PNNL CAPABILITIES FOR GRID-INTERACTIVE EFFICIENT BUILDINGS

Electrical Energy Storage System

- Consists of a 125 kilowatt (kW), 250 kW-hour lithium-ion battery
- Connected to a Pacific Northwest National Laboratory (PNNL) building and an adjacent thermal energy storage system (TESS)
- Used to explore transactive energy concepts, leveraging building operations to improve power grid reliability and energy efficiency

A KEY TESTING CAPABILITY

The 125 kW battery was installed in 2022 at PNNL's Systems Engineering Building (SEB), a large office and laboratory structure fitted with sensors that enable evaluation of building control ideas and technologies. Together, the battery, the SEB, TESS, and other on-site capabilities comprise a unique national testing resource. Researchers here can learn how to optimize the use of energy storage and other methods, subsequently providing solutions to reduce energy consumption, grid stress, carbon, and costs.

EXPANDING THE SCOPE OF RESEARCH

The battery can provide power to the SEB for several hours on one charge, and it can be tested as an individual storage resource or in conjunction with other SEB capabilities. For instance, the battery is connected to PNNL's TESS, which consists of a chiller, three large ice storage canisters, and associated controls. The chiller circulates glycol through the water-filled canisters to create ice, and also generates chilled water to cool the SEB.

The 125 kilowatt (kW), 250 kW-hour lithium-ion battery at PNNL will make it possible to explore new aspects of grid services and use of clean energy.

Researchers are learning the most effective and efficient methods for using the battery and the TESS—together and separately—to show how storage devices can charge at times when electricity is cheaper and then provide an alternate energy source for a building when prices, due to increased demand on the grid, are higher. In all cases, researchers are striving to create storage methodologies and solutions that concurrently assure building functionality and occupant comfort.

SUPPORTING GRID SERVICES AND CLEAN ENERGY

The shifting of battery charging to times of less electricity demand is one type of a "grid service"—that is, a building employs the battery to obtain, store, and then discharge electricity for building needs in a way that takes pressure off the grid during peak electricity consumption periods. In turn, this enables the grid to better balance supply and demand, improving reliability and flexibility.

Such an approach is particularly helpful in managing and mitigating the ups and downs of clean energy use on the grid. For instance, in a scenario in which the wind suddenly quits blowing and energy generation at a wind farm plummets, the grid could quickly turn to other options, such as electricity load management in buildings. This would include the temporary use of on-site stored energy to meet a building's immediate needs and reduce demand on the grid.

Energy system flexibility is critical in addressing the challenges of clean energy so that future generations can readily experience the benefits of a decarbonized environment.

FUNDING SOURCES

The State of Washington's Department of Commerce funded the battery as part of its efforts to establish testbed capabilities in the state to advance clean energy. The Department of Energy's Building Technologies Office will fund research and development projects involving the battery.

ABOUT PNNL

PNNL is a Department of Energy Office of Science laboratory located in Richland, Washington, with an enduring mission to transform the world through courageous discovery and innovation. Our science and technology inspires and enables the world to live prosperously, safely, and securely.

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