Borrego Springs: A Future Photovoltaic Based Microgrid

2015 EPIC Innovation Symposium

December 3, 2015

Neal Bartek

Distributed Energy Resources Manager

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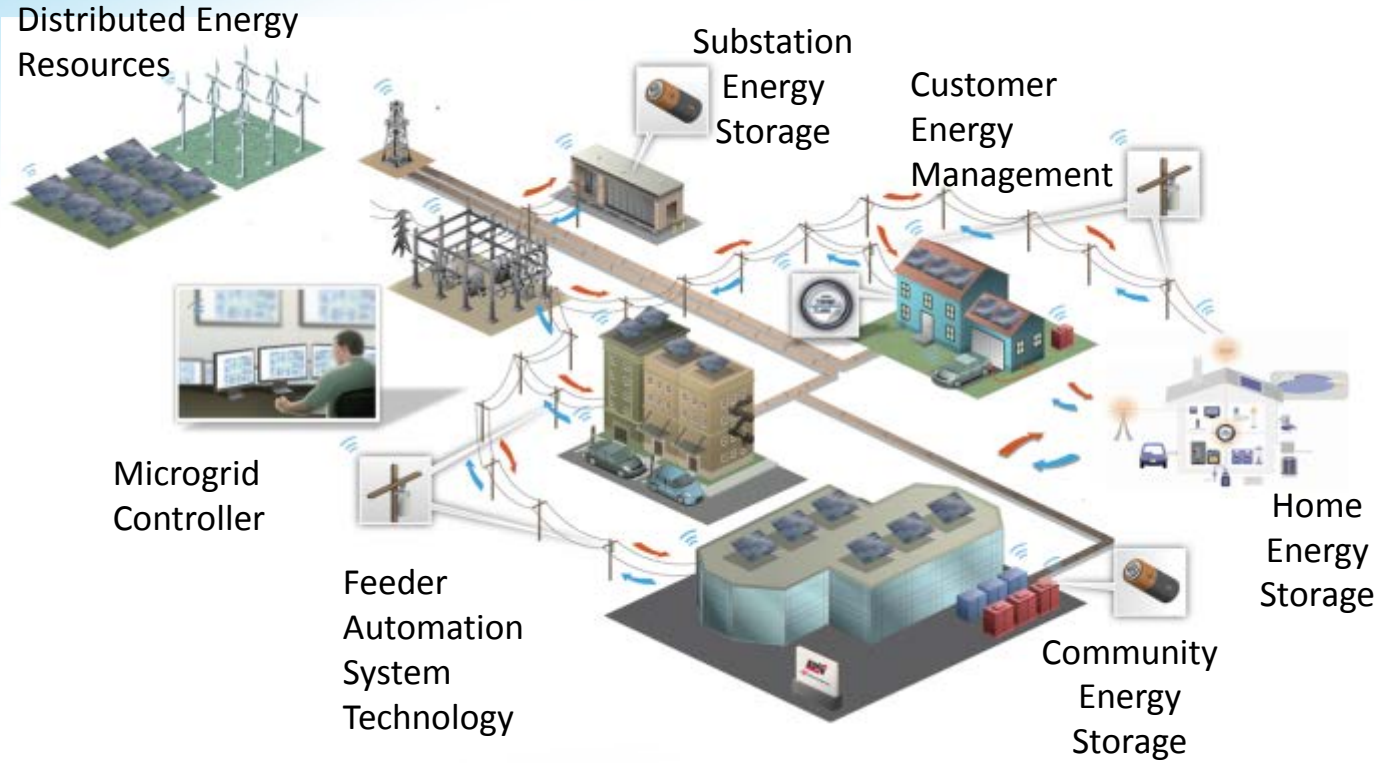
Borrego Springs Microgrid Demonstration Project (2010–2013)

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

Budget:	$8.0M DOE and $2.8M CEC plus matching funds from SDG&E and partners
Benefits:	▪ Integrate and leverage various generation and storage configurations ▪ Reduce the peak load of feeders and enhance system reliability ▪ Enable customers to become more active participants in managing their energy use

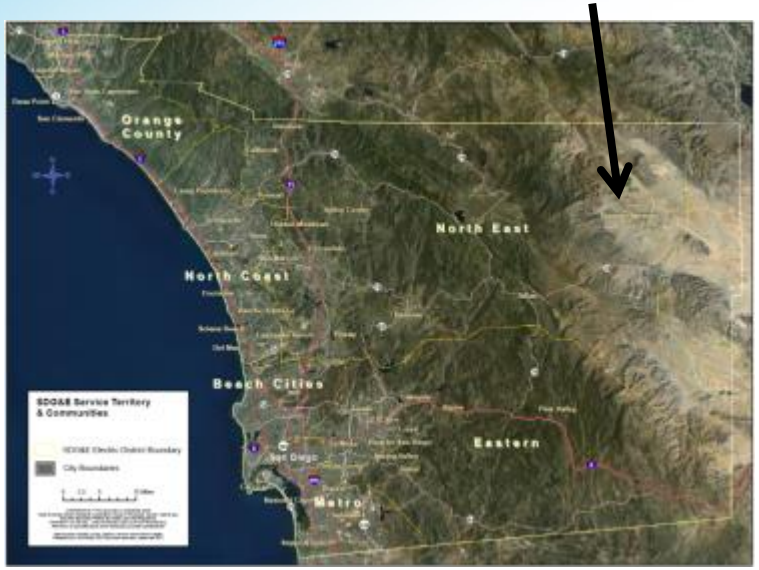


Site Selection – Borrego Springs

Key Strengths:

- Distant and isolated load pocket entirely surrounded by a state park
- High concentration of solar generation
  - NEM (~ 1 MW)
  - Transmission (LGIA) 26 MW (2/13)
  - Distribution (WDAT) 6 MW (9/14)
- Potential for reliability enhancements
- Opportunity to balance supply and demand to be more self-sufficient

Borrego Springs



Utility Owned Distributed Energy Resources (DER) in Borrego Springs

Distributed Generation

- Two 1.8 MW diesel generators

Substation Energy Storage (SES)

- Energy storage that supports a substation or a significant portion of a circuit, generally 500KW – 1MW so far
- Installed:

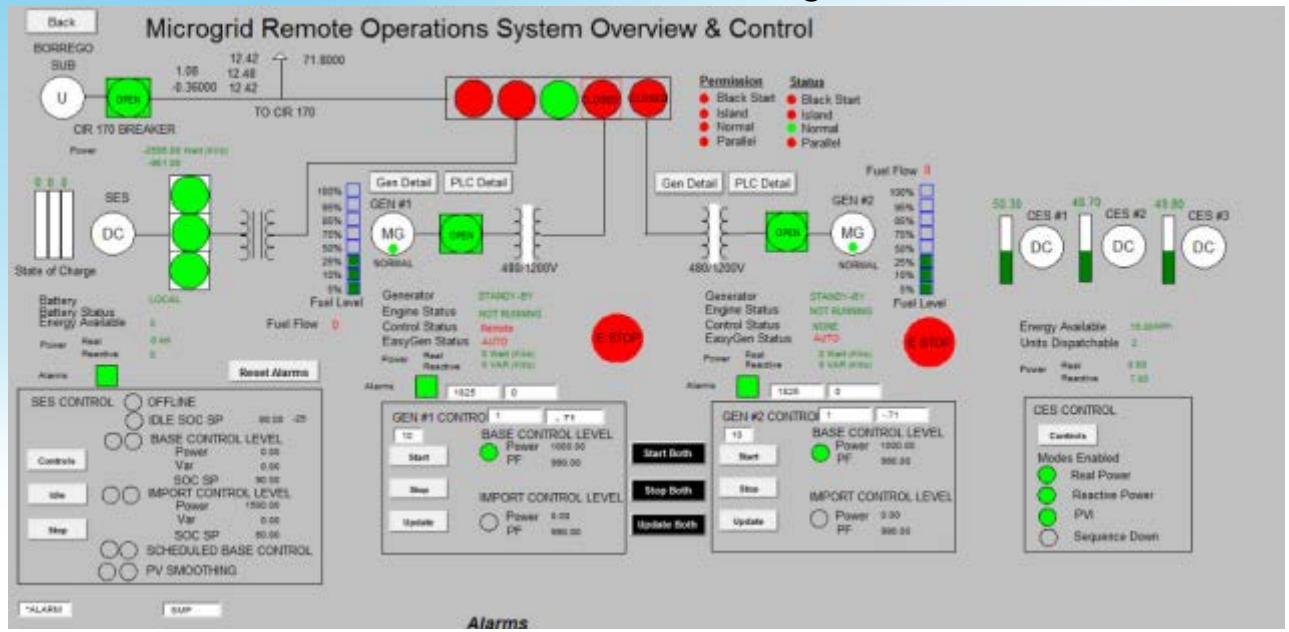
  2 units with 1.5MW/4.5MWh capacity

Community Energy Storage (CES)

- Energy storage that supports a small area, usually up to ~ 100kw
- Installed: 3 units with ~ 75KW/150KWh capacity

Microgrid Controls

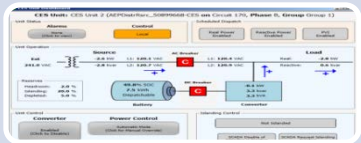
- Provides consolidated view/control of microgrid resources



Controls for generator 1

Controls for generator 2

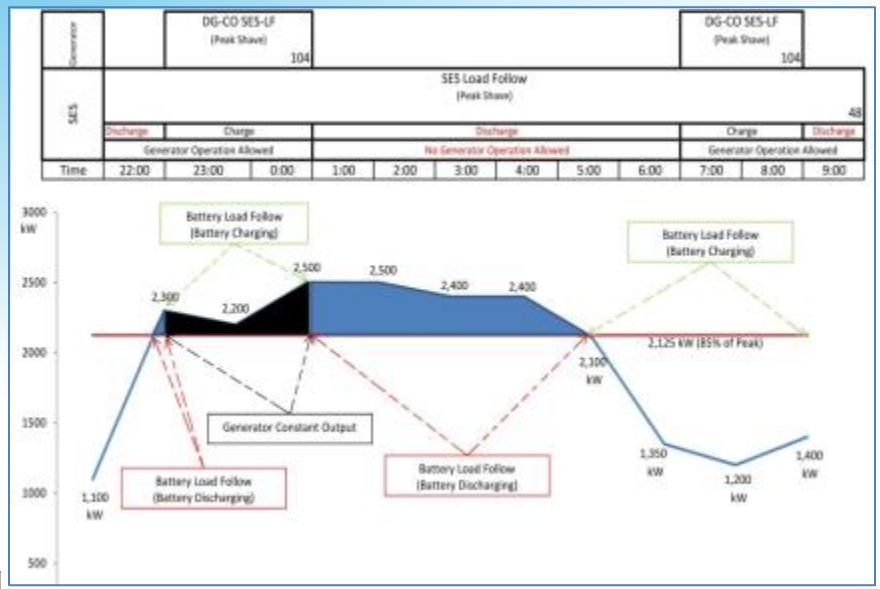
Controls for SES unit



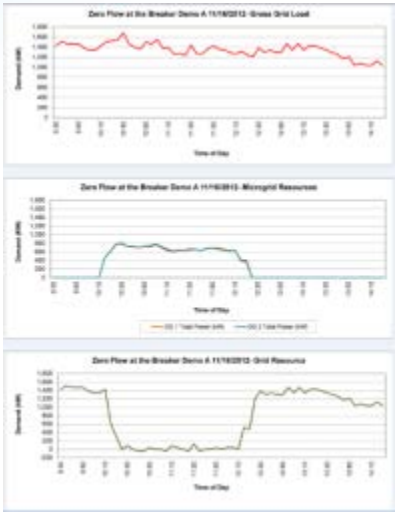
Controls for CES units

DOE/CEC Required Demonstrations

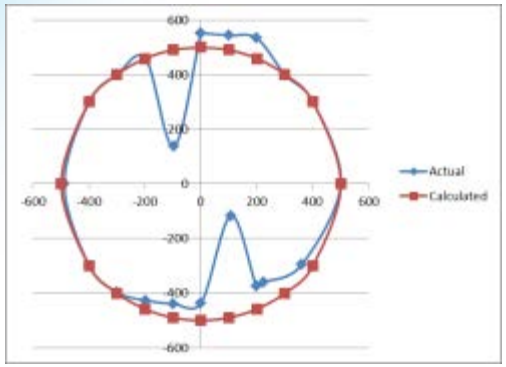
Var Control



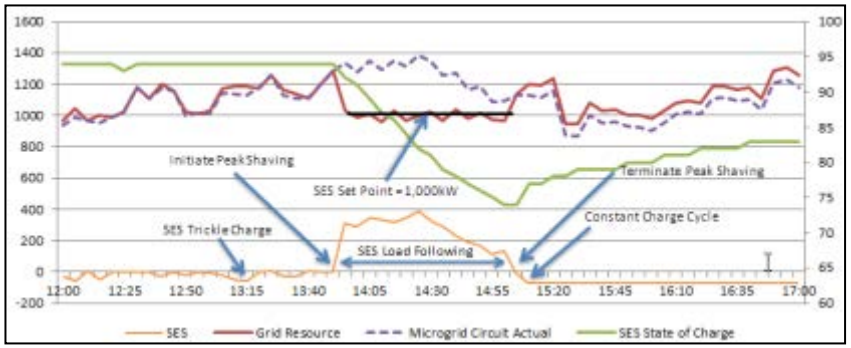
Peak Shave



"Virtual Island"



4-Quadrant Operation



Peak Shave

Energy Resilience Events (2012-2013)

SDGE
A Sempra Energy utility

Planned Outage	• June 23rd, 2012 • Microgrid provided power to 2,128 customers for ~ 5.5 hrs
Planned Islanding	• Q1 2013 • Conducted 7 islanding events over 3 days
Windstorm	• April 8th, 2013 • Microgrid provided power to 1,225 customers for ~ 6hrs
Flashflood	• August 25th, 2013 • CES units islanded six customers for ~ 5.5 hrs
Intense Thunderstorms	• September 6th, 2013 • Microgrid provided power for up to 1,056 customers for > 20 hrs

Borrego Microgrid 2.0 (2014-2018)

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

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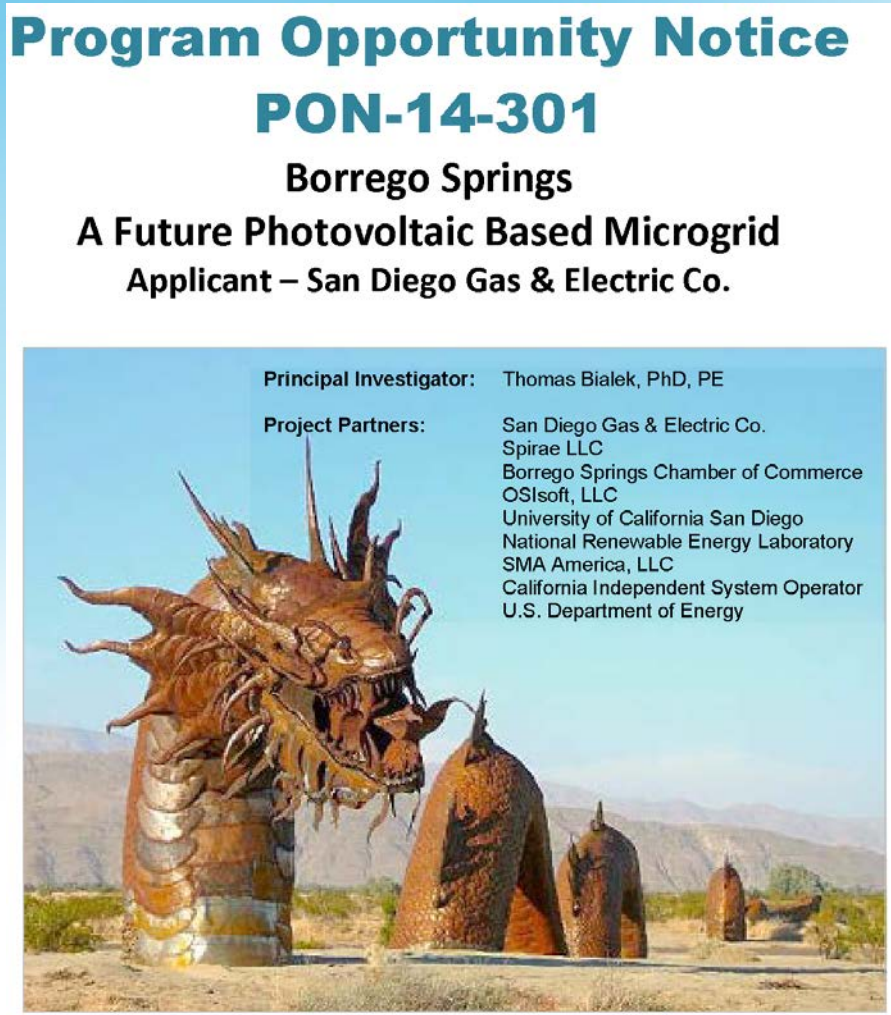
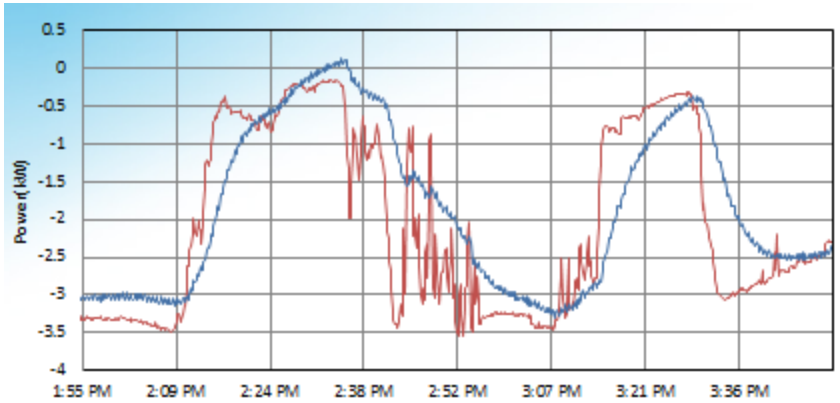


- **Project:** SDG&E to expand the scope of its existing Borrego microgrid project to enable the islanding of the entire Borrego substation during the day and to maintain critical loads as solar output drops, will be demonstrating a high-penetration, renewable-based microgrids in a California community.
- **Amount:** $4,724,802
- **Co-funding:** $1,739,560
- **Term:** 5/1/2015 to 3/31/2018

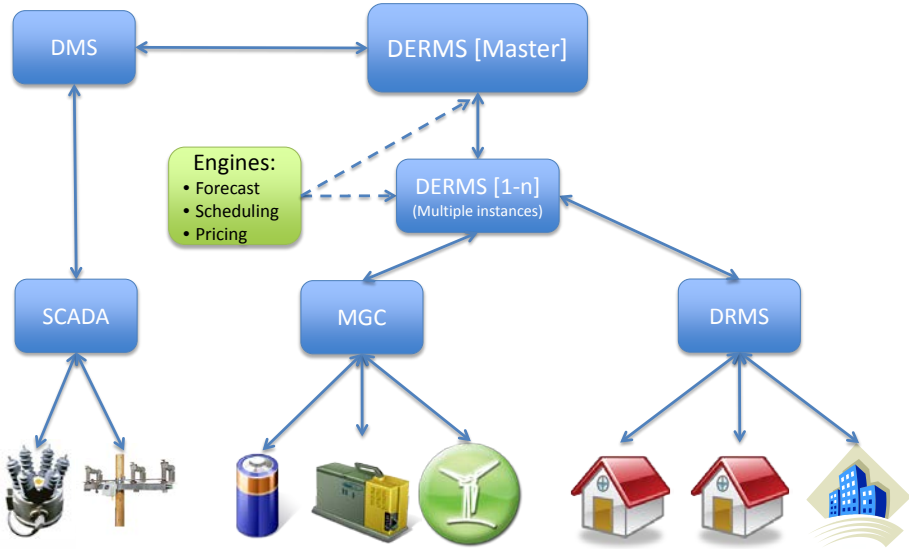
Project Tasks

- Work with the community to define critical loads and update infrastructure accordingly
- Develop commercial microgrid controller
- Evaluate innovative controls for incorporation into microgrid controller
- Utilize multiple test facilities and simulation tools to properly test the microgrid controller prior to deployment
- Develop tools, techniques and equipment to provide visibility of the microgrid to the CAISO



Anticipated Benefits for California

- 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
- Identify barriers to deployment of high-penetration, renewable-based microgrids and potential solutions to the barriers.
- Facilitate the creation of a replicable microgrid model by developing lessons learned and best practices.



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

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?

Neal Bartek

nbartek@semprautilities.com

http://www.sdge.com/smartgrid/