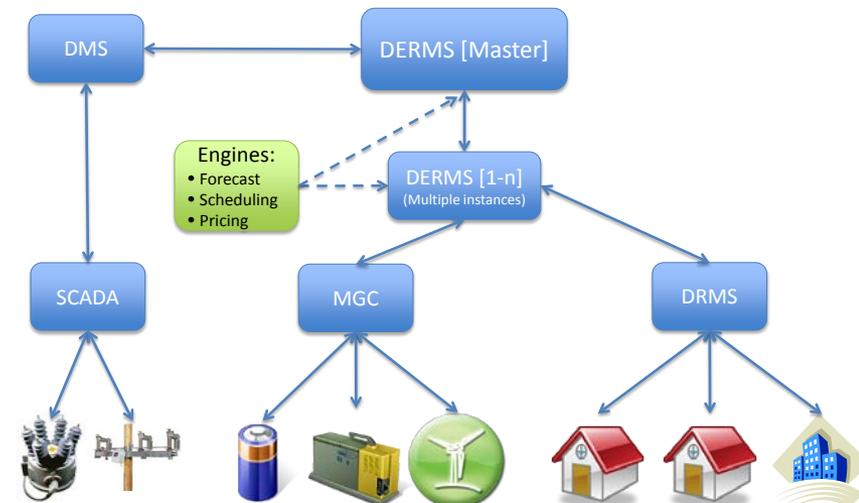
Increase Microgrid Load Capacity

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

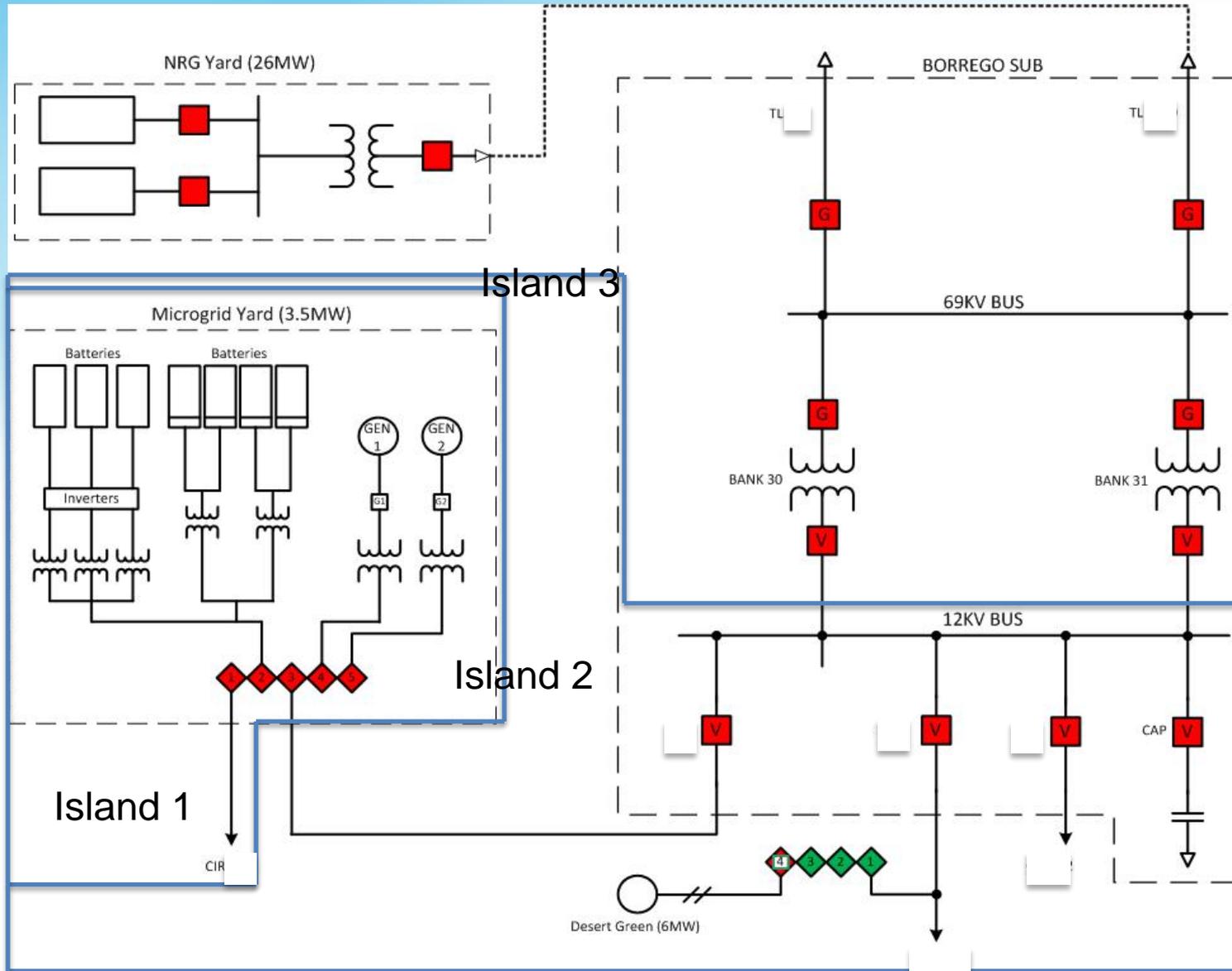


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- 10 hour outage to entire community required to perform compliance-driven transmission maintenance and to replace 2 suspect transmission poles
- Utilized Borrego Springs Microgrid to keep all 2800 customers energized during transmission outage
- Base 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



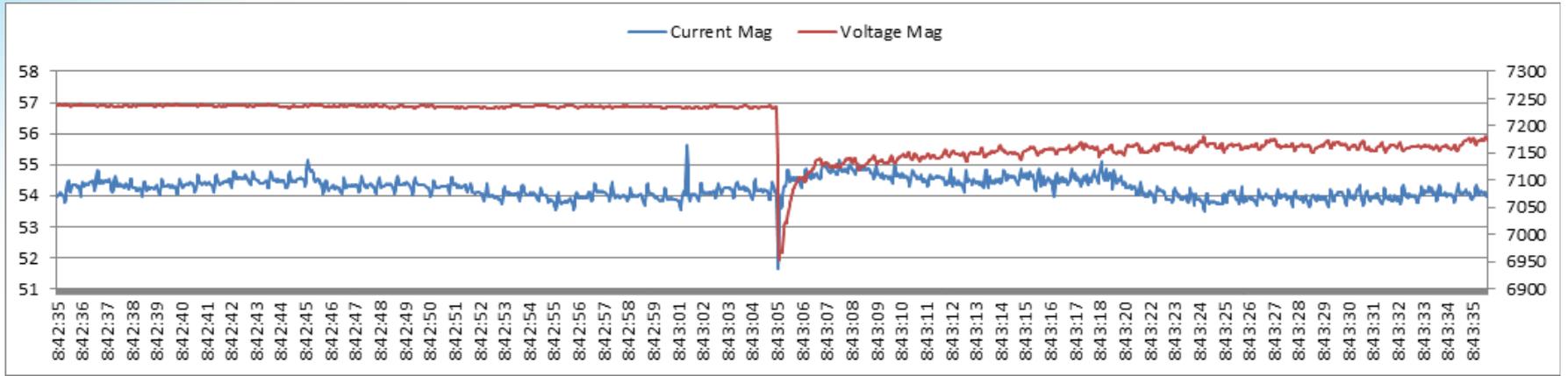
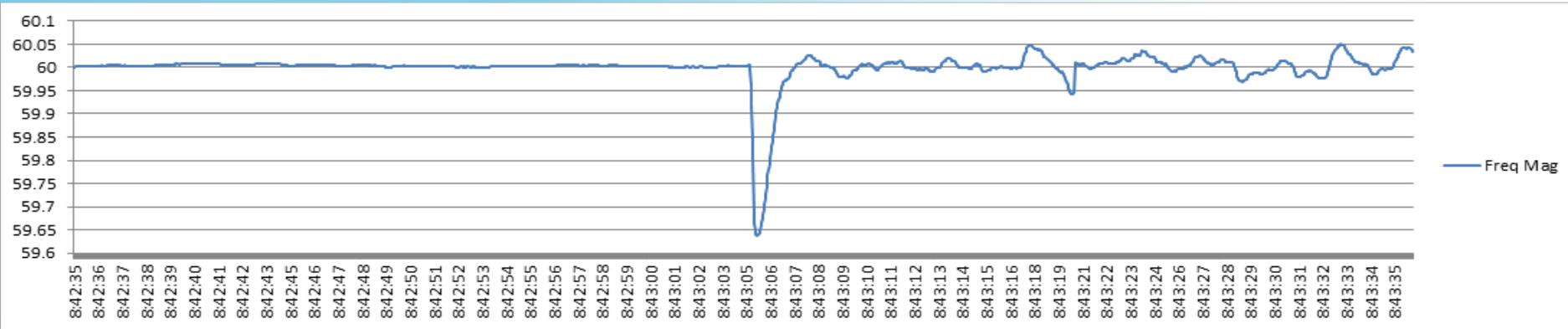
Normal Operations



May 21, 2015 Islanding Event - Transition to Island



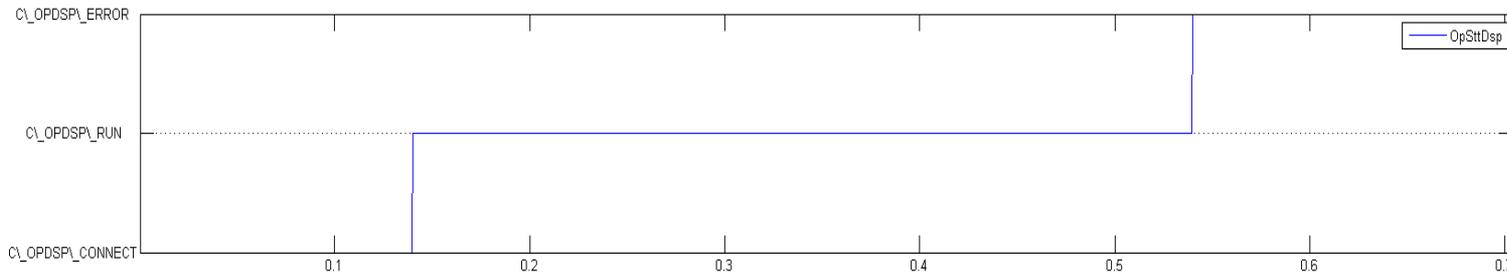
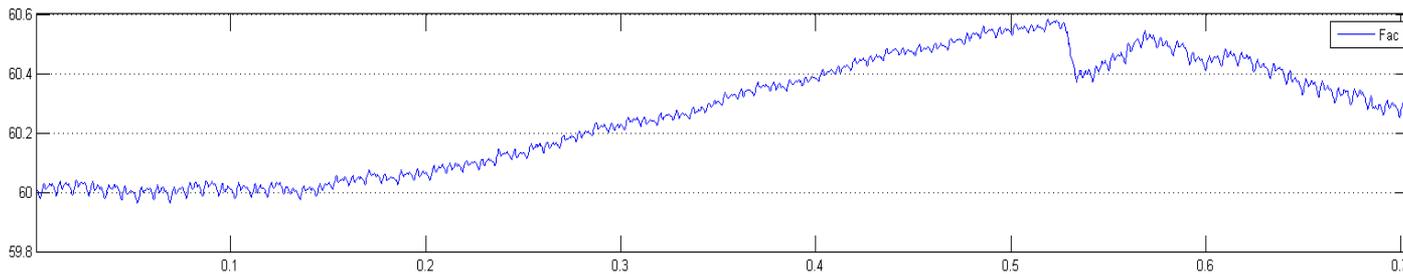
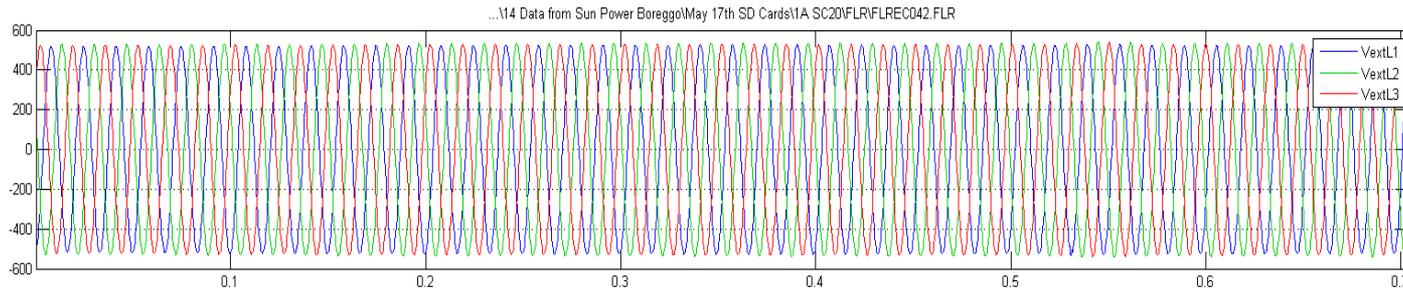
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May 17, 2016 Islanding Event - NRG Trips on Over Frequency



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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.

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Questions?

Thomas Bialek
Chief Engineer

tbialek@semprautilities.com
www.sdge.com/smartgrid/

