PUGET SOUND ENERGY

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Filed via Web Portal

Amanda Maxwell
Executive Director and Secretary
Washington Utilities and Transportation Commission
621 Woodland Square Loop SE
Lacey, WA 98503

Re: Puget Sound Energy's Informational Filing Notifying the Commission of 2021 All-Source RFP Resource Adequacy-Related Updates, Docket UE-210220

Dear Ms. Maxwell:

On June 14, 2021, the Washington Utilities and Transportation Commission ("Commission") entered Order 01 in the above-referenced docket, in which the Commission approved Puget Sound Energy's ("PSE") revised 2021 Draft All-Source Request for Proposals for Renewable and Peak Capacity Resources ("2021 All-Source RFP"), subject to conditions.[1] Consistent with condition three of Order 01, PSE submits this informational filing to summarize PSE's resource adequacy-related updates and notify the Commission of how these updates have been incorporated into the evaluation of bids during Phase 2 of PSE's 2021 All-Source RFP.

Background

Condition three of Order 01 required PSE to file a response to public comments on Effective Load Carrying Capability ("ELCC") methodology, inputs, assumptions, and use of stochastic analytical methods, as well as the use and consideration of the ELCC metric in PSE's evaluation of bids during Phase 2 of the 2021 All-Source RFP. PSE filed its response to public comments in December 2021, following an August 31, 2021 public ELCC workshop.[2]

[1] *In the Matter of the Petition of Puget Sound Energy for an Order Approving Proposed Request for Proposals*, Order 01 (Approving Revised Draft All-Source Request for Proposals Subject to Conditions), Docket UE-210220 (June 14, 2021) (Order 01).

[2] To provide greater transparency and ensure that PSE's methodology for calculating ELCC values is rigorous and accurate, PSE hired a consultant, Energy and Environmental Economics, Inc. (E3), to review its methodology for reasonableness and provide recommendations for improvements. E3 presented its initial findings and recommendations at an ELCC Workshop on August 31, 2021 and thereafter produced a final report, which was posted to PSE's RFP web site (www.pse.com/rfp) upon completion on October 8, 2021.

Further, if PSE "agree[d] that a revision of the ELCC methodology or implementation in Phase 2 is warranted," condition three required PSE to "file said revisions with the Commission and notify the Commission of the change in Phase 2 implementation."[3] As outlined in PSE's December 2021 response, PSE has worked closely with E3 to implement E3's recommended updates for Phase 2 of the 2021 All-Source RFP and the 2023 Electric Integrated Resource Plan (IRP) Progress Report. The results of PSE's and E3's modeling updates were presented in a PSE IRP Resource Adequacy Information Session on August 24, 2022.[4] Consistent with condition three, these resource adequacy-related updates are detailed below.

PSE's Resource Adequacy and ELCC Updates

E3 proposed six recommendations for improvements to PSE's resource adequacy methodology. In its December 2021 response comments, PSE indicated that it would attempt to incorporate these recommendations for Phase 2 of the 2021 All-Source RFP and the 2023 Electric IRP progress report, but might not be able to complete all changes due to time requirements to gather data, develop processes, update models, and benchmark results. In sum, PSE incorporated four of E3's six recommendations, in addition to making many other improvements to the resource adequacy analysis. Below is a description of each of the six recommendations and all changes made. PSE will provide further detail in the 2023 Electric IRP progress report.

Climate Change

In its December 2021 response comments, PSE stated that it "is currently developing a climate change update" and that "[t]his work will build on the Northwest Power and Conservation Council's climate change data, used in their recent resource adequacy work."[5] In Phase 2 of the 2021 All-Source RFP and in the forthcoming 2023 Electric IRP progress report, PSE has incorporated future climate change impacts in the resource adequacy analysis, relying on climate change data from the Northwest Power and Conservation Council ("Council"). This update has impacted three key inputs to the resource adequacy analysis: (1) energy demand; (2) hydroelectric generation; and (3) availability of market purchases.

The Council performed analysis on how the future climate of the Pacific Northwest may evolve over several scenarios. This analysis ultimately resulted in temperature and hydrological forecasts over a 30-year period (2020-2049) for each scenario. PSE followed the Council

[3] *See* Order 01 at paragraph 12.

[4] On August 24, 2022, PSE hosted a webinar to discuss Resource Adequacy. Topics include a summary of Energy + Environmental Economics' (E3) Resource Adequacy Modeling Results, an overview of the Western Resource Adequacy Program (WRAP), and an overview of the Northwest Regional Forecast by the Pacific Northwest Utilities Conference Committee (PNUCC). More information is available on PSE's IRP website.

[5] *See* "PSE Response to Public Comments on ELCC Calculations and Use," Docket UE-210220 at p. 16 (December 3, 2021) (December 2021 Response Comments).

analysis and leveraged the same climate scenarios A, C, and G representing CanESM, CCSM, and CNRM.

PSE then developed load forecasts for each of these climate scenarios and two model years (2029 and 2034). For each of these cases, PSE forecast load for 30 weather years (2020-2049). The model year (2029 and 2034) determines future economic conditions—including the amount of economic growth, penetration of air conditioning, adoption of electric vehicles, etc.—and these factors do not change across the thirty weather years. Along with the climate scenario, the model year also determines the amount of global warming and the resulting impacts of climate change (i.e., more warming and greater impacts in 2034 than in 2029). The weather years (2020-2049) capture the year-to-year fluctuations in energy demand due to variable weather across 30 years.

The Council also developed hydroelectric generation forecasts for each of the climate scenarios and the two model years. The climate change forecasts influence the amount and timing of rainfall, snowmelt, and ultimately water inflows. The University of Washington Climate Impacts Group ("CIG") provided water inflows for the Columbia River and coastal drainages in Washington covering the Mid-C and Baker hydro plants. The daily inflows are also for the same three climate change scenarios A, C, and G. PSE then used this water inflow data to determine the total generation at each hydroelectric plant. The hydro generation varies across 30 weather years, which are the same weather years used for the load forecast.

Lastly, PSE assessed the availability of market purchases from neighboring utilities and market. Just as the climate impacts load and hydrological conditions for PSE's system, it also impacts these conditions for the greater Pacific Northwest region and the West more generally. PSE used the Council's Classic GENESYS model to characterize the region's curtailments and California imports. During a Pacific Northwest-wide load-curtailment event, there is not enough physical power supply available in the region (including available imports from California) for the region's utilities to fully meet their firm loads plus operating reserve obligations. To mimic how the Pacific Northwest wholesale markets would likely operate in such a situation, PSE developed the Wholesale Market Purchase Curtailment Model ("WPCM")—a tool to calculate PSE's share of the curtailment in the Northwest region. To assess a wide range of regional market conditions, PSE combined the 30 years of energy demand forecasts with each of the 30 years of hydro generation forecasts to simulate the availability of market purchases across 900 years.

By implementing these methodological updates, PSE captured future impacts of climate change on energy demand, hydroelectric generation, and availability of market purchases from other systems.

Seasonal Resource Needs and ELCCs

PSE also stated in its December 2021 response comments that it would "evaluate the modeling work associated with isolating a summer and a winter peak need, and the

corresponding ELCC values."[6] For Phase 2 of the 2021 All-Source RFP and the 2023 Electric IRP progress report, PSE elected to perform resource adequacy analysis on a seasonal basis rather than on an annual basis. This allowed PSE to determine the resource need specific to each season and assess how the contribution of resources toward the Planning Reserve Margin ("PRM") differs by season. PSE chose to model two seasons: winter and summer. The winter season corresponds to the months November-March, and the summer season corresponds to the months June-September. PSE selected these months to align with the seasons defined for the Western Resource Adequacy Program ("WRAP").

E3 performed a seasonal resource adequacy analysis and calculated separate PRM and ELCC values for winter and summer. The seasonal PRM sets the total amount of resources needed in that season and the seasonal ELCC corresponds to a resource's contribution towards the PRM in that season. The PRMs for winter and summer are calculated such that, if PSE adds enough resources to satisfy them, PSE will meet its annual target of five percent loss of load probability ("LOLP"). The ELCCs for winter and summer are calculated such that they only consider how a resource contributes towards reliability in winter or summer, respectively.

Resource-Specific ELCCs and Generic Resource Assumptions

PSE indicated in its December 2021 response comments that PSE would "run resource-specific ELCCs for Phase 2 of the All-Source RFP and update generic resource assumptions for the 2023 Electric IRP progress report using the most up-to-date information." Accordingly, PSE directed E3 to calculate resource-specific ELCCs for bids received through the 2021 All-Source RFP. These ELCCs captured specific attributes of resource bids, which include the following:

- Location-specific generation profiles for renewable resources
- Energy storage was modeled for unique two, four, and six hour duration levels
- ELCC saturation curves by resource type were developed to account for the cumulative effects of adding similar resources
- Transmission limitations in cases where resources would leverage existing transmission that could have insufficient capacity at times to deliver power from all resources, including the bid resource
- Interconnection limitations in cases where multiple resources would be located behind the same new interconnection (e.g., solar plus battery storage)
- Interconnection limitations in cases where a new resource would be located behind an existing interconnection (e.g., storage paired with an existing wind project)

[6] *Id.*

PSE also updated its generic energy storage assumptions for the 2021 All-Source RFP and the 2023 Electric IRP progress report as follows:

- Storage can discharge at its rated capacity for its rated duration. A minimum state of charge does not apply to the modeled energy capacity. For example, a 100 MW four-hour lithium-ion battery resource that is fully charged can discharge to the grid at 100 MW for four consecutive hours

- Storage can help meet PSE's operating reserve requirements. When providing operating reserves, storage resources are on standby and do not discharge to the grid.

- The Northwest Power Pool ("NWPP") Reserve Sharing Program can be called when an energy storage resource is added to the system.

- Storage can have forced outages. The modeled forced outage rate for lithium-ion storage is two percent and for pumped storage is one percent.

NWPP Reserve Sharing Program

PSE indicated in its December 2021 response comments that PSE would "review its modeling code and assumptions to ensure that assumptions are being correctly applied for the NWPP reserve sharing program."[7] In the 2021 IRP, PSE did not model the reserve sharing program consistently when modeling the ELCC of energy storage resources. In the updated modeling, when E3 calculated the ELCC of energy storage resources, E3 maintained the same reserving sharing program assumptions that are used in the base case. The NWPP reserve sharing program allows PSE to rely on neighboring systems to make up for insufficient resources for the first 60 minutes following a qualifying event. E3 maintained these assumptions across all cases.

GENESYS Sensitivity

PSE indicated in its December 2021 response comment filing that PSE would "run an additional sensitivity of a GENESYS model run assuming regional capacity additions such that the region meets a 5 percent LOLP standard."[8] PSE did not run this additional sensitivity. E3 initially recommended performing this sensitivity to see if it would result in an increase in the ELCC of storage resources. However, after E3's modeling showed that the ELCC of energy storage is very high (>95 percent for four-hour lithium-ion battery) and that there is sufficient energy to charge the energy storage to meet reliability needs,[9] E3 recommended ***not*** performing this sensitivity as it would not add significant value considering the new results.

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[7] December 2021 Response Comments at p. 16.

[8] *Id.*

[9] Please note that this is the ELCC for the first 100 MW tranche of energy storage and that the ELCC declines with increasing penetration.

Off-System Energy Storage Resources

PSE indicated in its December 2021 filing that PSE would "evaluate the modeling work to update the model to differentiate between on-system vs. off-system energy storage resources." PSE also indicated that this recommendation may need to be considered for future IRP cycles to allow adequate time for model preparation and quality review.[10]

PSE did not assess the potential for off-system energy storage to charge at times when PSE's system is short while the wider region has adequate supply. However, in the 2023 Electric IRP progress report, the ELCC of energy storage resources is very high (>95% for four-hour lithium-ion batteries), indicating that charging limitations for on-system energy storage resources are insignificant.[11]

For Phase 2 of the 2021 All-Source RFP, PSE directed E3 to calculate the ELCC of on-system energy storage bids and off-system energy storage bids. E3 did not assess the potential for off-system energy storage to charge at times when PSE's system is short while the wider region has adequate supply. However, like for the 2023 Electric IRP progress report, this analysis did not indicate that charging limitations resulted in lower ELCC values. The modeling of off-system energy storage resources did capture transmission limitations; if there were times when PSE's system was short but there was insufficient transmission to deliver power from the energy storage resource, then this would impact the ELCC of the resource bid.

Load and Renewable Correlations

Finally, PSE also stated in its December 2021 response comment filing that PSE would "follow-up with E3 to explore different ways to approach correlations between wind/load and solar/load." PSE also indicated that this recommendation may need to be considered for future IRP cycles to allow adequate time for model preparation and quality review.[12]

In addition to updating the load profiles based on climate change impacts, PSE also updated the renewable energy profiles. With changes to load profiles, renewable profiles, and many other assumptions for Phase 2 of the 2021 All-Source RFP and the 2023 Electric IRP progress report, PSE and E3 did not have sufficient time to incorporate load and renewable correlations in the resource adequacy analysis. These correlations warrant study for future studies.

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[10] *Id.*

[11] Please note that this is the ELCC for the first 100 MW tranche of energy storage and that the ELCC declines with increasing penetration.

[12] *Id.*

Questions regarding this informational filing should be directed to Sheri Maynard, Business Initiatives and Sr. Commercial Development Manager, at sheri.maynard@pse.com or (425) 462-3114. If you have any other questions, please contact me at (425) 456-2142.

Sincerely,

/s/ Jon Piliaris

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