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March 18, 2022

Amanda Maxwell
Executive Director and Secretary
Washington Utilities and Transportation Commission
P.O. Box 47250
Olympia, WA 98504-7250

Re: Puget Sound Energy's Clean Energy Plan (CEIP) pursuant to WAC 480-100-640 Docket No. UE-210795, Comments of Sierra Club

Dear Ms. Maxwell,

Sierra Club appreciates the opportunity to comment on Puget Sound Energy's ("PSE") Clean Energy Implementation Plan ("CEIP"). These comments were prepared with the assistance of Michael Goggin of Grid Strategies, LLC. As these comments demonstrate, PSE must revise the CEIP by deploying greater clean energy resources in order to increase benefits for ratepayers.

PSE did incorporate some of Sierra Club's recommendations from our February 2021 IRP comments, resulting in a larger near-term deployment of renewable and storage resources. However, the record is clear that the company can still increase benefits for its ratepayers by deploying even more clean energy resources. PSE's own modeling shows that a larger near-term deployment of renewable energy could save its ratepayers $127 million. Had PSE evaluated lower-cost and higher-value regional renewable resources, it would have found even larger ratepayer benefits from additional near-term renewable investment. By correcting these flaws with the specific recommendations provided in our comments, PSE's modeling will correctly show the value of deploying more—and more diverse—renewable resources in the near-term, resulting in a win-win-win for its ratepayers, electric reliability, and the environment.

I. FLAWS IN PSE'S CEIP

A. PSE's CEIP Modeling Improperly Constrained Near-term Deployments of Renewable Energy, Increasing Costs for Ratepayers by $127 Million

According to PSE's corrected CEIP report[1] and responses to discovery,[2] PSE explained that after its initial model runs proposed 900 MW of wind resources in Washington state by 2025, PSE subsequently constrained the model so it would only add 500 MW of Washington wind. In the constrained run, the model built 500 MW of Washington wind and 300 MW of Washington solar, instead of 900 MW of Washington wind in the unconstrained run. Our primary concern here is that the constrained modeling runs add significantly less total renewable energy, increasing both emissions and costs for ratepayers.

Not only did the total renewable capacity deployment decrease from 900 MW in the initial unconstrained run to 800 MW in the constrained run, but the total renewable MWh output declined even further because wind resources are replaced with lower capacity factor solar resources. PSE assumed a capacity factor of 36% for Washington wind resources and 24% for Washington solar resources.[3] As a result, the MWh output of PSE's constrained portfolio is equal to that of 700 MW of Washington wind, when the initial unconstrained modeling deployed 900 MW of Washington wind. Thus, the MWh renewable output of the unconstrained run was approximately 29% greater than that of the constrained run that PSE chose as its recommended portfolio.

Procuring less renewable energy not only increases air pollution and GHG emissions, but also harms ratepayers. In response to Sierra Club Data Request 7b, PSE admitted that the constrained portfolio with less renewable energy is "$127 million more expensive than the first, unconstrained model run." The fact is, PSE could score a win-win-win for ratepayers, reliability, and emission reductions by deploying more—and more diverse—renewable resources in the near term.

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[1] Puget Sound Energy, *2021 PSE Clean Energy Implementation Plan* at 31 (Feb. 1, 2022), *available at* https://irp.cdn-website.com/dc0dca78/files/uploaded/2022_0201_PSE%202021%20Corrected%20Clean%20Energy%20Implementation%20Plan.pdf [hereinafter "PSE 2021 CEIP"]. "In the first run, the model selected a large amount of WA wind to meet the clean energy targets at the end of the CEIP period in 2025 to take advantage of the expiring production tax credits (PTCs). This outcome did not seem to reflect what PSE likely would acquire through our All-Source RFP process, given the risk to system reliability from an overreliance on WA wind. Although PSE received a strong response from bidders for wind energy projects, we also received a strong response for solar and BESS projects. Next, PSE performed a second model run that considered a more diverse set of renewable resources: a smaller amount of wind (500 MW) spread over two years instead of one, plus the addition of 300 MW of solar in 2024–2025."

[2] In response to Sierra Club Data Request 7a, PSE explains that in the initial unconstrained model run, "The Aurora Long-Term Capacity Expansion model added 900 MW of Washington Wind in the year 2025."

[3] PSE 2021 CEIP at 119-120.

PSE is correct that a more diverse portfolio of renewable resources offers benefits for reliability. However, arbitrarily constraining the model's ability to deploy renewable resources is the wrong way to address that concern. The fundamental problem is that the Aurora capacity expansion model does not account for the reliability benefits from output diversity among additions of wind, solar, and storage resources, as explained in more detail in the next section. However, utilities have developed methods that do account for the reliability benefits of diversity effects in portfolios of those resources.[4] That PSE's model is inadequately accounting for those reliability benefits shows that the model itself needs to be corrected to directly account for the capacity value and other reliability benefits of a diverse portfolio of renewable resources. Indirectly constraining the model fails to correct the fundamental problem that the model is undervaluing the reliability contributions of diverse wind, solar, and storage resources. PSE should adopt modeling methods that account for output diversity synergies among wind, solar, and storage resources, such as by crediting resource additions with the diversity benefits they create with other resources and iteratively assessing the total capacity value of candidate portfolios. As discussed below, PSE should also allow Montana and Idaho wind resources to compete in its modeling, as the low-cost and complementary profile of those resources relative to PSE's load and existing resources make them a better option for achieving the resource diversity PSE seeks.

B. PSE Understated the Capacity Value of Diverse Renewable and Storage Resources

"Capacity value" is the contribution of a single resource or group of resources towards meeting periods of high electricity demand. PSE's capacity expansion analysis through the Aurora model included a simplistic assessment of capacity value that diminished the actual contributions of adding a diverse portfolio of renewable and storage resources. The Aurora model uses a declining ELCC curve for each resource, which captures saturation effects that cause the ELCC of an individual resource type to decline as its penetration increases, but does not account for the offsetting diversity benefits that keep ELCCs high in portfolios of resource types with different output profiles, like wind, solar, and storage. The CEIP ignored significant diversity benefits among new resources. A study of the Northwest power system by industry consultant Energy and Environmental Economics, Inc. ("E3") found that "[a]t high penetrations of renewables and storage, most of the ELCC is realized through diversity."[5]

These synergistic benefits among wind, solar, and storage occur because wind and solar have negatively correlated output profiles, and because solar and wind complement storage by shortening the duration of peak net load periods (as illustrated in the example below for a

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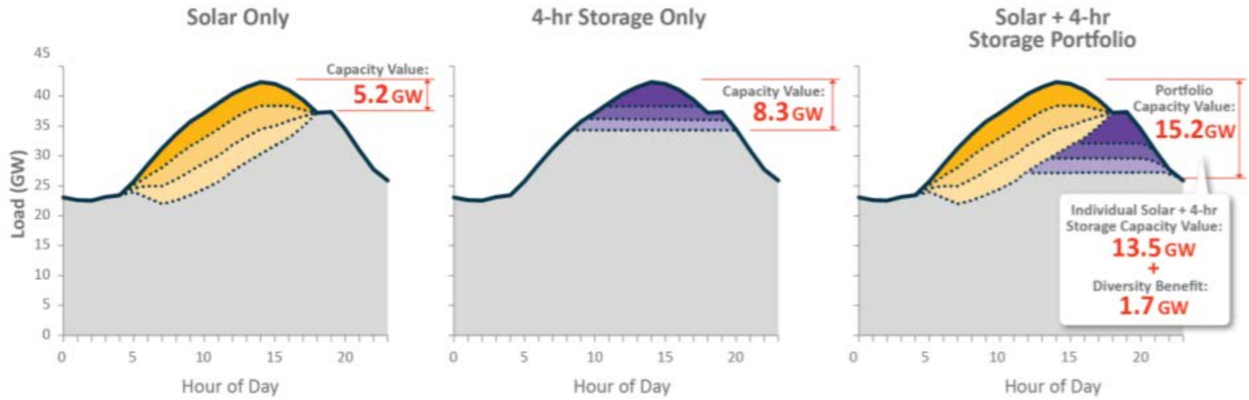
[4] For a discussion of why using a declining ELCC curve for each resource, the method employed in the Aurora capacity expansion model used by PSE, understates its true ELCC relative to E3's multi-dimensional approach, *see* Arne Olson et al., Energy and Environmental Economics, *ELCC Concepts and Considerations for Implementation* at slide 28-30 (Aug. 30, 2021), *available at* https://www.nyiso.com/documents/20142/24172725/NYISO%20ELCC_210820_August%2030%20Presentation.pdf.

[5] Zach Ming et al., *Resource Adequacy in the Pacific Northwest* at 61 (Energy and Environmental Economics Mar. 2019), *available at* https://www.ethree.com/wp-content/uploads/2019/03/E3_Resource_Adequacy_in_the_Pacific-Northwest_March_2019.pdf [hereinafter "Resource Adequacy in the Pacific Northwest"].

hypothetical power system). As a result, portfolios of wind, solar, and storage resources provide a capacity value that is greater than the sum of the capacity values of their component parts.

Figure 1: E3 chart showing complementary capacity value benefit between solar and storage[6]



Similarly, geographically diverse wind resources complement each other because their output profiles tend to be weakly correlated. For example, the experts at E3 found that Montana wind resources tend to be most productive during time periods when Pacific Northwest wind output is lower, and vice versa.[7] As a result, their combined output is greater than the sum of their parts; yet PSE's analysis did not account for that benefit. Montana wind output also tends to be high during periods when PSE's demand is high, so E3's analysis shows that nearly 20 GW of Montana and Wyoming wind can be added to the Pacific Northwest power system before the capacity value of that resource drops below 50% of its nameplate capacity.[8] As explained above, PSE should directly account for these output profile and capacity value synergies in its modeling of optimal portfolios of resource additions.

C. PSE Unreasonably Excluded Montana and Idaho Renewable Resources as Near-term CEIP Options

Despite its high-capacity value and low-cost, PSE excluded Montana wind additions from its analysis of resource options for the 2022-2025 CEIP period: "PSE did not evaluate any other resource mixes to achieve resource diversity. Montana wind, Wyoming wind, Idaho wind, Wyoming solar and Idaho solar were assumed to not be available in the 2022-2025 CEIP period due to transmission limitations. Similarly, resources such as offshore wind and pumped hydroelectric storage have long lead times that make them challenging to pursue in this CEIP period."[9] PSE must evaluate these additional resources in a revised plan for several reasons.

First, renewable resources from Montana and Idaho are available for delivery over PSE's existing transmission during the 2022-2025 CEIP period. PSE owns 758.5 MW of transmission

[6] Nick Schlag et al., *Capacity and Reliability Planning in the Era of Decarbonization* at 6 (E3 Aug. 2020), *available at* https://www.ethree.com/wp-content/uploads/2020/08/E3-Practical-Application-of-ELCC.pdf.
[7] Resource Adequacy in the Pacific Northwest at 55-56
[8] *Id.*
[9] Resp. to Sierra Club DR 7c.

capacity on the Broadview to Townsend segment of the Colstrip Transmission System. After the closure of Colstrip units 1 and 2, PSE's stake in the Colstrip coal plant now totals only 393 MW of nameplate capacity,[10] which will further drop to 0 MW when PSE exits Colstrip in 2025.

Second, several factors make it prudent for PSE to procure low-cost, high-capacity value renewable resources in the 2022-2025 CEIP period. PSE's states that it needs "369 MW of new electric capacity resources in 2026, which we expect will increase to 527 MW in 2027"[11] as it exits Colstrip. As noted above, E3 found that Montana wind resources offer a capacity value in excess of 50%, with significant output diversity relative to Pacific Northwest wind and solar resources. As a result, Montana wind resources are ideal for addressing PSE's stated reliability concerns regarding an over-reliance on Washington wind. Also, as discussed in the next section, PSE correctly concluded that front-loading renewable investment into the first CEIP period reduces risk and assists PSE with meeting CETA's requirements.

Even before PSE fully exits the Colstrip coal plant in 2025, PSE can deliver additional Montana wind resources over its 758.5 MW Colstrip Transmission System capacity. As noted above, PSE owns 393 MW of Colstrip coal capacity, which combined with the 350 MW of wind under construction at the Clearwater site in Montana totals only 743 MW of nameplate capacity, less than PSE's transmission capacity.

By taking advantage of output diversity among wind plants, and between wind and solar plants, PSE could likely interconnect large amounts of additional Montana renewable resources onto its Colstrip Transmission System capacity while keeping renewable curtailment to economically acceptable levels. Due to geographic diversity in wind output patterns across even relatively short distances,[12] multiple wind plants seldom produce at their full nameplate capacity at the same time. As a result, depending on the geographic diversity of the wind resources, it is economically optimal to interconnect 10-40% more wind capacity relative to available transmission capacity. For example, in its recent IRP, PacifiCorp found that in one case it could interconnect 1,100 MW of additional wind onto 800 MW of additional transmission capacity (wind capacity 37.5% higher than the available transmission capacity), while in another case it could add 1,920 MW of wind onto 1,700 MW of additional transmission capacity (13% more wind capacity).[13] In addition, PSE should add storage near renewable resources in Montana to limit transmission congestion by absorbing renewable energy that would otherwise be curtailed, and then discharging that energy when renewable output decreases or the transmission congestion is alleviated.

The Colstrip coal plant does not often operate at full output, particularly during spring and fall periods when wind output is highest, creating further opportunity to deliver Montana wind

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[10] *Thermal Power*, Puget Sound Energy, https://www.pse.com/pages/energy-supply/thermal-power (last visited Mar. 17, 2022).
[11] PSE 2021 CEIP at 120.
[12] Hannele Holttinen et al., *Design and Operation of Power Systems with Large Amounts of Wind Power*, IEA Wind Task 25, at 25 (2009), *available at* https://www.vttresearch.com/sites/default/files/pdf/tiedotteet/2009/T2493.pdf.
[13] PacifiCorp, *2019 Integrated Resource Plan*, Vol. 1 at 247 (Oct. 18, 2019), *available at* https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/integrated-resource-plan/2019_IRP_Volume_I.pdf.

resources to PSE's footprint over the Colstrip Transmission System. The Colstrip coal plant operated at a 77% capacity factor in 2021, with an average of 47% during April-June.[14] The plant's output can be further reduced during periods when its generation is uneconomic relative to zero marginal cost renewable resources, providing significant benefits for PSE ratepayers and the environment. In addition, if PSE's share of Colstrip Transmission System capacity is fully utilized during some hours, excess wind output could likely be delivered via other Colstrip Transmission System owners' capacity or sold to other market participants in Montana or elsewhere in the region via other transmission paths. Transmission losses and derates in the output of the Colstrip plant due to ambient conditions also create additional capacity to deliver renewable output over the Colstrip Transmission System.

Finally, PSE can also take steps to increase its transmission capacity to access additional renewable resources in the near term. Sierra Club's comments on PSE's draft IRP showed that PSE has many near-term options to increase transmission capacity to access diverse renewable resources.[15] As we noted, PSE has available numerous solutions it can implement within the next few years or even months using existing rights-of-way, such as deploying dynamic line ratings and other grid-enhancing technologies, replacing substation equipment, or reconductoring or adding new circuits to existing lines. PSE should include these steps, as well as initiating longer-term efforts to increase transmission access to in-state and regional renewable resources, in its 2022-2025 CEIP as they are essential for cost-effectively and reliably meeting PSE's clean energy and carbon reduction requirements.

D. PSE Should Evaluate the Potential Ratepayer and Environmental Benefits of Moving Some Investment from Distributed Energy Resources to Larger-Scale Resources

Distributed energy resources provide a range of important benefits. Still, PSE should evaluate whether it could maximize ratepayer and environmental benefits by shifting some investment from distributed to utility-scale resources. According to the utility, "PSE will incur a high incremental cost to meet the distributed energy resource subtarget; we expect none of these investments would be cost-effective before adopting CETA and considering customer benefit indicators."[16]

At a minimum, the Commission should direct PSE to evaluate the tradeoffs and quantify the net benefits of shifting the resource allocation towards more cost-effective utility-scale resources. PSE admitted that it had not analyzed whether ratepayer and environmental benefits can be better optimized by shifting investment from distributed to utility-scale resources.[17] An initial analysis of the cost figures provided in PSE's CEIP indicates that there may be large benefits from shifting the resource allocation towards utility-scale resources. Specifically, PSE's proposed

[14] Calculated based on just over 10 million MWh of generation from a 1480 MW nameplate capacity plant. Data available at: https://www.eia.gov/electricity/data/eia923/.
[15] Sierra Club, *Report on the Puget Sound Energy 2021 IRP Plan* at 36-44, No. UE-200304 (Wash. Utils. & Transp. Comm'n Feb. 25, 2021), *available at* https://apiproxy.utc.wa.gov/cases/GetDocument?docID=1395&year=2020&docketNumber=200304.
[16] PSE 2021 CEIP at 28.
[17] PSE Resp. to Sierra Club DR 6.

distributed storage and solar energy resource programs have a cost of $5.20/watt, while the utility-scale renewable and storage programs cost $2.36/watt.[18] That result indicates that by shifting distributed resources investment to utility-scale, the same level of emissions savings could be achieved at 55% lower cost, or alternatively the emissions reductions provided by the distributed subtarget could be more than doubled by directing the same investment towards utility-scale resources. Because lower-income communities are disproportionately harmed by both higher electric bills and pollution from fossil generation, societal equity goals may be better achieved by maximizing emissions reductions and minimizing cost through the economies of scale offered by investment in utility-scale generating resources. Still, we should be clear that utilities must maximize all cost-effective renewable resource options, from residential rooftop to utility-scale.

II. POSITIVE ASPECTS OF PSE'S CEIP

The CEIP addressed some of Sierra Club's concerns with the 2021 IRP, such as the IRP's use of outdated cost information for renewable and storage resources, resulting in a larger near-term deployment of renewable and storage resources in the CEIP.

PSE's CEIP also correctly concluded that there are significant benefits to deploying clean energy resources as soon as possible: "PSE prefers to take more aggressive early action in this first CEIP period as opposed to waiting until the second CEIP period when the costs and risks are less clear and could be higher."[19] PSE elaborated that "Puget Sound Energy ("PSE") considered a number of factors in determining the risks of waiting until the second Clean Energy Implementation Plan ("CEIP") period to take action. Those risks include uncertainty related to resource costs, higher inflation, the expiration of existing production tax credits, and the cost of emissions pursuant to the Climate Commitment Act. Given these future uncertainties, PSE believes it is prudent to take aggressive action in this first CEIP four-year period."[20]

However, as shown above, PSE could greatly increase its near-term deployment of low-cost and high-value clean energy resources, thereby further reducing emissions, ratepayer costs, and risks.

Finally, Sierra Club supports PSE's planned use of an all-source request for proposal ("RFP") to drive resource procurement decisions. All-source RFPs are a best practice for minimizing ratepayer costs by creating a level playing field on which resources can compete. We encourage PSE and the Commission to continue using all-source RFPs to address any future resource needs.

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[18] The 106 MW of distributed resource investment costs approximately $55 million while the 850 MW of utility-scale investment costs $201 million, based on data showing MW from each program in PSE's CEIP at pages 28 and 42, and cost at page 180.

[19] PSE 2021 CEIP at 25.

[20] Resp. to Sierra Club DR 5.

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Respectfully submitted,

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