Received
Records Management
02/05/21 16:54
State Of WASH.
UTIL. AND TRANSP.
COMMISSION

February 5, 2021

Mark Johnson
Executive Director and Secretary
Washington Utilities and Transportation Commission
621 Woodland Square Loop SE
Lacey, WA 98504-7250

RE: Comments of Renewable Northwest, Docket UE-200304
Utilities and Transportation Commission's January 5, 2021, Notice of Opportunity to File Written Comments Relating to Puget Sound Energy's 2021 Draft Integrated Resource Plan for Electricity, Docket UE-200304.

I. INTRODUCTION

Renewable Northwest thanks the Washington Utilities and Transportation Commission ("the Commission") for this opportunity to comment in response to the Commission's January 5, 2021, Notice of Opportunity ("Notice") to File Written Comments relating to Puget Sound Energy's 2021 Draft Integrated Resource Plan ("Draft IRP") for Electricity, which Puget Sound Energy ("PSE" or "the Company") published January 4, 2021.

Renewable Northwest was an active stakeholder during the public participation process of PSE's Draft IRP development, including submission of written feedback on the Company's generic resource assumptions, transmission constraints, portfolio sensitivities, electric portfolio model, flexibility analysis, and draft portfolio results. We have noted in these comments various areas for improvement in the Draft IRP for PSE and the Commission to consider, bearing in mind the important role of this IRP to plan for compliance with the clean energy standards of Washington's Clean Energy Transformation Act ("CETA"), and as such, to inform PSE's first Clean Energy Implementation Plan ("CEIP"), set to be published later this year.[1]

In these comments, we identify areas where PSE's Draft IRP does not align with the most current resource costs and characteristics. We offer recommendations for revising PSE's key analytical assumptions, resource adequacy considerations, and various sensitivity analyses with the goal of nudging the Company toward a least-cost portfolio with the best likelihood of meeting CETA's clean energy standards.

[1] WAC 480-100-640

Finally, we appreciate the gesture of PSE's recent announcement of its "Beyond Net Zero Carbon" goal, which commits its electric operations to compliance with the standards mandated by CETA.[2] We think the Company is making strides in creating a path toward meeting those goals, but we urge PSE and the Commission to consider where the Draft IRP may be hindered by traditional resource planning assumptions not relevant to an energy transformation toward a dynamic mix of non-emitting resources. We look forward to continued participation in the development of PSE's 2021 IRP.

II. COMMENTS

A. Regulatory Context

CETA broadly requires Washington utilities to achieve greenhouse gas neutrality by 2030 and to serve Washington customers with one hundred percent non-emitting and renewable electricity by 2045.[3] Utilities must identify steps to achieve these standards using the new tool of Clean Energy Implementation Plans, and those CEIPs must in turn "identify specific actions to be taken by the investor-owned utility over the next four years, *consistent with the utility's long-range integrated resource plan* and resource adequacy requirements, that demonstrate progress toward meeting the standards under RCW 19.405.040(1) and 19.405.050(1)" as well as interim targets to ensure incremental progress.[4]

The Commission worked for months with many stakeholders, including Renewable Northwest, to craft new rules aligning utility IRPs with CEIPs and CETA's substantive requirements. These new rules point to some key downstream effects of IRPs: first, "[t]he commission will consider the information reported in the integrated resource plan when it evaluates the performance of the utility in rate and other proceedings"[5]; and second, a utility's "CEIP must describe how [its] specific actions ... [a]re consistent with the utility's integrated resource plan."[6] The main takeaway of this structure is that it is important to get as much correct as possible in the IRP, as analytical missteps could have repercussions both for utility cost recovery and for achieving CETA's critically important substantive standards.

---

[2] PSE sets "Beyond Net Zero Carbon" goal (Jan. 21, 2021), *available at* https://www.pse.com/press-release/details/pse-sets-beyond-net-zero-carbon-goal?utm_source=Social&utm_medium=LINKEDIN&utm_campaign=TOGETHER.

[3] RCW 19.405.040(1) & 19.405.050(1) (emphasis added).

[4] RCW 19.405.060(1)(b)(iii).

[5] WAC 480-100-238(6).

[6] WAC 480-100-640(6)(d).

With that backdrop in mind, we offer the following comments on PSE's Draft IRP, assessing elements of the Draft IRP not only against specific provisions of the Commission's rules as appropriate, but also against the broader context of how the information in this IRP will be used in future planning, procurement, and ultimately cost recovery efforts.

B. Resource Plan Decisions

Renewable Northwest appreciates PSE's efforts to update its traditional resource planning tools and philosophies to fit with Washington's nation-leading clean energy goals, as set forth in CETA. The resulting portfolio of resources represented in PSE's Draft IRP, which includes 3,547 MW of distributed energy resources ("DERs") and 4,462 MW of incremental renewable resources over the 24-year planning horizon, is a strong step toward the Company's fulfillment of its recent commitment to have a 100% carbon-free electric supply by 2045 -- with one significant exception which will be discussed below.

For the final IRP, PSE will be testing its preferred resource mix against the two-percent cost threshold outlined by CETA (RCW 19.405.060(3)(a)), an alternative compliance mechanism.[7] We request that, if PSE proposes in the final IRP to rely on the two-percent cost threshold for alternative compliance, PSE make it clear how that proposal fits with its commitment to provide customers with 100% carbon-free electricity by 2045, and how the use of alternative compliance with CETA will be adjusted to achieve that goal. Further, in considering how the cost threshold may inform PSE's resource decisions, we have outlined in these comments areas where PSE's modeling assumptions or inputs should be clarified or revised for the Company to make the case that it has "maximized investments in renewable resources and nonemitting electric generation," a requirement for use of alternative compliance with CETA's clean energy standards.[8]

Moving now to the Company's preferred portfolio, we appreciate the extent to which DERs appear in PSE's planning horizon. However, the heavy back-end of these procurements, with 2,284 MW of DERs preferred from 2031-2045, may be a source of PSE's perceived need for flexible capacity by 2026. DERs have the ability to provide critical peak shaving and reduce capacity needs for the system at a much lower cost compared to building new centralized infrastructure. In fact, recent techno-economic optimization modeling shows that scenarios in which DER resources are included earlier in the portfolio leads to lower costs over the long run to the tune of multiple billion dollars with savings accruing at a much faster rate[9]. In addition, investing in DERs may allow PSE to utilize its transmission capacity to be fully utilized efficiently and lead to lower overall costs. We encourage PSE to consider ongoing pilot projects

[7] P. 3-16
[8] RCW 19.405.060(3)(b)
[9] Why Local Solar For All Costs Less: A New Roadmap for the Lowest Cost Grid. Vibrant Clean Energy, LLC.

for distributed energy management systems to ensure the grid-balancing value of these resources is captured in portfolio modeling.[10]

PSE's preference for flexible capacity to maintain resource adequacy is contrary to the clean energy standards mandated by CETA, and we still have questions about the Company's resource assumptions which informed the portfolio model to opt for flexible capacity following 2025 coal retirements. Though the Draft IRP claims that PSE's "current modeling results show alternative fuel enabled combustion turbines as the most cost-effective resource to meet capacity resource needs that cannot otherwise be met by demand-side resources and distributed and renewable energy resources," PSE's modeling of alternative fuel enabled combustion turbines -- limited to sensitivity W in the Draft IRP -- may not support the claim that this resource is least cost. Sensitivity W explores a ramped schedule of DER procurements with biofuel as the fuel source for new frame peaker resources. Because PSE assumes a *fixed* biofuel price of $30.53 per million British Thermal Units over the entire study period, the model does not consider volatility of that market, inflation, or limited access to the resource.[11] And while sensitivity M will be completed for the final IRP to explore hydrogen as an alternative fuel for peaker plants, broadly projecting the viability of flexible capacity -- considering the regulatory environment and the lack of supporting data -- makes it difficult not to question PSE's resource agnosticism.

Because PSE states in the Draft IRP that alternative fuel enabled combustion turbines are the least cost resource to meet the remaining capacity needs after maximum deployment of DERs and incremental renewables, it appears that an assumption of PSE's model may be that these new combustion turbines will operate with a null social cost of greenhouse gas ("SCGHG") and zero CETA-related penalties. At the very least, PSE should caveat its flexible capacity resource selections with "assuming availability of comparably-priced alternative fuels." It is not clear from the Draft IRP whether new procurements for gas enabled combustion turbines would still be least cost, considering the incorporation of the SCGHG -- ranging from $69 per ton in 2020 and $238 per ton in 2052 -- and CETA penalties into the model.[12] In any event, these questions regarding the analytical foundations of PSE's flexible capacity preference lead us to concerns regarding not only PSE's pending incremental cost calculation but also how the IRP will inform PSE's CEIP and downstream resource actions; to alleviate these concerns would likely require significant changes in the company's final IRP.

---

[10] *See, e.g.,* "Opus One Tests 'Transactive Energy' for California Rooftop Solar, Behind-the-Meter Batteries," *available at* https://www.greentechmedia.com/articles/read/opus-one-tests-transactive-energy-for-california-rooftop-solar-behind-the-meter-batteries.

[11] P. 8-70

[12] P. 5-58

C. Key Analytical Assumptions

In the "Electric Resource Assumptions" section, PSE provides details on the type and operational characteristics of the resources considered in the 2021 IRP. We would like to suggest two recommendations that would provide a better understanding to how resources are operated historically:

1. **Pumped-hydro storage:** It is our understanding that PSE considers splitting up the nameplate capacity of the generic pumped hydro resource to account for reasonable joint ownership considerations. In doing so, the model assumes that PSE's share from the resource would be 50 MW. As PSE rightly mentions, pumped hydro storage resources can provide capacity as well as sub-hour flexibility, two key value streams that will be increasingly important in the future power system. Additionally, since the nameplate capacity of a typical pumped hydro storage resource ranges from 250 MW to 3 GW, a model that reflects less than 25% of the average capacity of a pumped hydro resource may not accurately reflect the costs and benefits of the resource. Thus, we suggest that PSE consider at least **100-150 MW** of nameplate capacity of pumped hydro with 8-, 10-, and 12-hour duration in their modeling to ensure the resource receives thorough consideration. Additional assessment is warranted because of pumped hydro's unique characteristics as a CETA-compliant resource, one that can integrate large shares of renewables into PSE's system, and one that can provide flexibility (valued at $10/kW-year in this IRP) and other reserve products required to balance the grid.

2. **Hybrid resources:** PSE has modeled three different combinations of hybrid resources: eastern Washington solar + 2-hour Lithium-ion battery, eastern Washington wind + 2-hour Lithium-ion battery, and Montana wind + pumped hydro. While we appreciate PSE's addition of these resources into this IRP cycle and the company's recognition of the emergence of hybrid projects as cost-effective, non-emitting resources, below we highlight some additional hybrid resource configurations that may enhance PSE's modeling of hybrids and provide better understanding for the current and future IRPs.

   First, hybrid resources can provide valuable energy during hours of peak demand or hours with highest probability of loss of load because they have the inherent ability to shift delivery of energy based on the needs of the grid. This means hybrids can provide **capacity and additional grid flexibility**, thereby helping to integrate large shares of renewable energy resources. While PV coupled with batteries is the most prevalent hybrid resource currently, utility innovations in this field have shown that concepts like triple-hybrids consisting of wind + solar + batteries are also techno-economically viable generation resources.[13] Second, typically solar or wind resources are coupled with a **4-hour duration** Li-ion battery system to ensure sufficient MWhs are shifted from the generating resource to the battery during low-demand hours to avoid curtailment and allow for discharge across high-demand hours, as well as to ensure that the additional capital cost of the battery is effectively utilized to the maximum extent.[14] Modeling 2-hour Li-ion batteries might not lead to complete realization of benefits that a 4-hour system can provide, a result that could skew the selection of hybrid and storage resources -- or lack thereof -- in a preferred portfolio. Finally, hybrid resources are also flexible in terms of the variety of operational **configurations** available. Apart from the generic AC-coupled systems, recent industry developments in DC-coupled systems have provided additional options to deploy hybrid resources. In these systems, batteries provide the extra benefit of recapturing "clipped" energy from oversized solar systems, and DC-coupled systems enable low-voltage harvesting periods when inverters cannot generate power from the solar system. Modeling different operational configurations could similarly unlock benefits that change the composition and costs of PSE's resource portfolios.

Renewable Northwest appreciates the additional sensitivities conducted by PSE, in particular pertaining to emission reduction pathways which are not only highly probable due to recent policy developments but can also be a cost-effective resource strategy over the long run if implemented efficiently. Since PSE's Mid-Case buildout includes 907 MW of "flexible capacity" resources that may not be consistent either with CETA's standards or with the company's emission-reduction goals, we recommend additional exploration of alternative resources. In particular, we recommend that PSE take a harder look at cost-effective resources such as storage, demand response, and hybrids to fill that capacity need. A portfolio approach similar to "Sensitivity P", considering a mixture of 4-hour standalone storage, 8-10 pumped hydro, solar/wind paired with 4-hour storage and demand response could likely meet early morning and evening peak needs during winter months that the company's loss of load heatmap matrix (Figure 3-14) has shown. Thus, we suggested in comments to PSE that it assess a modification to the Scenario P in order to prioritize selection of these resources before a new gas plant, which would not only threaten PSE's CETA compliance and emission goals but also create financial risks related to stranded assets in the future. We look forward to seeing the results of this modified sensitivity.

---

[13] *See*, *e.g.*, Portland General Electric's December 2020 press release regarding the wind + solar + battery storage Wheatridge Renewable Energy Facility procured as a result of a 2018 competitive solicitation: https://portlandgeneral.com/news/2020-12-8-pges-and-nextera-energy-resources-leading-edge-renewable-energy.

[14] NREL Annual Technology Baseline, 2020, *available at* https://atb.nrel.gov/electricity/2020/index.php?t=st

In previous comments to PSE, we have also highlighted four key dimensions of a robust flexibility resource and subsequent analysis.[15] These are: first, absolute power output capacity range (in "MW"); second, the speed of power output change, or ramp rate (in "MW/min"); third, the duration of energy levels (in "MWh"); and finally the carbon intensity (in "CO2e/MWh"). Resources which have a larger range between their minimum and maximum "MW" output, such as pumped-hydro storage systems, can provide the flexibility to adjust to a wider range of power system conditions. Resources that can change their output quickly or can be easily turned on or off, including 2-, 4- & 6-hour Li-ion, flow battery storage systems, and demand response ("DR"), have a higher ramp rate and are more flexible because they adjust faster to changes in power system conditions. Resources that can deliver energy for longer durations increase flexibility because they can address prolonged disturbances or outages. Resources such as conventional and combined cycle combustion turbines can provide dispatchable power but by definition have low capacity utilization when used as peakers and are emission-intensive when ramped up or down rapidly. These different dimensions are important to consider in any holistic flexibility analysis and, thus, in calculating benefits, we recommend PSE consider not just the frequency of flex violations but their magnitude, speed, duration, and carbon intensity. Based on these dimensions, we anticipate that PSE may identify a different resource or resources to fill that flexible capacity need, and we recommend that PSE continue to study clean, non-emitting, and flexible capacity resources which meet all the required characteristics of each dimension.

D. Resource Adequacy Analysis

Renewable Northwest appreciates Draft IRP's detailed description of PSE's efforts to maintain a reliable and adequate system during all hours of the year using the multi-scenario probabilistic Resource Adequacy Model ("RAM"). Evaluating the capacity credit of individual resources is an integral part of this analysis, which informs the planning reserve margin ("PRM") to maintain the system under the standard of 5% loss of load probability ("LOLP"). Having taken a close look into the analysis provided, we have the following thoughts:

1. The LOLP matrix for 2027 and 2031 shows peak demand hours for winter months during mornings from (8 a.m. - 11 a.m.) and evenings from (6 p.m. to 10 p.m.); as noted above, the resource needs associated with these peaks can likely be met by a portfolio of flexible resources such as pumped hydro, standalone storage, hybrids, demand response, and market purchases at a lower cost than that associated with the flexible capacity resources that currently appear in PSE's preferred portfolio. The duration (assuming full discharge) for all storage resources combined contributes up to 16 hours, excluding demand response. PSE should consider this portfolio approach instead of investing in new gas

[15] Feedback of Renewable Northwest re: Flexibility Analysis & Portfolio Draft Results. Submitted December 21, 2020.

infrastructure which will likely end up being stranded, leading to financial losses for the company and its customers.

2. The Draft IRP's peak capacity credit for hybrid solar + storage resources appears to be skewed because coupling solar or wind with 2-hour Li-ion storage contributes much less to peak capacity than a similar resource paired with 4-hour storage. In fact, 4-hour storage is the industry standard for pairing with renewable resources due to their cheaper $/kW capital costs[16] as well as costs related to the balance-of-system ("BoS"), in addition to the ability to provide 4-hour dispatch during evening hours when the solar is ramped down and demand is high on the grid. Research has shown that hybrid solar + storage (4-hour duration) can deliver greater than 99% ELCC in the Western US at a lower cost than a combustion turbine peaker power plant in an analysis conducted using Strategic Energy and Risk Valuation Model (SERVM) by Astrape Consulting.[17]

3. PSE is an active participant in the regional resource adequacy program ("RAP") being developed by the Northwest Power Pool ("NWPP") in consultation with the Southwest Power Pool ("SPP"). This program has the ability to unlock the geographical and resource diversity of the region and allow utilities to share resources during stress hours instead of following the traditional "go-it alone" approach. The program is currently in the detailed design phase, and its non-binding forward showing will launch in Q3-2021, with the binding + operational program to be launched in 2024 -- two years before PSE's Draft IRP shows a need for new flexible capacity. Thus, it would be prudent for PSE to assess whether participation in the program could reduce or even eliminate the need for new flexible capacity assets, especially when combined with some set of the non-emitting resources discussed above.

E. <u>Electric Analysis</u>

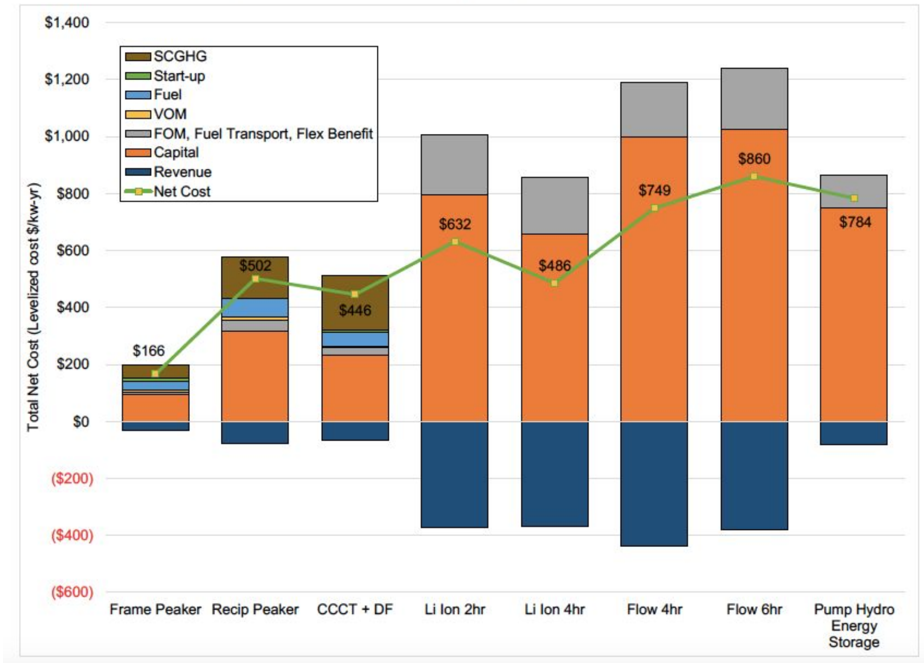
PSE provides a levelized cost of capacity comparison for peakers, baseload gas plants, and energy storage resources in the Mid Scenario, illustrated by *Figure 8-12* in the Draft IRP:

---

[16] See Figure 9. 2018 U.S. Utility-Scale PhotovoltaicsPlus-Energy Storage System Costs Benchmark. Fu et al. 2018. NREL. Available at: https://atb.nrel.gov/electricity/2020/index.php?t=st

[17] California Public Utility Commission. Joint IOU Study. August 2020. Available at: https://www.astrape.com/2020-joint-ca-iou-elcc-study-report-1/
Astrapé Consulting was contracted by the California Investor Owned Utilities to examine the annual marginal ELCC values for the resource classes and locations using the SERVM model which calibrates the reliability planning to loss of load expectation (LOLE) of 0.1 or 1 day in 10 years.

Figure 8-12: Net Cost of Capacity in the Portfolio Model



However, public data and other IRP filings support lower capital cost estimates ($/kW) than PSE has incorporated in their modeling. For example, the National Renewable Energy Laboratory's ("NREL") 2018 Annual Technology Baseline ("ATB") reports meaningfully lower costs for 2-hour and 4-hour lithium-ion batteries with mid-cost projections (shown in *Figure 1* below). The most recent cost estimates reflected in NREL's 2020 ATB are lower still at $1500/kW for a moderate-level projection (shown in *Figure 2* below). On the other hand, the 4-hour Li-ion battery capital cost assumed for the "Levelized Capacity Cost" (in PSE's Figure 8-12 reproduced above) calculation would produce a range of $2300-2400 kW/year, assuming a 15-year system lifecycle and a capacity credit of 25% -- a very conservative estimate. Battery storage costs are falling rapidly and efficiencies are increasing due to technological advancements and economies of scale. Battery storage systems are increasingly emerging as important assets for the future grid -- and even the present grid -- to integrate increasing penetrations of non-emitting resources. Thus, evaluating their cost and operating parameters appropriately in the current IRP cycle would not only meet the company's obligations this IRP cycle but also lay important groundwork for future resource planning.

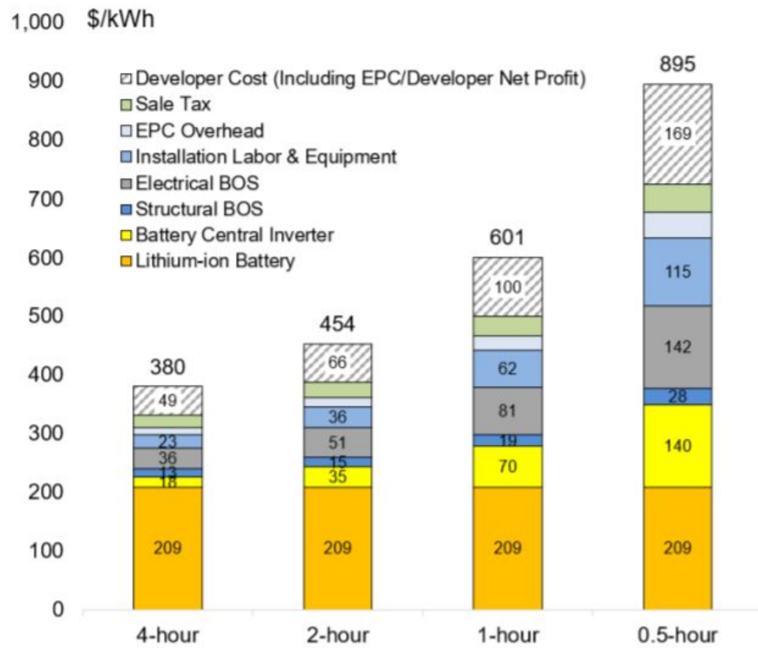


Figure 1. 2018 U.S. utility-scale lithium-ion standalone storage costs for durations of 0.5-4 hours (60 MW_{DC}), NREL's 2018 Annual Technology Baseline.[18]

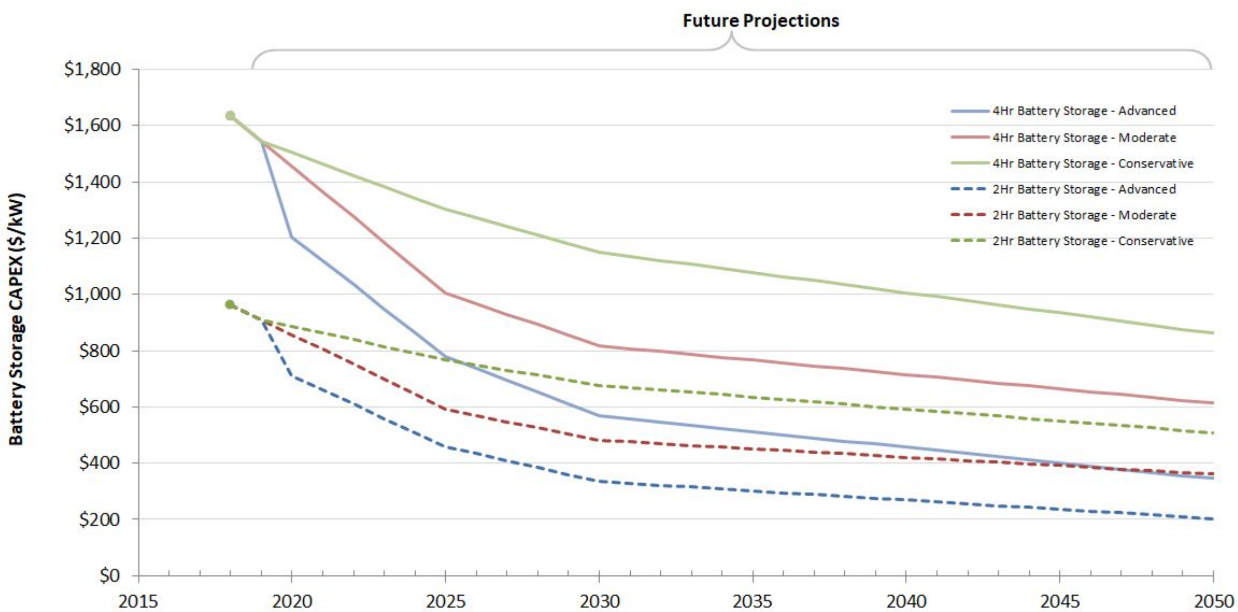


Figure 2. Li-ion battery storage projection (in $/kW) from NREL's Annual Technology Baseline 2020.[19]

---

[18] NREL Annual Technology Baseline, 2020, *available at* https://atb.nrel.gov/electricity/2020/index.php?t=st.
[19] Battery Storage cost values from W. Cole and A. W. Frazier, "Cost Projections for Utility-scale Battery Storage: 2020 Update," NREL/TP-6A20-75385. Golden, CO: National Renewable Energy Laboratory. https://www.nrel.gov/docs/fy20osti/75385.pdf.

We appreciate PSE's solicitation of stakeholder feedback during the development of a list of sensitivities to inform the IRP. We provided written feedback on some of these sensitivities to PSE in December, and the Company generally seems open to some adjustment for the final IRP. Below, we outline how various sensitivities could be improved to better inform PSE's preferred portfolio.

1. Sensitivity A -- Renewable Overgeneration Test
   This sensitivity explores the importance of market sales by preventing excess renewable generation from being sold to the Mid-C market. The 24-year levelized costs are only slightly higher than those of the Mid Scenario, and the model successfully minimizes overgeneration of renewables by selecting biogas and battery storage and likely curtailing any excess renewable generation. These details make sensitivity A an attractive option, especially considering the decreased peaking capacity compared to the Mid Scenario. However, because this sensitivity is relevant to discussions occurring at the state agencies regarding the definition of "use" in RCW 19.405.040(1)(a)(ii), it may be informative for PSE to explore how market availability would be affected if all Washington utilities operated within a CETA compliance structure such that renewable overgeneration was minimized. This would be difficult to model, as the sudden drop in Washington market sales may alter the way other utilities in the region participate in the market. Regardless, it may be worth PSE addressing in the final IRP that selection of sensitivity A's portfolio would imply other utilities would have similar resource planning strategies, and thus, the impact to market availability would be difficult to forecast.

2. Sensitivity B -- Reduced Market Reliance at Peak Hours
   This sensitivity restricts PSE's reliance on market purchases to meet peak load. This analysis will be completed for the final IRP. However, the context PSE provides for this sensitivity is problematic: "PSE currently uses market purchases of energy in order to meet demand at peak demand hours. As CETA pushes the generation mix of the Pacific Northwest to become increasingly renewable, energy may not be available for purchase on the Mid-C market."[20] Because there is meaningful variability in the generation profiles of renewable resources across the region, and because storage technologies -- especially as costs continue to fall -- will improve the flexibility of the grid, this narrative presents an overly narrow and arguably incorrect view of the cause of potential limits in the market at peak hours. If peak-hour market availability does decrease over the planning

[20] P. 5-45

horizon, it will likely be in part because of the more extreme weather events, a consequence of the global climate shift, making region-wide events of high energy demand more common.

3. Sensitivity E -- Firm Transmission as a Percentage of Resource Nameplate
This sensitivity explores the cost savings associated with securing firm transmission as a percentage of resource nameplate capacity, given renewable resources often generate below their maximum outputs. While PSE's results indicate there may be some cost savings associated with securing firm transmission as a percentage of nameplate capacity PSE does not feel the savings would "add materially to the IRP portfolio development process."[21] However, we recommend PSE continue exploring solutions to transmission underutilization both in future IRP efforts and upcoming resource acquisition decisions. In fact, we are hoping to meet with PSE transmission planning staff in upcoming months to explore additional possibilities for unlocking flexibility in the existing transmission system. We also look forward to seeing PSE's future modeling of co-located wind and solar with shared, limited transmission capacity due to the complementary relationship between the generation profiles of these resources.[22]

4. Sensitivity O -- Natural Gas Generation Out by 2045
This sensitivity forces the model to retire all emitting resources by 2045 as opposed to at the end of their economic life. Renewable Northwest requested in December that PSE model a new sensitivity for its final IRP, building on sensitivity O. Sensitivity O still opts for new gas but forces the model to retire existing fossil resources by 2045. A new or revised sensitivity forcing the model to select from the full suite of non-emitting resources -- including 4-hour lithium-ion batteries, pumped hydro storage, and hybrid resources -- to meet all capacity needs and allowing existing fossil resources to economically retire would be more informative, especially if the conservation measures of the Mid Scenario were applied on the front end to reduce capacity need over the planning horizon.

5. Sensitivity P -- Must-take Battery and Must-take Pumped Hydro Energy Storage
This sensitivity is split into two analyses: 1) batteries as must-take resources following coal retirements in 2025, and 2) pumped hydro storage as must-take resources following coal retirements in 2025. As follow-up to our December 15 feedback to PSE on its draft portfolio results, PSE agreed to modify sensitivity P to better illustrate the resource mix and portfolio costs of diverse storage options that align better with the portfolios that are emerging by other utilities in the region.

---

[21] P. 8-46
[22] P. 8-47

Sensitivity P currently explores a forced delay of peaking capacity additions to determine the portfolio cost impacts associated with earlier procurements of battery storage and demand response. Battery storage in this sensitivity is represented by 2-hour lithium-ion batteries, which PSE chose because they are least cost. However, while these duration-limited batteries may be least cost up front, the incrementally more expensive 4-hour lithium-ion battery would contribute more to resource adequacy and flexibility while also reducing the amount of storage procurements required to replace peaking capacity resources. Moreover, PSE's Mid Scenario considers 4-hour lithium-ion batteries, likely because this appears to be the industry standard,[23] so changing sensitivity P in this way would better fit with PSE's portfolio comparisons.

PSE has agreed to run a sensitivity allowing the model to select from a *mix* of storage options, notably 4-hour lithium-ion batteries and 8-hour pumped hydro storage. We look forward to seeing how this additional storage resource diversification may influence PSE's final resource strategy.

III. CONCLUSION

Renewable Northwest thanks PSE and the Commission for their consideration of this feedback. We are optimistic that the changes and additional analysis we have recommended above will help PSE to identify a least-cost portfolio that also puts the Company on a path to achieving CETA's clean energy standards and the Company's own emission reduction goals. We look forward to continued engagement as a stakeholder in this 2021 IRP process.

Sincerely,

/s/ Katie Ware
Katie Ware
Washington Policy Manager
Renewable Northwest
katie@renewablenw.org

/s/ Sashwat Roy
Sashwat Roy
Technology & Policy Analyst
Renewable Northwest
sashwat@renewablenw.org

/s/ Max Greene
Max Greene
Regulatory & Policy Director
Renewable Northwest
max@renewablenw.org

[23] *See, e.g.*, Avista's Draft 2021 Electric IRP (Jan. 4, 2021), at 9-13, *available at* https://www.myavista.com/-/media/myavista/content-documents/about-us/our-company/irp-documents/avista-2021-draft-electric-irp.pdf.