U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HEARING CHARTER

Innovations in Battery Storage for Renewable Energy

Friday, May 1, 2015
9:00 a.m. – 11:00 a.m.
2318 Rayburn House Office Building

PURPOSE

The Subcommittee on Energy will hold a hearing titled *Innovations in Battery Storage for Renewable Energy* on Friday, May 1, 2015, starting at 9:00 a.m. in Room 2318 of the Rayburn House Office Building. The purpose of the hearing is to provide an overview of the state of large-scale battery storage and recent technology breakthroughs achieved through research and development at the Department of Energy national laboratories. The hearing will also highlight how innovative companies are transitioning basic science research in battery storage technology conducted at the national laboratories to the commercial market.

WITNESS LIST

- **Dr. Imre Gyuk,** *Energy Storage Program Manager, Office of Electricity Delivery and Energy Reliability*, Department of Energy
- **Dr. Jud Virden, Jr.,** *Associate Laboratory Director for Energy and Environment Directorate*, Pacific Northwest National Laboratory
- **Mr. Phil Giudice**, *Chief Executive Officer*, Ambri
- **Dr. Jay Whitacre**, *Chief Technology Officer*, Aquion Energy

BACKGROUND

Because power production from renewable energy sources like wind and solar is intermittent and dependent on weather, utilities struggle to predict when renewable power will be available. Adding renewable sources to the power grid also increases the complexity and challenge of operating an electricity system to match supply and demand.[1]

Large-scale energy storage through batteries is a critical component of successfully integrating renewable resources like wind and solar into the power grid. This allows utilities to use power produced from renewable energy when and where it is necessary, taking full advantage of available renewable energy sources. Common forms of energy storage typically include methods that convert electricity to kinetic or potential energy, through pumped

[1] Pacific Northwest National Laboratory, *Large-scale energy storage*, Available at http://energyenvironment.pnnl.gov/ei/energy_storage.asp

hydroelectric and compressed air systems, and then discharge that energy back to the grid when demand is high.[2]

Through the development of advanced battery technology, electricity could be efficiently stored in electrochemical energy storage systems and then released when needed, without being dependent on natural resources like hydroelectric storage. Diverse battery technology could address two key energy storage needs: providing high power applications where the battery must respond rapidly and be able to discharge electricity for short time periods, or providing energy management applications where the battery may respond more slowly, but must be able to discharge electricity for several hours.[3] Grid-scale energy storage technology typically involves different chemical reactions and battery construction. Two different battery designs are redox flow and solid-state. Redox flow batteries typically contain slow chemical processes well-suited for energy management, while solid state batteries contain potential for high energy density and rapid energy discharge.[4]

The Department of Energy Office of Electricity Delivery and Energy Reliability's (OE) Energy Storage Program conducts research and development on a broad variety of energy storage mechanisms, including conventional and advanced batteries, flywheels, electrochemical capacitors, superconducting magnetic energy storage (SMES), power electronics, and control systems, as well as research and development into advanced electrolytes and nano-structured electrodes to improve energy storage density.[5] According to DOE, enhanced energy storage can provide benefits to the power industry and consumers, to include improved power quality, improved stability and reliability of transmission and distribution systems, improved availability of distributed generation sources, and increasing the lifespan of existing infrastructure and electricity equipment. Challenges to widespread deployment of energy storage technologies include cost, validated reliability and safety, regulatory challenges, and industry acceptance.[6]

Important questions and key issues to be discussed at the hearing include:

- What are the Administration's goals for energy storage technology research and development?

- What are key technology breakthroughs achieved through the Department of Energy's work on grid-scale energy storage? How have those breakthroughs transferred to the private sector?

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[2] Pacific Northwest National Laboratory, *Large-scale energy storage,* Available at http://energyenvironment.pnnl.gov/ei/energy_storage.asp

[3] Congressional Research Service, *Energy Storage for Power Grids and Electric Transportation: A Technology Assessment*, March 27, 2012. Available at http://www.fas.org/sgp/crs/misc/R42455.pdf

[4] Pacific Northwest National Laboratory, *Large-scale energy storage,* Available at http://energyenvironment.pnnl.gov/ei/energy_storage.asp

[5] Department of Energy, Office of Electricity Delivery and Energy Reliability, *Energy Storage Program*, Available at http://energy.gov/oe/services/technology-development/energy-storage

[6] Department of Energy, *Grid Energy Storage*, December 2013. Available at http://energy.gov/sites/prod/files/2014/09/f18/Grid%20Energy%20Storage%20December%202013.pdf

- What basic research has contributed to the development of private sector witnesses' unique battery technology? In what ways did partnership with the national labs and the Department of Energy advance the development of private sector battery technology?

- What next steps in R&D and technology development will contribute to expanded use of advanced, grid-scale energy storage technology by the private sector? What impact could the deployment of new battery storage technologies by the private sector have on the energy market, particularly for reducing cost and increasing reliability for renewable power?

Additional Reading:

Bloomberg Business, *The $5 Billion Race to Build a Better Battery*, Available at http://www.bloomberg.com/news/articles/2015-04-14/gates-pritzkers-take-on-musk-in-5-billion-race-for-new-battery