



September 25, 2015

Steven King, Executive Director and Secretary
Washington Utilities and Transportation Commission
Attn: Records Center
PO Box 47250
Olympia WA 98504-7250

RE: Docket UE-151069 - Modeling Energy Storage in Integrated Resource Planning

Dear Mr. King:

Western Grid Group (WGG) appreciates the opportunity to provide comments regarding the incorporation of energy storage cost-benefit analysis into the Integrated Resource Planning (IRP) processes conducted by Washington State's three investor-owned electric utilities. We share the Commission's view that the tangible benefits of energy storage systems (ESS) provide avoided integration costs that should be reflected in utility resource plans.

WGG is a not-for-profit public interest organization that has been actively involved in all major state and regional planning initiatives in the west since 2003. The group is staffed by former state regulators, clean energy project developers and state officials. We work to develop and implement policies that enable the development of a clean, diversified, and reliable grid within the Western Interconnection. We advocate for:

- Improved efficiency of the existing grid, through technology, operational reform, and market changes, to provide near-term access for clean power;
- Ensuring that transmission and system planning incorporates all cost-effective energy efficiency, dynamic load resources and distributed generation, and minimizes and mitigates electric sector environmental impacts; and
- Expansion of the grid, to access and deliver renewable energy; minimize life-cycle greenhouse gas emissions; and enhance system reliability.

We believe that market and procurement mechanisms are vital to the creation of policy platforms that will properly incent the adoption of new technologies that provide reliability benefits to the grid. We commend the Washington State Utilities and Transportation Commission (WUTC) for addressing the importance of ESS. Our comments follow.

BEFORE THE STATE OF WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

COMMISSIONERS

David Danner, Chairman
Ann Rendahl
Philip Jones

IN THE MATTER OF MODELING ENERGY
STORAGE IN INTEGRATED RESOURCE
PLANNING

DOCKET UE-151069

Comments of Western Grid Group

In its May 2015 white paper, “Modeling Energy Storage: Challenges and Opportunities for Washington Utilities”, staff has fittingly noted that the lack of an organized energy market within Washington or the northwest region presents a significant challenge to proper valuation of energy storage systems (ESS). Washington’s utilities have been unable to monetize the beneficial reliability services yielded by ESS, in part because there presently is no standard methodology for quantifying such benefits, and in part because utilities lack the modeling capabilities necessary to do so.

There are clearly numerous benefits that accrue from participation in organized markets, including broadened footprints for resource balancing, reduced individual spinning reserve requirements, economic efficiency of centralized dispatch, increased market liquidity, and clear pricing signals that fairly compensate resource adequacy and ancillary service providers. Some of these benefits may also be realized by participation in Energy Imbalance Markets (EIM)¹.

Because Washington’s regulated utilities each act as their own Balancing Area Authorities, they must provide the ancillary services required to maintain continuous balance between loads and resources. The utilities receive no compensation for provision of these services, and thus there have been no established “sales comparables” to provide guidance on their value. ESS has incontrovertibly been proven, however, to reliably provide certain ancillary services, including voltage support, frequency response, ramping regulation, and responsive (supplemental) reserves.

Western Grid Group strongly supports staff’s observation that ESS provides value in the form of avoided costs, and therefore its value should be reflected in utility planning.

¹ Puget Sound Energy announced on March 1st of this year its intent to join the California Independent System Operator (CAISO) EIM effective October 1, 2016.

Current utility IRP modeling efforts are inherently limited in their ability to accurately reflect the value of ESS, largely because the utility power flow and production cost models are built primarily on the basis of centralized, thermal (gas, coal, nuclear) power stations. Power flow models are somewhat effective at modeling system reliability on a contingency basis, while production cost models are effective for optimizing resource needs on the basis of cost, emissions, and other factors on an annual 8760-hour basis. These models require extensive datasets to characterize the attributes of particular resources within a generation fleet. However, utility models to date typically do not have accurate, consistent, or current cost and performance information to adequately characterize ESS and/or other existing and evolving renewable technologies².

New datasets and modeling tools are currently evolving for a variety of clean energy resources, including ESS. The National Renewable Energy Laboratory (NREL) is now finalizing robust and comprehensive datasets for wind and solar resources that contain the most recent resource data for 120,000 sites in the continental U.S. The dataset toolkits also contain forecast data and sub-hourly power production data (5 minute for solar; 15 minute for wind) for dozens of the most current wind turbines and several solar generator configurations, including both photovoltaics (PV) and Concentrating Solar Power (CSP) facilities. And as demonstrated during the UTC Energy Storage Modeling Workshop held on August 25th, Pacific Northwest National Laboratory (PNNL) has developed a very robust Battery Storage Evaluation Tool (BSET) that characterizes and quantifies severable value attributes of a variety of battery types, ranging from Distributed Generation (DG) scale to utility grid scale. An essential next step in enabling utilities to maximize ESS value streams will be the development of dispatch control systems that can optimize battery performance in actual operational timeframes.

Western Grid Group recommends that Washington utilities should utilize common ESS cost-benefit datasets and uniform modeling practices as guided by the UTC, rather than working in isolation with disparate models and assumptions. Datasets should contain the most current information available.

A key challenge becomes identifying and/or taking a role in advising the development of such common resources.

Western Grid Group is active in several key committees of the Western Electricity Coordinating Council (WECC), including the Scenario Planning Steering Group (SPSG), the Transmission Expansion Planning Policy Committee (TEPPC), and TEPPC's Technical Advisory Subcommittee (TAS) working groups. We work to advise and inform various WECC study committee efforts. One of our current requests to the Chair of WECC's SPSG is to undertake an effort starting in early 2016 to develop robust datasets for a variety of ESS technologies. WGG will be pleased to coordinate with and provide updates to WUTC staff on these matters.

In its August 7th Notice of Opportunity to Provide Written Comments on this matter, the WUTC posed a question as to whether it would be appropriate for Washington to use rates for

² Many of today's inverter-based generators can provide an array of ancillary services that are often not selected under utility procurement practices, and therefore often not characterized in IRP models.

ancillary services in organized electricity markets as a proxy for valuing the ancillary benefits of energy storage in Washington. The staff white paper also recommends that a proxy be created for valuing the reliability services provided by ESS.

Western Grid Group strongly supports the concept of developing a proxy value for ancillary services available from ESS, and incorporating such value in IRP processes so that least cost models will more fairly select ESS alternatives. Moreover, there are existing models for such efforts.

Some relevant examples exist in the body of literature regarding the value of Concentrating Solar Power (CSP) with Thermal Energy Storage (TES) systems. While CSP is not a technology suitable for the solar regime in Washington State, several investigators have worked to quantify the value of the ancillary services available by utilizing TES systems, which are dispatchable. In 2011, NREL investigator Paul Denholm and colleagues published results of their work³ in optimizing multiple revenue streams that could be realized by CSP/TES plants by selling output and services into energy, capacity, and ancillary service contracts rather than a single power purchase agreement (PPA) for energy only. One of the breakthrough observations from the Denholm work is that CSP/TES plants could earn significantly higher revenues by selling into multiple procurement frameworks, and at less cost than selling under an energy-only contract. The reduced cost occurs because the multiple-revenue-stream-option results in much more use of the plant's output during solar hours and far less production during non-daylight hours, resulting in less need for capital intense storage equipment.

However, most relevant to the question posed by the UTC, is that the Denholm work demonstrated that the use of a production cost model in tandem with a Mixed Integer Program (MIP) model, allowed the investigators to optimize energy, capacity, and ancillary service revenue streams based on empirical Market Clearing Prices in the CAISO, and create a dispatch protocol that could be utilized in day ahead and hour ahead markets.

This work is not dissimilar to the method used by PNNL in the development of BSET. *Further, it demonstrates that this approach can be utilized for other types of storage beyond batteries. It also provides an example of creating a proxy for planning purposes, based upon an organized market.*

Other investigators have undertaken similar efforts to quantify the value of storage associated with CSP plants in an effort to quantify and assign benefit to the avoided costs of having to provide grid services through other means. Both NREL and the CSP Alliance have also published works in this area⁴.

³ "How Thermal Energy Storage Enhances the Economic Viability of Concentrating Solar Power", Seyed Hossein Madaeni, Student Member, IEEE, Ramteen Sioshansi, Member, IEEE, and Paul Denholm, Member, IEEE; Proceedings of the Institute of Electrical and Electronics Engineers (Volume 100, Issue 2), June 20, 2011.

⁴ See "NREL Quantifies Value of CSP to the Grid", <http://www.nrel.gov/docs/fy14osti/62503.pdf>; and "The Economic and Reliability Benefits of CSP with Thermal Energy Storage: Literature Review and Research Needs, 2014", <http://www.csp-alliance.org/csapa-report/>

We cite one final example that utilized empirical market clearing prices for energy and ancillary service prices in the ERCOT market. In 2013/14, Spanish engineering and technology company Abengoa Solar also explored the additional value that dispatchable CSP/TES plants could provide in Texas. The team utilized their own proprietary MS Sim (a production cost model developed specifically for molten salt power towers) in tandem with an MIP model for their evaluation. The investigators “back-casted” market clearing prices for energy, responsive reserves, non-spinning reserves, regulation-up, and regulation-down services. The MIP model allowed them to optimize revenues on the basis of 2011 and 2012 clearing prices (2011 prices were a high “bookend” year due to scarcity pricing and weather extremes, while 2012 was a historically low bookend year). Again, the results demonstrated that greater revenues could be achieved, and that an optimized dispatch schedule for day ahead and hour ahead markets could be developed to achieve optimized plant performance.

These examples provide some optimism for the possibility of a valuation methodology for ESS grid services. However, they create some questions. Which organized market(s) could create a reasonable proxy for Washington State? ERCOT pricing is far more similar to that of Washington’s regulated utilities than CAISO pricing. But local climate and system topology (primary generating resources, reserve margins, system inertia constraints, etc.) may differ greatly.

Western Grid Group would urge that WUTC staff conduct benchmarking analysis to find, either (a) which organized markets in the U.S. might serve as the best proxy for establishing the value of ESS-based ancillary services, and/or (b) other valuation methodologies that may be less dependent on clearing prices in particular markets.

We also note that the majority of effort undertaken by both the WUTC and Washington’s utilities to date has centered on battery storage. Understanding that pumped hydro and battery storage are the prominent storage technologies in use currently, other technologies such as Compressed Air Energy Storage (CAES), Liquid Air Energy Storage (LAES)⁵, kinetic energy storage, flywheels, and many other forms of ESS are in development and demonstration stages. The proxy valuation under consideration by the WUTC could shape confidence about the viability of such technologies and further their growth. Further, we believe that it is valuable for Washington utilities to be well informed about emerging technologies that may have great value in future resource plans.

Western Grid Group urges the WUTC to convene a 2016 workshop aimed at updating utility staff and interested stakeholders on the status of developing ESS technologies.

In final comments, Western Grid Group again concurs with staff in their observation that new IRP frameworks are needed; frameworks that will enable utility IRP models to more fairly select ESS and other highly efficient and low-carbon technologies by assigning real value to avoided integration costs.

⁵ See <http://www.madaenergie.com/index.php/technology-and-market/our-technology>

Western Grid Group commends the UTC for elevating the importance of the real value of ESS. Thank you for the opportunity to provide comments.

RESPECTFULLY SUBMITTED this 25th day of September, 2015.

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