Resource Planning Advisory Group supplemental feedback report

This report includes RPAG member feedback from the September 30, 2025 RPAG meeting that was received after the feedback report was completed.

Feedback

The following records participant questions and PSE responses from comments submitted via online feedback form or email to isp@pse.com.

PSE endeavors to provide clarity in responses but subsequent follow-up may be required at times. Please direct any follow-up clarifications to isp@pse.com.

PSE responses are in teal italics.

1. Katie Chamberlain on behalf of Renewable Northwest and Megan Larkin on behalf of Climate Solutions, October 30, 2025 via isp@pse.com

I. Introduction

Renewable Northwest ("RNW") and Climate Solutions thank Puget Sound Energy ("PSE" or "the Company") for the opportunity to comment on the September 30, 2025 Resource Planning Advisory Group ("RPAG") meeting. The September 30 RPAG meeting provided the results of E3's Resource Adequacy ("RA") analysis and additional details regarding the modeling approach.

RNW and Climate Solutions appreciate the work that PSE and E3 have put into the RA Study and that PSE is planning for a reliable system using an updated analytical approach. As members of the RPAG, we have two primary concerns with the proposed new RA

methodology. First, the output of the RA analysis, specifically the planning reserve margin ("PRM") and effective load carrying capacity ("ELCC") values are primary determinants of the ISP results and future procurement needs. Accordingly, this new RA approach needs to be fully vetted prior to implementation. Instead, significant questions remain that may drastically alter the results. Second, we reiterate the multiple questions and comments voiced during the RPAG meeting regarding the lack of coordination of both the analysis and results with the Western Resource Adequacy Program ("WRAP"). We encourage the Company to provide additional detail and information about the new RA approach and explicitly identify potential and planned coordination with WRAP. We provide more detail regarding our concerns and recommendations below.

In addition to feedback for the September 30, 2025 RPAG, we provide comments on responses from the October 1, 2025 Feedback Memo.

Feedback on the September 30 RPAG meeting are addressed below. Feedback on the October feedback memo are addressed in a separate supplemental memo.

II. The methodology, inputs, and results of the new RA analysis raise questions but are not sufficiently documented for stakeholders to provide meaningful feedback.

E3 has produced a complex methodology that purports to be the industry standard for evaluating RA. RNW and Climate Solutions applaud PSE for working to modernize their RA approach. However, a model is only as good as its inputs and assumptions. Oversight and model validation are necessary to make sure that both are accurate as well as appropriately reflecting inherent uncertainty.

E3's presentation of the initial results of the new RA approach detail large changes compared to the 2025 IRP, including a 273 MW increase in projected shortfalls in winter, and a 373 MW decrease in summer for the year 2031, as well as significant changes in the ELCC of different resources. Together, the changes in load variability, PRM, and ELCC values can significantly affect the resulting portfolios, potentially shifting resource selections by hundreds of megawatts and/or introducing bias toward or against particular resource types.

Accordingly, ensuring these values are correct is critical for the 2027 ISP so that the Preferred Portfolio (that will then shape future procurements) reflects the true need and optimal resource mix for a reliable and affordable power system. Absent this rigorous analysis, customers may be forced to pay for resources that do not represent the least cost, least risk option.

Although we appreciate the time and effort that E3 and PSE have spent providing an overview during the RPAG meetings, we find that at this time **the methodology is not sufficiently documented, nor are the inputs or results detailed enough to provide meaningful feedback to either PSE or E3, and request additional details before these results (serving as inputs for the capacity expansion step) are locked.** We provide initial reactions to the findings, as well as recommendations for both documentation of the new RA approach, as well as considerations for the 2027 ISP analysis.

E3 presented the updated methodology for review at the May 15, 2025 RPAG meeting (presentation, meeting recording, and summary). The May 2025 presentation included an overview of the RA modeling and updates to the methodology which included the new approach to the regional model (Slide 25, May 15 RPAG). During this RPAG meeting, members learned about and discussed the recommendations from E3 from the 2021 IRP model review and the implementation of the updates, which concluded in this planning process with correlating wind and solar generation to loads and temperatures.

PSE did not hear concerns or suggested modifications to the modeling methodology after this presentation. Additionally, E3's RA methodology for PSE and the larger regional analysis, presented to the Commission during the UTC and DOE RA workshop on Sept. 22, 2025, are largely similar. Given that PSE has conducted two RPAG meetings reviewing its RA methodology and the need to use this methodology to proceed with time-sensitive ISP analysis, PSE is not planning to make adjustments to the RA methodology at this time but will consider feedback for future analyses. PSE will be working with E3 to prepare a comparison of key input assumptions with the prior study to illustrate how temperatures and hydro conditions differ between the hybrid methodology in the last study and the current study. PSE will share that comparison when it is reasonably available.

We also encourage you to review our response in the September 30 Feedback report which addresses many of the topics below.

a) The high-level descriptions of the methodology and the initial results of the RA assessment compared to the 2025 IRP raise concerns.

RNW and Climate Solutions' primary concerns based on the information currently available are the accuracy of the load variability and the ELCC accreditation values, especially given their significant deviation from the 2025 IRP values.

Many of the drastic changes between the 2025 IRP and new RA analysis are due to the assumed increase in load variability in winter. Given that the increased load variability is the result of a new method, that has not yet been subject to regulatory oversight, its results and potential implications on resource selection warrant close scrutiny. The large change in winter peak load variability and

loss of load durations compared to the 2025 IRP suggests that the analysis may be overestimating the likelihood of extreme tail risk events. In fact, the large difference between the two analyses further highlights how likely it is to have over- or under-estimated values.

First, the results of E3's "detrended" temperature data necessitate further clarification. Despite detrending which should "decrease seasonal peak temperature variability" (slide 34), temperature detrending results in a "wider range of temperatures" (slide 35) and increased daily peak load variability for winter. This result needs to be fully justified.

Second, it seems that the detrended temperature data and the weather conditions (historical weather/load conditions) used at the training and inference steps do not account for future risks associated with changing future climate conditions. By only considering the period up to 2022, it is unclear whether the analysis is forward looking and/or climate-informed. If not, it might fail to account for higher temperatures in winter and decreased likelihood of cold snaps that climate change informed temperatures would address and consequently lead to inflated or erroneous resource needs.[1] This could have significant impacts because temperature is now correlated with loads and renewable generation.

Third, correlating loads with historical renewable generation and weather conditions does better capture historical relationships, but there is a tradeoff to this modeling approach which is that it narrows the possible outcomes and implies false precision. For example, there could be significant variability in what wind generation could be during a cold snap in the future. But because wind generation has been low over a few historical observations (a small sample size) the neural network model will forecast continued low wind generation during future events. The neural network approach therefore has an overreliance on a few historical events, rather than reflecting causal relationships. The result is that the correlation between temperature and historical loads is misrepresenting the risks of high loads with low renewable generation – resulting in a higher LOLP, reliability target, and peak load, and lower ELCCs for variable generation resources.

Increased winter peak load variability and loss of load durations are driving the shortfall results (as discussed on slides 39, 40, and 41). Longer duration and more frequent loss of load events appear to be driving the reduction in ELCCs for candidate resources. The

[1] https://www.science.org/doi/full/10.1126/sciadv.adp1346

change in ELCC values (declines for wind and storage and increases for solar) reflects a drastic deviation from the prior analysis as well as WRAP ELCCs,[2] which warrants much closer scrutiny before the ELCC values are finalized.

We encourage the Company to also provide clarifications on the following items:

- An additional concern, also raised during the RPAG meeting, stems from the modeling of resource saturation leading to lower ELCC values for energy storage and renewable energy resources. Our understanding is that one ELCC curve is applied per technology, reflecting lower firm capacity as the resource saturates – failing, however, to incorporate the geographic (and generation profile) diversity that is available to PSE.

  ELCC curves were developed using geographic diversity for wind and solar using the same definition zones as WRAP. The results were presented on slide 47 of the September 30 RPAG meeting.

- It is not clear from the slides whether thermal resources are also modeled following the same methodology and what the resulting ELCCs are. We assume that ELCCs for thermal units should reflect correlated events, including fuel supply availability.

  Thermal resources are modeled using the same ELCC methodology and included on slide 43 and noted on slide 52 at a 95% ELCC.

- Given the significant differences in ELCCs between E3's update and the WRAP values, we would appreciate additional details as to the Company's interpretation of said differences, whether future coordination with WRAP will occur, and/or parallel WRAP efforts to forecast regional ELCCs and PRMs will be informing the 2027 ISP.
- See response below in section III.
- The reason that PSE is not using the NW Power and Conservation Council's redeveloped GENESYS model[3] for Resource Adequacy analysis—which was specifically created in collaboration with regional stakeholders through a public process.

[2] For example, WRAP ELCC values for BC wind in winter range from 17% to 25% for November through March for the 2025-2026 season. While future values would have lower ELCCs, it is unclear why they would be as low as 3%, as identified the 2027 ISP in Slide 47 of the September 30 RPAG Meeting.
[3] Comparison of original and redeveloped GENESYS is available at: https://www.nwcouncil.org/2021powerplan_genesys-model/

As discussed in the RPAG meeting, across the industry, methods for these climate models are still emerging. Some climate models do not have the same details for the tail event conditions for temperature datasets. Therefore, we had to move away from the GENSYS models for this ISP.

- b) Additional documentation and specification would improve transparency and feedback on the new RA methodology and its implications for portfolio selection.

RNW and Climate Solutions appreciate the significant effort that PSE and E3 have put into developing and implementing an updated RA approach. However, given the potential influence that this new methodology will have on the 2027 ISP and on future procurement decisions, we believe that additional transparency, documentation, and validation are essential.

Accordingly, we recommend that PSE and E3 provide detailed, PSE-specific documentation of the new RA methodology and modeling inputs as soon as possible.

E3 should publish a single, comprehensive document that clearly describes all inputs, assumptions, and parameters used in the RECAP and RECLAIM models, specific to the analysis for PSE.[4] This would include documentation of all assumptions, parameters, and variables for both the RECAP and RECLAIM model in a single source. All underlying data should be made public in anticipation of what will be requested in the ISP Discovery process. This should include the historical temperature and load data sets used, the process for temperature detrending, renewable generation profiles, LOLP distributions, LOLE curve values, and ELCC values for all resources and saturation levels.

PSE will document and, to the degree possible, publish details of the analysis and assumptions with the final Integrated System Plan.

III. Commit to scenario modeling in the ISP to inform impact of input assumptions

[4] E3 has high-level documentation for the RECAP methodology on the website, but none for the RECLAIM model

Scenario analysis will be critically important to identify if different resource portfolios can offer similar RA results at lower costs. After reviewing the new RA approach and identifying potential issues that could arise, RNW and Climate Solutions have identified the following specific scenarios that we recommend including in the ISP modeling:

- **Scenario without PRMs**: The rationale for this type of scenario is to identify the impact of the PRM on the resource portfolio and LOLP.
- **Scenario with WRAP ELCC values**: Given the significant differences between the newly presented E3, the 2025 IRP, and the WRAP ELCC values (all of which were designed to estimate the firm capacity contribution of resources following the best available data and methodologies), it would be instructive to understand what the impact of differing assumptions is on portfolio development (the sensitivity of the results to ELCC inputs, best practices for the development of which are still being established). An additional sensitivity with 2025 IRP ELCC values would be informative.
- **Scenario with higher market purchases:** During the RPAG meeting both E3 and PSE made comments that PSE seeks to rely less on market purchases and that the 2027 ISP will not allow for as high of market purchases. Understanding what the impact of reduced
  market reliance is on the PRM as well as the resource selection would be valuable as the region considers the benefits of WRAP and organized markets.

  We are currently developing the list of sensitivities to be studied and will consider these suggestions in that process. PSE intends to finalize the list of sensitivities in early 2026.

  The Western Resource Adequacy Program (WRAP) has significant limitations that restrict its applicability for long-term planning purposes. WRAP's design emphasizes operational adequacy over planning, and relies heavily on historical data. The probabilistic analysis underlying WRAP assumes that "historical correlations will persist into the future" (BPM 105). Additionally, "ELCC calculations assume current operating practices and grid conditions" (BPM 102), which may not reflect future operational environments.

  To examine potential future operational environments, We would need to make assumptions to extrapolate a forward saturation curve from WRAP metrics. PSE will consider some kind of sensitivity analysis to examine the implications of different RA metrics. Such a sensitivity is much more time consuming than sensitivities such as changing resource costs,