Written Testimony on House Bill 2193

Before the Oregon House Committee on Energy and the Environment

March 17, 2015

Chair Vega Pederson, Vice-Chairs Johnson and Reardon, and Representatives Bentz, Boone, Heard, Helm, Holvey and Weidner.

I am Patrick Balducci, a Senior Economist at the Pacific Northwest National Laboratory (PNNL) and the Manager of PNNL's technical activities in support of the Washington Clean Energy Fund (CEF). I am an economist by training, with an MSc in Applied Environmental Economics from Imperial College London. I also have a BS in Economics from Lewis and Clark College in Portland.

PNNL is a United States Department of Energy (US DOE) lab managed by the Battelle Memorial Institute. Interdisciplinary teams at PNNL address many of America's most pressing issues in energy, the environment and national security through advances in basic and applied science. Founded in 1965, PNNL employs 4,300 staff and has an annual budget of more than $1 billion.

The US DOE's Energy Storage Program supports the Secretary of Energy's Goal to build a competitive, low-carbon economy and secure America's energy future. The program is designed to develop and demonstrate new and advanced energy storage technologies that will enable the stability and surety of the future electric utility grid. Additionally, this program enables increased deployment of variable renewable energy resources such as wind and solar power generation. The US DOE's Energy Storage Program focuses on accelerating the development and deployment of energy storage in the electric system through directly addressing the four principal challenges identified in the 2013 DOE Strategic Plan for Grid Energy Storage: cost competitive energy storage technology, validated reliability and safety, equitable regulatory environment, and industry acceptance.

At PNNL, we have ongoing research efforts to address all of these challenges. From new chemistries to improve flow battery operation to working with states and local utilities to fully understand the technical constraints and cost/benefit proposition of energy storage, PNNL is engaged in high-impact research designed to improve the efficiency of energy storage devices and enhance the results achieved from them following deployment. One such engagement is the research we are performing in support of the Washington Clean Energy Fund (CEF).

The Washington Clean Energy Fund is a multi-million dollar fund authorized by the Washington legislature and administered by the Washington State Department of Commerce, which is the State Energy Office. Washington CEF funding supports the development, demonstration, and deployment of clean energy technologies that save energy and reduce energy costs, reduce harmful air emissions, or otherwise increase energy independence for the state. Washington CEF grants are designed to achieve multiple objectives, including economic development and improved integration of renewables through energy storage.

The Washington CEF has awarded $14.3 million in support of five energy storage projects collectively valued at $43 million. These projects include lithium ion battery systems and advanced vanadium-flow battery assemblies built by UniEnergy Technologies in Washington State.

To support these projects, PNNL has partnered with the state, utilities, technology companies and university researchers to develop detailed characterizations of the various ways energy storage can increase renewable energy use and improve grid efficiency and resiliency. These services, called *use cases*, will be modeled, tested and evaluated for each individual project. PNNL will conduct benefits analysis, compile field data needed for use cases that help utilities and regulators understand the long-term benefits of new technologies, design plans for acceptance testing and strengthen control strategies.

PNNL continues to use these analytical tools for other projects in Washington state. We plan to collaborate with Washington State University to develop a battery control system for one project and to work with the University of Washington's Clean Energy Institute to share benefits experienced during the projects. PNNL also applied models to conduct a detailed financial feasibility analysis of a 4 MW / 16 MWh zinc bromide flow battery system proposed for deployment on Bainbridge Island, Washington. We looked at the range of potential uses for the energy storage system (ESS) and modeled its potential operations for one year to determine the optimal deployment of the storage system. Analyzed benefits include providing capacity, balancing load, deferring investment in distribution infrastructure, buying and selling energy (arbitrage) and mitigating outages. The results were promising with system benefits over the 20-year life of the ESS estimated at $26.6 million in present value teams. PNNL modeled several scenarios but the base case yielded a return-on-investment ratio of 1.32 and net benefits of approximately $6.5 million.

Research conducted at PNNL suggests that energy storage systems have the potential to improve the operating capabilities of the electric grid. Their ability to store energy and deliver power can increase the flexibility of grid operations while providing the reliability and robustness that will be necessary in the grid of the future — one that will be able to provide for projected increases in demand and the integration

of clean energy sources while being economically viable and environmentally sustainable. As a result, energy storage has received a great deal of attention in recent years. Entrepreneurs are working to commercialize a myriad of promising technologies, and venture capitalists and the U.S. Government are investing in this space. The technologies show promise but need further development to address performance, cost and durability.

Thank you for the opportunity to provide testimony to this Committee. I would be happy to answer any questions you have.

Sincerely,

Patrick Balducci
Senior Economist, Pacific Northwest National Laboratory