*INL researchers are helping develop a self-healing microgrid system for the village of Cordova, Alaska.*

Changing the World's Energy Future

# RADIANCE Project

## *Self-healing microgrids keep Cordova, Alaska, electrified*

The installation of a self-healing microgrid is enhancing grid resilience in the remote village of Cordova, Alaska.

Idaho National Laboratory Power and Energy Systems researchers helped design and demonstrate the system, which is built to maintain and restore power after a catastrophic event or a cyberattack.

The Cordova microgrid system includes switches that can isolate one part of a microgrid and automatically reroute power in case of an emergency. This "islanding" allows undamaged and critical parts of the grid—hospitals, emergency shelters and other vital services—to remain functional if part of the grid is damaged or disabled.

The project, Resilient Alaskan Distribution System Improvements using Automation, Network Analysis, Control and Energy Storage (RADIANCE), could help get Cordova's lights back on in minutes instead of months.

***The Place***

Cordova is a small fishing community on Prince William Sound. The only way to get there is by plane or boat.

The town's electrical grid is powered by a mix of hydroelectric, diesel and solar power and has no physical connection to the outside world, leaving it especially vulnerable to natural disasters. In the case of a catastrophic event, such as the Great Alaska Earthquake of 1964, Cordova might be completely cut off.

The situation is compounded by harsh weather and a seasonal consumer demand that changes significantly throughout the year.

The city needs a power system that is smart and flexible enough to continue providing electricity for essential public services.

INL Idaho National Laboratory

### The Technology

When combined with next-generation grid sensors, hydroelectric storage, battery storage and wind energy, Cordova's system of microgrids should remain partly functional even under extreme circumstances.

The eyes and the ears of Cordova's microgrid system will be state-of-the-art micro-PMUs (phasor measurement units), equipment that monitors changes in the grid in real time.

The micro-PMU takes measurements of power quality, harmonics and instability at a very fast rate.

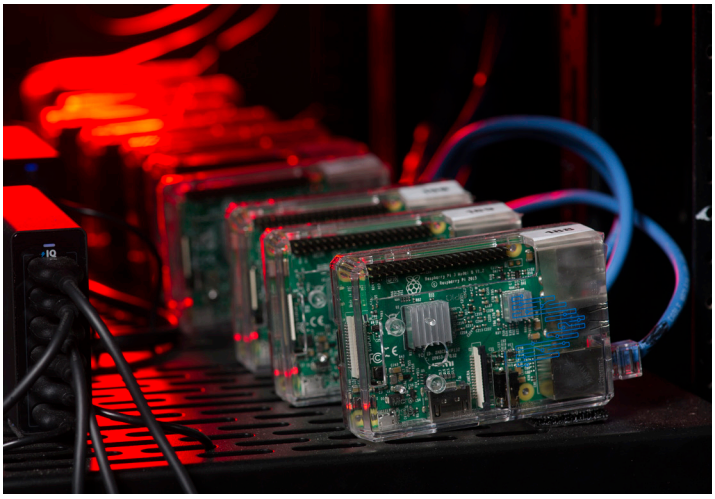
Based on highly detailed information from the micro-PMU, devices called microgrid controllers can make automated decisions about where to send the power by simultaneously coordinating loads, generation and storage.

The controllers work in coordination with the existing system to reduce fossil fuel consumption, improve power quality and enhance resiliency.

### The Tools

Before the equipment reached Cordova, the group simulated the microgrid system in a 26,000-square-foot high bay at INL's Energy Systems Laboratory.

There, Digital Real-Time Simulators allowed the researchers to model how a power grid would perform before assembling the equipment in the field. The team incorporated actual hardware into the simulation.



*These raspberry pi devices help simulate full-scale grid phenomena using Digital Real-Time Simulators at INL's Energy Systems Laboratory.*

For instance, Cordova recently experienced a mudslide that took out one of its underground power lines.

By simulating those kinds of disruptions in the lab and learning how the microgrid system recovers, researchers can reduce some of the risk and grow the science of microgrids.

Another part of the project will establish data connections between Cordova and the 58 dispersed village communities under the Alaska Village Electric Cooperative (AVEC). Electrical grids in the villages would then operate as a system of loosely networked microgrids in coordination with larger utilities in cities such as Anchorage and Fairbanks.

If one village experiences a damaged electrical grid, engineers can call upon the expertise and capabilities of other utilities in the network.

In the end, the power and energy systems group at INL hopes the technologies developed and the lessons learned at projects like Cordova can help make grids more resilient across the United States.

### The Partners

Partners include the Alaska Center for Energy and Power at the University of Alaska Fairbanks, the city of Cordova, the AVEC and the Cordova Electrical Cooperative (CEC). INL researchers will lead a Department of Energy (DOE) team that includes scientists and engineers from Sandia National Laboratories and Pacific Northwest National Laboratory.

### The Funding

DOE provided funding of up to $6.2 million for the project through the Grid Modernization Laboratory Consortium (GMLC). The GMLC is part of DOE's Grid Modernization Initiative, a comprehensive effort to help shape the future of the nation's grid.

### For more information

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