



## NREL + SAN DIEGO GAS & ELECTRIC

NREL is collaborating with San Diego Gas & Electric Company (SDG&E) to model a microgrid that the utility is expanding in Borrego Springs, California. Microgrids are small, self-powered electric grids that can operate independently or can be connected to the larger grid. NREL is evaluating how a microgrid controller with advanced functionality would perform for the Borrego Springs microgrid.

### R&D STRATEGY

NREL is constructing a scaled model of the Borrego Springs microgrid by employing power and controller hardware to represent the microgrid's large amount of distributed energy resources—including a large PV plant, energy storage systems, and diesel generators—while other circuit components are virtually represented in a model executing on real-time digital simulators (RTDS). NREL is then interfacing an actual microgrid controller similar to the one used at Borrego Springs to the power hardware and to the virtual components modeled on the RTDS to test the system's performance, particularly with regard to disconnection and reconnection of the microgrid to the utility.

NREL is also running this model of the Borrego Springs microgrid on a combination of the ESIF's RTDS and those at SDG&E's Integrated Test Facility, via a remote connection. Again, power hardware is representing some components on the NREL side, and the actual microgrid controller is interfaced to the power hardware and the model. This will allow SDG&E to use NREL's power hardware capabilities remotely, although it is not able to represent fast dynamics across the entire microgrid because of the communications delay.

### IMPACT

Microgrids can create a more resilient electric grid by disconnecting from the main grid during disturbances, such as outages, and continuing to operate independently. They may also need to operate with high penetrations of renewable generation in addition to traditional distributed energy resources. NREL's work can confirm the performance of a microgrid before it is actually deployed.



The installed Borrego Springs, California, microgrid. NREL is working with SDG&E to model the microgrid and test the advanced functionalities of its controller. *Photo courtesy of SDG&E*

### Partner with NREL at the ESIF

User facility access to the ESIF is awarded through the review and approval of user proposals, depending on the scientific merit, suitability of the user facilities, and the appropriateness of the work to DOE objectives, and includes a signed user agreement for the facility.

For more information, please visit:

[www.nrel.gov/esif/work-with-us.html](http://www.nrel.gov/esif/work-with-us.html)

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The Energy Systems Integration Facility (ESIF) at the National Renewable Energy Laboratory (NREL) provides the R&D capabilities needed for private industry, academia, government, and public entities to collaborate on utility-scale solutions for integrating renewable energy and other efficiency technologies into our energy systems.

To learn more about the ESIF, visit: [www.nrel.gov/esif](http://www.nrel.gov/esif).

### National Renewable Energy Laboratory

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