

PacifiCorp - Stakeholder Feedback Form

2019 Integrated Resource Plan

PacifiCorp (the Company) requests that stakeholders provide feedback to the Company upon the conclusion of each public input meeting and/or stakeholder conference calls, as scheduled. PacifiCorp values the input of its active and engaged stakeholder group, and stakeholder feedback is critical to the IRP public input process. PacifiCorp requests that stakeholders provide comments using this form, which will allow the Company to more easily review and summarize comments by topic and to readily identify specific recommendations, if any, being provided. Information collected will be used to better inform issues included in the 2019 IRP, including, but not limited to the process, assumptions, and analysis. In order to maintain open communication and provide the broader Stakeholder community with useful information, the Company will generally post all appropriate feedback on the IRP website unless you request otherwise, below.

Date of Submittal 7/23/2018

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Public Meeting Date comments address: 6/29/2018

Check here if not related to specific meeting

List additional organization attendees at cited meeting: _____

***IRP Topic(s) and/or Agenda Items:** List the specific topics that are being addressed in your comments.

Storage

Portfolio Construction

Scenarios

Supplemental Studies - Flexible Capacity Reserve Study

Supplemental Studies - Bulk Energy Storage Study (from 2017 IRP)

Supplemental Studies - Resource Adequacy / Market Reliance Study

Check here if any of the following information being submitted is copyrighted or confidential.

***Respondent Comment:** Please provide your feedback for each IRP topic listed above.

INTRODUCTION:

National Grid USA ("National Grid") and Rye Development, LLC ("Rye") are proud to be involved with the development of the two most promising pumped storage projects in the Pacific Northwest: the Swan Lake North Project in southern Oregon ("Swan Lake") and the Goldendale Energy Storage Project in southern Washington ("Goldendale"). Not only can these projects provide significant reductions in greenhouse gas (GHG) emissions and help states in the Pacific Northwest meet their GHG reduction goals, they also utilize environmentally-friendly "closed-loop" technology, are located near high voltage transmission corridors, and will be able to provide unmatched flexibility as a resource by serving multiple roles and providing stacked energy, capacity, and other reliability and economic benefits on a utility and/or regional basis. National Grid and Rye are jointly developing these projects and we anticipate a COD of 2024 for Swan Lake and 2028 for Goldendale.

GENERAL COMMENTS:

* Required fields

National Grid and Rye appreciate PacifiCorp's examination of bulk storage separately from battery storage in the studies undertaken for its 2017 IRP and we are encouraged by Pacificorp's commitment to more granular modeling of pumped storage systems in future IRPs. Given that pumped storage is a much more mature technology than most other forms of energy storage, and that it is deployable at significantly larger scales and has a useful life of three to four times longer than battery storage, National Grid and Rye request that pumped storage be considered as a separately-studied resource throughout PacifiCorp's modeling and analyses for the 2019 IRP, including sensitivities that specifically address new pumped storage. Furthermore, because the costs of pumped hydro facilities can vary significantly by site, and because potential sites for pumped storage on the high-voltage transmission system are limited by geography and other strategic considerations, we encourage PacifiCorp to consider site-specific information from existing, in-development resources in its analyses whenever possible to reduce uncertainty and produce more accurate results. We would be happy to provide details on the performance characteristics of our projects if PacifiCorp would like to use them in its analyses.

We urge PacifiCorp to give these issues comprehensive consideration in the current planning process. It is important that these issues be considered now, given the long lead timelines for permitting both natural gas and pumped storage facilities and the potential reliability issues associated with 1) the impending medium-term "capacity cliff" in the PNW region¹, and 2) PacifiCorp's anticipated retirements of a large portion of its dispatchable coal-fired resources (loss of 3,650 MW by 2036) combined with the planned addition of new variable wind and solar resources (2,700 MW and 1,860 MW, respectively, by 2036) without plans to add any spinning mass/rotating inertia to the system.² The importance of considering these issues now is elevated by concerns expressed by PNW regulatory commissions about over-reliance on the market/front-office transactions (FOTs) to provide capacity.³ We request that PacifiCorp:

- Give detailed consideration to the value of grid-scale storage in its 2019 IRP Supplemental Studies (especially the anticipated studies of Resource Adequacy/Market Reliance, Flexible Capacity Reserves, and any energy storage studies);
- Incorporate the value of pumped storage into considerations of intra-hour/EIM interactions and taking advantage of the solar oversupply from California; and
- Use caution with assumptions related to battery storage, for example, aggressive battery cost declines and optimistic degradation curves.

PacifiCorp Response:

The Resource Adequacy/Market Reliance study is not resource specific, as the presence of particular types of capacity resources in PacifiCorp's portfolio are not expected to change the maximum level of market reliance for Integrated Resource Plan (IRP) study purposes. Similarly, the Flexible Reserve Study primarily addresses the size of PacifiCorp's flexible reserve needs rather than the composition of portfolios which would serve those needs.

PacifiCorp has calculated Intra-hour Flexible Resource Credits for a range of pumped storage resources, as discussed in the October 9, 2018 public input meeting. These credits are based on Energy Imbalance Market (EIM) prices that reflect the load and resource balance of the entire EIM footprint, including solar resources in California.

In addition to these general comments, National Grid and Rye offer the following comments on more specific topics.

¹ See, for example, predictions of regional inadequacy by 2021 in the Pacific Northwest Power Supply Adequacy Assessment for 2023 at <https://www.nwcouncil.org/reports/pacific-northwest-power-supply-adequacy-assessment-2023>

² Pages 54 and 60 at

http://www.pacificcorp.com/content/dam/pacificcorp/doc/Energy_Sources/Integrated_Resource_Plan/2019_IRP/PacifiCorp_2019_IRP_PIM_June_28-29_2018_PUBLIC.pdf

³ For example, Washington Utilities and Transportation Commission's Letter Acknowledging Puget Sound Energy's 2017 Electric and Natural Gas Integrated Resource Plan, Docket UE-160918.

* Required fields

PORTFOLIO CONSTRUCTION

As PacifiCorp begins to construct the resource portfolios that will be included in its next IRP, National Grid and Rye request that it conduct a thorough analysis of the following portfolios.

First, a portfolio that has a large (e.g., ~400 MW) pumped storage facility as an anchor resource, with other resource additions added to optimize the portfolio, and which includes consideration of all of the following:

- The benefits a pumped storage resource can provide to a utility participating in the California Independent System Operator's Energy Imbalance Market ("EIM");
- The ability of pumped storage to leverage existing transmission and rights and provide for a more optimized use of transmission facilities;
- The ability of long-duration pumped storage resources to provide energy arbitrage;
- The potential for pumped storage to enhance and optimize the deployment of current and planned renewable facilities;
- The ability of pumped storage to allow existing generation plants to maintain optimal set points to minimize cycling and operations and maintenance costs;
- Other "portfolio effects" across PacifiCorp's generation fleet that would be provided by pumped storage resources;
- Life-cycle cost benefits due to the long lifespan of pumped storage assets (50 years); and
- The fact that pumped storage resources are highly adaptive to many "use cases" over time and provide many essential grid services, given their unparalleled flexibility.

PacifiCorp Response:

Pumped storage resources with up-to-date costs and operating characteristics are available to be selected and compete with other supply-side resources options. In addition, PacifiCorp may evaluate portfolio performance metrics as part of its portfolio evaluation. PacifiCorp may also consider these portfolio recommendations for specific portfolios regarding pumped storage.

Second, a portfolio that specifically models Swan Lake, given the lack of other attractive and mature pumped storage projects in the region.

And third, comparison cases of including vs. excluding Swan Lake in each portfolio and sensitivity that PacifiCorp ultimately elects to run.

SCENARIO PLANNING

National Grid and Rye understand that the IRP process must consider numerous future potential scenarios and account for significant uncertainty. Although there is no perfect way to account for the uncertainty inherent in long-term planning exercises, National Grid and Rye believe that PacifiCorp should, at a minimum, consider the following scenarios and variables, as they represent possible (perhaps likely) ways the future might unfold:

- Increased reliance on the EIM, inefficient spot markets without unit commitment, and increased intra-hour market volatility, which is likely to result in increased revenue for new pumped storage;
- Increasing environmental and operational constraints on the Northwest hydropower system, and greater variation in hydro years (i.e., more extreme wet/dry years due to climate change, and fewer "normal" years);
- Low adoption of electric vehicle ("EV") smart charging and potential interaction with/likely need for more storage to integrate renewables;

- Increased demand, further exacerbating the need for peaking resources, potentially coupled with increased EV adoption resulting in load increases and/or increased penetration of renewable generation facilities;
- High distributed energy resource (“DER”) penetration with specific consideration of the probability that DERs will be available/serve as anticipated (i.e, reliability likelihood);
- State of California passage of 100% clean energy requirements, likely resulting in regional spillage of increased excess solar from California, and potential for increased imports into CA from the PNW (we suggest incorporating the study on transfers between PNW and CA that CAISO is doing for the 2018-19 Transmission Plan (study underway, see <http://www.aiso.com/Documents/FinalStudyScopeforTransfersbetweenPacificNorthwestandCalifornia.pdf> and <http://www.aiso.com/planning/Pages/TransmissionPlanning/2018-2019TransmissionPlanningProcess.aspx>);
- While PacifiCorp's 2017 IRP showed no new thermal resources, it is still important to acknowledge the extreme political/social opposition to building new thermal resources, despite need for high flexibility;
- Battery cost declines that level out or decline at slower rates than historic trends, and faster than forecasted degradation, given high cycling rates (e.g., higher costs for Li-ion, given supply constraints (including cobalt) and increased demand); and
- Increasing demand for, and value placed on, flexible capacity, as compared to energy generation.

National Grid and Rye understand there are challenges and limitations to analyzing this wide range of scenarios and variables but even if analyzed at a lower level of rigor than other IRP analyses, consideration of the above scenarios will still be valuable and informative for the IRP process because it will contribute an important understanding to the robustness of a resource under a highly uncertain future.

FLEXIBLE CAPACITY RESERVE STUDY

National Grid and Rye request that PacifiCorp specifically consider pumped hydro storage as a resource in its next Flexible Reserve Study, using current performance characteristics reflecting the capabilities of modern pumped hydro storage facilities. Adding pumped hydro storage to PacifiCorp’s portfolio will increase the availability of other flexible resources while also minimizing GHG emissions.

PacifiCorp Response:

The Flexible Reserve Study has two components: the study first assesses the Company’s flexible reserve requirements, which are necessary to compensate for uncontrolled variations in load and resources, such as wind and solar. No dispatchable resources are considered as part of this assessment. The second part of the Flexible Reserve Study assesses whether the flexible reserve capability of the Company’s portfolio are sufficient to meet its obligations. Most of the Company’s Flexible Reserve requirements are reflected in its planning and risk (PaR) model, so the availability of additional flexible units can provide direct benefits. The Company has identified, and will be assessing separately, some multi-hour ramping constraints that may require additional flexibility that is not considered within the PaR model. To the extent any portfolios do not maintain adequate flexibility to cover these obligations, their results may be adjusted to compensate, potentially via the addition of flexible resources or other additional costs.

UPDATES TO BULK ENERGY STORAGE STUDY (2017 IRP)

National Grid and Rye request that PacifiCorp incorporate up-to-date cost and technology specifications in its next IRP. Preferably, this information would be specific to sites under development in the region (i.e. Swan Lake). In any event, the 2016 Bulk Storage Study by Black & Veatch should be updated with information on current pricing from turbine manufacturers and capabilities of new variable-speed projects in operation and under construction globally. It is important that PacifiCorp’s studies are based on operations data for new variable speed turbines because, unlike the turbines used in older pumped storage facilities, the new turbines can provide the ten-minute ramping capability needed to integrate renewable resources.

* Required fields

For example, below are pumped storage specs that should be updated with current data from turbine vendors on new, variable-speed pumped storage projects. National Grid and Rye would be happy to facilitate the updating of this information using up-to-date specs from, for example, our industry partners (e.g., General Electric). These specs include: minimum turndown capacity, ramp rate, start time to full load, scheduled maintenance, equivalent forced outage rate, EPC period, overnight EPC capital cost, owner's cost allowance, overnight total capital cost, overnight total capital cost standard deviation, fixed O&M costs, nonfuel variable O&M cost, decommissioning cost, round trip efficiency.

PacifiCorp Response:

PacifiCorp has Burns and McDonnell updating cost and performance assumptions around storage technologies for consideration in the 2019 IRP. This topic was discussed further at the July 26-27, 2018 public input meeting.

STUDY OF RESOURCE ADEQUACY / MARKET RELIANCE

National Grid and Rye recommend that studies of the potential to rely on markets for capacity consider both the availability and the economics of market resources; a market cannot be characterized by quantities alone. Additionally, National Grid and Rye recommend inclusion and consideration of:

Further aggressive growth of renewable generation in California. For example, California has already enacted a 50% Renewable Portfolio Standard (RPS), there has been a significant uptick in Power Purchase Agreements with Community Choice Aggregators and commercial and industrial customers seeking to exceed the RPS requirements, and there is pending California legislation that would further drive renewable generation growth. The EIM and its expanding footprint, and the potential for a Day-Ahead market. PacifiCorp's transmission access and Intertie rights.

National Grid and Rye also recommend that the Market Reliance Study include consideration of the limits and constraints of non-PacifiCorp-owned capacity that is available to the company on the market, and consideration of the higher flexibility value from a potential PacifiCorp-owned pumped storage facility, which would not be subject to such constraints on its utilization.

Additionally, based on the current market outlook and likely future scenarios—including the likely probability that the region will be short of flexible capacity due to increased renewable penetrations, pressure from California for the EIM/Pacific Northwest to provide reliability services without any new flexible capacity builds across the West Coast states, and significant retirements from the thermal fleet—National Grid and Rye suggest that the Market Reliance Study should carefully consider and seek to understand these risks in order to inform decisions for the next IRP. In particular, these risks should be carefully considered to ensure PacifiCorp pursues a portfolio with the appropriate duration/life-span and mix of new resources that will best protect ratepayers, while also ensuring its future resource mix is flexible enough to extract value, regardless of how future markets evolve. To do so, PacifiCorp must give thorough consideration to highly flexible resources like pumped storage.

Data Support: If applicable, provide any documents, hyper-links, etc. in support of comments. (i.e. gas forecast is too high - this forecast from EIA is more appropriate). If electronic attachments are provided with your comments, please list those attachment names here.

<http://www.aiso.com/Documents/FinalStudyScopeforTransfersbetweenPacificNorthwestandCalifornia.pdf> and <http://www.aiso.com/planning/Pages/TransmissionPlanning/2018-2019TransmissionPlanningProcess.aspx>

Recommendations: Provide any additional recommendations if not included above - specificity is greatly appreciated.

Recommendations are described in comments above.

* Required fields

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- Check here if you do **not** want your Stakeholder feedback and accompanying materials posted to the IRP website.

Thank you for participating.