

Integrated Resource Plan (IRP) Stakeholder Meeting on Delivery System Planning: Summary

v. 6/30/2022

Meeting details

- Monday, June 6 from 9 a.m. – 12 p.m.
- Links to:
 - [Meeting materials](#) (e.g. hot sheet and presentations)
 - [Meeting recording](#)

Action Items from June 6 Delivery System Planning Stakeholder Meeting

What	Who
Follow up with Renewable Northwest to discuss other utilities using cost information from RFPs.	Completed, PSE followed up with Renewable Northwest
Follow up with Don Marsh about the inclusion of solar in Energize Eastside.	Completed, see feedback report
Respond to Willard Westre's question: What is PSE doing to capture Non-Firm transmission line capacity?	Completed, see feedback report
Look into suggested research on the warming impacts of hydrogen leakage.	Completed, PSE reviewed the report and will ensure concerns are considered
Follow up with Climate Solution's questions on green hydrogen.	Completed, see feedback report
Provide a summary of work on hydrogen analysis to the Northwest Energy Coalition (NWEC).	Completed, see feedback report
Provide H2 partnership information to David Tomlinson.	Completed

Summary of IRP Comments and Questions during the Meeting

- **Follow up from March IRP meetings:**

This information can be found on [slides 7-9](#) of the presentation

- Kara Durbin shared how input from the March IRP meetings is shaping PSE's work, including assumptions around battery degradation, transmission length for battery installation, and the social cost of carbon.
- Feedback included:
 - A request from Renewable Northwest to understand more about why PSE cannot use bids for cost information due to confidentiality issues when this is a common industry practice. PSE will connect with the Resource Acquisition team and reach out to Renewable Northwest to learn more about how other utilities are using that approach.

- It is difficult to find materials and navigate the new PSE website layout for IRP meetings.
- **Delivery System Planning (DSP) Overview**
This information can be found on slides [11-12](#) of the presentation.
 - PSE reviewed the participation objectives for the meeting and provided an overview of the presentation, which included the Delivery System Planning (DSP) approach, grid and pipeline modernization, and updates to the hosting capacity map.
- **Delivery System Planning Ongoing Improvements**
This information can be found on slides [13-18](#) of the presentation.
 - PSE reviewed the historic IRP and DSP integration process and shared an overview of DSP and how it relates to the current IRP process. IRP and DSP are linked in the sense that the IRP optimizes resources to deliver power to the grid, and DSP ensures that electricity and gas are delivered to PSE customers.
 - Feedback included:
 - There is a missed opportunity to examine cost reductions in addition to distribution upgrades.
 - There was a request to see more specificity in the value of system services.
 - PSE actions and investments should match aspirations.
 - There was a suggestion that PSE needs to be more proactive in discussions and in their work with the Bonneville Power Administration (BPA) to develop renewables in the western part of the state.
 - DERs are not cost effective.
- **Grid Modernization**
This information can be found on slides [18-29](#) of the presentation.
 - PSE discussed their approach to grid modernization to be PSE customers' "clean energy provider of choice," which includes minimizing outages and impacts on the service territory. PSE has new initiatives to advance the grid, including a grid modernization strategy that was integrated into the Clean Energy Implementation Plan (CEIP). PSE sees an increase in DER options and grid modernization investments in the future.
 - Feedback included:
 - Concern about the lack of discussion around the lowest reasonable cost in the IRP process, and concern that IRP stakeholders are being excluded from the IRP process.
 - Excitement for the advancement of microgrids.
 - PSE shared investments and planning related to gas with the goal of minimizing emissions and eliminating leaks from the system. PSE is installing modern materials, looking into alternative fuels, and ensuring the system can support future needs.
 - PSE also discussed current efforts to test hydrogen components on the pipeline, a hybrid heating pilot, clean alternative fuels, the integration of renewable natural gases (RNGs) and reducing methane emissions.
 - Feedback included:

- It is important for PSE to address risk management for hydrogen leakage, and suggested information on the warming impacts of hydrogen leakage: <https://acp.copernicus.org/preprints/acp-2022-91/>.
 - Concerns about the suitability of hydrogen for heating and the cost and risks of hydrogen.
 - Suggestion that PSE use funds to explore other environmentally friendly energy storage, including gravity storage.
 - Concerns about hydrogen and RNG as cost effective solutions.
- **Delivery System Planning – Integrating Different Voices**
This information can be found on slides 30-38 of the presentation.
 - PSE shared an overview of the DSP enhancements underway and reviewed the factors that are evaluated during system planning and how PSE identifies needs. Some of the questions that PSE considers include how to optimize projects and investments and how benefits score against financial constraint.
 - PSE has the opportunity to add, evaluate, and weigh benefits on the integration of gas and electricity. PSE is thinking through how to incorporate social and racial equity into the process, and how DSP will close the gap on disparities in the planning process. PSE will continue to consider how to ensure that the right voices are represented throughout the data-driven process.
 - Feedback included:
 - Suggestion that stakeholders be included in the scoring processes for future IRPs.
 - Suggestion to improve the feedback loop between PSE and IRP stakeholders to be able to provide feedback.
 - PSE reviewed the current version of the [Hosting Capacity Map](#) and stakeholders provided live feedback on an interactive map (see Appendix for the interactive map, questions, and comments).
 - **Electrification**
This information can be found on slides 38-42 of the presentation.
 - PSE evaluates areas of electric need and looks to address reliability, capacity, or aging infrastructure. PSE also shared an overview of transmission and distribution (T&D) deferral value numbers.
 - Feedback included:
 - Comments about PSE's historical load growth and past electrification forecasts.
 - Suggestion that PSE commit to total electrification.
 - Suggested study that supports the use of grid-enhancing technologies (GETs).
 - **Resource Interconnection Costs**
This information can be found on slides 42-43 of the presentation.
 - The goal of resource interconnection investments is to allow DERs on the distribution level.
 - Feedback included:
 - Suggestion that batteries be located close to customers or near generation resources.

Note: Stakeholder questions were addressed in the meeting or included in the Feedback Report (see next page).

Feedback Report

Purpose: The following table records the IRP stakeholder unanswered questions and PSE responses from the Electric Progress Report discussion with IRP stakeholders and the meeting's feedback form. Meeting materials are available on the project [website](#).

Date	Question	Stakeholder	Comment	PSE Response
6/8/2022	1	Birtha Urethra	Annoyed. You guys didn't do your job you are getting paid to do something and it didn't happen.	Thank you for your feedback.
6/6/2022	2	James Adcock	I was disappointed that this meeting was "content free" and did not contain any cost numbers for example. Looking at the participant list they almost all looked to me to be highly trained professional people with many years of IRP experience. So I believe PSE should have been targeting to that level of expertise -- and treating those participants as-if they have that level of expertise -- rather than assuming that the audience had no knowledge of what PSE was talking about. "This is *not* our first "	Thank you for your feedback. As the agenda and pre-read material stated, this meeting was focused on the electric and gas delivery system planning. The material provided did not include costs associated with the portfolio modeling as this was not a focus of the June 6 meeting.
6/6/2022	3	Jon Lange	Switching to a TOU type rate structure could be one or the largest drivers of conservation of resources. What are the biggest obstacles to making this change? Switching to a Time of Use rate structure could be a very larger driver of conservation and siting of storage/DER's where they're most needed. What are the biggest obstacles to this transition?	<p>Some of the obstacles to implementing time varying rates (TVR):</p> <ul style="list-style-type: none"> • Customers' ability and willingness to shift load away from system peaks. • If customers respond, don't know if it will result in meaningful peak demand savings. • PSE is a winter peaking utility, and it may be harder for customers to respond to TVR given heating needs. <p>Programmatic Hurdles:</p> <ul style="list-style-type: none"> • Stakeholders are resistant to defaulting customers into TVR, thus impacts will be significantly lower customer participation than theoretically possible. • Significant customer outreach and education will be required for customers to understand the value proposition on an individual and system level. <p>Contingent Policy Hurdles:</p> <ul style="list-style-type: none"> • Low Income rate design options are not established (co-developed in current GRC). Significant changes to the proposed low-income

				<p>rate discount could dilute the ability of TVR to significantly achieve reduced peak demands.</p> <ul style="list-style-type: none"> Similarly, if PSE is required to offer bill protection, the TVR price signals are similarly diluted. <p>PSE has proposed pilots to help better understand some of these items before a full rollout. PSE is also replacing its metering infrastructure that will enable the TVR: https://www.pse.com/pages/meter-upgrade</p>
6/17/2022	4	Deepa Sivarajan, Climate Solutions	<p>Climate Solutions appreciates the opportunity to comment on the June 6th Delivery Systems Planning IRP presentation.</p> <p>Overall, the delivery systems planning outlined in the June 6th presentation here focused almost entirely on electricity and not on gas, except for a little discussion of renewable natural gas (RNG) and hydrogen. We believe there's a huge missed opportunity here for PSE to examine cost reductions instead of solely distribution upgrades.</p> <p>PSE should be developing non-pipeline alternatives (NPAs) of targeted energy efficiency, demand response, and electrification. In particular, the electrification assumptions outlined on the electric side should be reflected on the gas side as well. We also urge PSE to develop case studies to discuss these kinds of approaches and how they will be incorporated into the utility's gas planning.</p>	<p>Thank you for your feedback.</p> <p>Per the March 31 Gas Utility stakeholder meeting, PSE plans to run an electrification analysis through the gas utility planning models as well as the electric portfolio. The results of this analysis will be published in the Gas Utility IRP. Similar to past IRPs, the gas utility planning models will include energy efficiency actions.</p> <p>For the non-pipeline alternatives, please refer to PSE's response to question 8.</p>
6/17/2022	5	Deepa Sivarajan, Climate Solutions	<p>Value of System Services (Slide 18)</p> <p>We urge PSE to be more specific about the value of system services and the specific streams of value that are being considered. Values not currently listed include specifics on the values of solar and DER, as well as avoided CCA cost, locational value, and ensuring equitable benefits to overburdened communities per CETA.</p>	<p>Thank you for your feedback.</p>
6/17/2022	6	Deepa Sivarajan,	<p>Pipeline Modernization Strategy (Slides 22-23)</p> <p>We'd also like to see specificity from PSE on how the strategies outlined will work for the gas side of the business:</p>	<p>Thank you for your feedback.</p>

		Climate Solutions	How will “virtual power plants” work for gas?	PSE is applying the Grid Modernization strategies to inform the Pipeline Modernization approach. Initially, PSE will leverage the Virtual Power Plant platform to perform a Demand Response Pilot in the Duvall region. There are currently limited distributed pipeline solutions available to customers, but as technology continues to advance, PSE will apply the DSP methodology as needed to plan and implement according to customer needs.
6/17/2022	7	Deepa Sivarajan, Climate Solutions	Pipeline Modernization Strategy (Slides 22-23) Will PSE be performing geospatial load forecasting for gas? If so, for what applications?	At present, PSE performs current year and long-range manual geospatial gas load forecasting at the corporate and the gas system modeling level to ensure the gas system is able to maintain reliable service. As more automated methods of geospatial load forecasting become available and the capabilities of tools like Load Seer become apparent, PSE will assess its usefulness to the gas system and apply it as appropriate.
6/17/2022	8	Deepa Sivarajan, Climate Solutions	Pipeline Modernization Strategy (Slides 22-23) What non-pipe alternatives (NPAs) will PSE consider?	PSE’s current non-pipe analysis includes Energy Efficiency, Demand Response, Pressure Increase/Upate, and use of compressed natural gas (CNG) injection to avoid construction of pipelines to meet peak demands. As technology continues to advance and policies continue to change, targeted electrification, local renewable natural gas (RNG) and other items may be considered. Please note that demand response and energy efficiency actions are being piloted later in 2022 in the Duvall area to avoid building a pipeline solution.
6/17/2022	9	Deepa Sivarajan, Climate Solutions	Hydrogen (Slides 24-25) We were disappointed at the lack of specificity in PSE’s statements around the use of hydrogen, and we encourage PSE to answer the following questions to better determine how hydrogen will be a part of PSE’s future portfolio: What are the cost assumptions for hydrogen?	PSE plans to share more details regarding supply curves for various fuel sources in our September 22 gas utility IRP meeting.

6/17/2022	10	Deepa Sivarajan, Climate Solutions	How is PSE evaluating the technical limitations of blending hydrogen into existing pipelines?	PSE is performing engineering analysis and research of the pipeline system to understand: <ul style="list-style-type: none"> • Safety (including flammability of hydrogen) • Material impacts (steel embrittlement/polyethylene degradation) • System integrity (leak detection, risk on system based on components) • End use (appliances, industrial customers) • Heat content • System modeling/reliability This is done through: <ul style="list-style-type: none"> • Small demonstrations/pilots on our system • Industry consortiums (HyReady, American Gas Association, Renewable Hydrogen Alliance, Western Energy Institute) • Partnerships and studies/pilots with industry, universities, other utilities, and national labs
6/17/2022	11	Deepa Sivarajan, Climate Solutions	The slides use both the terms “hydrogen” and “green hydrogen” – is PSE considering other hydrogen uses apart from electrolytic hydrogen?	PSE’s primary focus is on Hydrogen produced using non-carbon emitting power, also referred to as “green power”. As technology and the hydrogen supply chains develop, there may be multiple ways to create hydrogen that significantly reduce carbon emissions. As hydrogen and hydrogen-related manufacturing technology and infrastructure evolve, PSE will remain engaged with these possibilities.
6/17/2022	12	Deepa Sivarajan, Climate Solutions	Given hydrogen’s high energy density, how much carbon will PSE be able to reduce by incorporating hydrogen, especially at lower blend levels?	Hydrogen has the highest energy content of any common fuel by weight, but it has the lowest energy content by volume. Please see question 13 for the potential carbon emissions reductions.
6/17/2022	13	Deepa Sivarajan, Climate Solutions	How much hydrogen can PSE’s existing system take, and what is the potential for emissions reductions?	From current research and case studies from industry, PSE believes that a 15% hydrogen blend by volume can be used in the existing system with minimal system upgrades. This would be about a 5-6% reduction in emissions.
6/17/2022	14	Deepa Sivarajan,	What types of customers will PSE direct hydrogen use towards? Will the limited amounts of hydrogen be reserved for hard-to-	PSE will use a multi-faceted approach in meeting its customers’ hydrogen needs with the goal of reducing carbon emissions at the lowest cost to our customers. We will be focusing on the hard-to-decarbonize sectors

		Climate Solutions	decarbonize sectors like PSE's industrial customers, rather than residential or commercial customers?	including PSE's industrial customers and the peak residential and commercial heating loads.
6/17/2022	15	Deepa Sivarajan, Climate Solutions	Is hydrogen considered for electricity generation, or only for pipelines?	Hydrogen at PSE is being evaluated for both electric generation and for natural gas pipelines.
6/17/2022	16	Deepa Sivarajan, Climate Solutions	What are the parameters of the Mitsubishi project and what are PSE's goals in conducting it?	<p>In May of 2021 PSE signed a joint development agreement with Mitsubishi Power Americas, Inc. to collaborate on project development and technology solutions in line with PSE's goal to become a "Beyond Net Zero Carbon" energy company by 2045.</p> <p>This agreement will help enable the implementation of large scale, carbon-free renewable generation and storage into PSE's service territory while continuing to meet customer expectations for uncompromised reliability, safety and affordability. Key areas of focus for the partnership will include:</p> <ul style="list-style-type: none"> • Developing green hydrogen production, storage and transportation facilities • Developing utility scale battery storage systems and developing hydrogen gas turbine combined cycle facilities • Collaborating to pursue cross-sector decarbonization opportunities to create synergies between the power sector and other industrial sectors in the region, including refineries, transportation and distribution
6/17/2022	17	Deepa Sivarajan, Climate Solutions	We raised a few of these questions in the June 6th meeting. At the time, Niecie Weatherby stated that she doesn't think it won't be much more expensive to blend hydrogen at 15-20% blend levels into the pipeline system. If this is the case, PSE needs to share its specific cost estimates for hydrogen (by color) in an IRP meeting well before its draft IRP is released. PSE also committed to getting back to us with an answer about how much carbon PSE will actually be able to reduce with lower blend levels, so we look forward to receiving that information.	<p>Thank you for your comment.</p> <p>PSE plans to share more details regarding supply curves for various fuel sources in our September 22 gas utility IRP meeting.</p> <p>Please see question 13 for carbon reduction information.</p>
6/17/2022	18	Deepa Sivarajan,	RNG (Slide 25) Similarly, we would like to see PSE drill down on specifics about RNG. The discussion on RNG in the June 6th presentation included no specifics about how PSE is estimating the technical	Thank you for your comment.

		Climate Solutions	assessment and availability of RNG, nor a supply curve to help us understand the cost considerations and economic potential of RNG.	The focus of the June 6 meeting was the electric and gas delivery system. The supply curve and availability of alternative fuels were out of scope for the agenda and focus of the June 6 meeting. PSE plans to share more details regarding supply curves for various fuel sources in our September 22 gas utility IRP meeting.
6/17/2022	19	Deepa Sivarajan, Climate Solutions	What metric is PSE using to measure the availability of RNG nationally and regionally? With utilities around the country potentially competing for limited resources, how will that be factored into the RNG potential assessment?	See PSEs response to question 18 above. We are considering the availability to be equal to the forecast of Renewable Natural Gas from the American Gas Foundation study in proportion to the share of gas load in the Pacific Northwest region.
6/17/2022	20	Deepa Sivarajan, Climate Solutions	How is PSE estimating RNG costs, particularly given that even cheaper RNG sources will be irrelevant because the highest price will set the market clearing price?	<p>Per our response to question 19, please refer to the Renewable Natural Gas data source https://gasfoundation.org/wp-content/uploads/2019/12/AGF-2019-RNG-Study-Full-Report-FINAL-12-18-19.pdf. This was provided in the March 31 stakeholder meeting, slide 29.</p> <p>There is not currently a market-clearing price. Each project has its own unique combination of qualifications (eligibility for high value vehicle markets, location, feedstock reliability, technology, etc., which drive cost and revenue expectations. We are seeing some developers beginning to aggregate multiple projects into a blended portfolio offering to smooth over the differences into a blended price- but most of these reflect out of region sources. PSE's preference is to obtain supply from local projects which are all unique.</p>
6/17/2022	21	Deepa Sivarajan, Climate Solutions	Why is PSE not considering using cost estimates from RFPs to identify RNG costs?	PSE to date has not received significant or relevant responses to RFPs regarding RNG costs. Every RNG project is different, so the best cost estimates come from discussion with individual project developers. This discussion would be confidential therefore PSE believes leveraging public data sources such as the one referenced in our response to question 20 is the most transparent way for PSE to evaluate RNG supply in the gas utility IRP.

6/17/2022	22	Deepa Sivarajan, Climate Solutions	What are the expected interconnection costs of RNG?	Interconnection costs are very specific to each project and location. These are not generic projects, and they are difficult to estimate. Please refer to our response to question 20. This is the most transparent way for PSE to evaluate RNG supply in the gas utility IRP.
6/17/2022	23	Deepa Sivarajan, Climate Solutions	<p>Hybrid Heating Pilot (Slide 25)</p> <p>Climate Solutions may be supportive of PSE incentivizing hybrid heat pumps as part of PSE's decarbonization strategy in the short-term, but we would like more information on the specifics:</p> <p>What does PSE mean by hybrid heating? Would a hybrid heating program incentivize new gas furnaces as the back-ups to heat pumps, or simply rely on a customer's existing gas furnace?</p>	<p>PSE defines hybrid heating as using a heat pump for most of the home (or business) heating needs but leveraging a gas furnace for heating in the coldest weather (less than 35°F).</p> <p>The pilot is focused on research at this time, not incentives for new system installations. This will allow PSE to establish typical all-electric, gas, and hybrid heating load profiles and annual energy usage through the pilot.</p> <p>Hybrid heating could include adding heat pumps to homes that have existing furnaces as well as new installations in existing or new homes. Each use case has different costs and benefits.</p>
6/17/2022	24	Deepa Sivarajan, Climate Solutions	What is the timeline for the hybrid heating pilot?	The pilot aims to achieve its research objectives in 2022. Additional work will be performed during the 2022-2023 winter months to further refine peak load impacts using load profile data.
6/17/2022	25	Deepa Sivarajan, Climate Solutions	The Clean Energy Transformation Act (CETA) clarifies that the following are in the public interest: an equitable distribution of benefits to overburdened communities, public health benefits, environmental benefits, economic benefits. How will these public interest benefits be incorporated into gas planning and the considerations in the use of hybrid heat pumps?	CETA does not apply to gas utilities when determining whether to pursue measures that reduce natural gas consumption including hybrid heat pumps. While CETA does not apply to gas utilities, PSE will address equity concerns in program design and implementation if transitioning gas customers to hybrid heat pumps is included in the gas resource plan.
6/17/2022	26	Deepa Sivarajan, Climate Solutions	Climate Solutions would not support incentivizing new gas furnaces as part of this program. Additionally, we would urge PSE to commit to a timeline whereby hybrid heat pumps would only be incentivized through 2030 and commit to a full electrification strategy for residential and commercial customers after that point.	Thank you for your feedback.

6/17/2022	27	Deepa Sivarajan, Climate Solutions	Equity (Slide 31) It's unclear what equity considerations PSE is referring to – are these related to CETA's requirement for an equitable distribution of benefits to overburdened communities? If so, how are these taken into account for delivery system planning enhancements?	As described in slides 32 and 33 from the June 6 meeting, PSE has started and is continuing to enhance our Delivery System Planning (DSP) processes to incorporate equity related to overburdened communities and the distribution of benefits as required by CETA. Slide 32 describes steps we are embarking on today including further evaluating overburdened communities. Slide 33 details PSE's plans to engage stakeholders and gather input from multiple voices and perspectives as we work to define specific equity benefits, metrics and relational value to plan the delivery system portfolio.
6/17/2022	28	Deepa Sivarajan, Climate Solutions	Hosting Capacity Maps (Slides 34-36) If hosting capacity maps are intended to be updated every few months, we believe they can remain focused on current capacity, but if it's more periodic, they need to be forward-looking to properly anticipate the incremental build-up of distributed energy resources (DER). Regarding winter vs. summer capacity loading – it depends on what is being valued. For a cost-focus, showing the winter loading is crucial because we are winter-peaking. For an emissions focus, summer peaking may be relevant because we run out of hydro towards the end of the summer	PSE is able to update the hosting capacity map on a periodic basis. The map currently displays the worst case scenario for today's system, regardless of season. We recognize that providing hosting capacity for both summer and winter would be beneficial to our customers and will be taken into consideration as we work to develop the next iteration of the map. Providing future-looking scenarios that account for the anticipated adoption of DER, as well as the impact of PSE major projects on hosting capacity would also provide value. This is also an option under consideration for future versions of the map.
6/17/2022	29	Deepa Sivarajan, Climate Solutions	Resource Interconnection Costs (Slide 43) How did PSE come up with the transmission interconnection costs?	Costs per mile for generator tie-lines (both 115 kV and 230 kV) are based on historical project costs for PSE to build transmission lines. As noted during the meeting, this only includes labor and materials. Real estate and permitting costs were not factored into the cost per mile for generator tie-lines due to the high variability of these costs across PSE's service territory. Substation costs were derived from the costs identified in recently completed generator interconnection studies. When interconnecting a generator tie-line to a PSE substation, these costs include, at a minimum, a dead-end structure, circuit breaker, two disconnect switches and the associated civil (i.e. foundations) and meter/relay work.
6/6/2022	30	Katie Ware	I see responses to renewable northwest's questions specifically, how to we obtain resources that we can't find -	PSE met with Renewable Northwest (RNW) staff Katie Ware and Sashwat Roy on June 14, 2022. We reviewed RNW's feedback received in the March 22 meeting regarding generic resource assumptions on operation and maintenance costs, battery augmentation for degradation and

			<p>There should be a layered approach to determining cost, PSE shared that they can't share information due to confidentiality and I would like to learn more about this</p>	<p>increased cycling, battery life, and the possibility of using the 2022 National Renewable Energy Laboratory (NREL) Annual Technology Baseline (ATB) if available by the end of June 2022.</p> <p>Regarding the feedback on obtaining information that was not included in the NREL ATB, PSE used data from Energy Information Administration (EIA) and Pacific Northwest National Laboratory (PNNL) to fill in the missing information.</p>
6/6/2022	31	Sashwat Roy	<p>What kind of modeling framework is being planned to use to calculate that T&D deferral value of distributed and stationary storage? i.e. are benefit-cost ratios being calculated from a third-party tool or is PSE using an internal tool?</p>	<p>PSE's planning process evaluates the benefits of traditional wires projects compared to non-wires alternatives. In this evaluation, the traditional wires solution provides no monetized benefit, but non-wires alternatives can provide bulk system generation capacity deferral and hourly avoided energy costs. For both wires and non-wires solutions, capital cost to build new infrastructure is evaluated against the costs to build and maintain non-wire alternatives such as distributed storage, in addition to costs for charging energy and augmentation. An economic evaluation is used to evaluate the deferral of wires projects using non-wires alternatives for a 10-year period. We are calculating benefit-cost ratios using a third party iDOT tool, described in more detail in the 2021 IRP Chapter 8. The benefits that are currently being scored to develop the benefit-cost ratio are outlined in slide 28 of the June 6 IRP meeting presentation with the development of new benefits associated with equity planned in the coming months.</p>
6/6/2022	32	Willard Westre	<p>PSE requires Firm Transmission for new generation resources based on nameplate rating. With renewables having capacity factors of 25-50% this means that about 2/3 of the transmission line capacity is wasted. What is PSE doing to capture the Non-Firm transmission line capacity?</p>	<p>In the short-term, it may be possible to remarket non-firm transmission or use that transmission to make net-revenue from non-firm sales in the wholesale energy market, both of which go to reduce power costs for customers. The ability to use non-firm transmission and the cost mitigation is uncertain, and would be affected by the specific transmission path. PSE's analysis has not reflected such short-term cost mitigation potential in IRP analysis.</p>
6/6/2022	33	Don Marsh	<p>Jens says that solar was evaluated to address summer peaks for Energize Eastside? Where is that study? PSE has not released it, to my knowledge. PSE focuses on avoided T&D, but non-wire alternatives can also increase resiliency if a big earthquake or storm damages wires. PSE does not appear to prioritize this</p>	<p>Yes, solar was reviewed to address the transmission deficiency identified in King County being addressed by the Energize Eastside project and found to be impracticable. The IRP specifically identified the technical potential of solar across PSE's entire service territory as 336 MW total on page 7 of App E in the 2021 IRP. King county is only a portion of PSE's entire system,</p>

			kind of resiliency, and so NWAs are dismissed or relegated to very small applications. Resiliency is so important to customers. Was solar evaluated for energy eastside as a summer peak service?	thus the solar potential would be much lower. This does not come close to addressing the Energize Eastside summer peak need of over 500 MWs.
6/6/2022	34	Randy Harty	Puget Staff did not mention the main reason for doing DER – it is to develop west side renewables to mitigate transmission problems from east to west. You are not allowing anything in your current RFP – You will have 400 mgw of Colstrip transmission on storage – yes you are working with Bonneville, but not nearly enough. You need to get proactive on that front.	Thank you for your feedback.
6/6/2022	35	James Adcock	\$500 DER isn't "more expensive" -- it is "crazy too expensive."	<p>The term “DER” captures several types of distributed resources, some of which are used to generate energy while others are used for capacity or ancillary services. Given that the resources are used to meet different resource needs, we cannot compare the cost of a DER capacity resource like distributed batteries to an energy resource like distributed solar panels.</p> <p>For example, a distributed solar resource is used to meet an energy need, but a distributed battery is used to meet either a winter or summer capacity need or ancillary services and reliability need. Meaning, they cannot be compared directly. It is best to compare the cost of a battery on a \$/kw-yr basis to other resources that meet similar capacity and reliability needs.</p> <p>The leveled cost of capacity is based on the peak capacity value of a resource. It is the total annual cost of resource less revenue and then leveled over the lifetime of the resource. This total net cost is then divided by the capacity of the resource to a \$/kw-yr number. Whereas to evaluate the leveled cost of energy, the total net cost calculated above is then divided by the energy produced for the year for a \$/MWh number. Since batteries do not produce energy, you cannot evaluate them for the value of their energy value. The two figures below are from the 2021 IRP, Chapter 8, and look at the total net cost of capacity vs. Total net cost of energy.</p> <p><i>Figure 1: Net Cost of Capacity in the Mid Scenario Portfolio Model</i></p>

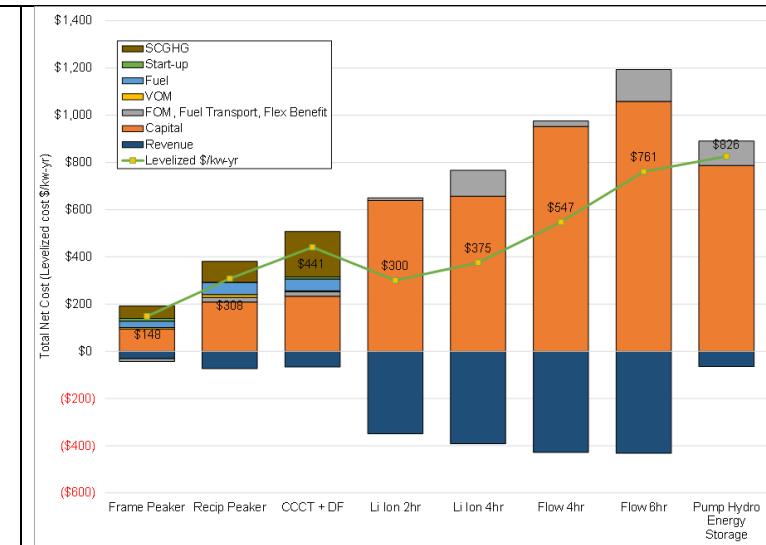
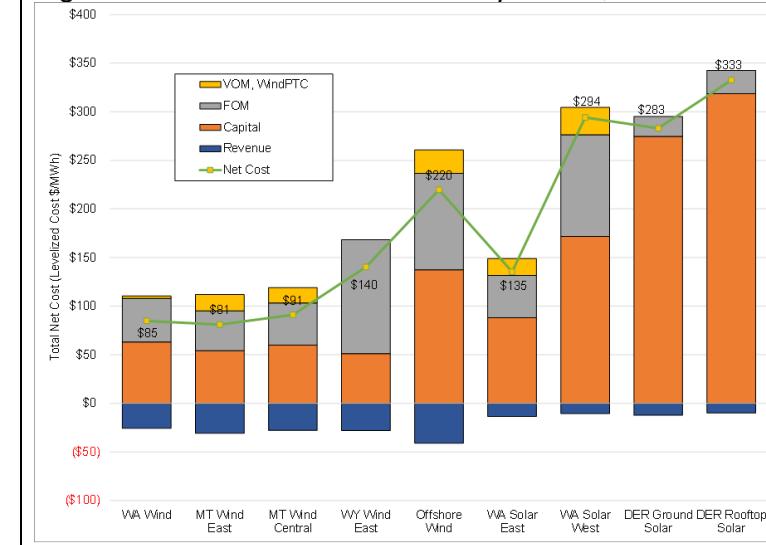


Figure 2: Wind and Solar Cost Components, Mid Scenario Portfolio



6/6/2022	36	James Adcock	<p>Slide 21 Raise Hand re "Lowest Reasonable Cost" and CEIP "Lowest Cost First."</p> <p>Hearing Puget say that there is no conservation of cost/discussion with IRP stakeholders about cost.</p>	<p>The preferred portfolio is the outcome of robust IRP analyses developed with stakeholder input during the 2021 IRP process. It meets the requirements of the Clean Energy Transformation Act and is informed by deterministic portfolio analysis, stochastic portfolio analysis and the Customer Benefit Analysis. The preferred portfolio is a new requirement in the IRP, and this first preferred portfolio marks a significant shift in PSE's resource direction since the 2017 IRP. The preferred portfolio focuses on clean resources to meet CETA requirements, as well as increases in distributed energy resources.</p> <p>The purpose of the June 6 meeting was to share information and provide updates to stakeholders on how PSE is advancing the work from the 2021 IRP process in preparation for the 2023 Electric Progress Report.</p>
6/6/2022	37	Anne Newcomb	<p>Slide 24. According to experts like Laura Feinstein; ex PSE engineer modernizing the regional energy grid, Hydrogen is not well suited for being fed into pipelines for heating due to the following concerns.</p> <p>Green hydrogen produced by excess renewable energy will be in high demand and is well suited for hard-to-decarbonize sectors like steelmaking, long-haul shipping, and aviation, and in generating electricity during windless, cloudy periods. Hydrogen is very expensive and explosive. Moving to electric will reduce GHG faster.</p> <p>Do you agree that green hydrogen is the only hydrogen that has a hope of reducing GHG?</p> <p>Will PSE be considering any other hydrogen besides green hydrogen?</p> <p>Would you agree hydrogen is more expensive and explosive?</p> <p>Would you agree changing the pipeline infrastructure will most likely be expensive as well?</p> <p>Green Hydrogen is a form of energy storage. Can PSE use the funds spent on hydrogen explorations on other safer more environmentally friendly storage possibilities like gravity storage?</p>	<p>Green hydrogen may be in high demand by multiple sectors, just like renewable natural gas, and carbon free power. Whether green hydrogen can or should be part of an economic way to reduce emissions in the gas utility industry remains to be seen. This question will be examined in PSE's 2023 gas IRP and IRPs in the future.</p> <p>PSE's primary focus is hydrogen that is ultimately produced using green power. There may be multiple ways to create hydrogen that significantly reduces emissions. As our economy possibly transitions to hydrogen produced using green power, it may be necessary to transition into such changes over time. The path to that goal is uncertain and PSE will be involved and engaged. The ultimate goal is hydrogen produced using only renewable electricity.</p> <p>PSE agrees that green hydrogen is more expensive than natural gas and some forms of RNG.</p> <p>PSE is studying the implications to the system of blending hydrogen into the gas utility system. At relatively low concentrations (up to 20%), industry research is indicating the pipeline infrastructure will not require extensive changes driving high system costs.</p>

				<p>The flammability of hydrogen will have to be addressed and is considered as part of the research that is outlined in question 10.</p> <p>In the 2023 electric Progress report, PSE will be comparing a transition to hydrogen with other forms of energy storage, including biodiesel, batteries, pumped-hydro storage.</p>																				
6/6/2022	38	Deepa Sivarajan, Climate Solutions	Slide 24: disappointed to not see more specifics here. What are the cost assumptions for hydrogen? How is PSE evaluating the technical limitations of blending hydrogen into existing pipelines, and what point would PSE shift to investing in new pipeline infrastructure to support higher blends? How much hydrogen can PSE's existing system take? Given hydrogen's high energy density, how much carbon will PSE be able to reduce by incorporating hydrogen, especially at lower blend levels?	<p>The focus of the June 6 meeting was electric and gas delivery system planning. The supply curve and availability of alternative fuels were out of scope for the agenda and focus of the June 6 meeting. PSE plans to share more details regarding supply curves for various fuel sources in our September 22 gas utility IRP meeting.</p> <p>Please see question 13 for carbon emission reduction.</p>																				
6/6/2022	39	Anne Newcomb	<p>Where are you finding methane leaks and how are you eliminating them?</p> <p>Can you give examples of RNG you will be using?</p>	<p>PSE has evaluated the leak causes and emissions released from sources in the table below.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="background-color: #d3d3d3; text-align: left; padding: 2px;">Cause</th> <th style="background-color: #d3d3d3; text-align: right; padding: 2px;">2020 Metric Tons CO2e</th> </tr> </thead> <tbody> <tr> <td style="padding: 2px;">Excavation Damage</td> <td style="text-align: right; padding: 2px;">11,489</td> </tr> <tr> <td style="padding: 2px;">Natural Force Damage</td> <td style="text-align: right; padding: 2px;">1,443</td> </tr> <tr> <td style="padding: 2px;">Pipe, Weld, or Joint Failure</td> <td style="text-align: right; padding: 2px;">1,226</td> </tr> <tr> <td style="padding: 2px;">Other Outside Force Damage</td> <td style="text-align: right; padding: 2px;">1,050</td> </tr> <tr> <td style="padding: 2px;">Active Nonhazardous Leaks</td> <td style="text-align: right; padding: 2px;">874</td> </tr> <tr> <td style="padding: 2px;">Equipment Failure</td> <td style="text-align: right; padding: 2px;">387</td> </tr> <tr> <td style="padding: 2px;">Other Cause</td> <td style="text-align: right; padding: 2px;">374</td> </tr> <tr> <td style="padding: 2px;">Incorrect Operations</td> <td style="text-align: right; padding: 2px;">125</td> </tr> <tr> <td style="padding: 2px;">Corrosion Failure</td> <td style="text-align: right; padding: 2px;">90</td> </tr> </tbody> </table> <p>PSE is eliminating methane emissions by 1) replacing leak prone assets 2) focusing on damage prevention and reducing excavation damages 3)</p>	Cause	2020 Metric Tons CO2e	Excavation Damage	11,489	Natural Force Damage	1,443	Pipe, Weld, or Joint Failure	1,226	Other Outside Force Damage	1,050	Active Nonhazardous Leaks	874	Equipment Failure	387	Other Cause	374	Incorrect Operations	125	Corrosion Failure	90
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			<p>prioritizing non-emergency leak repair 4) change field procedures, engineering designs, and other construction activities to reduce intentional release of methane, 5) using technology and data to identify new leaks and focus areas.</p> <p>Current RNG sources include:</p> <ul style="list-style-type: none"> • In 2020 PSE signed a 20-year agreement with Klickitat PUD to purchase RNG produced from the Roosevelt, Washington, landfill <ul style="list-style-type: none"> ◦ The agreement allows PSE to provide small volumes of RNG to all customers and allows us to offer a voluntary RNG program for individual customers that wish to have a greater percentage of their supply come from RNG sources
6/6/2022	40	Fred Heutte	<p>Question about slide 24 – Was not following the reference to 20% limit on hydrogen. Is PSE during a structural engineering analysis on that? Is hydrogen uniformly distributed as opposed to methane? Are there safety implications?</p> <p>There are assertions being made about hydrogen being blended in a distribution system, would be helpful to have a summary of Puget's approach to this in a future meeting</p>
6/6/2022	41	David Tomlinson	Can you provide PSE Contacts to discuss H2 partnerships?
6/6/2022	42	James Adcock	Question re Green Hydrogen on the Gas side vs. the more efficient round-trip Battery Storage on the electrical side -- how does PSE as an organization evaluate that tradeoff?
6/6/2022	43	Deepa Sivarajan, Climate Solutions	<p>Slide 25: What does PSE mean by hybrid heating? Would a hybrid heating program incentivize new gas furnaces as the back-ups to heat pumps?</p> <p>Slide 25: What metric is PSE using to measure the availability of RNG nationally and regionally? With utilities around the country</p>

			potentially competing for limited resources, how will that be factored into the RNG potential assessment?	
6/6/2022	44	Anne Newcomb	Is PSE looking at any only green Hydrogen?	We're focused on green hydrogen but also looking at the technical feasibility of incorporating hydrogen in general.
6/6/2022	45	James Adcock	Map 34: If DER in a region is less than consumption then why would there be a "Distribution Problem?"	Each distribution feeder has specific capacity limits, and the hosting capacity heat map on slide 34 shows how much generation capacity can be served without overloading the existing infrastructure. Overloading the existing distribution infrastructure by adding too much DER at a specific location would cause a "distribution problem" requiring upgrades to the distribution system.
6/6/2022	46	Joel Nightingale	Does this map substation loading layer correspond to winter peak, summer peak, overall energy use?	The hosting capacity map's substation loading layer is based on the available loading based on the most constrained peak considering all seasons. The constraint is either winter or summer depending on which load season is greater for the specific substation location.
6/6/2022	47	James Adcock	So I guess you are saying this heat map is *prior* to the addition of Energize Eastside? Which will certainly change the heat map.	The heat map depicts the current state of the electric system and shows local distribution system capacity constraints, not transmission issues such as those being addressed with the Energize Eastside project.
6/6/2022	48	Don Marsh	<p>Looks like project #9 on slide 38 is a capacity project. But it's only needed for an extremely unlikely outage emergency. Is that classified as reliability or capacity? I'm confused.</p> <p>Perhaps you can clarify what the difference is between a reliability project vs a capacity project?</p> <p>Referring to Bellevue project - PSE has capacity to meet peaks, it is only if there are significant outages. It is kind of like related to reliability, but you have no reliability issues there now. It is also kind of related to capacity, but I think if you're serving the peak and you have significant outages, that seem a little bit different than a pure capacity issue.</p>	<p>A reliability project is driven to improve the consistent availability of power to an area that experiences outages. These projects harden the system against things like trees contacting lines or other issues. A capacity project is due to increasing demand for energy in area exceeding the infrastructure or equipment ratings serving that area. For example, a transformer that is expected to be overloaded due to customer growth in an area.</p> <p>For transmission capacity projects, equipment overloads are identified under certain required conditions set by the North American Electric Reliability Corporation (NERC).</p> <p>Project #9 on slide 38 is a capacity project where the future demand for power will exceed the existing electric equipment capacity to serve that area.</p>

6/6/2022	49	Court Olson	Yes, forecasting electrical load is challenging in these times of transition, but PSE continues to overlook the potential for conservation and increased energy efficiency in the building stock which is getting increasing attention.	Thank you for your feedback. We will go over the Conservation Potential Assessment in the September meeting with IRP stakeholders.
6/6/2022	50	James Adcock	Slide 43: Is it really true that current PSE thermal plants are only connected to 1-mile-long tie line lengths?	Thermal gas plants interconnected within PSE's service territory are typically less than 1 mile in length. The IRP analysis has historically used 1-mile length as the assumption for generic resource interconnections within PSE's service territory.
6/6/2022	51	Northwest Energy Coalition (NWEC)	Provide a summary of work on hydrogen analysis to the Northwest Energy Coalition (NWEC).	PSE has begun the process of testing the blending of hydrogen on its equipment and gas appliances, but additional demonstration projects are needed to fully understand the range of benefits and operational characteristics of blending hydrogen within the gas system infrastructure. These demonstration or pilot projects are designed to help inform how to use the existing pipeline infrastructure to provide alternate fuels, with minimal impact to customer end use applications. The approach is intended to leverage industry research, seek partnership opportunities, and perform PSE-led demonstrations to achieve the objectives as quickly and efficiently as possible.

Feedback Addressed from June 6 Delivery System Planning IRP Meeting

What PSE heard	What PSE did
It is difficult to navigate the PSE website and find IRP materials.	Thank you for your feedback on the website. We developed the site with the intention of ease of access, this feedback is helpful to consider for incorporation the next time we can make website upgrades.
PSE actions and investments should match aspirations.	PSE is making strides to align our aspirational goals with our investments and long-term modeling process. There are legal, technological, and cost implications for our customers that must also be considered as we continue to make progress towards our clean energy goals.
Distributed Energy Resources (DERs) are too expensive.	DERs are evaluated with the portfolio model similar to other resource alternatives. The model evaluates the benefits of all types of resources that may not be limited to cost.
Concern about the lack of discussion around the lowest reasonable cost in the IRP process, and concern that IRP stakeholders are being excluded from the IRP process.	The focus of the June 6 th meeting was on the delivery system planning. PSE plans to share resource and fuel costs in our September stakeholder meetings.
Explore additional methods of environmentally friendly energy storage outside of green hydrogen, including gravity storage.	This is included as part of the generic resources.
Improve the feedback loop between PSE and IRP stakeholders.	PSE will follow up with Triangle to better understand stakeholders' concerns regarding the feedback loop.
Include stakeholders in future IRP scoring processes.	PSE will include advisory group input in future scoring processes.
PSE should commit to complete electrification.	PSE is committed to decarbonization and studying its effects on the delivery system.
Suggestion that batteries be located close to customers or near generation resources.	PSE agrees that there are benefits to locating batteries close to customers or generation resources.

Appendix: Breakout Room Mural

Click and drag to move around the Mural board. Double click on a sticky note to add your comment, then drag it over to the appropriate spot on the map if relevant. Include your name or initials on the note so PSE can follow up with you if needed.

The sticky notes are color coded: Yellow = information to share on the map, green = categorizing and describing existing information, purple = forward looking information vs. what currently exists on the map.

If you run out of sticky notes, click on the color category you would like to use to comment and select "CTRL + C" followed by "CTRL + V" to copy the sticky note.

If you agree with an existing comment, cluster a note with your name near the comment. Please do not touch other people's sticky notes.

What information should be included in the map?

- Include DER projects in Development
- Outage heat map/service reliability data
- Critical services e.g., hospitals
- Blue = easiest Red = least easy
- A link to definitions of Highly Impacted Communities and Vulnerable Populations will likely help PSE avoid Q's

How should current information be categorized and described?

- If focusing on costs, winter loading is crucial because we are winter-peaking. For an emissions focus, summer may be relevant because of running low on hydro at the end of the summer (Deepa Sivarajan, Climate Solutions)
- What does high impact community refer to. How are they impacted
- Ability to remove various layers. If possible substation and line data overlay would be helpful, including voltage data (Sudipto)
- The order and color is confusing. Prioritization color and order of importance in the legend differs by category.
- Yes, to winter vs summer capacity loading.

How should the map incorporate forward-looking vs. current day information?

- Include Load Growth Forecasts
- If the maps are intended to be updated every few months, they can remain focused on current capacity - but if more period, they need to be more forward-looking (Deepa Sivarajan, Climate Solutions)
- Planning as well as Operational data is good. If possible this can regularly update from the current snapshot of either the planning or operational case (Sudipto)
- Way to go!!!
- VERY COOL!

Additional Questions

Additional Comments

- This will be so useful when looking at proposed projects. It will really help us understand (Don)
- Agreed. Nice work PSE - Markus (WASEIA)

- Include both 1-phase and 3-phase hosting capacity?
- Add the location of existing DER on the distribution system?
- Link to an automated portal for DER interconnection applications (Schedule 152)?
- Display winter vs. summer capacity loading?
- Display areas benefiting from known voltage concerns elimination?
- Does the color coding display hosting capacity in a meaningful way?
- Implement time-series analysis vs. existing single-hour "snapshot."
- Implement forward looking map with future system improvements and their impact on hosting capacity?

IRP Stakeholder Attendees (alphabetical by first name)

1. Aaron Tam – Attorney General
2. Anne Newcomb - IATC
3. Aruna Ranaweera – Hecate Energy
4. Arvia Morris – Zipcon
5. Bill Will - WASEIA
6. Brad Cebulko - Strategen Consulting
7. Byron Harmon - UTC
8. Carol Loughlin – Lakeridge Resources
9. Court Olson – Optimum Building
10. Damon Fisher - Avista
11. David Branchcomb – Sierra Pacific Industries
12. David Morton - Resident
13. David Tomlinson - Solar Horizon/Eurus Energy Contractor
14. Deepa Sivarajan - Climate Solutions
15. Don Marsh – Sierra Club
16. Elyse Hammerly – The Glarus Group
17. Fred Heutte - NWEC
18. Halley Miklos – ConEdison
19. James Adcock - Electrical Engineer Stakeholder
20. Jeffrey Larsen
21. Jennifer Snyder - UTC
22. Joel Nightingale - UTC
23. Jon Lange – Sun Energy Systems
24. Katie Ware – Renewable NW
25. Lawrence Becker - Frontier
26. Marilyn Subala
27. Markus Virta - WASEIA
28. Mike Hopkins – Fortis BC
29. Monica Blakeslee-Kish – Energy Solution
30. Nancy Shimeall
31. Patrick Leslie – Monolith Energy
32. Randy Hardy – Hardy Energy Consulting
33. Sashwat Roy – Renewable NW
34. Stephanie Chase - UTC
35. Sudipto Bhowmik - ibvEnergy
36. Willard Westre - Union of Concerned Scientists (Willard Westre)

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3. Bob Williams
4. Catherine Koch
5. Cindy Vu
6. Corey Corbett
7. Doug Hart
8. Eleanor Ewry
9. Elizabeth Hossner
10. Gretchen Aliabadi
11. Gurvinder Singh
12. Jennifer Coulson
13. Jennifer Magat
14. Jens Nedrud
15. Jesse Durst
16. Kara Durbin
17. Kasey Curtis
18. Kelly Xu
19. Leslie Almond
20. Mark Lenssen
21. Michelle Wildie
22. Nacie Weatherby
23. Phillip Popoff
24. Reid Shibata
25. Renchang Dai
26. Tyler Tobin
27. Wendy Gerlitz

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2. Claire Wendle
3. Seth Baker
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