Integrated Resource Plan (IRP) Stakeholder Webinar on Resource Adequacy Information Session: Summary

v. 9/19/2022

Meeting Information

- Wednesday, 08/24/2022 from 1:00-4:30 p.m.
- Links to:
  - Meeting materials (e.g. hot sheet and presentations)
  - Meeting recording

Summary of 08/24/2022 IRP Meeting

- **Recap from July Demand Forecast Integrated Resource Plan (IRP)**
  This information can be found on slides 7-9 of the presentation
  - Phillip Popoff, Director of Resource Planning Analytics, PSE, discussed themes and feedback from the Demand Forecast Webinar for IRP Stakeholders on July 12th and how PSE responded, including:
    - Demand side resources
    - Climate Commitment Act (CCA) compliance within the load forecast
    - Conservation planning programs
    - Appliance-use heating trend tracking
    - Climate change analysis
  - Discussed the evolution of PSE's resource adequacy analysis from 2021 to 2023:
    - Outlined the workshops, findings, and report for the 2021 All-Source Request for Proposals
    - Previewed the modeling work and results for the 2023 Electric Progress report with Energy + Environmental Economics (E3)

- **Western Resource Adequacy Program (WRAP)**
  This information can be found on slides 10-30 of the presentation
  - Ryan Roy, Director of Technology Modeling & Analysis, Western Power Pool, discussed WRAP Design Overview:
    - Industry-driven initiative to ensure resource adequacy
    - Voluntary participation
    - Implementation through bilateral transactions
  - What the WRAP implements:
    - A binding forward Showing framework, which establishes regional reliability metrics, capacity critical hours (CCHs), and qualifying capacity contribution (QCC) with a compliance review of portfolio
    - A binding operational program evaluating participants operational situation relative to Forward Showing assumptions
    - Safely lowers requirements and informs resource selection
    - Drives investment savings
  - Preliminary Metrics – Metrics based on modeling from data of Phase 3A WRAP participants highlighting thoughtful process for interpretation.

        - Planning reserve margin modeled by month for Northwest and Desert Southwest/East regions
        - Qualifying Capacity Contributions (QCCs): resource type and accreditation methodology
        - Storage and Run of River for 3A Hydro Average QCCs in Winter 2023-2024 and Summer 2024
        - Solar ELCC Zones: North and South
        - ELCC Wind Zones: North and South
    - Timeline and Status – Transitions between programs and current phase activities.

- **Pacific Northwest Utilities Conference Committee (PNUCC) 2022 Northwest Regional Forecast**
  This information can be found on slides 31-40 of the presentation
    - Aliza Seelig, Analytics and Policy Director, PNUCC, gave a brief introduction of PNUCC and the Northwest Regional Forecast, which included an overview of:
        - Sum-of-utilities requirements and resources
        - Planning load forecast comparison
        - Evolution of generating resources with number of solar and wind resources increasing while coal plants availability is declining
        - Prospective energy load needs vs resources as needs grow

- **Puget Sound Resource Adequacy, Energy + Environmental Economics (E3)**
  This information can be found on slides 42-69 of the presentation
    - Arne Olson, Senior Partner, E3, shared background on E3 RECAP model for loss of load analysis.
    - Resource Adequacy and its role in reducing loss of load events:
        - Resource adequacy is increasing in complexity, importance, and reliability
        - Planners are increasingly using loss of load probability (LOLP) models to support enhancements.
    - Defined the planning reserve margin (PRM) and the effective load carrying capability (ELCC) in reference to PSE:
        - ELCC captures saturation effects at increasing penetrations and diversity benefits among technologies
    - Changes in the 2023 IRP:
        - Market availability and average purchase curtailments
        - Examples of winter weeks with loss of load
    - Joe Hooker, Associate Director, E3, presented the 2023 vs 2021 IRP results:
        - Planning Reserve Margin (PRM): total megawatts needed and resources available to PSE in summer and winter
        - Effective load carrying capacity (ELCC) results
        - ELCC saturation curves for wind, solar, and storage
        - Summary of key results

- **PSE Resource Needs & Market Reliance**
  This information can be found on slides 70-81 of the presentation
  - Phillip Popoff reviewed:
    - Capacity needs before examining market reliance
    - PSE Resource Adequacy Study for capacity needs, comparing 2021 and 2023 IRP results
    - Peak load higher in winter, peak need higher in summer
  - Defined market reliance, its importance, updates, and risk matrix from prior IRPs
    - 2021 IRP background for Market Risk Assessment
  - Western Electricity Coordinating Council's (WECC) analysis of resource adequacy over the next 10 years
  - Key elements of need for additional capacity
  - Resource adequacy conclusions:
    - Capacity need
    - ELCC
    - Reliance on short-term markets for firm capacity
    - Impact of need and ELCC updates on resource plan

- **Next steps:**
  This information can be found on slides 82-84 of the presentation
  - Sophie Glass, Triangle Associates, closed the meeting and shared the next steps for the IRP stakeholder feedback process.
    - August 26: A recording and transcript of the chat will be available.
    - August 31: Feedback forms are due.
    - September 21: A feedback report of comments and summary will be posted to pse.com/irp

Feedback Report

Purpose: The following table records the IRP stakeholder unanswered questions and PSE responses from the Resource Adequacy Information Session discussion with IRP stakeholders and the meeting's feedback form. Meeting materials are available on the project website.

Date	Stakeholder	Question	PSE Response
8/24	Don Marsh	What happened when there was a loss of load on PSE's system? How many people were impacted, and were they surprised? Or were outages pre-arranged with commercial or industrial customers?	The loss of load events discussed during this meeting were not real-life events, but rather forecasted modeling exercises. Each simulated loss of load event has a different magnitude and duration.
8/24	Mark Boissevain	Oregon East Solar? Similar to Id or Wy?	No, the IRP team did not model eastern Oregon solar as a specific resource option because the solar profile is similar to that of Eastern Washington. For the 2023 Electric Progress Report, we are modeling generic solar resources along the Boardman to Hemingway transmission expansion and then the Gateway West expansion to Wyoming. Generic solar resources were sited near substations including Populous, ID, Jim Bridger, WY and Aeolus, WY.
8/29	Willard Westre	I have serious concerns regarding the ELCC analysis that overly degrades the performance of renewable resources with respect to fossil fuel resources. E3 in its section of the presentation	Thank you for your comments and feedback. Please note that saturation curves are not an input assumption from the resource adequacy model, they are

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		defined ELCC as **"How many MW provided by each resource - measured as a % of nameplate capacity"**. It is with respect to this definition that I wish to question the analysis. Primarily, it is the **application of saturation** to the analysis which I believe is without justification. I find no mention of saturation effects in my extensive search of ELCC reports by NREL, other utilities, or agencies – only in PSE and E3 presentations. In previous webinars PSE has never defined the rationale for saturation nor how it fits in the ELCC calculation. Neither does saturation meet the smell test. This saturation thinking tries to make you think that the sequence in which a resource comes into play effects its actual energy output. Does PSE have any measured data that an identical wind turbine in a near identical location at an identical time having less measured output than one installed earlier in the installation sequence – I doubt it. The fact that it has a lower **percentage** increase in the incremental change in the overall system has nothing to do with the magnitude of its **actual** capacity increase, if you consider the definition of ELCC above. The new turbine's actual output is the **same** not incrementally lower. Its contribution to the Planning Reserve Margin is also the same. Applying saturation to the actual available-perfect-capacity (at the time of interest) of a wind turbine is an error. This is true for solar and batteries as well. This applies not only to new	observed by studying the output of the analysis. Observing saturation curves is standard in the industry. Why do we observe saturation curves? Use wind located in central Washington as an example in the following hypothetical example. If we add 100 MW of wind, and the wind is blowing 100% during four loss of load events, three of which are 75 MW and one where there is a 170 MW loss of load event. The first 100 MW of wind covers the first three loss of load events. An additional 100 MW in the same location (for a total of 200 MW) only covers one loss of load event. This example shows the first 100 MW was more effective, because it eliminated three loss of load events, whereas the second 100 MW only eliminated one loss of load event. Again, this is normal across the electric industry. Effective Load Carrying Capacity (ELCC) introduced by Garver in 1966 [1] defined the capacity credit of a resource as the amount of new load can be added to a system (or perfect capacity can be reduced) at the initial reliability metric (5% LOLP) after the resource is added. As additional resources are added, the marginal effective load carrying capacity declines. EIA and MIT studies show the

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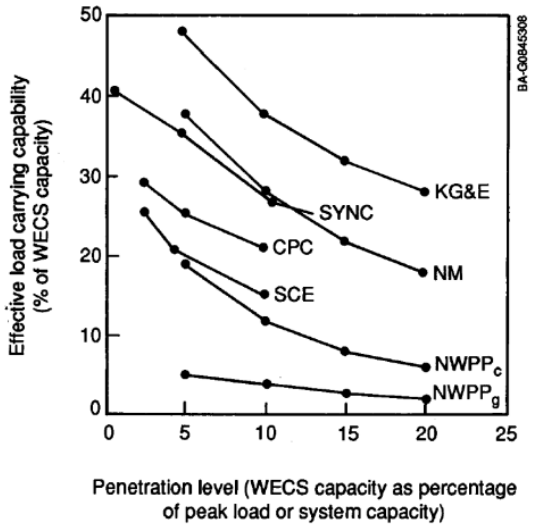
		resources but to all the existing renewables that have PSE's saturation-derated capacity values. Perhaps the saturation thinking had some credibility in the past of a total wind loss when PSE wind farms were all located in a single (Eastern WA) wind zone. In this case, if the wind was not blowing in that zone, additional turbines would have no effect. Now however, PSE has wind farms in 3 wind zones (Eastern WA, Western WA, & OR) with a fourth (MT East) to be added later this year, a fifth (MT Central), in the near future, and plans for 2 more regions in Wyoming. This regional diversity will greatly reduce the probability of any total wind loss event. The magnitude of the saturation error can be easily seen in PSE IRP Figure 7-17. In this chart PSE gives the first (350MW) MT East windfarm a 41.4% rating, but derates the second MT East windfarm to 21.8%. Additionally, it derates the MT Central windfarm to 30.1% even though Central wind is in a different wind zone which NREL and E3 rate higher than MT east wind. These systemic analysis errors have a huge impact on the 2856 MW of Additional Perfect Capacity Needed shown in chart on Slide 71. **PSE should recalculate the Perfect Capacity contribution of renewables without a so-called saturation effect before using it as the basis for final resource needs in the Sept 13 Electric Progress Report.**	ELCC saturation on VERs [2][3] as shown in the Figure below as an example. [1]L. L. Garver, "Effective load carrying capability of generating units," IEEE Transactions on Power Apparatus and Systems, vol. PAS-85, pp. 910–919, August 1966 [2]https://www.eia.gov/renewable/workshop/pdf/Session2_Marcy.pdf [3]Cheng, Alan. (2006). Economic modeling of intermittency in wind power generation. Civil and Environmental Engineering. 

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8/30	Don Marsh	I am writing on behalf of Sierra Club regarding the "Resource Adequacy Information Session" presented by PSE to IRP stakeholders on August 24. We object to inadequate public participation and distortions stemming from how PSE uses Resource Adequacy. **INADEQUATE PARTICIPATION.** A year ago, the UTC noted PSE's inadequate level of public participation (DOCKET UE-210571, Order 01). In this critical meeting, PSE fell far short of the level of public participation expected by the Commission.*1* PSE declared the meeting to be an "Information Session" rather than a participatory meeting. This prevented the public from providing meaningful input regarding Resource Adequacy, a foundational building block from which PSE's subsequent modeling and analysis will emerge. During the meeting, Director Popoff acknowledged the previous contributions of stakeholders such as James Adcock on climate change and Court Olson on possible winter weather variation. Yet, when Fred Heutte, a very experienced representative from Northwest Energy Coalition, tried to make an important point during the meeting, he was rushed by the facilitator and censored himself in frustration. Sophie Glass, the neutral moderator who had previously done a reasonable job of conducting meetings of IRP stakeholders, was put in the untenable position of pressuring participants to rush	Thank you for your response and feedback. PSE is evaluating the IRP stakeholder participation process which will likely be further refined for the next IRP cycle. PSE will consider resource adequacy modeling of different types of batteries for the 2025 IRP cycle. This session was a follow-up to the August 31, 2021 IRP stakeholder meeting where E3 presented PSE's ELCC approach and methodology. This session was also a follow-up to the Aug. 31 discussion on the recommended updates and how that affected the RA analysis and ELCCs. PSE solicited public feedback after the August public meeting and incorporated feedback received into the 2023 IRP cycle. All materials for this meeting can be found at pse.com/irp/get-involved under the August 24 Resource Adequacy accordion. The purpose of the August 24 Resource Adequacy meeting was not to discuss process goals for the IRP, as outlined in Mr. Marsh's comments. The high-level objective of PSE's IRP process is to determine how to achieve the goals of CETA, including achieving net carbon neutrality by 2030 and full decarbonization

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		through their questions. As she explained during the meeting, she was simply trying to keep the meeting on schedule (which was set by PSE). An unfortunate pattern persists. For many substantive questions raised in IRP meetings, PSE cuts discussion short by saying it will provide a written response. This prevents full discussion by all the participants. On some occasions, PSE summarizes the results of these discussions in later meetings, but the questioners don't always agree with PSE's conclusions. There is little opportunity for further discussion. [FOOTNOTE] *1 "Although this docket is not the appropriate forum to address PSE's IRP process, stakeholder comments regarding PSE's lack of transparency and poor communication with its IRP Advisory Group continue to be a source of frustration. Unfortunately, we heard from multiple stakeholders in this proceeding that similar issues are impeding PSE's development of its CEIP. To address these concerns, the Commission will work with stakeholders to explore changes to the public participation process. In the coming months, the Commission plans to facilitate discussions on topics such as advisory group leadership and governance, maintaining adequate advisory group staffing to increase real time engagement, eliminating communication barriers between utilities and advisory group members, and improving information sharing, data sharing, and data analysis*	by 2045, maintaining resource adequacy, and equity objectives under both CETA and CCA at the lowest reasonable cost. The objective of this meeting was to focus on two key elements of the process: Define the magnitude of resource need (in MW of perfect capacity) for PSE to maintain its resource adequacy target of 5% loss of load probability, and Describe how different resource alternatives are able to fill in the need for perfect capacity as identified above. Understanding needs is a prerequisite to identifying solutions and this approach is consistently applied across the utility industry in both the public and private sectors. Understanding resource adequacy, or more specifically, understanding when and where additional resources are needed, is fundamental to achieving the goals of CETA. Beginning with resources adequacy does not preclude the use of some resources types, as this comment suggests. On the contrary, fully understanding resource needs provides PSE with the opportunity to identify the many different ways that needs might be filled in the context of CETA.

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		between utilities and advisory group members. The Commission hopes to work collaboratively with regulated companies and stakeholders to improve the public participation process for all participants." [END FOOTNOTE] To remedy this problem, more discussion of controversial issues should take place in IRP meetings where all stakeholders can listen and participate. In cases where details must be taken offline, PSE should report what conclusions were reached with the questioning parties. In cases where no agreement is reached, that should be reported to stakeholders at the next meeting. This would improve participation, transparency, and accountability for outcomes. **RESOURCE ADEQUACY**. At the conclusion of the meeting, I tried to raise concerns about how the IRP process should change after passage of the Clean Energy Transformation Act (CETA). I felt pressured by the facilitator to end my remarks prematurely, and Director Popoff subsequently dismissed my suggestions as wishful thinking. I would like to clarify the points that I wasn't allowed to adequately explain. **What should the process be?** Director Popoff said no other IRP goal can be considered until Resource Adequacy is studied. Popoff further claims that because Resource Adequacy is a requirement of CETA, every other goal can be ignored until	PSE will endeavor to continue to improve communication about the process, to help stakeholders understand the overall process and where the topics for specific meetings fit into that process.

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		Resource Adequacy is determined. Let's consider the goals CETA tries to achieve: 1. Reduced greenhouse gas emissions 2. Reliable electrical service 3. Reasonable prices for electricity 4. Equity of access and impacts for all customers To achieve the highest benefit for the most customers, CETA goals should be considered together. Popoff's preferred process would identify the holes first (by studying Resource Adequacy) and then attempt to fill those holes with resources from PSE's All-Source RFP. However, this siloed approach will miss opportunities that would serve multiple purposes. It is common knowledge that batteries and other DERs offer multiple benefits, and their cost-effectiveness is dependent on full recognition of the layer cake of these benefits.*2* By considering one criterion to the exclusion of others, PSE may not find the best strategy to serve customers and mitigate environmental impacts. **Reliability and equity**. Resource Adequacy is important to maintain system reliability, but it is only one factor in determining the reliability that PSE customers experience throughout the year. During the past decade, PSE has not improved overall reliability in its service territory. From the UTC's	

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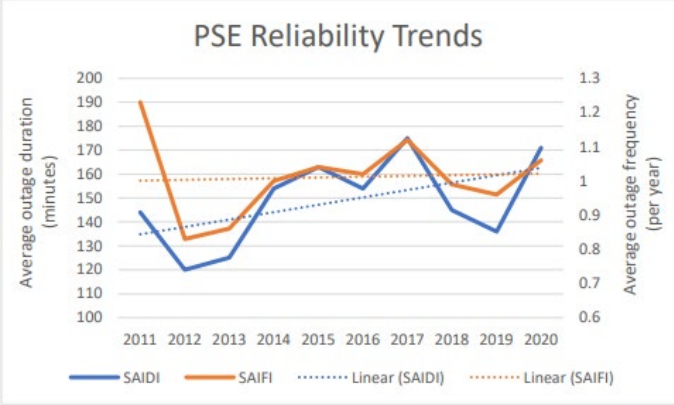
		web page showing reliability metrics,3 I produced the following graphs of SAIDI and SAIFI, metrics that measure the average duration and frequency of outages for PSE customers: [FOOTNOTE] *2 Battery benefits include diurnal storage, spinning reserve, operating reserve, emergency power, voltage support, frequency regulation, peak load shaving, energy arbitrage, carbon abatement, and local economic development. 3* *https://www.utc.wa.gov/regulated-industries/utilities/energy/infrastructure-and-energy-planning/annualreliability-reports-electric-companies* [END FOOTNOTE]  The average PSE customer endured about one outage per year for an average 2 to 3 hours. According to the federal Energy Information Administration,4 PSE's outage frequency is	

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		average for the US, but the duration is about 30% worse than the average and trending upwards. PSE's customers would appreciate better reliability than PSE has been delivering. Also, service reliability is not uniform or equitable. In the high-income city of Bellevue (where PSE's headquarters is located), there are only half the number of outages compared to lower-income parts of the service territory in Whatcom, Skagit, and Thurston Counties. One way of improving distribution reliability would be siting moderately sized grid batteries in neighborhood substations, as suggested by the industry consultant Acelerex during recent land use hearings. Such batteries could provide power to customers in many emergency scenarios where more remote energy resources (even remote batteries) would not be able to maintain service. By starting with Resource Adequacy, would PSE's traditional IRP process identify the desirability of this kind of solution? **Technologies ignored**. PSE's IRP is intended to look forward 20 years. During that period, gasoline-powered vehicles will no longer be sold in the state of Washington. The battery capacity of the growing fleet of electric vehicles will dwarf the capacity of utility-scale and residential batteries combined. It is not rational to assume that this immense storage	

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		resource will remain untapped as we strive to create a 100% emissions free grid by 2045. During the 2019 IRP, PSE asked stakeholders to vote on different sensitivities to be studied. The sensitivity that received the most votes was Vehicle-To-Grid. In 2022, Ford added a Vehicle-To [FOOTNOTE] *4* *https://www.eia.gov/electricity/annual/html/epa_11_01.html* [END FOOTNOTE] House feature to the electric version of the most popular vehicle in the nation (the Ford F-150). It is time to include that study as a sensitivity (or even a default assumption) in the 2023 IRP. PSE did good work in designing a Time-Varying Rates (TVR) program which could reduce peak demand significantly, reducing customer costs and power outages due to grid stress. However, PSE has been slow to roll out the program. The 2023 IRP should assume that TVR is operating for most of the IRP planning period. In the Resource Adequacy presentation, PSE assumed that batteries would use lithium-ion chemistry and have relatively short duration (2, 4, or 6 hours). During the IRP planning period, it is highly likely that grid scale batteries with longer durations will become economic and be installed. For example, grid batteries are being installed in California based on iron-phosphate and zinc-	

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		bromine chemistries, both of which have advantages over lithium-ion batteries for grid storage applications. *5* Georgia Power and Great River Energy have contracted for iron-air batteries manufactured by Form Energy with a duration of up to 100 hours. *6* Aside from large grid batteries, there have been many announcements about Virtual Power Plants that coordinate the capacity of thousands of residential batteries. Tesla's VPP supplied 17 MW to the electric grid operated by Pacific Gas and Electric during a period of peak demand on August 17.*7* Meanwhile, Duke Energy Florida announced a "Bring Your Own Battery" program for owners of any residential battery.*8* Other utilities with bring-your-own battery programs include Liberty Utilities, Green Mountain Power, and Hawaiian Electric.*9* PSE has not announced any specific VPP plans. Many of these solutions might not be included in the 2023 IRP if they are evaluated primarily for their ability to solve Resource Adequacy issues. We need PSE to be more holistic in its analysis. Sincerely, Don Marsh Sierra Club Washington State Energy Committee [FOOTNOTE] *5 https://techxplore.com/news/2022-01-major-energy-storage-projectenough-power.html 6 https://www.energy-storage.news/form-energy-in-talks-with-georgia-power-for-100-hour-iron-air-batterystorage-project/,*	

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		https://formenergy.com/form-energy-collaborating-with-leading-georgia-electric-utility/ 7 https://www.utilitydive.com/news/pge-tesla-virtual-power-plant/630310/ 8 https://news.duke-energy.com/releases/duke-energy-florida-s-innovative-battery-storage-projects-providecustomer-grid-benefits 9 https://www.hawaiianelectric.com/products-and-services/customer-renewable-programs/rooftop-solar/batterybonus, https://greenmountainpower.com/rebates-programs/home-energy-storage/bring-your-own-device/, https://new-hampshire.libertyutilities.com/concord/liberty-utilities-home-battery-storage-pilot-approved--1.html [END FOOTNOTE]	
8/31	Court Olson	Thank you for inviting feedback to PSE's August 24th Resource Adequacy presentation to stakeholders. I'm writing because it is my belief that PSE's projected large gap in future "Perfect Power Capacity" is unsubstantiated, and it appears to ignore energy efficiency trends in the buildings sector. To aid the reader, I begin my comments here with a summary. SUMMARY	Thank you for your feedback. Addressing how conservation and demand response are treated in portfolio modeling was not the intent of this meeting. As explained above, the purpose of this meeting was to identify the amount of capacity PSE needs to maintain its resource adequacy targets and how different kinds of resources can contribute to those capacity needs, as inputs to the portfolio analysis. PSE agrees that the use of time varying rates to shift peak loads, as well as demand response programs are

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		· I have substantial experience and knowledge about green buildings and trends in the building industry. · The federal DOE reports that buildings are 80% of the demand on the electricity grid today. However, this percentage will decline in the future due to continuing long-term improvements of energy efficiency in buildings and with the electrification of the transportation sector. ·In the future, I do not expect electricity demand from the buildings sector to increase rapidly. Given the ever-tightening Washington state energy code which will require nearly net zero energy consumption in new buildings by 2031, and given the increasing trend for stronger energy efficiency measures in the existing building stock, at some point before 2050 I think it likely that the total energy demand in the buildings sector will start to decline. However, the trend toward buildings electrification is currently picking up speed, and that will likely produce a small increase in electricity demand over the next twenty years that must be accommodated. · That said, by the fourth quarter of this century, and perhaps even earlier in the third quarter, as less energy efficient older building stock is retired, the total electricity demand from the buildings sector may well be less than it is today. So, we must avoid excessive electric grid infrastructure build up based	important tools in meeting anticipated future demand. These types of programs, and other tools that reduce energy consumption, are considered as part of the IRP process. The Resource Adequacy analysis presented at the August 24, 2022 stakeholder meeting was completed prior to adding in conservation. This is industry practice, because the IRP process treats conservation as a resource. We start with a condition where there is no additional conservation, so we can calculate the value that conservation has to reducing the net present value cost to the portfolio. The "before conservation load forecast" is just an input to allow us to identify how much conservation/demand response are cost effective in the portfolio analysis. For example, please refer to the 2021 IRP, Chapter 8, Figure 8-158, page 8-182. This table illustrates that conservation and demand response reduce the net present value cost to customers by about $2 - $2.5 billion and reduces risk by about $3 billion. We start using a load forecast without conservation and demand response so we can demonstrate how valuable those resources are to the portfolio.

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		on the false anticipation of a perpetually increasing need from the buildings sector.· PSE appears to be either unaware of, or turning a blind eye to, these trends in the building sector, because it continues to overestimate future electricity demand.· If PSE was to implement a time varying rates structure, promote consumer use of short-term batteries in buildings to avoid peak load rates, also promote off-peak charging of batteries in the transportation sector, and also implement a strong demand response program, then added peak generation capacity and associated transmission infrastructure growth could likely be avoided. With such measures, due to the ever-improving energy efficiency in buildings, by 2050 the total peak load demand on the electrical grid could potentially start to decline.· Therefore, I contend that a significant part of PSE's projected shortfall in "Perfect Capacity" seems to be founded on incorrect demand forecasting. PSE needs to fully understand and include lower demand trends in the building sector, as well as implement more off-peak demand incentives to substantially reduce their projected shortfall in "Perfect Capacity." PERSONAL BACKGROUND Because I have 40 years of experience overseeing design and construction of commercial buildings, and I've studied green buildings and energy efficiency a lot, I feel qualified to make the	That is, the load forecast before conservation is an important starting point as an input, so we can identify how much conservation is cost effective, which is an output. PSE will endeavor to continue to try and communicate more clearly about the process.

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		comments in this message. Here are some further details on my background in bullets form. Obtained three college degrees (in Construction Science, Civil Engineering and Construction Management). Oversaw three dozen commercial building projects. Was an early follower of the U.S. Green Building Council, and became a LEED Accredited Professional. Oversaw design and construction of the first LEED Platinum building in Washington. Completed a college course in photovoltaic/solar energy applications. Completed an intensive course in Passive House design concepts. Taught green building courses at a major university. Did extensive readings and attended dozens of programs on high performance buildings, and the global transition to a clean energy economy. Was instrumental in the drafting and passage of two key bills related to green buildings in the Washington legislature. Became a member of five local green building focused organizations, including a founding member of Shift Zero.	

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		Oversaw the design and construction of the deep energy efficiency and electrification renovation of my own home. · Attended PSE IRP stakeholder meetings for about ten years now. DECLINING ENERGY DEMAND TRENDS IN THE BUILDINGS SECTOR According to a 2015 report by the federal DOE, buildings consume about 80% of the power on the electrical grid. So, buildings play a big role in grid demand forecasting. However, that role of the buildings sector is not static; it is changing. While the number of buildings in Washington is increasing with the population, due to 2007 legislation that requires step by step tightening of our State Energy Code through 2031, the energy demand from new buildings is increasing at a reduced pace. That 2007 law requires that by 2031 new buildings must use 70% less energy than the 2006 state energy code allowed. In my judgement, given popular interests and industry trends, it is highly likely that we will see at least some local jurisdictions adopting a net zero energy code in the future –possibly even before 2031. (BTW, some building owners are today already demonstrating that we can build net-positive energy buildings here in western Washington.) Consequently, I expect that energy demand growth from new buildings will	

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		be slowing to a trickle before the end of the twenty-year horizon of PSE's 2023 IRP. Over that same twenty-year horizon, energy demand from our existing building stock will also be declining. Recent legislation requires it. Over the next ten years existing commercial and multifamily buildings of 20,000 square feet or larger will have to meet new efficiency performance standards state-wide. Furthermore, in that same period some of the existing building stock will be retired from service just due to normal attrition. In twenty years perhaps 10 to 15% of our existing building stock will be gone. Most of those will likely be older buildings that were built when little insulation or energy efficiency was required; in short, we'll be retiring many energy hogs. Most of those old buildings are sure to be replaced with new, highly energy efficient buildings. Consequently, I expect that at some point before 2050, even as our population grows, the total energy demand from all buildings will start to decline. Looking beyond 2050, that downward total demand trend will likely be picking up speed as more and more older and inefficient buildings are retired. I expect that in the last ten years of this 2023 IRP twenty-year time horizon, many retired buildings will be replaced with new net-zero, or close to net-zero, buildings. ANTICIPATING THE EFFECTS OF BUILDINGS ELECTRIFICATION ON THE ELECTRICAL GRID	

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		Of course, there is another ongoing trend the buildings sector that is picking up speed. Buildings are moving away from fossil fuels consumption. In many buildings, that transition will be adding some demand to the electric grid. Recent action by the state code council requires the use of heat pumps for space and water heating in new commercial and multifamily buildings starting next year. A similar change for new single family and small multi-plex residential buildings could be eminent. So, many new buildings will clearly be adding demand to the electrical grid as they abandon the use of fossil gas fuels. However, since the energy efficiency requirements are tightening every three years through 2031, the amount of this electricity demand increase caused by new buildings will be lessening over the next ten years. If at some point jurisdictions implement net zero energy codes, then the amount of added electricity demand from new buildings may become quite small indeed. With the recent passage of the federal Inflation Reduction Act (IRA), federal incentives will also be pushing the existing residential building sector toward heat pump space and water heating. Without significant improvement in the heat loss that occurs through the skin of homes, existing residences switching to heat pumps could add substantial electrical load to the grid. However, IRA also incentivizes building envelope efficiency	

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		improvements, so if those envelope improvement measures are simultaneously implemented with the new heat pumps, then the amount of added electrical demand may be small. Possibly, that overall residential electricity demand increase could even become negligible, because a significant portion of the existing residential building stock is currently heated with quite inefficient electric resistance heating elements, rather than with fossil gas fuel. Replacing that electric resistance heating with heat pump sources would reduce the electric load in such homes (or any other building type using electric resistance heating). Going forward, putting the impacts of all of these rather new government policies onto a timeline is challenging. Much depends on the pace that building owners choose to adopt these new policies. The IRA incentives for homeowners to switch to heat pumps will likely be impactful by the end of the next decade and perhaps well beyond, but because of the potential for replacement of electric resistance heating in some buildings at the same time that fossil gas heating is being retired in other buildings, the net electric demand increase in existing buildings due to IRA may be small. Of course, new buildings will definitely be adding some electrical load, since they will mostly (if not all) be using electricity for space and water heating. That said, the retirement of older and highly energy inefficient buildings should help mitigate some of	

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		this added electricity demand from new buildingsAs I see all of these factors in play, I expect a rather modest total increase in electricity consumption from the buildings sector during the next twenty years. That said, if PSE was to promote consumer battery storage systems, along with a time varying rates structure, and also implement a strong demand response program, then this modest general increase in total electrical demand from buildings would not lead to a higher electricity peak demand than we have today. This peak demand mitigation seems quite feasible to me. If peak demand was to remain steady and not increase, then increasing the system wide peak generation capacity and transmission infrastructure could be avoided. ANTICIPATING GRID DEMAND FROM ELECTRIFICATION OF THE TRANSPORTATION SECTORThere is no question that the transportation sector is transitioning away from fossil fuels. What isn't easily predictable is the rate of that transition, and how big of a role hydrogen fuel cells will ultimately play. Clearly over the next twenty years here in the Puget Sound region there will be significant electrification of cars and small trucks, along with buses and light rail. Since all but the light rail electrification will be battery powered, it is quite feasible that through time varying rates and other vehicle charging incentives, PSE could significantly incentivize vehicle charging to occur	

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		during off-peak hours. Off-peak vehicle charging would largely avoid the need for significant increase in peak generation capability and transmission infrastructure due to electrification of the transportation sector. CLOSING PSE'S PERCEIVED FUTURE SHORTFALL IN "PERFECT CAPACITY" Everyone wants to be sure that the electric grid of the future can reliably cover demand. However, at the same time, we should not be overbuilding infrastructure in anticipation of an inflated demand projection. That appears to be what PSE is doing. Since 80% of the current demand on the grid is going to buildings, understanding and realistically forecasting future energy trends in the buildings sector is essential for determining the amount of "Perfect Capacity" needed in the future. PSE has not been transparent about how it performs its demand forecasting. Based upon PSE's overstated forecasts in the previous four IRP cycles, there is something fundamentally wrong with the way PSE makes its demand projections. In my view that process needs serious overhaul and rethinking. From my relatively well-informed experience in the building industry, I do not see the current trends in the buildings sector as having the potential to create such a large gap in future "Perfect Capacity" as PSE presented in the August 24th Resource Adequacy stakeholders meeting.	

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		I am, consequently suspicious that PSE's "Perfect Capacity" shortfall projection is heavily influenced by its inherent biases and by a narrow vision of reality. Here are PSE's problems as I see them: 1. PSE is both an electricity and a gas utility. It wants to keep using gas to generate electricity as long as possible because selling gas is profitable. (Also, in part, it likes gas peaker plants because they are a lot easier to turn off and on than renewable generating resources are.) 2. PSE can get a higher markup and rate of return for its private investors on new infrastructure construction than it can get from selling power. So, PSE seems inclined to overbuild to satisfy its investors. 3. PSE chooses to avoid or ignore the strong trends in energy conservation in the buildings sector that are at play here in Washington. (1) PSE mistakenly portrays itself as leading, if not controlling, building sector energy conservation through its incentive programs (but these programs are not as strong as needed and, shamefully, they don't incentivize switching from fossil gas to heat pumps), and (2) PSE fails to adequately acknowledge that the building sector is largely moving independently and with increasing urgency towards energy efficiency along with electrification. This trend is	

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		(a) due largely to the increasing government tightening of the energy code and existing building performance standards, but (b) also due to the increasing public popularity and demand for highly efficient, more comfortable, and low climate impact green buildings, and (c) recently, due to strong federal incentives towards efficiency and electrification of buildings.ONCLUSION It is not my intention here to be disrespectful to PSE. I understand that our whole society is in a state of rapid change relating to energy consumption. Future electricity demand is not easy to predict. That said, I highly recommend that PSE take a very hard and critical look at how it is projecting future demand. PSE has been repeatedly wrong in past IRP cycles, and it seems to be very much off track now, given the building sector trends that I've just described. It's time to think outside of the old box that PSE has been using for demand forecasting. We ratepayers can't afford to have PSE overbuild the electric grid infrastructure. Sincerely *Court*	
9/7	Randy Hardy	PSE IRP, These comments/recommendations are submitted as a follow up to my oral remarks during PSE's	Thank you for the feedback.) (1) PSE will evaluate the most cost-effective approach for firming up the 1,500

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		August 24 meeting on its 2023 IRP. As a long time PNW energy consultant, I followed development of PSE's current IRP closely and, as a former CEO of both BPA and Seattle City Light, I have some observations which might be helpful. (1) Decreased Reliance on Mid C Spot Market Purchases For the last 10-15 years PSE has purchased up to 1,500 MW of Mid C spot market energy/capacity, mainly for reliability purposes. In its 2021 IRP PSE proposed to decrease such spot market purchases from 1,500 MW to 500 MW by 2027. This decision was based on a decreasing volume of firm transactions / power available from Mid C and increasing volatility of both price and power availability at that trading hub. In the 2023 IRP, PSE is considering (based on discussions at your August 24 IRP meeting) further decreasing its Mid C spot market purchases to zero by 2028. I would support this tentative direction based on two conditions. First, PSE replace the total 1,500 MW of spot market purchases with firm capacity resources, or at least call options from such firm resources to meet loads generated by extreme weather events consistent with the seasonal Planning Reserve Margins (PRMs) specified in PSE's 2023 IRP. Because PSE already possesses 1,500 MW of firm transmission from Mid C to Covington substation it should be able to acquire the necessary firm	MW of Mid C transmission. The intention is to close this with firm resources. PSE plans to continue to be engaged in the WRAP. (2) To clarify, PSE leveraged the classic GENSYS model from the Northwest Power and Conservation Council, not the new model, which is currently a work in progress. The assumptions in the classic GENESYS model were updated to reflect climate change for the 2023 Electric Progress Report, which included updated hydro shapes for both BPA's and PSE's system as well as updated regional and PSE specific temperatures. (3) PSE plans to further evaluate the implications to the portfolio of shorter vs. longer duration storage resources.

Date	Stakeholder	Question	PSE Response
		resources and deliver them to its service territory with a high degree of certainty. This increased degree of resource acquisition certainty seems even more assured given that BPA recently announced its intention to install series capacitors (SCPs) on the Schultz-Raver 500 KV transmission line. This upgrade will create an additional 1,600 MW of available transmission capacity (ATC) on BPA's Cross Cascade North (CCN) transmission path (i.e. the I-90 corridor), the primary transmission corridor to wheel eastside resources to the Puget Sound area. While all of this 1,600 MW of ATC will no doubt be allocated to transmission service requests (TSRs) already in the BPA queue, many resources receiving that ATC are no doubt under evaluation in PSE's current RFP, or will be eligible for acquisition in future PSE RFPs. The second condition (for decreasing PSE's Mid C spot market purchases to zero) is that PSE continue its active participation/membership in the Western Resource Adequacy Program (WRAP) sponsored by the Western Power Pool. This participation will ensure that PSE can eventually access regional generation diversity (supplied by WRAP members) for RA purposes. (2) IRP Linkages to NWPCC GENYSIS Model A second issue I raised during PSE's August 24 IRP call was concern about possible PSE IRP reliance on the new GENYSIS hydro/resource	

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		model being developed by the Northwest Power and Conservation Council (NWPCC). This concern arises from E3's extensive modeling of RA issues discussed on August 24. While my understanding is that PSE's 2021 IRP (and presumably its 2023 IRP) used/will use the previous NWPCC version of GENYSIS to help calculate resource acquisition needs, it is not clear to me what version of GENYSIS E3 used in its RA modeling for PSE. I would strongly recommend PSE avoid using any data deriving from the new GENYSIS model. This model, although used by NWPCC in development of its Eighth Power Plan, is still undergoing changes due to its anomalous results of PNW hydro system output. Briefly put, the new GENYSIS model assumes a degree of PNW hydro system flexibility that, in the view of BPA and many PNW hydro based utilities, is not realistically available in real world hydro operations. It also assumes an amount of California winter solar imports (to allow PNW winter hydro to be held back for peak reliability needs) that are not likely available in the near term (according to CAISO officials) given that state's serious capacity shortages from 2022 to 2030. (3) Implications of Reducing Mid C Purchases Finally, replacing Mid C purchases with firm energy/capacity acquisitions is desirable, but it will affect the amount and types of RA acquisitions PSE needs to consider. With the possible exception of high capacity factor, winter generating Montana	

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		wind, PSE will need to keep at least some reliance on both longer duration storage resources and even dual fueled (e.g. biodiesel fueled) CTs mentioned in your 2021 IRP and located presumably in PSE's service territory west of the Cascades. Use of, for example, pumped storage resources, with their 8 hour discharge duration, will complement PSE's 4 hour Li-ion batteries, thus better handling likely longer term nighttime winter cold snaps (E3's emphasis on shorter winter events non-withstanding) and will help mitigate some of the saturation effects especially affecting shorter term storage resources. These possible effects on PSE's resource acquisition strategy will no doubt be thoroughly considered in your 2033 IRP, but I thought it might help to flag some of the key issues now since they are also connected to any PSE decision to further reduce Mid C spot market purchases. Randy	

Feedback Addressed from August 24 Resource Adequacy Information Session IRP Meeting

What PSE heard	What PSE did
PSE needs to provide more context and clarity on the steps in which IRP stakeholders can have a role in conservation planning.	PSE prepares a Biennial Conservation Plan (BCP) consistent with RCW 19.285.040(1), WAC 480-109-120, and requirements outlined in Appendix A of the Commission Order 01 of Docket UE-190905. Stakeholder engagement related to the development of the BCP occurs at various steps of plan development, as described in the BCP. In addition, after the BCP is filed with the Washington Utilities and Transportation Commission by November 1st of every odd-numbered year, the public has opportunities to submit written comments on the BCP within 30 days of the utility's filing and participate at any WUTC meetings to review and consider the BCP.
Participation in the IRP process is critical to stakeholders.	PSE agrees that stakeholder engagement is critical to the IRP process. We are assessing the stakeholder process for the next IRP cycle in order to improve the process.
It is critical to include the most recent data in forecasting models.	PSE agrees. It is important to include the most recent data in forecasting models as feasible.
It is good to see that PSE is incorporating climate change into modeling and resource planning.	Thank you for your comment.
Concerns about PSE's commitment to meeting the 2030 CETA requirements.	PSE is committed to achieving the 2030 CETA requirements, as outlined in our 2021 Clean Energy Implementation Plan (CEIP).

Attendees (alphabetical by first name)

1. Aaron Stoll
2. Aaron Tam
3. Amy Wheeless
4. Andres Alvarez
5. Andrew Kiss
6. Bill Will
7. Bradley Cebulko
8. Brian Grunkemeyer
9. Charlee Thompson
10. Chris Searcy
11. Clark Rein
12. Cody Duncan
13. Corey Schwab
14. Court Olson
15. Darryl Nevins
16. David Musgrove
17. Don Marsh
18. Duane Ball
19. Elena Cardenas
20. Ellyn Murphy
21. Fred Heutte
22. Garrett Lehman
23. Gordon Baxter
24. James Adcock
25. Jesse McNeill
26. Jim Schretter
27. Joel Nightingale
28. John Crosson
29. John Hejkal
30. Jon Sdao
31. Laurie Hutchinson
32. Lori Hermanson
33. Mark Boissevain
34. Markus Virta
35. Matthew Pagan
36. Michael Berry
37. Michael M.
38. Michael P Dunnigan
39. Michael Rooney
40. Mike Elenbaas
41. Mike Hermanson
42. Natasha Bryan
43. Nelli Doroshkin
44. Patrick Leslie
45. Peter Besenovsky
46. Philip Jones
47. Philipp Schmidt-Pathmann
48. Brian Duncan
49. Rachel Clark
50. Rebecca Sexton
51. Rhett Hurless
52. Ruoshui Li
53. Ryan Sherlock
54. Sarah Edmonds
55. Sashwat Roy
56. Sean Yovan
57. Sergio Dueñas
58. Stephanie Chase
59. Steve Edburg
60. Stewart Rosman
61. Tina Lee
62. Virginia Lohr
63. Vivek Balasubramaniam
64. Willard Westre

Puget Sound Energy Staff Observers (alphabetical by first name)

1. Alexandra Karpoff
2. Allison Jacobs
3. Anthony O'Rourke
4. Bob Williams
5. Brett Rendina
6. Brian Tyson
7. Carryn Vande Griend
8. Cindy Vu
9. Doug Hart
10. Elizabeth Hossner
11. Gilbert Archuleta
12. Hannah Wahl
13. Jennifer Coulson
14. Jennifer Magat
15. Jessica Zahnow
16. Jisong Wu
17. John Mannetti
18. Laura Hatfield

19. Laxman Subedi
20. Leslie Almond
21. Lorin Molander
22. Marc Alberts
23. Meredith Mathis
24. Nathan Critchfield
25. Nick Gemperle
26. Phil Haines
27. Phillip Popoff
28. Ping Liu
29. Ray Outlaw
30. Renchang Dai
31. Scott Williams
32. Sheri Maynard
33. Tyler Tobin
34. Wendy Gerlitz
35. Zeia Lomax

Consultant Staff and Guest Speakers (alphabetical by first name)

1. Aliza Seelig (PNUCC)
2. Arne Olson (E3)
3. Claire Moerder
4. Claire Wendle
5. Joe Hooker (E3)
6. Kim Zamora Delgado
7. Ryan Roy (WPP)
8. Seth Baker
9. Sophie Glass
10. Will Henderson