September 25, 2015

Mr. Steven V. King
Executive Director and Secretary
Washington Utilities and Transportation Commission
1300 South Evergreen Park Drive
Olympia, WA 98504-7250

RE: Renewable Northwest Comments on Docket UE-151069, Modeling Energy Storage in Integrated Resource Planning.

Renewable Northwest appreciates the opportunity to comment on the Washington Utilities and Transportation Commission's ("Commission") investigation into modeling energy storage in utility integrated resource plans ("IRPs"). We commend the Commission for recognizing the many benefits of energy storage technologies and exploring how best to ensure that utilities consider the broad benefits of all types of energy storage in connection with their planning and procurement processes.

Renewable Northwest is a nonprofit advocacy organization that brings together its business and nonprofit members to promote the expansion of environmentally responsible renewable energy resources in the Pacific Northwest. For over 20 years, Renewable Northwest has advocated for the Pacific Northwest region to build on its clean energy legacy by deploying new renewable energy technologies like wind, solar, and geothermal energy. These resources help reduce emissions, support local economies, and improve energy security and resilience. Renewable energy, along with energy efficiency, has already led to significant carbon emission reductions from fossil fuel generators and will continue to do so as penetration increases. Our experience demonstrates that renewable energy, along with energy efficiency, can be the foundation for the clean, reliable, and affordable electricity system of the future.

Storage technologies are the next pillar of a cleaner, more efficient, and more reliable electric grid. These technologies can add value to utility portfolios through the provision of a range of services. Accurately modeling the value of energy storage projects is an important component of least-cost, least-risk planning for a utility's capacity, flexibility, and transmission requirements, as storage projects can provide all of these services. Furthermore, storage technologies have the ability to cost-effectively facilitate additional renewable energy development—and can do so without increasing carbon dioxide emissions.

Renewable Northwest has been actively involved in the IRPs for both Puget Sound Energy ("PSE") (UE-120767) and Pacific Power (UE-120416). In addition, Renewable Northwest participated in the Commission's storage workshop held on August 25, 2015. Based in part on our participation in these IRPs and the workshop, we agree with the Commission that the modeling of the potential costs and benefits of energy storage technologies can and should be improved. It is our view that guidance from the Commission is necessary to ensure that utilities improve their modeling in this area to more accurately value the benefits of storage.

Potential uses, benefits and value propositions for storage

The Commission has identified a thorough list of value propositions *to a utility* associated with energy storage projects.[1] If the broader public interest is considered, Renewable Northwest also recognizes that additional values from energy storage projects exist. With the Environmental Protection Agency's ("EPA") adoption of a final rule under the Clean Power Plan as a backdrop, storage projects have the ability to contribute to carbon dioxide emissions reductions from the electricity sector, as well as from the transportation sector, by leveraging electric vehicles.

The Clean Power Plan is based on increased generation from renewable energy resources and efficient natural gas plants, and reduced generation from coal-fired plants. Energy storage facilitates this increased penetration of renewable energy and can also increase the capacity factors of existing combined cycle natural gas plants by charging when these plants would have been ramped down. Storage can then discharge during peak demand periods to avoid using less efficient peaker plants.

In addition, storage projects have the potential to provide public benefits by avoiding incremental increases in water usage from the electricity sector and improving the local air quality as compared to conventional generators. As a transmission asset, storage projects may decrease the environmental and social impacts associated with building new transmission infrastructure. As a distribution asset, energy storage can improve reliability, power quality, and efficiency to industrial, commercial, and residential customers. Renewable Northwest encourages the Commission to take a broad view of the utility and public benefits associated with storage.

One valuable benefit of energy storage projects identified by Commission Staff is the ability to provide instantaneous power during periods of peak demand—"shaving the peak" off the load profile—which also adds "capacity value" to the system. In addition, storage projects have the ability to shift power from times when it is abundant and cheap to times when it is costly and scarce, providing an "arbitrage value." Rather than focusing narrowly on the individual values of "peak shaving," "capacity value," and "arbitrage," we encourage the Commission to take a more holistic view of the system needs and how storage can make the system run more efficiently. As utilities increase their share of variable generation on the grid, storage analysis and IRPs should be focused on how storage can enable a diverse portfolio of renewable energy

[1] This list of value propositions includes peak shaving, transmission and distribution upgrade deferrals, outage mitigation, system balancing (regulation and frequency control, load following, energy imbalance), contingency reserves, reactive power support, network stability services, and system black start capability.

resources to better contribute to meeting a utility's daily load profile.[2] Modeling individual renewable energy resources and individual storage projects using traditional production cost analysis will undervalue both renewable energy and energy storage resources. The synergies between a portfolio of diverse renewable generation in combination with storage resources should be studied in detail to assess the collective benefits to the system.

One of the other significant benefits of energy storage is the "modularity of solution." This aspect of storage renders itself as a strong mechanism to handle risks associated with investments in the electric system while facing periods of uncertainty (like we have right now). The ability to build what is necessary at any point in time and the capability to augment or scale-up in the future is a significant advantage of storage resources. Storage is also far more "mobile" of an asset as compared to traditional infrastructure. If system dynamics change to where the storage resource is no longer needed at its original point of deployment, a storage resource can be relocated elsewhere. We encourage the Commission to include these value attributes in evaluation of the benefits of storage resources.

Models, tools and other approaches for valuing storage

The Commission's August 25th workshop on energy storage provided a useful and informative overview of the state of storage projects and policy in Washington State. Most notably, the Pacific Northwest National Lab presented a recently released battery storage modeling tool, the Battery Storage Evaluation Tool ("BSET"). The BSET tool has the ability to optimize energy storage value streams while selecting optimal sites and sizes for battery storage projects unique to a utility's service territory. The model also has the ability to bundle services, co-optimizing the value streams that a particular storage project may provide to a utility, and giving the utility an ability to value the benefits of storage that are specific and unique to its situation.

In general, detailed hourly (and preferably sub-hourly) production cost models that can model the operation of the entire generation fleet such as PLEXOS[3] are required to fully comprehend and analyze the benefits of energy storage resources. In addition to market price-based analysis, which can be limited in its ability to value the benefits of storage on the system, these grid simulation tools can calculate the total cost of system operation, and compare production costs

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[2] For example, an NREL study found that "[b]atteries with several hours of capacity provide an alternative to combustion turbines for meeting peak capacity requirements. Even when compared to state-of-the-art highly flexible combustion turbines, batteries can provide a greater operational value, which is reflected in a lower system-wide production cost. By shifting load and providing operating reserves, batteries can reduce the cost of operating the power system to a traditional electric utility." National Renewable Energy Laboratory, "The Relative Economic Merits of Storage and Combustion Turbines for Meeting Peak Capacity Requirements Under Increased Penetration of Solar Photovoltaics," Page iv, *available at* http://www.nrel.gov/docs/fy15osti/64841.pdf.
[3] http://energyexemplar.com/software/plexos-desktop-edition/.

with and without potential new generation options.[4] Traditional capacity expansion models used by utilities generally do not have the level of granularity to capture the benefits provided by energy storage devices. Renewable Northwest recommends that the Commission require utilities to use the BSET or a similar tool for modeling the various value streams associated with energy storage projects. As the BSET tool focuses on batteries, work done by Argonne National Laboratory and the National Renewable Energy Laboratory provides a robust tool for evaluating the multiple value streams associated with pumped storage projects.[5]

Incorporating storage into IRPs and procurement processes

The Commission has asked for feedback on how to incorporate storage into the IRP and procurement processes. How to incorporate storage projects into the existing IRP process is not entirely clear because storage projects provide such a diverse range of benefits beyond the conventional energy and capacity needs that are the focus of the IRPs. What is clear is that the effectiveness of IRPs to capture such broad benefits can be improved. For example, whenever a capacity need is identified in a utility's IRP, storage technologies should be considered for meeting that capacity need, just as any other resource would be considered. Next, using a storage modeling program such as the BSET, a storage project that meets the identified capacity need should be analyzed for any additional value streams the project can provide beyond fulfilling the capacity benefit, such as energy arbitrage, balancing services, and transmission or distribution upgrade deferrals. Once the revenues from these other value streams are deducted from the revenue requirement of the storage project, the remaining levelized cost of the storage project could be compared to the next best alternative capacity resource.

One pertinent example of where storage has become a preferred alternative resource in other markets is as an alternative to gas peaker plants in California. Southern California Edison ("SCE") announced the procurement of 264 MW of storage capacity in late 2014, 100 MW of which will be deployed in a grid-interconnected installation.[6] While California notably has a statutory procurement requirement of 1.3 GW by 2022, SCE noted that storage was cost competitive with traditional peaking resources. SCE's procurement far exceeded the current storage capacity requirement, and storage proved cost effective when appropriately modeled against traditional resources. In addition, SCE preferred the ability of the storage resources to provide future flexibility and non-peaking grid needs – such as mitigating grid congestion, balancing voltage and frequency, and integration of more and more renewable resources.

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[4] NREL's 2013 "The Value of Energy Storage for Grid Applications" study offers additional background on the ability of production cost simulation tools to more accurately value storage resources as alternatives to traditional generation resources: http://www.nrel.gov/docs/fy13osti/58465.pdf.

[5] *See, e.g.,* Vladimir Koritarov et al., "Modeling and Simulation of Advanced Pumped-Storage Hydropower Technologies and their Contributions to the Power System."

[6] http://newsroom.edison.com/releases/sce-unveils-largest-battery-energy-storage-project-in-north-america.

For Washington investor-owned utilities ("IOUs") in particular, of the 700 MW in projected peak capacity needed by PSE alone,[7] storage could be a more cost effective and higher performance resource. SCE's "least cost, best-fit methodology" of evaluating various peak capacity alternatives could prove a useful guide alongside modeling recommendations made in these comments.[8] Additionally, for Washington IOUs who have expressed concern over volatility in gas prices, storage provides the benefit of mitigating potential violent commodity price spikes as experienced in the Northeast, resulting in record spot production prices for gas peaker facilities. Risks associated with investments in long-term pipeline capacity, as is referenced in PSE's 2015 IRP, can be mitigated with storage as an alternative to gas peaker facilities.[9]

On the procurement side, all-source request for proposals ("RFPs") for capacity that include a clear recognition of the values for ancillary services and transmission deferrals could allow storage projects to more fairly compete. In order to ensure that storage resources have a fair opportunity to compete in procurement processes, we recommend that the Commission require any utility RFP for capacity to consider bids from storage projects. These storage-as-capacity resources should be eligible to provide other system services when not acting as capacity, and all of the benefits these assets offer to the grid and to Washington ratepayers should be appropriately quantified. As a positive example, we encourage the Commission to look at the requirements of the California Public Utility Commission's "Local Capacity Requirements" ("LCR") construct, which requires utilities to procure a mix of conventional resources and distributed renewable resources, demand response, and storage in order to meet capacity requirements in a transmission-constrained zone. Under this construct, SCE's LCR Request For Offers resulted in a diverse mix of capacity sources, including 264 MW of storage.[10]

A unique attribute of storage projects that does not readily fit into the IRP process is the ability to provide important transmission and distribution services. For example, energy storage is now being analyzed by system operators and transmission companies as a way to mitigate transmission overload and voltage stability problems caused by contingency events. Such operational functionality will have to be identified by a utility's transmission and distribution study processes, outside of the traditional IRP analysis. Some storage projects may be identified initially as serving a transmission need, while others may initially be considered as a capacity-type resource. Regardless of how a storage project is first identified, a full valuation of the capabilities of a storage project will require all projects to go through some sort of a transmission or distribution value screen.

Storage and ancillary services

[7] http://pse.com/aboutpse/EnergySupply/Documents/DRAFT_IRP_2015_Chap1.pdf.
[8] http://www.utilitydive.com/news/inside-southern-california-edisons-energy-storage-strategy/406044/.
[9] http://pse.com/aboutpse/EnergySupply/Documents/DRAFT_IRP_2015_Chap1.pdf.
[10] https://www.sce.com/wps/portal/home/procurement/solicitation/lcr/.

Storage projects have the potential to be efficient providers of ancillary services. For example, a 100 MW storage facility has a 200 MW operating range—100 MW of generation and 100 MW of "load." With the ability to serve as both generation and load, storage can efficiently provide ancillary services such as frequency response and voltage control without having to rely on conventional generators. In addition, conventional generators are often turned off during periods of abundant renewable energy generation, making them unavailable to provide ancillary services to the renewable energy resources on the grid. If the conventional generator is left running at its minimum generation level in order to be ready to provide ancillary services, it is effectively crowding out cleaner and more cost-effective energy resources and making the grid less flexible and able to absorb clean renewable energy when it is abundant. Storage technologies are well-suited to providing ancillary services during times where there is abundant renewable energy because storage projects do not have the same start-up and minimum generation constraints.

As acknowledged by Commission Staff, the IOUs have state and federal rates or tariffs for many of the identified ancillary services. Some utilities, such as PSE, also obtain balancing services from the Bonneville Power Administration and are charged the Variable Energy Balancing Service rate for these services; this charge is then passed onto ratepayers. We support Staff's suggestion that the Commission require utilities to file an "Avoided Ancillary Services Cost" tariff that identifies how much it costs each utility to provide or obtain each service. This cost information could then be factored into the analysis of storage in the IRP process.

Renewable Northwest encourages the Commission to use region-specific ancillary services costs prior to using proxy prices from other markets. Our understanding is that region-specific rates or tariffs exist for all of the identified ancillary services, with the possible exception of "reactive power support."

Additional issues for consideration

In addition to better analyzing storage in IRP and procurement processes, certain benefits of storage should be analyzed prior to the IRP process. As noted above, storage should be looked at as more than just a capacity resource in the IRP and should be co-optimized for all the value streams it can provide. In particular, the transmission and distribution services that storage can provide should be analyzed prior to the IRP process. A storage project that is identified as capable of fulfilling a transmission or distribution need could then have its additional value streams analyzed through a tool such as the BSET and run through the IRP to develop a full assessment of the various values it can offer.

The Commission should also consider the lifespan and lifecycle of potential energy storage projects. Valuing the benefits of storage over the entire lifetime of potential projects will have a direct impact on the projected benefits that a particular project can provide to a utility. While the project lifespan and lifecycle varies with each individual storage technology and project application, it is critical to use up-to-date assumptions on the projected useful life of storage as technologies improve over time.

It is important in any proceeding involving utility infrastructure and advanced technologies to touch upon system safety. Renewable Northwest recognizes that there were safety issues with some of the first energy storage systems (specifically, batteries) that came to the market years ago. Our understanding is that previous issues with batteries at the grid scale were a result of improper selection of technology for the application (i.e. lead acid when lithium-ion should have been selected) or due to a control issue which resulted in the batteries being used outside of their operating limits (i.e. overcharging the batteries).

Technology developments and additional safeguards now provide platforms with greatly improved safety profiles as compared with these legacy systems. Battery manufacturers across all technology types perform extensive safety testing to ensure that any failure is contained. Today's systems are also built with robust monitoring and control systems to shut down and isolate an excursion before it spreads. As a final failsafe measure, properly designed battery enclosures (container or building) are designed with data center-level fire suppression systems to localize the impact of any event.

Finally, Renewable Northwest recommends that the Commission avoid taking a position for or against any specific storage technology at this time. Instead, the Commission should treat the safety aspects of energy storage the same way that it treats other equipment purchases by its regulated utilities. We would expect that a utility, in screening respondents to an RFP, would ensure that it is selecting a technology and vendor with a robust safety record.

Recommendations

Renewable Northwest supports the Commission moving forward with developing procedures and tools for investor-owned utilities to reflect the value of energy storage in their planning and procurement processes. The staff white paper, workshop presentation, and stakeholder discussion identified several important elements to consider in order to accurately value energy storage.

Specifically, we recommend that the Commission provide further guidance to utilities on how to accurately and fully value energy storage projects and incorporate that valuation into their IRP, procurement, and transmission and distribution planning processes. At this time, we recommend that the guidance be "technology agnostic," as opposed to focusing on a narrow subset of storage technology types. We also recommend that the Commission require an "Avoided Ancillary

Services Cost" filing by each utility so that these costs can be accurately included in the valuation of storage.

Thank you for the opportunity to comment,

/s/ Cameron Yourkowski, Senior Policy Manager
/s/ Dina Dubson Kelley, Senior Staff Counsel
/s/ Kelly Hall, Washington Policy Coordinator