Idaho National Laboratory leading the charge on microgrids

By: Sharon Fisher November 22, 2019

The microgrid at Idaho National Laboratory features a number of renewable energy sources. Photo by Sharon Fisher

Editor's Note: This is the third in a three-part series on Idaho National Laboratory.
IDAHO FALLS – Electrical transmission consists of four main parts: The things that produce electricity, the things that consume electricity, the things that store electricity and the wires that transmit the electricity from one of the things to the other.

Idaho National Laboratory (INL) is working in all four of these areas.

Balancing sources
Increasingly, electricity is generated by multiple sources, including renewable energy, but some forms of renewable energy, particularly solar and wind, aren't always available all the time. Sometimes the sun doesn't shine. Sometimes the wind doesn't blow. In that case, the electricity people need has to come from another place.

Often, that other place is a battery. The issue of how to store energy – especially energy from an intermittent source like solar and wind – is increasingly of interest, especially as there are more and more such intermittent renewable energy sources. Moreover, storing energy in a microgrid could also provide a use for batteries that have reached the end of their useful life in places like electric cars, but still have storage capacity, said INL tour guide Ryan Weeks.

A flow battery is a combination of a battery and a fuel cell. Photo by Sharon Fisher

Another kind of battery for this purpose is a flow battery, Weeks said. It is part battery and part fuel cell, and is useful for relatively large, stationary locations where they can be used for a long time.
As much as possible, people want to collect energy from the wind or the sun when it's available, and a number of companies are working on technology solutions to store the energy. The other issue is that when there is too much power generation, electric systems can be overloaded and even shut down.
In the meantime, the only alternative to letting the energy go to waste, or simply not collecting it, is to send it to other places on the grid, looking for a place that could use it. One of the things INL is testing is how to balance energy creation and energy use, Weeks said.

INL installation
To be able to test various aspects of the electrical grid, INL has set up a 100 kilowatt microgrid test bed in its town installation here. It consists of a little building with a typical household's worth of appliances such as a washer, dryer and refrigerator, as well as small wind and solar generators of various types, Weeks said.

Ryan Weeks. Photo by Sharon Fisher

These are connected to flow batteries outside the building, as well as various kinds of storage units inside the main building, plus a variety of cables and other transmission lines that let INL staffers compare the performance of the grid based on which components are being used and how the grid responds to loads such as the washer or dryer kicking on, Weeks said.

While the system doesn't currently include generation of nuclear energy, it could conceivably include a small modular reactor at some point in the future, Weeks said. INL is also performing research in this area and is expected to house an SMR at the desert site by 2026.

Use cases

Microgrids – which can both power themselves and be connected to a larger electrical grid – can be useful in cases where a region loses power, Weeks said. They can also be useful in remote areas that don't have a larger electrical grid, such as a fishing village in Cordova, Alaska or a Native American reservation in Blue Lake Rancheria, in Northern California, where some of the research performed at INL is being used.

In addition, the research is proving helpful in military installations, which might not have an electrical grid to supply power, Weeks said. While military installations are increasingly making use of renewable energy sources such as wind and solar, they are backed up by generators, and having the generator constantly turning on and off reduces its lifespan. Altogether, INL has worked with the Department of Defense on more than 25 such projects around the world.