Energy Storage in PSE's IRP

October 20, 2017

Introduction

CENSE (Coalition of Eastside Neighborhoods for Sensible Energy) is pleased with the UTC's *Policy Statement on Treatment of Energy Storage Technologies in Integrated Resource Planning and Resource Acquisition*, issued on October 11, 2017.

CENSE is especially attentive to the following paragraph in the Policy Statement:

> *At its core, the IRP process is the basis for utilities to plan for and procure resources to meet system load. To that end, utilities must be able to demonstrate in any prudence determination for a new resource acquisition that their analysis of resource options included a storage alternative. In such analyses, utilities must demonstrate that they have reasonably considered all of the costs and benefits of each option, to allow for comparison on similar terms and planning assumptions. This policy applies to investments in generation and distribution projects, as well as* ***transmission projects that have not been selected for regional cost allocation through a regional transmission planning process pursuant to the Federal Energy Regulatory Commission's Order 1000****.*[1]

The bold text perfectly describes two transmission projects that PSE has included in Chapter 8 of its Draft IRP: *Energize Eastside* and the *Lake Hills-Phantom Lake 115kV Transmission Line*.

As the UTC is aware, Energize Eastside was not selected for regional cost allocation. This was the primary reason FERC dismissed a complaint filed by CENSE and Citizens for Sane Eastside Energy in 2015:

> *The record before us shows that the Energize Eastside Project is located completely within Puget Sound's service territory, that it was included in Puget Sound's local transmission plan to meet Puget Sound's reliability needs, and that neither Puget Sound, nor any other eligible party, requested to have the project selected in the regional transmission plan for purposes of cost allocation; therefore,* ***the project is not subject to the Order No. 1000 regional approval process****…*[2]

Although both of PSE's transmission projects fall under the same exemption from Order 1000, there are differences in how PSE analyzed energy storage as an adjunct or alternative for each.

For Energize Eastside, PSE hired Strategen to analyze the potential of energy storage in 2015. We find this report to be full of outdated assumptions, unexplained limitations, and absurd conclusions. We elaborate later in this document.

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[1] https://www.utc.wa.gov/_layouts/15/CasesPublicWebsite/GetDocument.ashx?docID=113&year=2015&docketNumber=151069, p. 10

[2] https://energizeeastside2.blob.core.windows.net/media/Default/Library/Reports/2015_1021_FERC_OrderDismissingComplaint.pdf, p. 24

For the Lake Hills project, PSE never analyzed energy storage or any other cost-effective solution such as FLISR (Fault Location, Isolation, and Service Restoration).[3] CENSE has hired Northern Plains Power Technologies to analyze FLISR's potential to provide better reliability at lower cost and lower environmental impact than PSE's proposed transmission line. We will mention the possibility of an energy storage solution later in this document.

Storage analysis for Energize Eastside

PSE's Energize Eastside project deserves careful analysis of energy storage as a cost-effective, less destructive alternative. Energize Eastside was proposed in 2013, before energy storage was feasible. PSE hired E3 to analyze a "non-wires solution" in 2014, and batteries were not even mentioned as a technology that might play a role. In 2015, PSE hired Strategen to augment E3's study with energy storage, but there are flaws with Strategen's report.

In its Draft IRP, PSE selected Energize Eastside "to illustrate the evaluation, analysis and community involvement PSE performs in the process of making system improvement decisions."[4] If Energize Eastside is a good example of how transmission upgrades are documented in the IRP, it can serve as a case study for how the UTC's new Policy Statement will be applied.

The first step is to correct significant flaws in the Strategen report. Here are a few that we noticed:

1. Strategen did not update E3's finding of a 14 MW shortfall in 2021. This predicted shortfall is now 3-4 years out of date, and some significant changes have occurred. For example, in 2016 PSE found that customers conserved 7% more electricity than the company had predicted. This higher rate of conservation could significantly reduce the shortfall or delay the need for several years. PSE's IRP would implement more demand response than E3 anticipated in 2014. This could reduce the magnitude of demand peaks and the size of the shortfall. Updating this crucial number is important in determining the size of energy storage that is needed.

2. Strategen states that a battery must be five times bigger than the need, due to a "21% effectiveness factor."[5] This factor seems low compared to other utilities. We would like to see comparisons with other grid battery installations to verify that it is reasonable.

3. Strategen concludes that the battery should be rated to deliver 121 MW or 328 MW, depending on coverage levels. These ratings imply effectiveness factors of 11.5% or 4%, respectively. Strategen explains these unusually low values are "due to many factors, such as: 1) the number of transformers serving the area, (2) system impedance, and 3) **use of the Eastside facilities for energy transfer not related to local demand.**" Do these non-local transfers serve *regional* demand that FERC stated was not the purpose of this project?

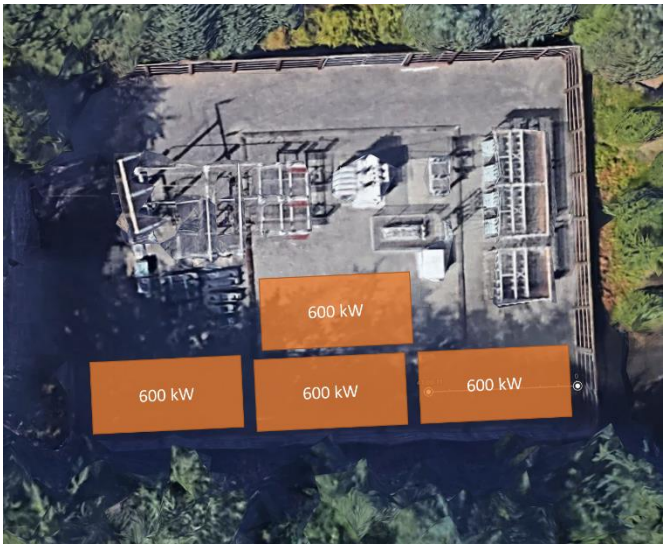
4. Strategen assumed that lithium ion batteries would be used instead of flow batteries. See the "2% per year cell degradation rate" footnote on page 15. Flow batteries, which PSE has since determined would be more cost-effective than lithium ion batteries, do not have cells that

[3] https://www.greentechmedia.com/articles/read/flisr-when-an-hour-outage-becomes-two-minutes
[4] https://pse.com/aboutpse/EnergySupply/Documents/IRP17_Ch8.pdf, p. 8-30
[5] http://www.energizeeastsideeis.org/uploads/4/7/3/1/47314045/eastside_system_energy_storage_alternatives_screening_study_march_2015.pdf, p. 14

degrade at a measurable annual rate.

5. Strategen appears to restrict the analysis to a large, centrally-located grid battery. In the years that have passed since this study was concluded, residential and commercial "behind-the-meter" batteries have entered the market. Furthermore, it will soon become possible to tap idle batteries in electric vehicles to serve demand peaks. Grid batteries can be distributed throughout neighborhood substations. Would any of these solutions address the "system impedance" issues that Strategen assumes would reduce effectiveness?

On the last point, we can illustrate the potential of flow batteries placed in neighborhood substations using overhead photos from Google maps overlaid with appropriately scaled flow batteries (dimensions were taken from specifications published by UniEnergy Technologies). Here we show multiple 600 kW batteries (500 kW peak for 4 hours) placed in the Lake Hills and Phantom Lake substations:



Lake Hills substation

Phantom Lake substation

The flow batteries from UniEnergy Technologies can be stacked, effectively doubling the capacity for a given footprint. Stacking batteries could raise the combined rating for these two substations to 10.8 MW, a significant percentage of E3's shortfall. There are other substations that could accommodate batteries. A solution like this could defer or eliminate the need for both transmission projects, thus saving ratepayer dollars.

We ask PSE to perform a thorough study of the costs of locating batteries in substations. The analysis should include expected price reductions for batteries as well as multiple benefits, such as deferral of transmission investments, increased effectiveness of renewable energy, power outage backup, increased grid resilience and diversity, lower construction impact on the community, and lower risk of distributed facilities compared to a single centrally-located battery. If such a plan is not economically feasible today, it would be helpful to know what storage cost would make this scenario attractive. We also ask PSE to compare this proposal with "behind the meter" storage located in homes and businesses.

Future grid

Although we appreciate the UTC's Policy Statement regarding energy storage, it only hints at a future of ubiquitous, low-cost energy storage that is approaching rapidly.

Costs have fallen dramatically in the last five years, and additional reductions appear likely. MIT is experimenting with a battery made of inexpensive sulfur, water, and salt.[6] Stanford has a battery based on sodium.[7] Both teams estimate their batteries will cost one-fifth of the lithium ion batteries that are popular today. Will one of these become available commercially? It is hard to say which battery designs will become dominant, but there are many smart people racing to capture this enormous market. Batteries will become a major component in our future grid.

The falling price of batteries is matched by declining costs for renewable energy like wind and solar:

> *Electricity utilities that perform best going forward will likely be those that strategically transition to renewable energy-based business models in a way that avoids the financial damage typically incurred by late movers.*[8]

The era of batteries will supplant the need to construct expensive and destructive transmission lines through residential communities. Although transmission lines may still be needed to transport renewable electricity from wind and solar farms to urban centers, neither Energize Eastside nor the Lake Hills project serve this purpose. Both are intended to fix future reliability problems after an emergency has caused failure in PSE's transmission network. However, batteries can address the same issue. If batteries aren't less expensive than a transmission line now, they soon will be. PSE's analysis should make this crossover point clear.

Conclusion

The potential benefits of batteries for ratepayers and the environment are growing quickly. However, PSE's transmission projects are more predictably profitable for the company than batteries. The interests and aspirations of PSE and ratepayers will remain at odds until the UTC provides financial incentives for utilities that support the new Policy Statement.

Is there a win-win scenario for both PSE and the communities it serves? We think so! Ratepayers could reap substantial savings if PSE invests in batteries incrementally, rather than investing $300 million in an inflexible transmission project with much more capacity than the Eastside may need in the future.

The UTC could incentivize smaller financial investments in smart solutions by increasing the allowed return on investment for modern, environmentally responsible technologies. Perhaps a 15-18 percent rate of return would increase PSE's interest in batteries and other solutions that reduce peak demand and greenhouse gas emissions (demand response, electrical efficiency, distributed generation, etc.)

Even with higher returns for PSE, ratepayers will save money. PSE will become a more efficient, attractive, and profitable company.

This outcome would better reflect the environmental values and innovation of the Pacific Northwest.

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[6] https://newatlas.com/air-breathing-battery/51720/

[7] https://newatlas.com/sodium-ion-battery-cheaper-lithium/51682/

[8] https://cleantechnica.com/2017/10/12/utilities-scramble-catch-stunning-fall-renewable-energy-costs/