From: pascoeenergy@aol.com
To: Records Management (UTC)
Cc: michele.kvam@pse.com
Subject: UE-200304 Pascoe Comments
Date: Friday, February 5, 2021 10:44:41 AM
Attachments: UE-200304_PascoeComments.pdf

External Email

Docket No. UE-200304
Puget Sound Energy 2021 Draft Electric IRP

COMMENTS of BILL PASCOE

I have participated in the last three PSE IRP processes as an active member of the various technical and stakeholder advisory groups. My Montana-based consulting business, Pascoe Energy Consulting, works with clients that are developing clean energy projects in Montana. As such, my role in the PSE IRP processes has been to advocate for Montana's clean energy resources and work to assure that these resources are properly characterized and evaluated in PSE's IRP analysis. The comments that follow are my own and are not those of specific clients of Pascoe Energy Consulting. I can be reached at pascoeenergy@aol.com or 406-560-2075.

1. **Relying on new build combustion turbines is risky.**

The Draft IRP includes four new combustion turbines (CTs) over the planning horizon with the first CT installation in 2026. Although CTs may appear attractive due to their relatively low capital cost and ability to be dispatched continuously during extreme weather events, this appears to be a risky path to follow.

New CTs will encounter significant opposition from PSE's customers who want PSE to avoid new investments in fossil fuel-fired generation. As a result, these units will be extremely difficult to permit.

The Draft IRP suggests that these units can, at some future time, be fired with non-carbon-emitting fuels. This may be a "silver bullet" solution for the Draft IRP, but there is enormous uncertainty about the availability and cost of these futuristic fuels, which creates substantial risk for PSE and its customers.

If, despite these risks, PSE decides to pursue CTs to backstop its system against extreme weather events, PSE should move aggressively to acquire utility-scale energy storage as soon as possible to reduce the use of its existing gas-fired generators to meet requirements for daily energy shaping, load following and ancillary services under non-emergency operating conditions.

2. Pumped storage hydro is undervalued in the Draft IRP.

Pumped storage hydro (PSH) is far and away the world leader in utility-scale energy storage installed capacity. PSH has been demonstrated by many successful projects and comes with little technological risk.

However, the Draft IRP appears to prefer batteries to PSH. This preference appears to be the result of modelling methods and assumptions that systematically undervalue PSH relative to batteries.

The generic 8-hour PSH resource modelled in the Draft IRP has a nameplate capital cost (per kilowatt) that is roughly 30% higher than the preferred 4-hour lithium battery. [Draft IRP, pages 5-28 and D-74] However, this initial cost disadvantage is more than offset by 8-hour PSH providing 50% more ELCC capacity than 4-hour lithium batteries. [Draft IRP, page 2-12]

The Draft IRP's levelized cost of capacity analysis shows that the cost per effective kilowatt is approximately the same for 8-hour PSH and 4-hour lithium batteries. [Draft IRP, page 8-25] However, this analysis credits much more "revenue" to the batteries than to PSH resulting in a lower net levelized cost of capacity for the batteries.

This difference in "revenue" or dispatch value could be the result of a couple of factors. First, it is not clear from Figure 8-12 if the analysis is based on the same amount of capacity for PSH and batteries. If the analysis is comparing the first 25 MW of batteries against the first 100 MW of PSH, this would favor the batteries since the first increment of any resource has more dispatch value than successive increments due to saturations effects.

Second, and more importantly, the Draft IRP models batteries with much more flexible operating characteristics than PSH. [Draft IRP, page D-74] Figure D-32 shows operating characteristics for PSH that reflect older technology. Modern quaternary technology that will be deployed at the Gordon Butte PSH project in Montana makes the full operating range available, similar to batteries but with no degradation effects. The dispatch value of 8-hour PSH with the full operating range provided by modern technology should exceed the dispatch value of 4-hour lithium batteries and result in an equal or lower net levelized cost of capacity.

Figure D-32 also includes other assumptions that disfavor PSH. The useful life of PSH is shown as 30 years (same as batteries) while hydroelectric facilities commonly have useful lives of 50 to 60 years and even longer. The first year available for PSH is shown as 2028 while Gordon Butte is fully licensed and permitted and could be on-line as soon as 2025 or 2026. There are other Pacific Northwest PSH projects that also appear to be positioned to beat a 2028 on-line date. Finally, it is not at all clear from Figure D-32 how battery degradation is accounted for in the Draft IRP analysis.

3. Montana Wind is PSE's best renewable resource option.

The Draft IRP correctly concludes that Montana Wind is the best renewable resource option for PSE based on the high capacity factors and high ELCC capacity values of the Montana Wind resource.

However, the Draft IRP incorrectly suggests that Montana Wind and Wyoming Wind have comparable delivered costs. Wyoming Wind does have capacity factors and capacity values similar to Montana Wind. However, transmission costs from Wyoming are much higher than transmission costs from Montana. This is not surprising since PSE has 750 MW of existing transmission rights in the Colstrip Transmission System (CTS), BPA Montana Intertie (BPA-MI) and across the BPA Main Grid to PSE's system that have been historically used to deliver PSE's Colstrip generation. The CTS and BPA-MI were built in the 1980's at costs representative of that era and have since been substantially depreciated resulting in the current transmission rates shown in Table 1.

Table 1 - Existing Montana Transmission to Reach BPA Main Grid @ Garrison

Segment	CTS /1	BPA-MI /2	Total
Rate ($/kw-mo)	$ 0.83	$ 0.51	$ 1.34

/1 - Colstrip Transmission System
/2 - BPA Montana Intertie

In addition, the Colstrip owners and BPA have studied the cost of adding transfer capacity to the CTS and BPA-MI (and beyond to Mid-C) by adding additional substation equipment along these facilities. Rough transmission rates for these upgrades are shown in Table 2.

Table 2 - Montana Transmission Upgrades to Reach BPA Main Grid @ Mid-Columbia

Segment	CTS+MI /1	M2W /2	Total
Capacity (MW) /3	800	550	
Capital Cost (million$) /3	$ 252	$ 140	
Capital Cost ($/kw)	$ 315	$ 255	
Annual Cost ($/kw) /4	$ 48.83	$ 39.45	
Rate ($/kw-mo)	$ 4.07	$ 3.29	$ 7.36

/1 - Colstrip Transmission System & BPA Montana Intertie
/2 - BPA Montana to Washington project
/3 - Montana Renewables Development Action Plan, June 2018
/4- Annualization factor of 15.5% based on ratio of Gross Rev Req to Net Plant in PSE 2020 Formula Rate Filing

On the other hand, accessing Wyoming Wind would require building major new transmission projects across Wyoming and Idaho to reach the BPA Main Grid. The projects currently under consideration are the Gateway West and Boardman to Hemingway 500 kV lines. Rough transmission rates for these projects are shown in Table 3.

Table 3 - New Wyoming/Idaho Transmission to Reach BPA Main Grid @ Boardman

Segment	GW /1	B2H /2	Total
Capacity (MW) /3	1,700	1,000	
Capital Cost (million$) /4	$ 2,922	$ 1,183	
Capital Cost ($/kw)	$ 1,719	$ 1,183	
Annual Cost ($/kw) /5	$ 266.42	$ 183.37	
Rate ($/kw-mo)	$ 22.20	$ 15.28	$ 37.48

/1 - Gateway West project
/2 - Boardman to Hemingway project
/3 - WECC Path Rating Catalog
/4 - NTTG 2018-2019 Regional Transmission Plan
/5- Annualization factor of 15.5% based on ratio of Gross Rev Req to Net Plant in PSE 2020 Formula Rate Filing

Although these transmission rate estimates are rough and more refined estimates may narrow the gap to some extent, the huge spread between the transmission rates clearly shows that transmission costs from Wyoming (Table 3) are much higher than the existing Montana transmission rights controlled by PSE (Table 1) and upgrades to the CTS and BPA systems (Table 2). Note that these results are dramatically different than the Draft IRP which shows transmission costs from Montana and Wyoming to be substantially equivalent. [Draft IRP, pages 5-42 and 8-26]

Based on these high-level transmission cost estimates, PSE should move as quickly as possible to acquire 750 MW of Montana Wind as soon as its existing Montana transmission rights are available. PSE should also evaluate the opportunity to acquire additional Montana Wind by funding the transmission upgrades shown in Table 2.

Given the advantages of Montana Wind over other renewable resource options available to PSE and the finite transmission capacity availability from Montana, PSE should also evaluate combining Montana Wind with Montana PSH. In addition to increasing the ELCC of the resources delivered over PSE's Montana transmission rights, this combination would allow PSE to acquire additional low-cost Montana Wind and use the PSH to reshape the additional wind energy to fit (with occasional clipping or use of non-firm transmission) within PSE's available firm transmission rights.