

Forage for Storage: Energy Storage Solutions

CHALLENGE

Energy storage systems can be used to mitigate the variability between renewable power generation, such as solar and wind, and power demand—helping to maintain electric grid stability. However, current technologies to store excess energy, like batteries, are costly. Existing residential and commercial buildings and infrastructure, such as water heaters, refrigerated warehouses, and air conditioning units, are untapped energy management resources, due to their flexibility in managing their available energy and power consumption. When coupled with a software-based solution, this infrastructure and their associated buildings can serve as a *virtual storage* resource to provide a low-cost, smaller-scale investment option for utilities.



Buildings and infrastructure, such as HVAC units, can serve as energy storage systems.

SOLUTION

Researchers at Pacific Northwest National Laboratory and Oak Ridge National Laboratory are leading an effort to address this challenge with partners University of Florida, United Technologies Research Center and Tennessee Valley Authority. The three-year effort kicked off in Fiscal Year 2016 and involves understanding the capacity of these virtual storage systems as well as providing characterization methods and decision-support tools that guide building owners and utilities in identifying these potential resources and evaluating associated investments. The team is developing algorithms to optimally control these resources; these will be evaluated as part of the publicly available VOLTTRON™ platform, which coordinates energy use between the grid and a building's systems.

IMPACT

Preliminary capacity analysis of virtual storage resources is complete. The team found that these proposed energy storage systems nationally have the power flexibility potential of 81 gigawatts—approximately 10 percent of the national generation capacity. The analysis also revealed monetary benefit—the revenue earned by the utility or grid operator for coordinating power within, for example, 20 residential air conditioners and one commercial HVAC system serving 17 zones is greater than twice the revenue from using a 50-kW/100 kWh battery. The findings also show roughly three times the savings to the customer or building owner.

The U.S. Department of Energy launched the GMLC in November 2014. The consortium, a strategic partnership between DOE headquarters and the national laboratories, brings together leading experts and resources to collaborate on national grid modernization goals. The GMLC's work is focused in **six technical areas** viewed as essential to modernization efforts:

- Devices and Integration
- Sensing and Measurement
- Systems Operations, Power Flow and Control
- Design and Planning
- Resilience and Security
- Institutional Support.

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