RPAG meeting

2025 IRP

January 17, 2024

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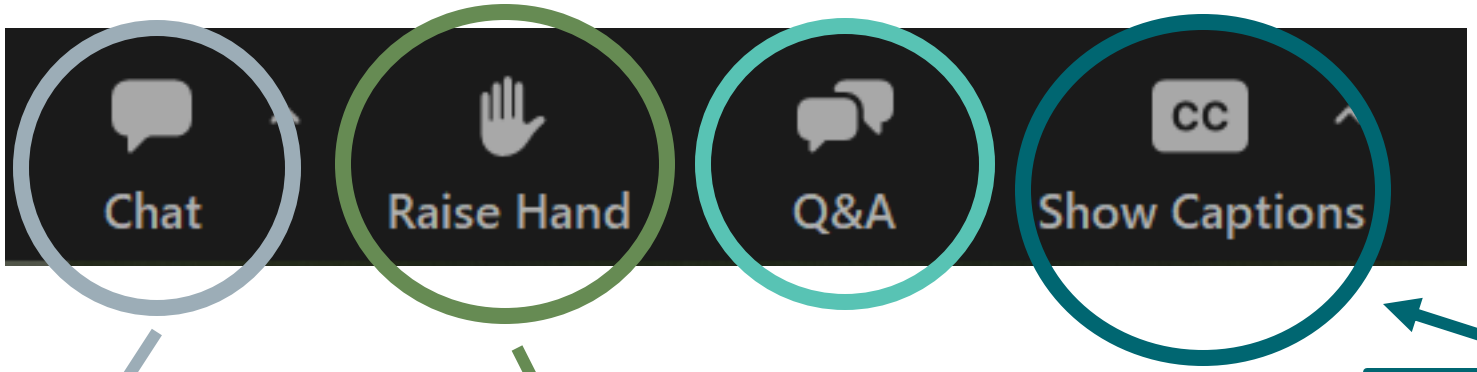
Welcome to the webinar!

The Q&A tool will be turned off during the meeting



RPAG members and PSE staff are welcome to use the chat feature

During the public comment period, raise your hand if you would like to make a verbal comment

Click to see real-time closed captioning

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Safety moment

Space heater safety

- Keep space heaters at least three feet away from flammable materials like curtains or blankets
- Never place a space heater on top of furniture or near water
- Never leave children unattended near a space heater
- Never plug a space heater into an extension cord

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Facilitator requests

- Engage constructively and courteously towards all participants
- Respect the role of the facilitator to guide the group process
- Avoid use of acronyms and explain technical questions
- Use the Feedback Form for additional input to PSE
- Aim to focus on the meeting topic
- Public comments will occur after PSE's presentations

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Agenda

Time	Agenda Item	Presenter / Facilitator
12:00 p.m. – 12:05 p.m.	Introduction and agenda review	Sophie Glass, Triangle Associates
12:05 p.m. – 12:35 p.m.	RPAG convening assessment overview	Sophie Glass, Triangle Associates
12:35 p.m. - 1:50 p.m.	Resource adequacy methodology	Jennifer Coulson, PSE Arne Olson, E3 Joe Hooker, E3
1:50 p.m. - 2:00 p.m.	Next steps and public comment opportunity	Sophie Glass, Triangle Associates
2:00 p.m.	Adjourn	All

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Today's speakers

Sophie Glass

Facilitator, Triangle Associates

Phillip Popoff

Director, Resource Planning and Analytics, PSE

Jennifer Coulson

Manager, Operations and Gas Analysis, PSE

Arne Olson

Senior Partner, Energy + Environmental Economics (E3)

Joe Hooker

Director, Energy + Environmental Economics (E3)

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Thematic Summary of Resource Planning Advisory Group Member Interviews

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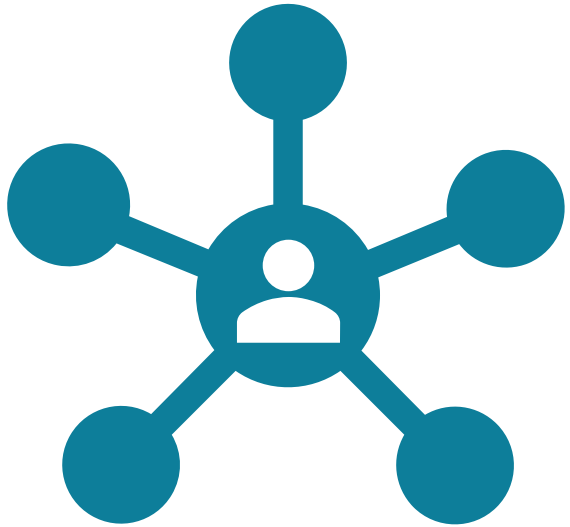
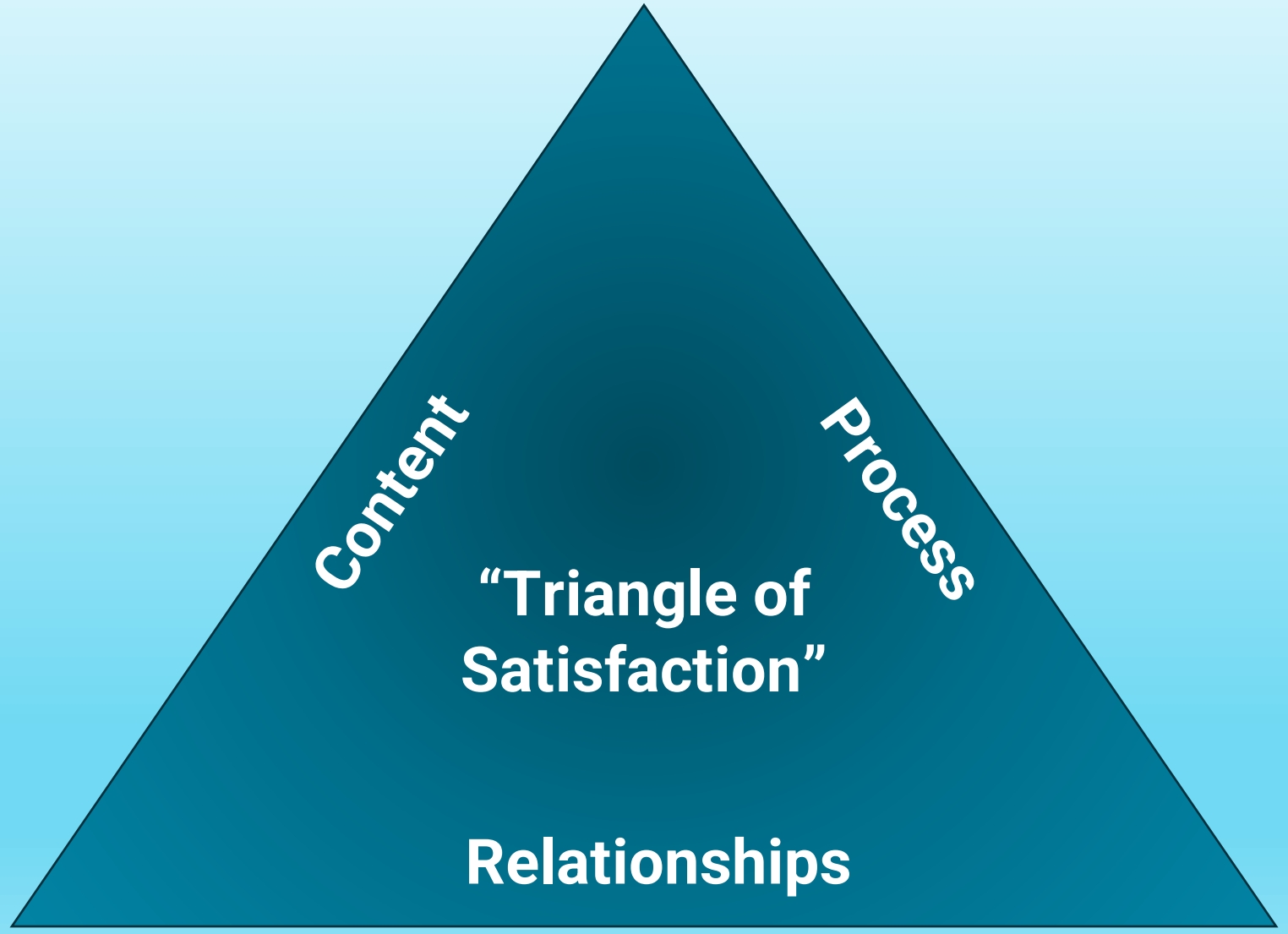
Convening Assessment

- Facilitation team conversations with 10 members.
  - 1 non-responsive
- Asked questions related to member hopes and concerns re: RPAG
- Reviewed the draft RPAG charter



Framework: Triangle of Satisfaction



Convening Assessment: Initial Feedback from RPAG Members

Content | Process | Relationships

Major Theme (2+ participants)

- **Mutual benefit:** Want to bring information back to respective organizations and learn from this process.

Convening Assessment: Initial Feedback from RPAG Members

Content | **Process** | Relationships

Major Themes (2+ Participants)

- **Diverse Public Perspective:** Important to have representation from named communities. People who participate in public webinars aren't representative of the public.
- **Meaningful Public Input:** Need to engage the public in a conversational, relational way for meaningful input so the public isn't left out of the process.
- **Accountability to RPAG:** PSE should listen to RPAG, explain their decisions, and acknowledge feedback even if it isn't actionable.

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Convening Assessment: Initial Feedback from RPAG Members

Content | **Process** | Relationships

Major Themes (2+ Participants)

- **Information and Materials:** Need time to read and digest materials and come prepared. Need enough information to guide the process well.
- **Lean into contentious topics:** Don't avoid uncomfortable topics since RPAG members need to reach a path forward.
- **Choose your own adventure:** Offer different levels of engagement for members based on capacity and different ways to participate (e.g. meetings, feedback form, email, etc.)
- **Filling the Equity Seat:** PSE needs to incorporate environmental/racial/social justice perspectives into the IRP.
- **Connect the Concepts:** Avoid siloing equity perspective, technical perspective, and public perspective.

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Convening Assessment: Initial Feedback from RPAG Members

Content | Process | **Relationships**

Major Themes (2+ Participants)

- **Listen with Openness:** RPAG members should truly listen to each other and not dismiss each other or be adversarial. Create an environment where all viewpoints are valued. Give members the benefit of the doubt.
- **Balanced Perspectives:** Need diverse, balanced perspectives. Don't want a few members to dominate the conversation.

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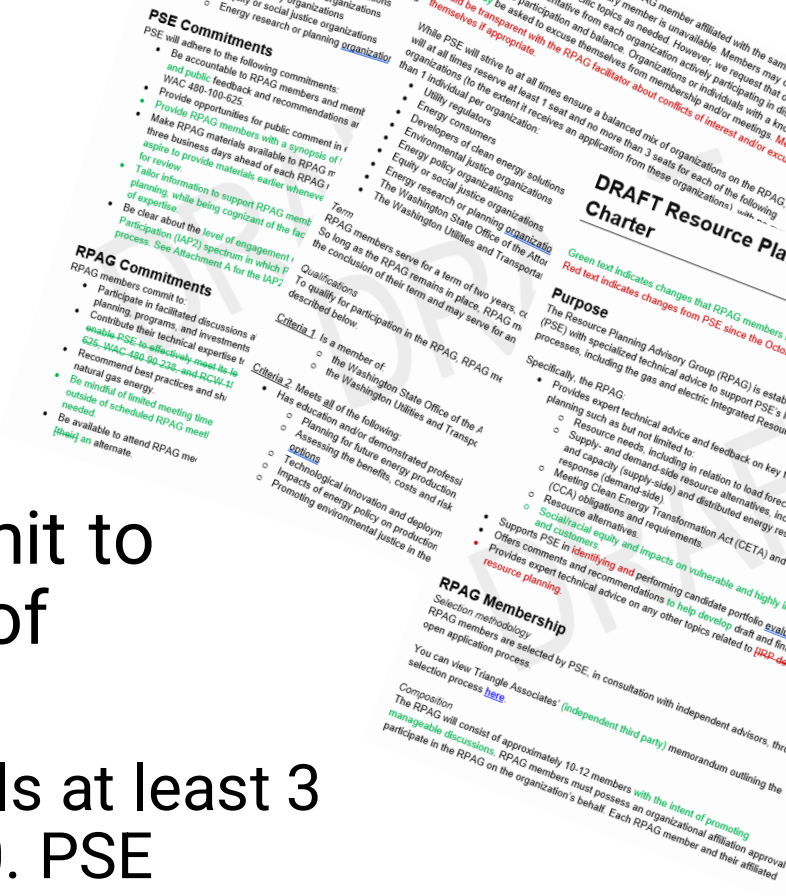
Charter Recommendations

- See draft document for all accepted changes.
- RPAG suggestion on meeting materials: Commit to sending meeting materials 5 days in advance of meetings.
  - Charter revision: PSE will continue to send materials at least 3 days in advance consistent with WAC 480-100-630. PSE added a line about aspiring to send materials even further in advance when possible.



Resource Adequacy

Jennifer Coulson, PSE

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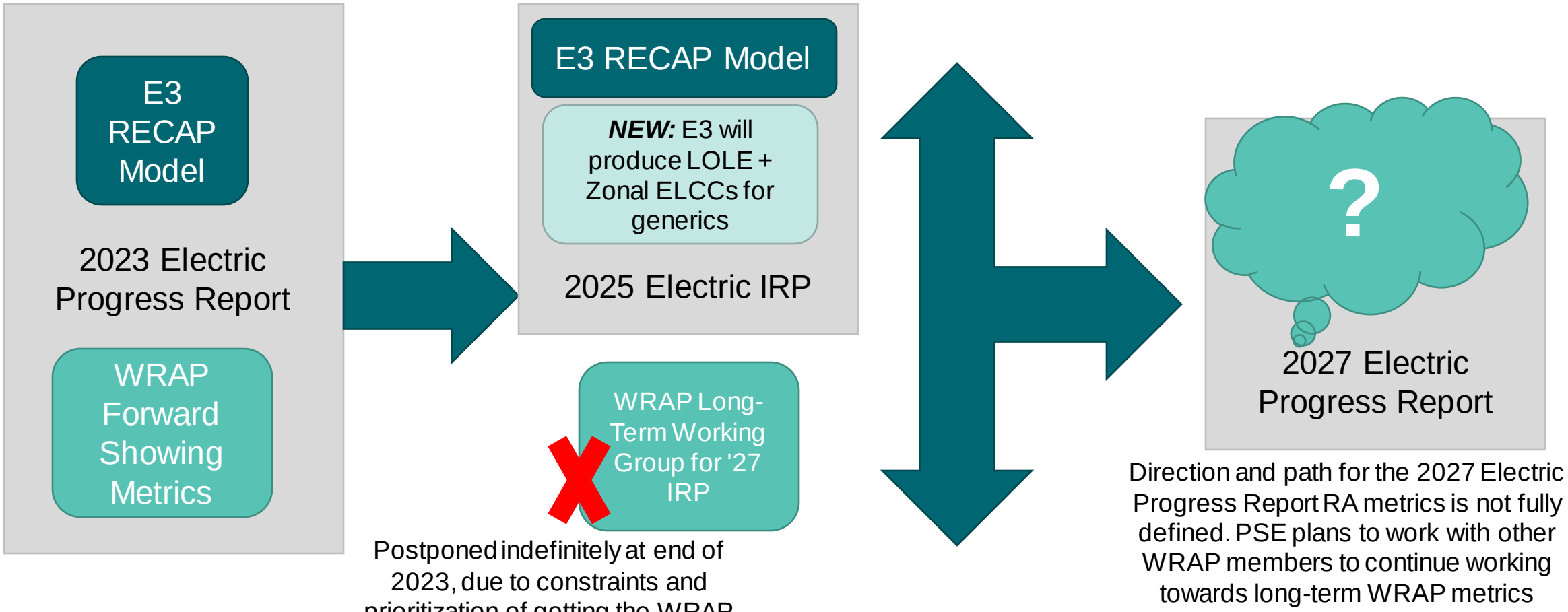
PSE's RA Analysis Roadmap



Postponed indefinitely at end of 2023, due to constraints and prioritization of getting the WRAP operational

Direction and path for the 2027 Electric Progress Report RA metrics is not fully defined. PSE plans to work with other WRAP members to continue working towards long-term WRAP metrics

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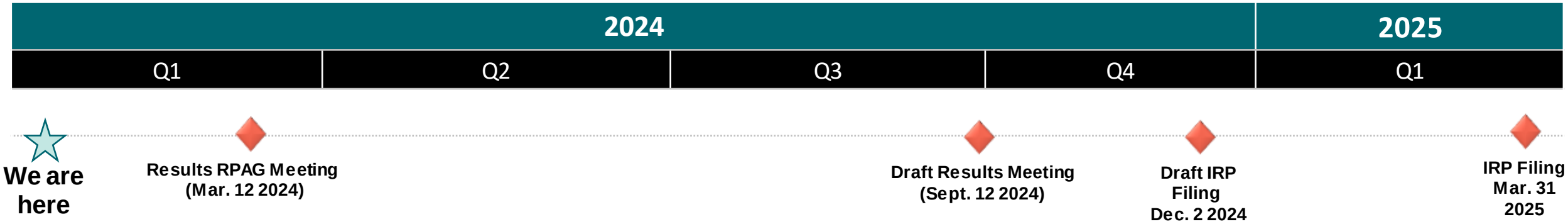
2025 Resource Adequacy Analysis Timeline



SUBJECT TO CHANGE

E3 RECAP Modeling

- Run reference case from Aurora through Recap for backend check, ensure the portfolio is adequate

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E3 Resource Adequacy Modeling

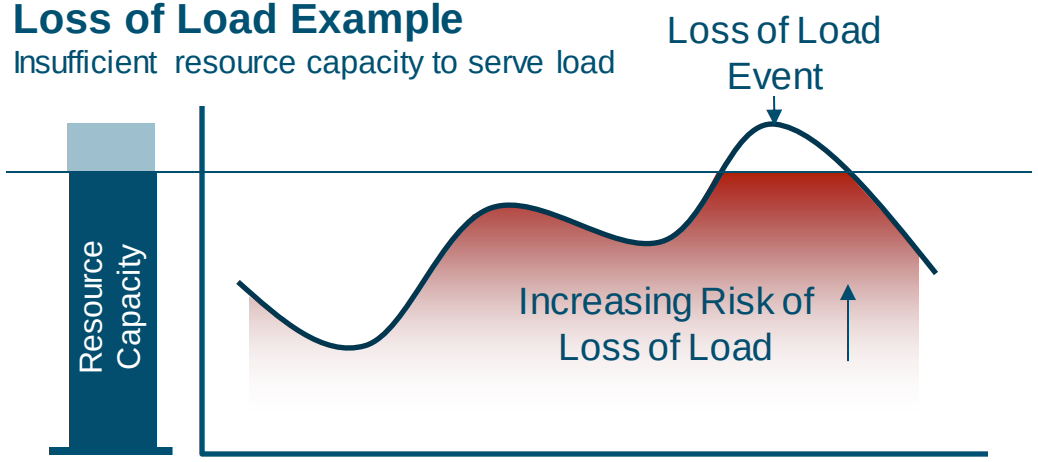
Energy+Environmental Economics

What is resource adequacy?

- **Resource adequacy is a measure of the ability of a portfolio of generation resources to meet load across a wide range of system conditions, accounting for supply & demand variability**
- **No system is planned to achieve a perfect level of adequacy**
  - The most common standard used throughout North America is a "one-day-in-ten-year" standard
  - For the PSE's 2025 IRP, E3 will perform modeling for both a 5% LOLP standard (up to 1 year with loss of load every 20 years) and 0.1 LOLE standard (up to 1 loss of load event every 10 years)

Loss of Load Example

Insufficient resource capacity to serve load



NERC Definition of Resource Adequacy:

"The ability of supply-side and demand-side resources to meet the aggregate electrical demand (including losses)"

Source: NERC Glossary of Terms

PRM and ELCC

Planning Reserve Margin (PRM)

The PRM is the total amount of capacity needed to satisfy the reliability target. (E3 will perform modeling for both 5% LOLP and 0.1 LOLE.)

"How many MW needed in total"

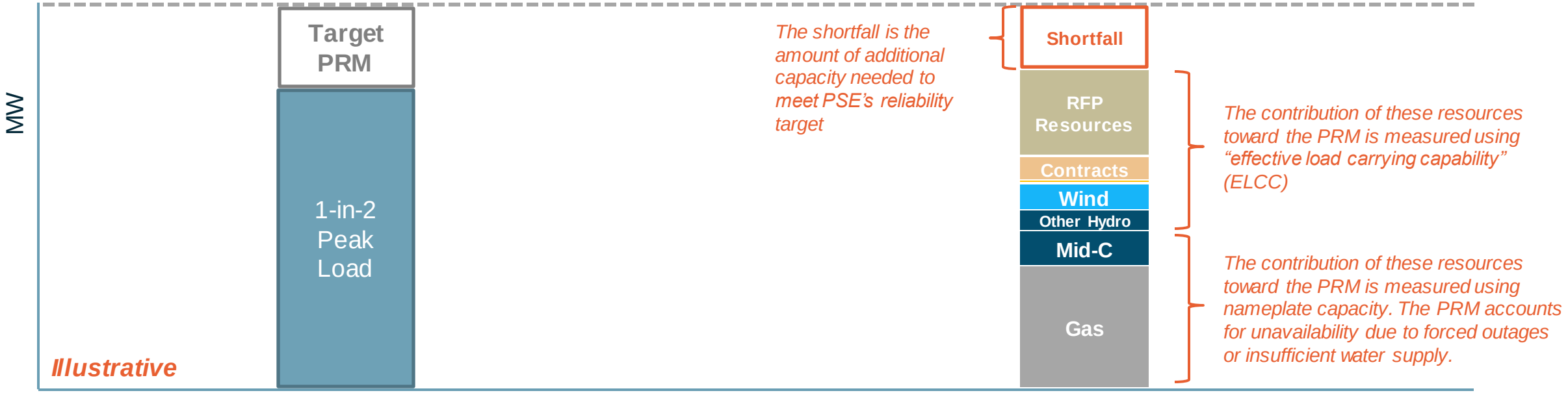
Measured as % above PSE's expected peak load

Effective Load Carrying Capability (ELCC)

The ELCC is the equivalent "perfect" capacity that a resource provides in meeting PSE's reliability target

"How many MW provided by each resource"

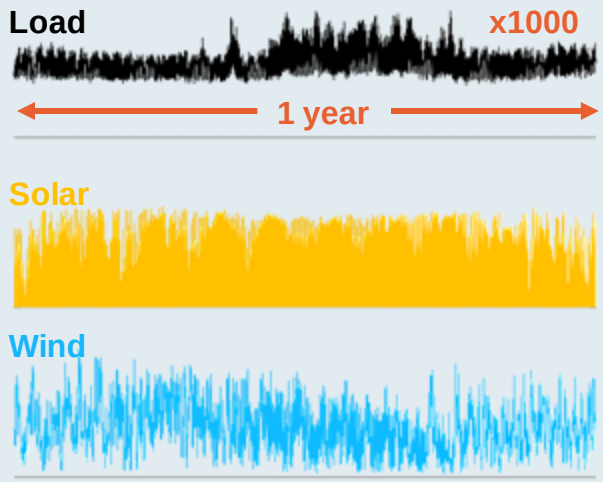
Measured as % of nameplate capacity



Planners are increasingly using probability-based models to support enhancements to resource adequacy

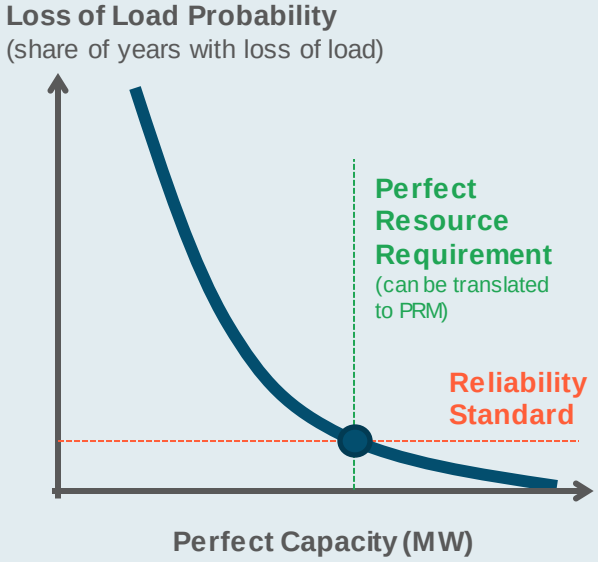
Develop a representation of the loads and resources of an electric system in a loss of load probability model

LOLP modeling allows a utility to evaluate resource adequacy across all hours of the year under a broad range of weather conditions, producing statistical measures of the risk of loss of load



Identify the amount of perfect capacity needed to achieve the desired level of reliability

Factors that impact the amount of perfect capacity needed include load & weather variability, operating reserve needs

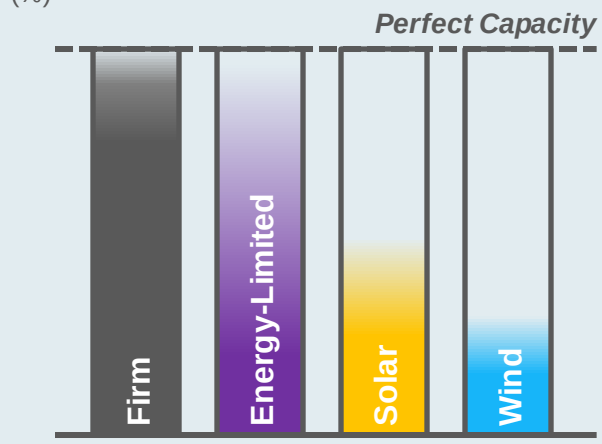


Outputs:

- Total Resource Need (TRN), in MW
- Planning Reserve Margin (PRM) = (TRN ÷ 1-in-2 peak load) - 1

Calculate capacity contributions of different resources using effective load carrying capability

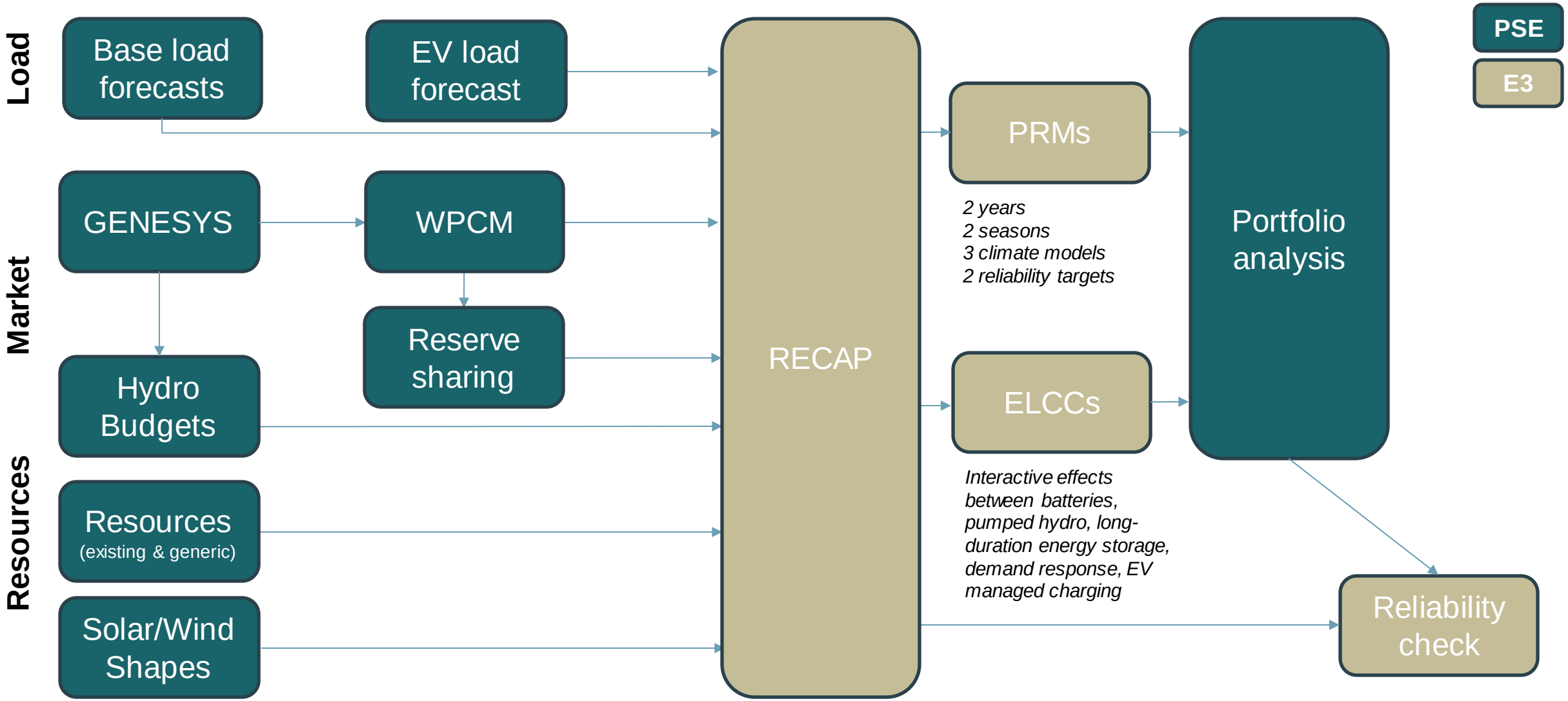
ELCC measures a resource's contribution to the system's needs relative to perfect capacity, accounting for its limitations and constraints



Outputs:

- Individual resource Effective Load-Carrying Capacity (ELCC), in MW and % of nameplate

Overview of key Inputs/Outputs



Generic Resource Modeling by WRAP Zone

- One set of ELCCs will be developed per WRAP zone and resource type.
- Where PSE has modeled multiple resource profiles per WRAP zone, an average of the resources will be used to develop ELCCs that align with WRAP zones.

Resource Location	WRAP Zone
BC	Zone 1: British Columbia
WA, West	Zone 2: W WA, NW OR
WA, East	Zone 3: E WA, E OR, SW OR, N ID
MT, East	Zone 4: MT
MT, Central	
ID	Zone 5: ID
WY, East	Zone 6: WY, UT
WY, West	

Questions and comments

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Next steps

Sophie Glass, Triangle Associates

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Upcoming activities

Date	Activity
January 19, 2024	Feedback form for January 12 RPAG meeting closes
January 24, 2024	Feedback form for January 17 RPAG meeting closes

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Public comment opportunity

Please raise your “hand” if you would like to provide comment.

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Thanks for joining us!

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Appendix

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Convening Assessment: Initial Feedback from RPAG Members

Content | Process | Relationships

Individual Comments

- **Analytical Process:** The IRP is analytical and theoretical - not a resource acquisition plan.
- **Informing Procurement:** IRP informs procurement phase - not just a theoretical exercise.
- **Identify Solutions:** RPAG should help PSE identify shared solutions to put forward the best plan.
- **Resource Adequacy:** Want a focus on resource adequacy and planning for capacity in long term.
- **Modeling:** Want to focus on modeling processes and outcomes.
- **Cost and Risk Assessment:** Interest in more traditional planning focus - cost and risk assessment.
- **Be Proactive not Reactive:** Concerned PSE is deferring major political decisions to legislative decisions.
- **Accessible IRP:** Making the final IRP searchable and more accessible for the public.

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Convening Assessment: Initial Feedback from RPAG Members

Content | **Process** | Relationships

Individual Comments

- **Balance Meeting Time:** Need balance between presentation and dialogue.
- **RPAG as Advisors:** Define the RPAG's lane as advisors, not plan developers.
- **Report-out:** Facilitators could create an independent 3rd party report-out of the IRP process.
- **Formal Record:** Create a formal docket to keep a record and increase accountability and responsiveness.
- **Discover Issues to Address**: Open dialogue and canvassing of issues can anticipate issues and ensure they get addressed.
- **Steering Committee:** Creating an RPAG steering committee or co-chairs could be helpful.
- **NDAs:** Signing a non-disclosure agreement (NDA) could be helpful so PSE can give members the information they need to advise decisions.
- **Meeting Targets:** Concern that PSE will not be able to meet their targets and CETA requirements.
- **Prioritize Meeting Deadlines:** Need strong project management to avoid getting bogged down by public disappointment

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Convening Assessment: Initial Feedback from RPAG Members

Content | Process | **Relationships**

Individual Comments

- **Building Trust:** This is a long-term process we need to be comfortable with one another.
- **Interest in meeting in person occasionally**: Opportunity to build relationships.
- **Involving Top Level Leadership:** Ensure top PSE leadership is paying attention to these conversations; their occasional presence would be a sign of engagement.
- **Conflicts of Interest:** RPAG members should disclose any conflicts of interest.

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Appendix

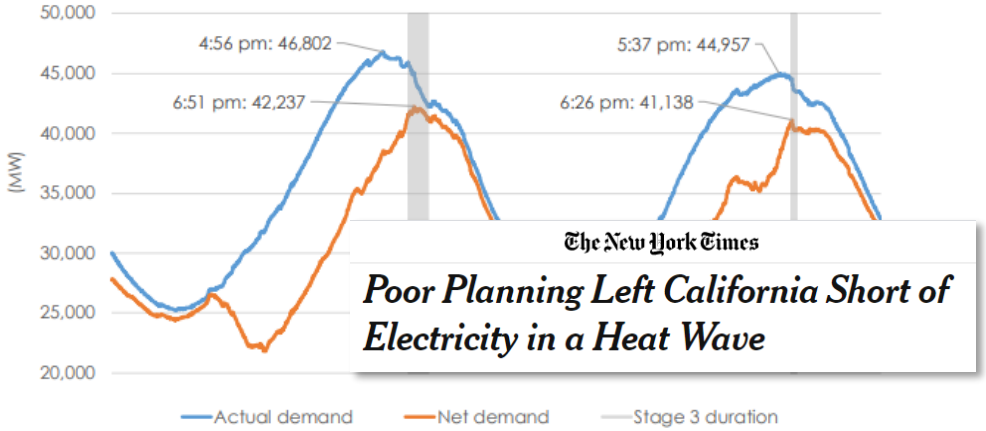
Energy+Environmental Economics

Summary of E3 Recommendations on ELCC Analysis

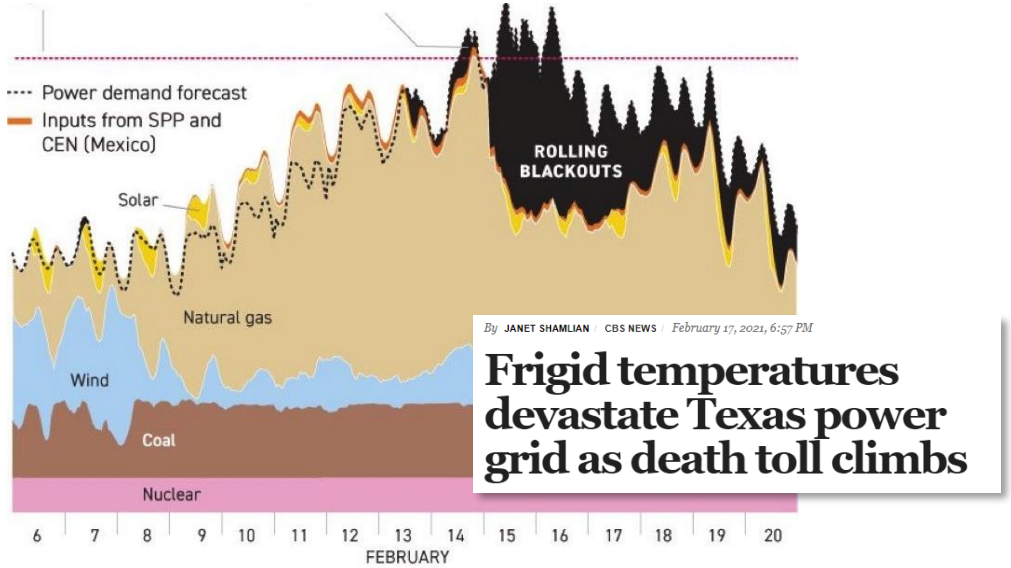
Key Issue From 2021 Review	Description from 2021 review	Result of E3's 2021 Review	Addressed in 2023 EPR	Addressed in the 2025 IRP	Comments for 2025 IRP
LOLP Approach	Is PSE's general LOLP approach reasonable for ELCC purposes?				The 5% LOLP standard was deemed reasonable. The 2025 IRP will also evaluate a 0.1 LOLE standard.
Mid-C Market Availability	Does PSE's treatment of Mid-C market availability disadvantage battery storage ELCCs?				Market availability inputs will be developed using the classic GENESYS model and ensuring the region satisfies a 5% LOLP reliability target.
Generic Battery Storage Characteristics	Are PSE's generic battery storage characteristics reasonable?				The modeling assumptions for batteries are consistent with standard industry practice. (Limited historical data suggest the modeled forced outage rate is optimistic.)
Resource Correlations	Are the resource correlations used by PSE reasonable?		Not incorporated	Not incorporated	The underlying weather data for loads (based on future climate projections) and renewables (based on historical observations) do not reflect the same hourly conditions.
Temperature Data	Is PSE's temperature input data a reasonable basis for forecasts?				The energy demand, hydro generation, and market availability data reflect future climate change scenarios.
Hydro Operations	Are hydro operations captured correctly?				The modeling reflects hydro dispatch capabilities and energy limitations.
Battery Storage Dispatch	Are battery storage resources dispatching appropriately?				Batteries dispatch anytime the system has a need and batteries have energy available.

Resource adequacy is increasing in complexity and importance

- **Transition towards renewables and storage introduces new sources of complexity in resource adequacy planning**
  - The concept of planning exclusively for "peak" demand becoming obsolete
  - Resource adequacy frameworks must be modernized to consider conditions across all hours of the year – as underscored by California's rotating outages during August 2020 "net peak" period
- **Reliable electricity supply is becoming increasingly important to society:**
  - Ability to supply cooling and heating electric demands in more frequent extreme weather events is increasingly a matter of life or death
  - Economy-wide decarbonization goals will drive electrification of transportation and buildings, making the electric industry the keystone of future energy economy

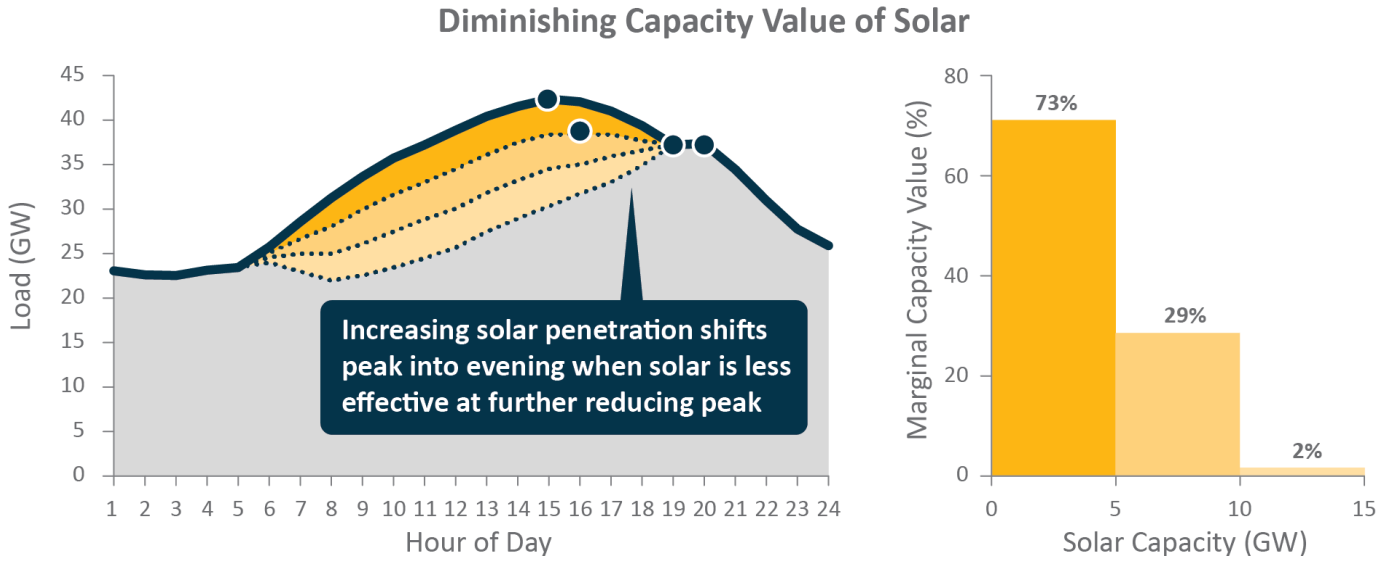


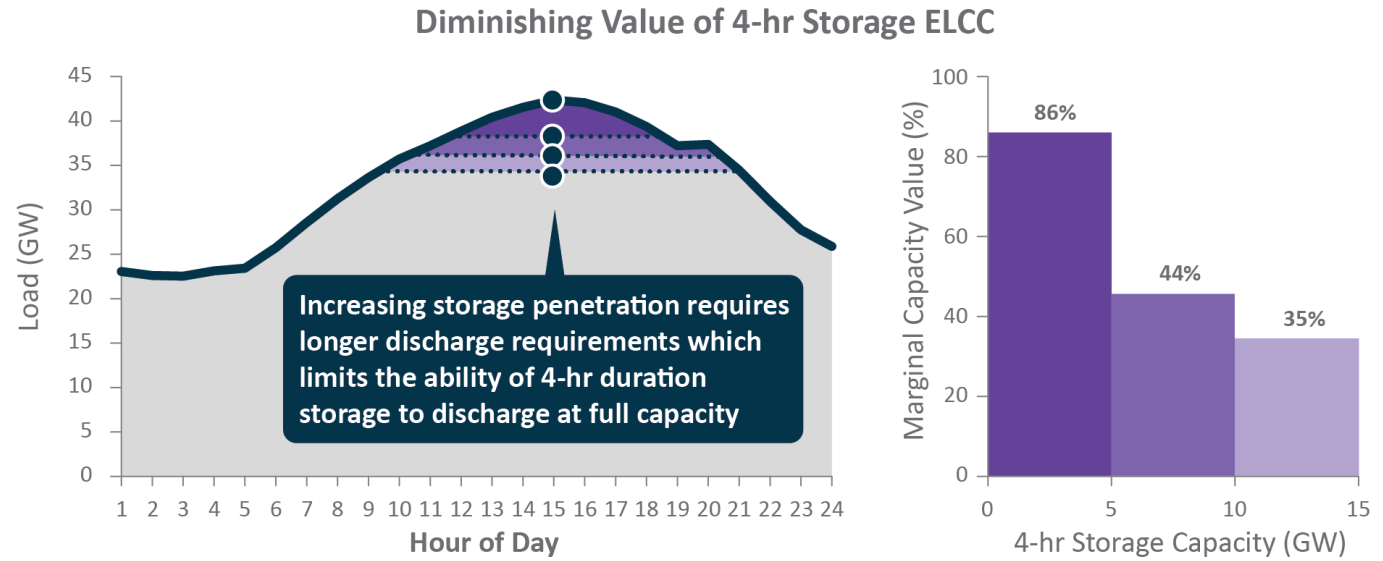
Graph source: http://www.caiso.com/Documents/Final-Root-Cause-Analysis-Mid-August-2020-Extreme-Heat-Wave.pdf



Graph source: https://twitter.com/bcshaffer/status/1364635609214586882

ELCC captures saturation effects at increasing penetrations



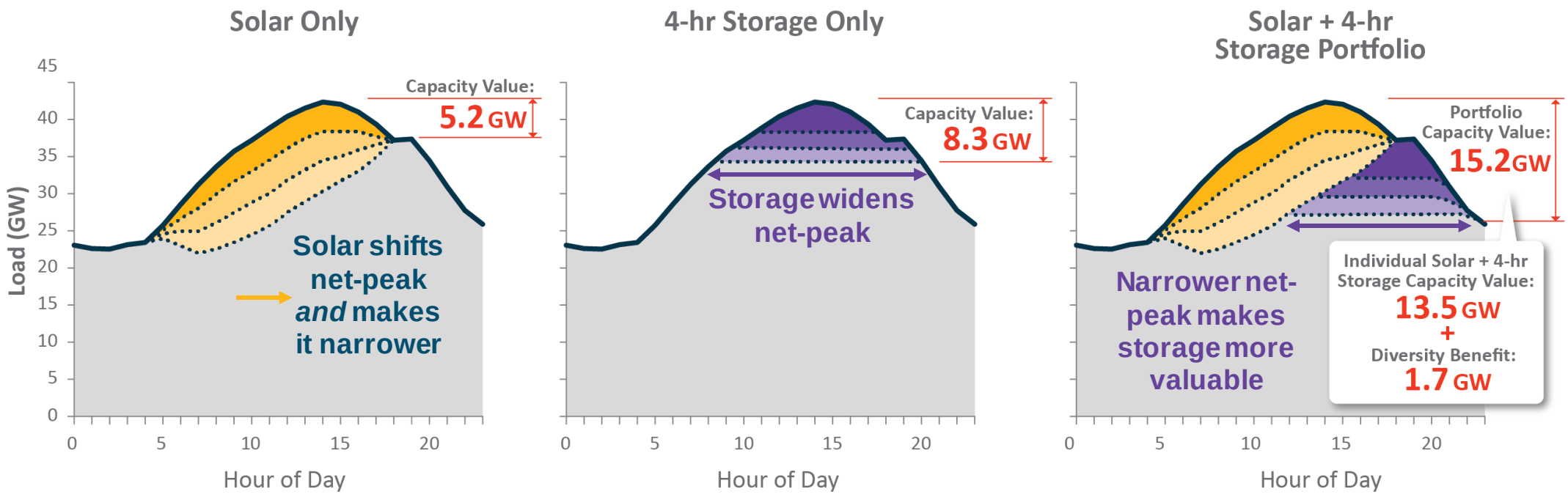


Solar and other **variable resources** (e.g. wind) exhibit declining value due to variability of production profiles

Storage and other **energy-limited resources** (e.g. DR, hydro) exhibit declining value due to limited ability to generate over sustained periods

ELCC captures diversity benefits among technologies

- Resources with complementary characteristics can result in a greater ELCC than the sum of their parts. These synergistic interactions are also described as a "diversity benefit"
- As penetrations of intermittent and energy-limited resource grow, the magnitude of these interactive effects will increase and become non-negligible



Changes in the 2023 IRP

Input	Changes
Framework	• Seasonal PRM and ELCCs rather than annual values
Climate change	• Modeling across three climate models, which represent different climate futures
Load	• Simulations of the future rather than historical observations • Appropriately incorporating long-term temperature trends when studying a single snapshot year ◆
Operating reserves	• Balancing reserves updated based on modeled intra-hour variability
Hydro	• Simulations of the future rather than historical hydrological conditions • Flexibility to shift Mid-C and Baker generation based on hydrological conditions ◆
Wind and solar	• Simulations for 250 years, provided by DNV
Market imports	• Simulations based on simulated regional loads and resources
Storage	• No minimum state of charge applied to the contracted energy capacity ◆ • Can discharge at rated capacity for the rated duration ◆ • NWPP Reserve Sharing Program can be called when modeling the ELCC of storage ◆ • Forced outages modeled for storage • Can provide operating reserves without fully discharging

◆ *Recommended changes in E3's Sept. 2021 report: "Review of Puget Sound Energy Effective Load Carrying Capability Methodology"*

Recommendations not incorporated in the 2023 IRP

Input	Changes not made
Wind and solar	• The modeling does not include correlations between load and renewable output during extreme events. For example, in the Pacific Northwest, intense cold weather could drive increased demand and decreased renewable output at the same time. These impacts are not included in the modeling
Market imports	• The modeling of the Pacific Northwest region does not add sufficient resources in the region to hit a loss of load probability of 5% for the region. E3 recommended performing this as a sensitivity to see if it would result in an increase in the ELCC of storage resource. The new analysis does not include this sensitivity, but it does result in a very high ELCC for storage at initial tranches.

These were recommended changes in E3's Sept. 2021 report: "Review of Puget Sound Energy Effective Load Carrying Capability Methodology." As discussed in the report, E3 recommends exploring load/wind/solar correlations in future IRP cycles. E3 also recommends revisiting the 5% sensitivity in future IRP cycles.

Summary of E3 Recommendations on ELCC Analysis

Key Issue	Potential Impact on ELCC	Result of E3 Review	E3 Conclusions and Recommendations
General LOLP Approach	High		+ PSE's approach produces a portfolio that meets both the 5% LOLP standard and produces LOLE results that are close to the 0.1 industry standard, making the difference in methodology immaterial + Given the LOLP approach and a 5% LOLP standard is used by other utilities in the region, PSE's approach is reasonable
PSE's Treatment of Mid-C Market Availability	High		+ PSE's current treatment of Mid-C disadvantages battery storage ELCCs, but whether it is appropriate to assume an adequate regional system is a real and difficult question + To assess the impact of changes in PSE's approach to Mid-C on ELCC values, E3 recommends an additional GENESYS model run assuming regional capacity additions such that the region meets a 5% LOLP standard before recalculating ELCC
PSE's Generic Battery Storage Characteristics	High		+ PSE's round-trip efficiency assumptions are reasonable + PSE's application of minimum SOC and one-way efficiency both discount battery storage's maximum and overall potential ELCC results as applied in the RFP context + E3 recommends that PSE restates its ELCC values for battery storage in a manner more aligned with industry standards, and that PSE aligns the presentation of ELCC values with the characterization of nameplate capacity (MW) values in RFP documentation
Resource Correlations Used by PSE	Medium		+ Correlations between wind/solar and between weather/load are reasonable, while permutation of hydro output and weather is reasonable and in line with common industry practice + Lack of correlated renewable and load shapes does not have a large impact on battery ELCCs + For future IRP cycles, E3 recommends utilizing weather-matched load aligned with wind and solar data
PSE's Temperature Input Data	Medium		+ PSE's synthesis of temperature data from the University of Washington appears reasonable based on data E3 has reviewed + For future IRP cycles, E3 recommends that PSE analyze the impact of the Temperature Sensitivity shown in its IRP on the current RFP and investigate potential modifications of the temperature data set to reflect a changing climate
Hydro Operations	Medium		+ PSE's modeling of hydro resources as a shaped output rather than a dispatchable resource and as a resource without energy limitations both lead to over-estimation of battery storage ELCCs, but ultimate impact is likely minor + For future IRP cycles, E3 recommends PSE update its modeling to reflect hydro dispatch capabilities and hydro energy limitations
Battery Storage Resource Dispatch	High		+ If there are issues with the reported dispatch of generic battery storage resources in PSE's modeling, this will have a material impact on battery storage ELCC results + However, specific conclusions require further investigation at this time