Blue Lake Rancheria Microgrid

Secure, reliable microgrid for northern California tribal community

INL helped install a microgrid capable of powering an American Red Cross disaster shelter on Blue Lake Rancheria land during an emergency. *(Blue Lake Hotel photo used with permission from Blue Lake Rancheria).*

Idaho National Laboratory collaborated with diverse agencies to build a renewable, self-sustaining microgrid at the Blue Lake Rancheria (BLR), the trust lands of a sovereign Native American tribe in northwestern California. The BLR consists of approximately 91 acres near the city of Blue Lake, 17 miles north of Eureka.

This work resulted in development of a first-of-its-kind smart microgrid that can operate while connected to the grid or when "islanded" independently from the utility power supply.

The microgrid project served as a forerunner to future energy projects benefiting similar communities. The project earned POWERGRID International's 2018 Project of the Year Award for Distributed Energy Resources Integration. It also was first runner-up for a 2017 Projects of the Year Award sponsored by the publications Power Engineering and Renewable Energy World.

THE PROJECT

The effort modernized the BLR's power grid to ensure a sustainable and resilient energy future for a Native American tribe. Critical loads on the BLR grid include the tribe's economic centers and a designated American Red Cross Emergency Shelter.

The microgrid includes a 409-kW solar photovoltaic array, 950 kWh of battery storage, a 175-kW biomass gasified/fuel cell power system and diesel generators. Operators manage and control these energy resources with software from Siemens, an engineering company that specializes in industrial automation and control.

The BLR microgrid is capable of coordinating with the local utility to disconnect from the larger grid and operate independently (islanding), which can increase electricity reliability. The microgrid prepares the community for a broad range of power system complexities that can arise due to natural calamities, attacks or other unforeseen events.

The project demonstrates how national laboratory assets can be leveraged to build resilient rural communities. A key highlight of this project is the diversity in partnerships forged among a U.S. Department of Energy national laboratory, international companies, a state university and local contractors.

THE PARTNERS

A grant from the California Energy Commission's Electric Program Investment Charge Program helped fund the project. Other partners

INL
Idaho National Laboratory

included Humboldt State University's Schatz Energy Research Center and Pacific Gas & Electric (PG&E).

The microgrid features a Siemens Microgrid Management System, a battery storage system from Tesla Motors and controllable demand. INL's involvement empowers the community to leverage unique national laboratory assets to make strides in 21st-century energy systems.

INL'S ROLE

The Power and Energy Real-Time Laboratory (PERL) at INL performed simulations to test the microgrid's ability to participate in one or more PG&E demand-response programs. INL researchers created a simulated BLR microgrid environment to simulate several what-if scenarios.

The Digital Real-Time Simulator (DRTS) racks at INL are configured for dynamic simulations that accommodate Power-Hardware-In-the-Loop (PHIL), Controller-Hardware-In-the-Loop (CHIL) and emulation of real-world grid events. This capability facilitated testing and validation of the Siemens controller and other power system components such as the Tesla battery and power inverter setup. Feedback from the DRTS was used to improve the microgrid management system controller before deployment.

These exclusive grid emulation and dynamic testing capabilities were used to minimize risks ranging from technical barriers to establishing the new microgrid. These resources could forecast possible outage scenarios, analyze system response and fine tune the controller to operate as intended under extreme contingencies such as earthquakes. INL's infrastructure helped resolve device integration issues and minimized deployment risks. INL's distinctive test bed also was used to train future trainers prior to controller installation.

PERL researchers have built a reputation through pioneering contributions to the power systems community. From establishing geographically distributed cosimulations to developing state-of-the-art front-end controllers for grid devices, INL's active role in grid modernization projects has given its experts a distinct vantage point for the future. More information and a video about the project are on the Siemens website.

INL's Power & Energy Systems engineers use a Digital Real-Time Simulator to test hardware and controllers by emulating real-world grid events.

"One of the lessons learned in this project is the absolutely essential role of testing at INL. In hindsight we recommend [such] testing as a core component of any microgrid project. By operating and troubleshooting complex microgrid systems in a test environment, developers can safely conduct fine-tuning and … most importantly, dramatically de-risk transitions to the end user's live systems."

– Jana Ganion, reservation sustainability director

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