Resource Planning Advisory Group meeting

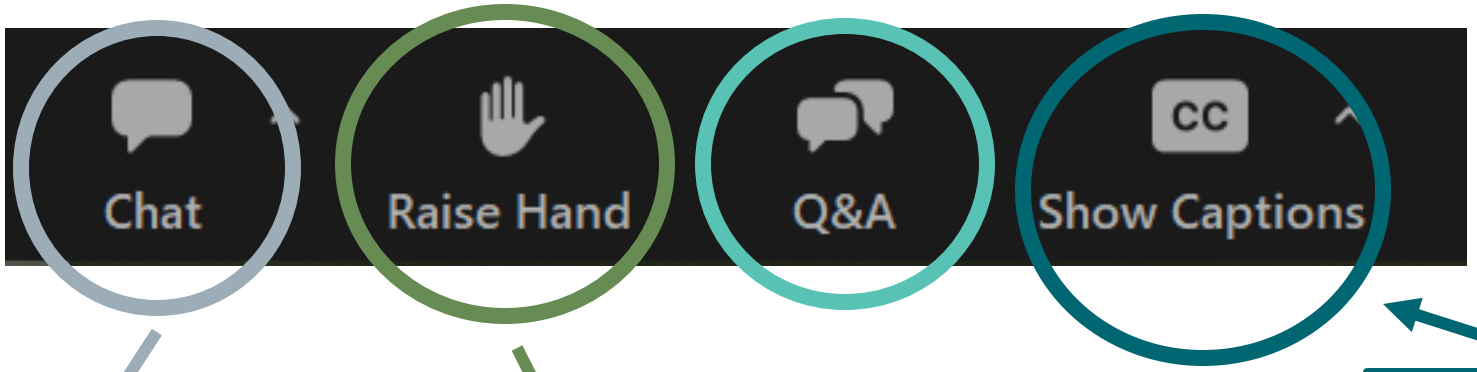
2025 Integrated Resource Plan

May 14, 2024

PUGET SOUND ENERGY

Welcome to the meeting!

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

PSE PUGET SOUND ENERGY

Safety moment

May is Motorcycle Safety Awareness Month

- Be on the lookout for motorcyclists
- Focus on driving and avoid distractions
- Use turn signals
- Give motorcyclists plenty of room
- Don’t speed

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Facilitator requests

- Engage constructively and courteously towards all participants
- Take space and make space
- 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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Today's speakers

Sophie Glass

Facilitator, Triangle Associates

Kara Durbin

Director, Clean Energy Strategy, PSE

Phillip Popoff

Director, Resource Planning Analytics, PSE

Michael O'Brien

Senior Engagement Manager, Western Power Pool

Ryan Roy

Director of Operations and Technology, Western Power Pool

Jennifer Coulson

Manager, Operations and Gas Analysis, PSE

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Agenda

Time	Agenda Item	Presenter / Facilitator
10:00 a.m. – 10:05 a.m.	Introduction and agenda review	Sophie Glass, Triangle Associates
10:05 a.m. – 10:10 a.m.	IRP process updates	Kara Durbin, PSE
10:10 a.m. – 10:15 a.m.	Feedback summary from 3/25 webinar	Phillip Popoff, PSE
10:15 a.m. – 11:45 a.m.	Western Resource Adequacy Program (WRAP) methodology overview	Phillip Popoff, PSE Michael O'Brien and Ryan Roy, Western Power Pool
11:45 a.m. – 12:00 p.m.	Break	All
12:00 p.m. – 12:30 p.m.	Forecasting future WRAP resource adequacy requirements	Jennifer Coulson, PSE
12:30 p.m. – 12:50 p.m.	Discussion and poll	All
12:50 p.m. – 1:00 p.m.	Next steps and public comment opportunity	Sophie Glass, Triangle Associates
1:00 p.m.	Adjourn	All

IRP process updates

Kara Durbin, PSE

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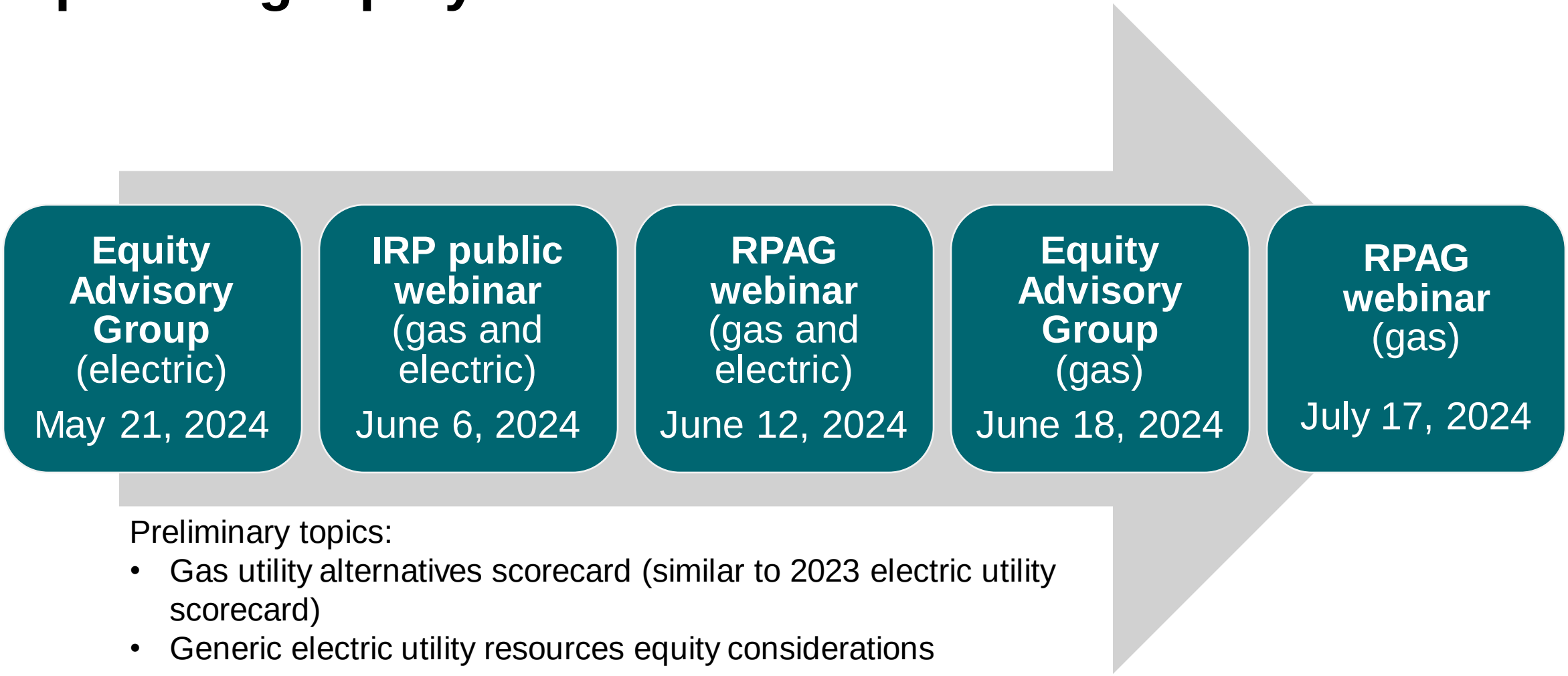
Upcoming equity in the IRP discussions



Preliminary topics:

- Gas utility alternatives scorecard (similar to 2023 electric utility scorecard)
- Generic electric utility resources equity considerations

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Washington State Legislature passed HB 1589 in April 2024

What it does:

- Streamlines planning processes into a single Integrated System Plan due Jan. 1, 2027
- Facilitates development of critical energy infrastructure needed to meet clean energy goals
- Accelerates depreciation of natural gas infrastructure to ensure an equitable distribution of costs

What it does NOT do:

- Ban new natural gas hookups
- Change PSE's obligation to serve natural gas customers

Read the HB 1589 Fact Sheet on PSE's website.

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Feedback summary

Phillip Popoff, PSE

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March 25 RPAG meeting feedback summary

Public feedback included:

- Concerns with small modular reactors (SMR) as a generating resource
- PSE should provide additional details about overcoming transmission constraints

RPAG feedback included:

- PSE should do full cost and emissions analysis that include fuel cycle impacts
- Support for additional geothermal modeling
- Clarifying questions about specific modeled resources

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Western Resource Adequacy Program introductions

Phillip Popoff, PSE

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Western Resource Adequacy Program

May 14, 2024

Ryan Roy
Director of Operations and Technology, WPP

Michael O'Brien
Senior Engagement Manager, WPP WRAP

Puget Sound Energy – Resource Planning Advisory Group (RPAG)

WRAP Overview

- **Western Power Pool**
- **Program Roles**
- **Value Proposition**
- **Forward Showing**
  - Advance Assessment Data
  - Reliability Metrics (Loss of Load Expectation Studies and Planning Reserve Margins)
  - Capacity Requirement
  - Qualifying Capacity Contribution (QCC)
- **Operation Program**
  - Time Horizons
  - Sharing Calculations
- **Current Status**
- **Future Implementation**

WRAP
POWERED BY WPP

WPP Provides a Range of Valuable Grid Integration and Coordination Services to its Customer-Members throughout the entire Western Interconnection

- Reserve Sharing Group
- Frequency Response Sharing Group
- Training
- Transmission Services
- Resource Adequacy*
- Hydro Modeling

*Under WPP independent governance (others governed by participants or agreements)

Current WRAP Participants

Arizona Public Service
Avista
Bonneville Power Administration
Calpine
Chelan County PUD
Clatskanie PUD
Eugene Water & Electric Board
Grant PUD
Idaho Power
Northwestern Energy
NV Energy
PacifiCorp
Portland General Electric
Powerex
Public Service Company of New Mexico
Puget Sound Energy
Salt River Project
Seattle City Light
Shell Energy
Snohomish PUD
Tacoma Power
The Energy Authority

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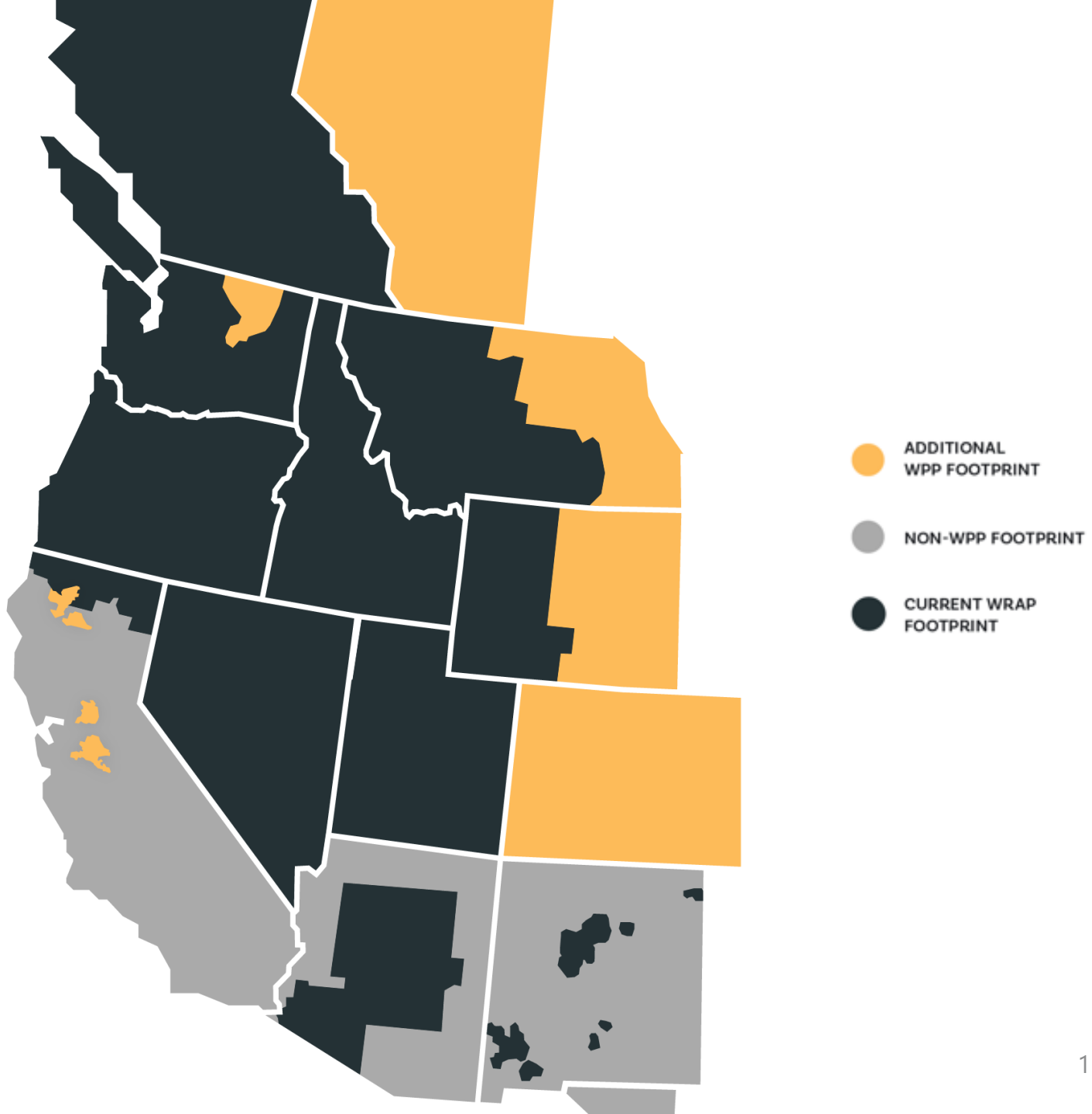

ROLES OF THE PA AND PO

- **Western Power Pool** (WPP) serves as the **Program Administrator (PA)** of the WRAP
  - Undertakes all actions necessary to implement and administer program
- **Southwest Power Pool** (SPP) serves as the **Program Operator (PO)** of the WRAP
  - Provides technical, analytical, and implementation support to the Program Administrator

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WRAP VALUE PROPOSITION

- **Binding forward showing** requires Participants to show they have secured their share of the regional capacity need for the upcoming season using common planning and capacity accreditation metrics
- **Binding operational program** obligates Participants with surplus to assist Participants with a deficit in the hours of highest need using bilateral trading mechanisms

⇨ Set of common analytically derived reliability metrics

⇨ Leveraging load and resource diversity for reliability

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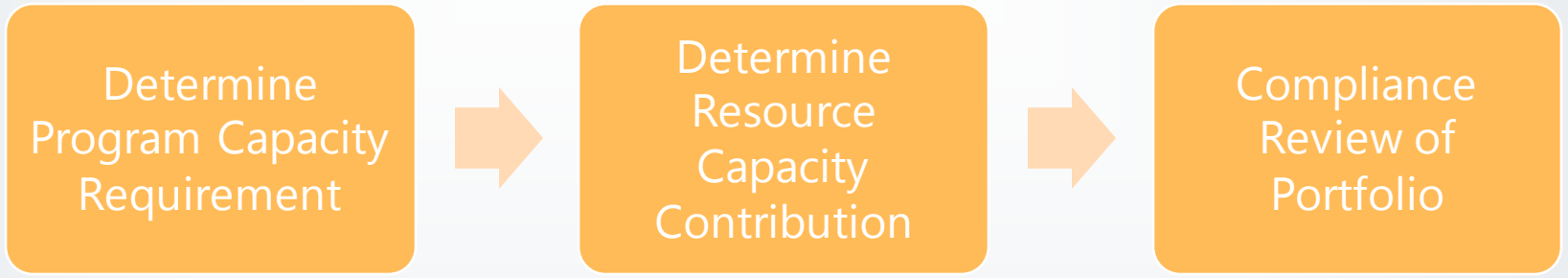
Program Design Overview

Forward Showing



» Establishes a **regional reliability metric** (seasonal 1 event-day in 10 years LOLE)

– Transition away from utility-by-utility RA programs and assumptions

» Registered resources receive a **Qualifying Capacity Contribution** (QCC) in advance of forward showing deadlines (seven months ahead of winter and summer seasons)

– Resource-agnostic, consistent methodology for assessing capacity contribution

» Non-compliance with forward showing requirements (capacity or transmission) results in a **Forward Showing Deficiency Charge**

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Program Design Overview

Forward Showing – Advanced Assessment (BPM 101)

» Determines monthly Forward Showing Planning Reserve Margins (PRMs) for Summer and Winter Seasons two years ahead, and Advisory Binding Seasons five years ahead

Advance Assessment Data Items
Thermal Resource data
NERC GADs or equivalent outage data for the last six years for Thermal Resources
Historical Load Data for the previous 10 years
Wind & solar (VERs), Storage Hydro, Energy Storage Resources, and Run-of-River (RoR) resources
Hourly generation profiles for last 1- years for VERs and ROR
Nameplate of all resources
Storage Hydro Monthly QCC Values (as calculate by specific workbook)

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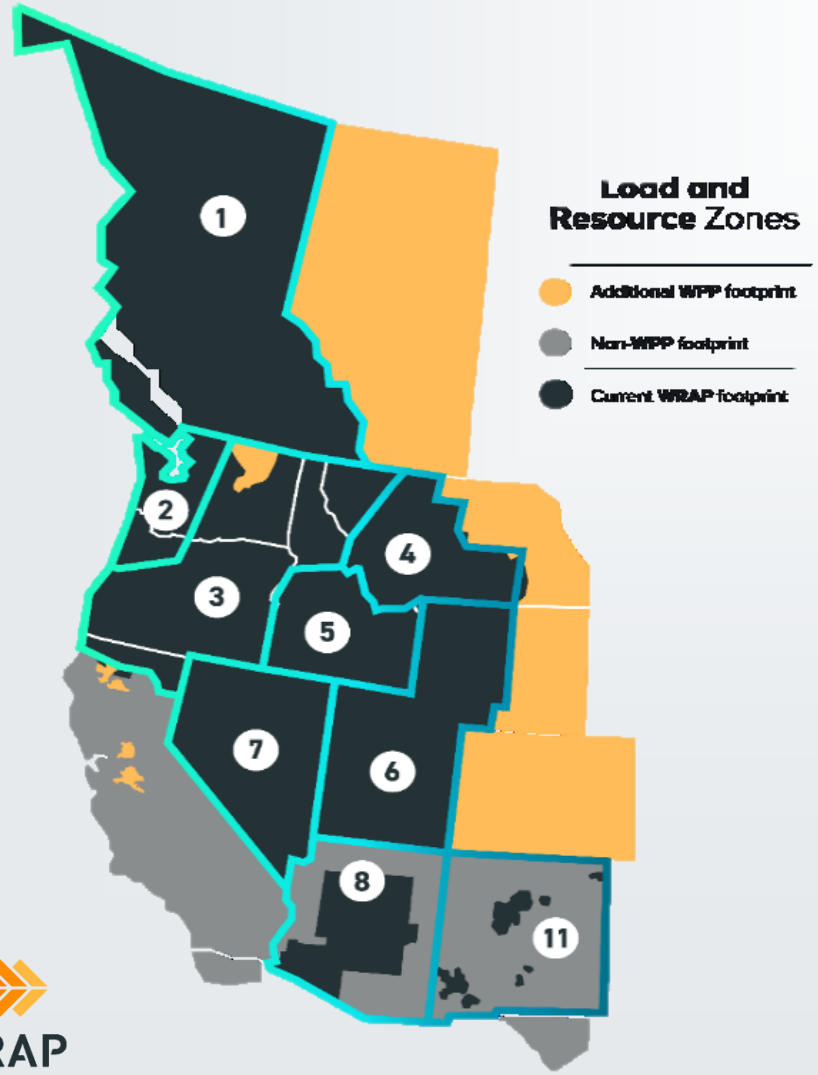
Program Design Overview

Forward Showing– Reliability Metrics (BPM 102)



- PO runs a **Loss of Load Expectation Study**
  - Uses Load and Resource Zones (LRZs) to distinguish weather variability across the WRAP and within Subregions
  - Subregions used for determination of Monthly FSPRMs
    - Northwest (LRZs 1, 2, 3, 4)
    - Southwest and East (5, 6, 7, 8, 11)

- Calculate amount of **QCC** need to meet **reliability metric**
  - Develop forty historical weather yeas to model impact on load
  - Simulate stack of qualified resources with thermal outages and variations in generation
  - Amount of capacity converted to UCAP values to calculate PRMs.

$$\textbf{FSPRM}(\%)\ \frac{\text{UCAP}_{1-\text{in}-10}\ -\text{P50 Load Forecast}\text{P50}}{\textbf{P50 Load Forecast}} *100$$

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PROGRAM DESIGN OVERVIEW

FORWARD SHOWING – CAPACITY REQUIREMENTS (BPM 103)

» Amount of monthly capacity (**Portfolio QCC**) a Participant is required to demonstrate in a Binding Season

$$FS\ Capacity\ Requirement = FS\ Capacity\ Requirement\ Unadjusted + Contingency\ Reserve\ Adjustment$$

where

$$FS\ Capacity\ Requirement\ Unadjusted = (P50\ Peak\ Load\ Forecast - Demand\ Response) * (1 + FSPRM)$$

Note: Appropriate treatment of Demand Response will require Tariff change

» **Monthly P50 Peak Load Forecast** for a Binding Season (looking back over the months of a Binding Season for five years)

- Attest to significant loads added or removed
- Apply load growth factor: WRAP-wide growth rate (currently TBD or Participant alternative

» **Contingency Reserve Adjustment**: LOLE Study assumes *average* 6% peak load. FS Capacity Requirement adjustment considers *each* Participant's *actual* imports/exports and any Contingency Reserve contracts to ensure correct amount of capacity required

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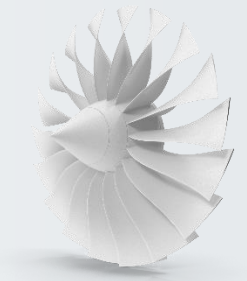
PROGRAM DESIGN OVERVIEW

FORWARD SHOWING – QCC METHODOLOGY (BPMS 105 AND 106)



- Qualified Resources must be **registered** in the WRAP through the **Advance Assessment** before being used to meet the monthly FS Capacity Requirements in a FS Submittal
  - Facility name, Unit ID, Prime Mover, Fuel Type, BAA, % Ownership/Contract, Summer/Winter Max Capacity etc.
    - *Capability Testing for Thermal, Long Duration Storage, and Demand Response every five years*
    - *Operational Testing of all resources as annual demonstration can operate at a high percentage of generating capability*
- **Thermal** or **Long Duration Storage**: calculate EFOF based on performance during CCHs
- **Variable Energy Resources**: ELCC analysis by VER Zones for resource type
- **Energy Storage**: ELCC analysis based on at least four continuous hours of operation
- **Hybrid Facilities:** Use method to each resource component and cap at interconnection limit
- **Demand Response**: Based on max load reduction capable of sustaining for up to five hours
- **Storage Hydro:** QCCs calculated by Participant owners based on performance during CCHs
- **RoR Hydro**: Based on historical performance during CCHs over the last ten years
- **Contracts:** QCC based on resources behind sale or agreed to between buyer and seller

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Program Design Overview

Operations Program

- Evaluates participants operational situation relative to Forward Showing assumptions
- Obligates participants with calculated surplus to assist participants with a calculated deficit on the hours of highest need
- Surplus Participant that fails to provide assigned Energy Deployment must pay **Energy Delivery Failure Charge**

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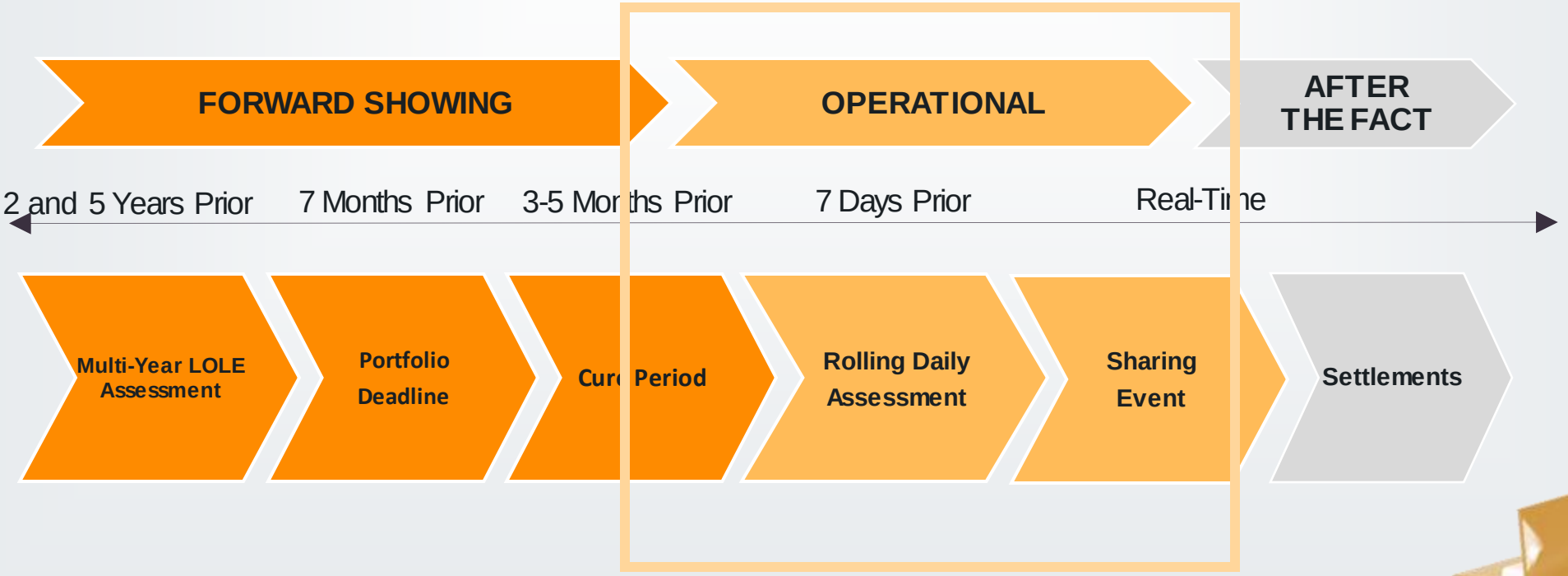
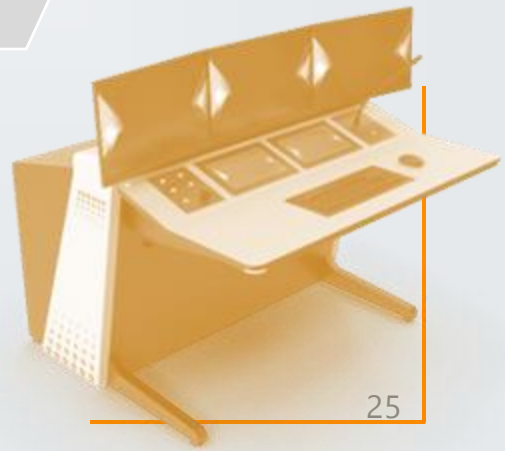
PROGRAM DESIGN OVERVIEW

OPERATIONS PROGRAM – TIME HORIZONS





PROGRAM DESIGN OVERVIEW

OPERATIONS PROGRAM – SHARING CALCULATION

CURRENTLY AVAILABLE CAPACITY

FS Capacity Requirement — Current Conditions

[(P50+FSPRM)+(Δ Forced Outages + Δ ROR Performance+ VER Performance)]

-

CURRENT NEED

(Load Forecast + Δ Contingency Reserves + Uncertainty)

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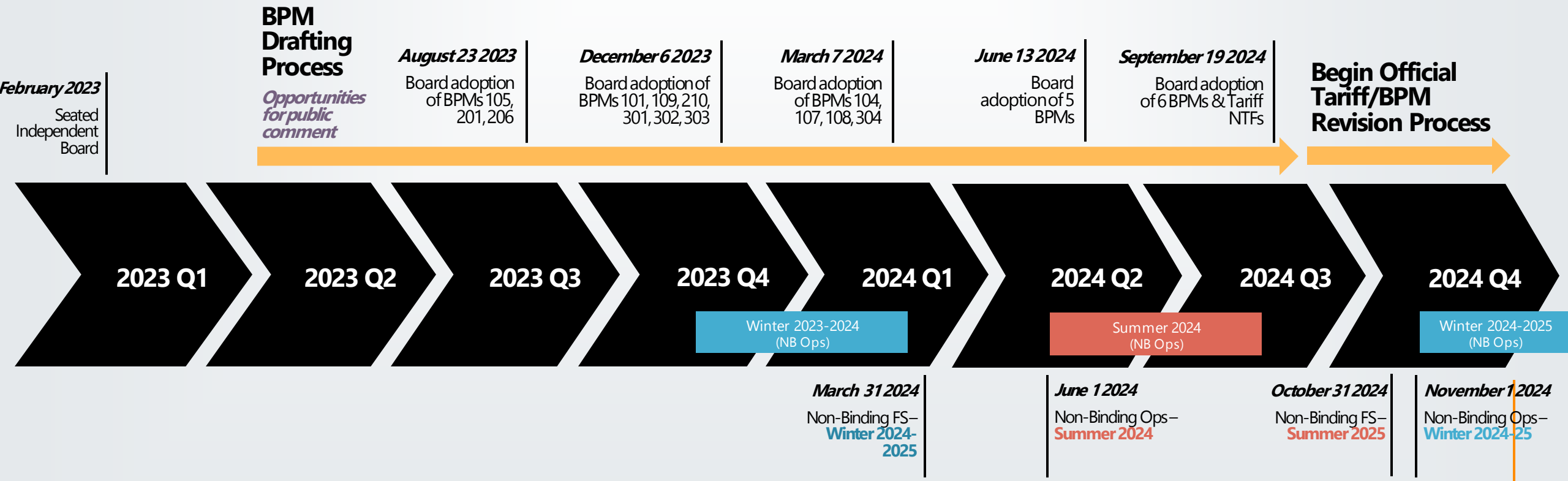
2023-2024 IMPLEMENTATION

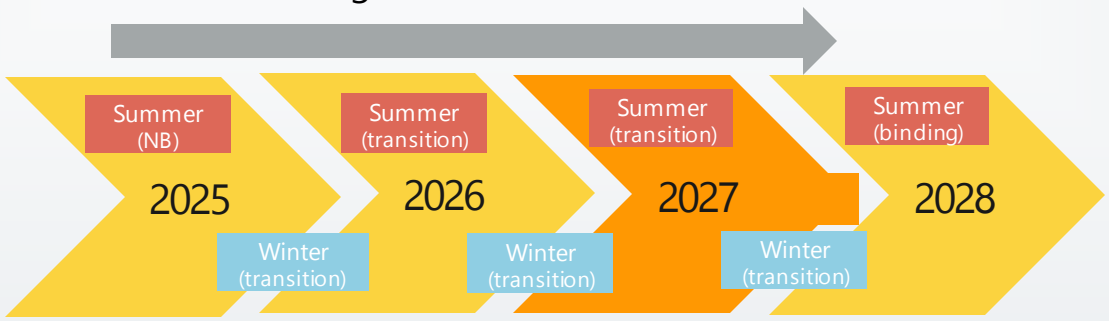


Winter Season: November – March 15
Summer Season: June – September 15

Implementation Ahead

Transition Seasons (Ops and FS)

Summer 25 through Winter 27-28



Targeting Binding Program With Revised Transition Provisions

Modified Excused Transition Deficits and Cone Charge Deductions

Binding Program Without Transition Provisions

Summer 28 and all seasons following

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QUESTIONS?

wrap@westernpowerpool.org

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Forecasting future WRAP resource adequacy requirements

Jennifer Coulson, PSE

May 14, 2024

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Forecasting future WRAP resource adequacy requirements

The 25 IRP will run two sets of resource adequacy metrics:

- PSE metrics that were produced via E3
- Forecasted future WRAP RA requirements

Why evaluate both metrics?

The region is moving towards the WRAP program; this program uses a different methodology and approach to evaluate each resources capacity contribution.

To help mitigate the gap between operations and longer-term planning PSE would like to work towards leveraging long-term planning WRAP metrics within the IRP process.

In lieu of these metrics being created via a formal WRAP group, PSE has produced a forecasted WRAP metric for longer-term projections that we will walk through today.

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Overview of approach for applying WRAP PRM

- WRAP uses five-year average historic normal Peak Load
- Emulating by using five-year rolling average of forecast peaks from 2025 IRP demand forecast
- Applying monthly WRAP PRM developed by SPP
  - SPP completed the analytics and modeling for the WRAP and their participants for the forward showing metrics
- Months selected with highest total need to represent respective seasons

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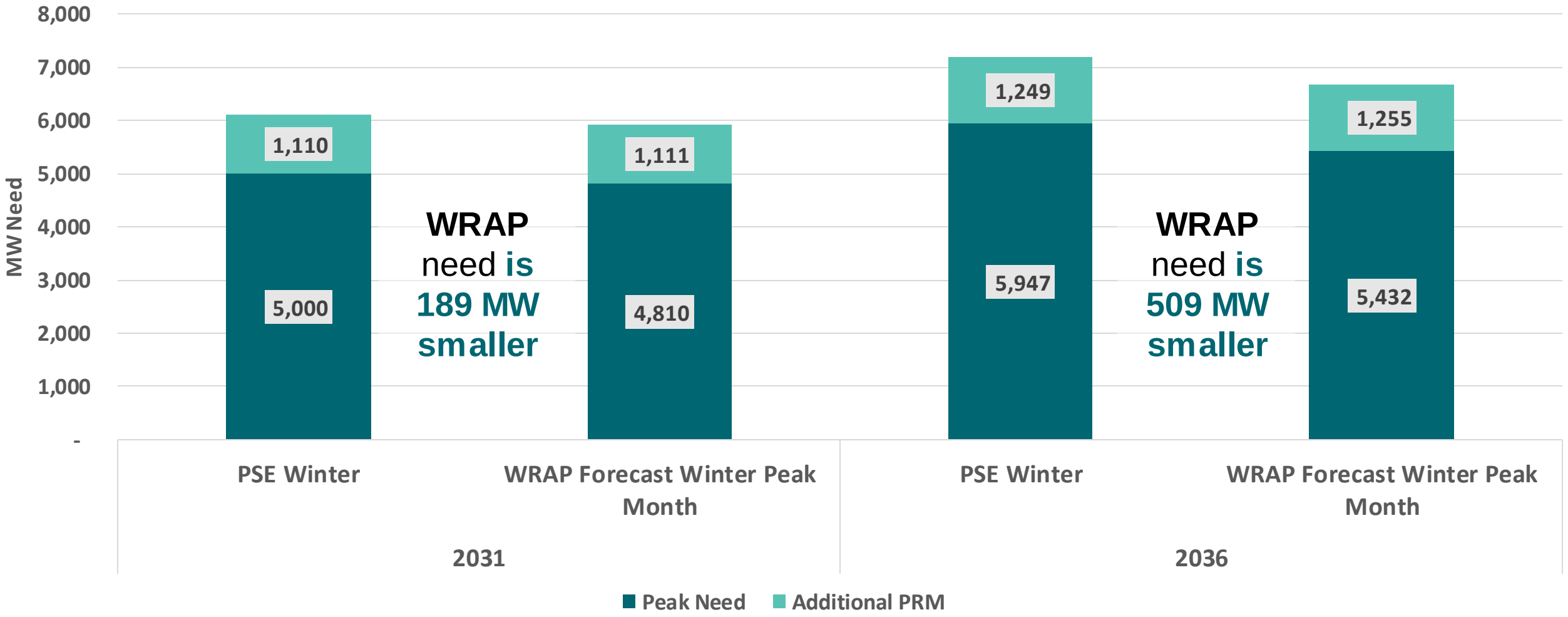
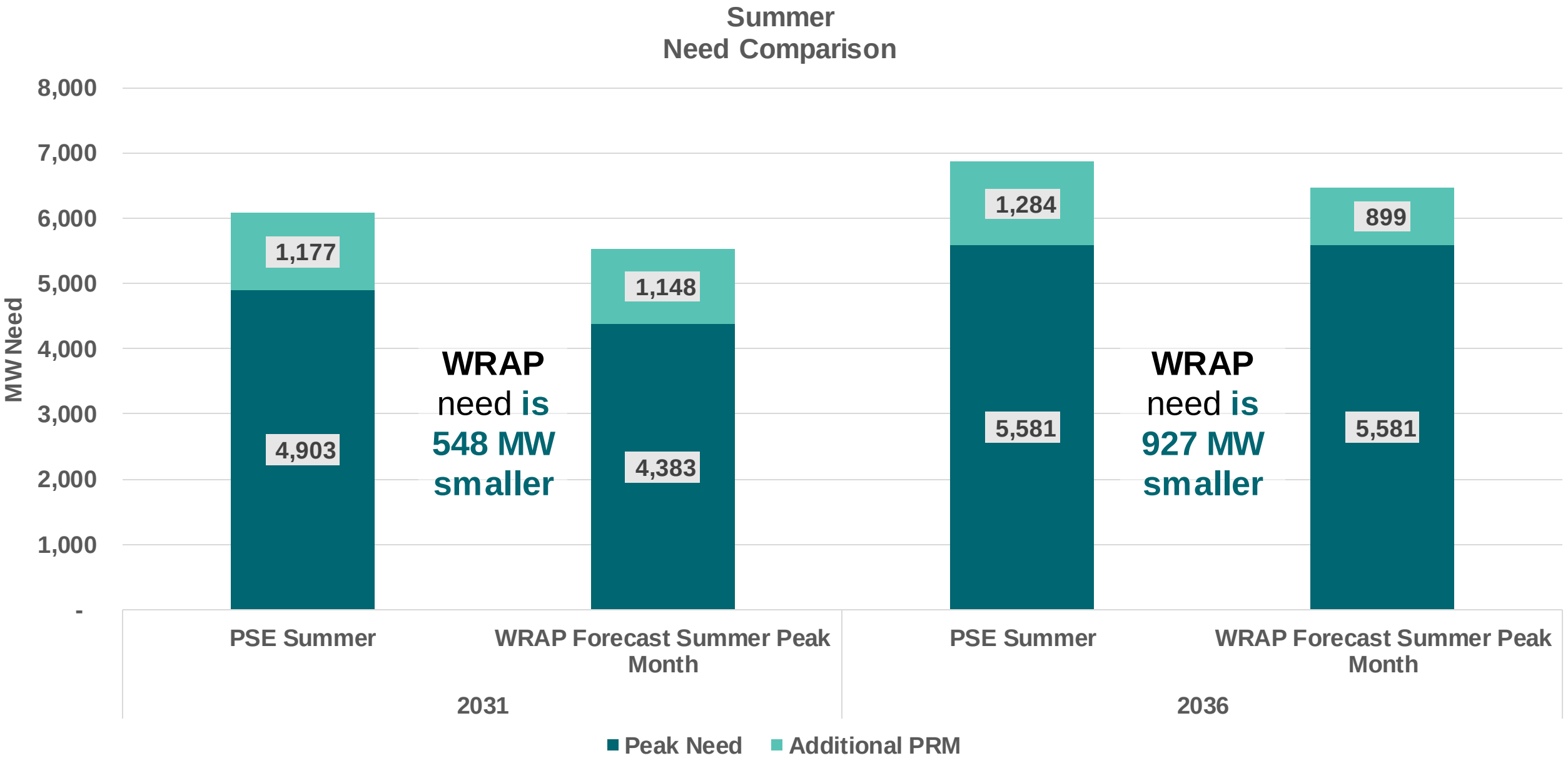
Winter
Need Comparison




Summer
Need Comparison
MW Need
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
-
1,177
4,903
1,148
4,383
1,284
5,581
899
5,581
WRAP need is 548 MW smaller
WRAP need is 927 MW smaller
PSE Summer
WRAP Forecast Summer Peak Month
PSE Summer
WRAP Forecast Summer Peak Month
2031
2036
Peak Need
Additional PRM

Overview of application of WRAP Effective Load Carrying Capability (ELCCs)

- To determine regional build out to ensure PSE is reflecting saturation effects, we leveraged two different sources:
  - Through 2034, the Pacific Northwest Utilities Conference Committee's (PNUCC) *2024 Northwest Regional Forecast.* PNUCC's *Forecast* aggregates Northwest utility reported plans for future resources (backed out PSEs reported resources)
  - To extend out to 2045, used PSEs Power Price AURORA model regional build out
- Mapped regional build out to WRAP zones by location and technology
- Utilized saturation curves and ELCCs from material provided by WRAP

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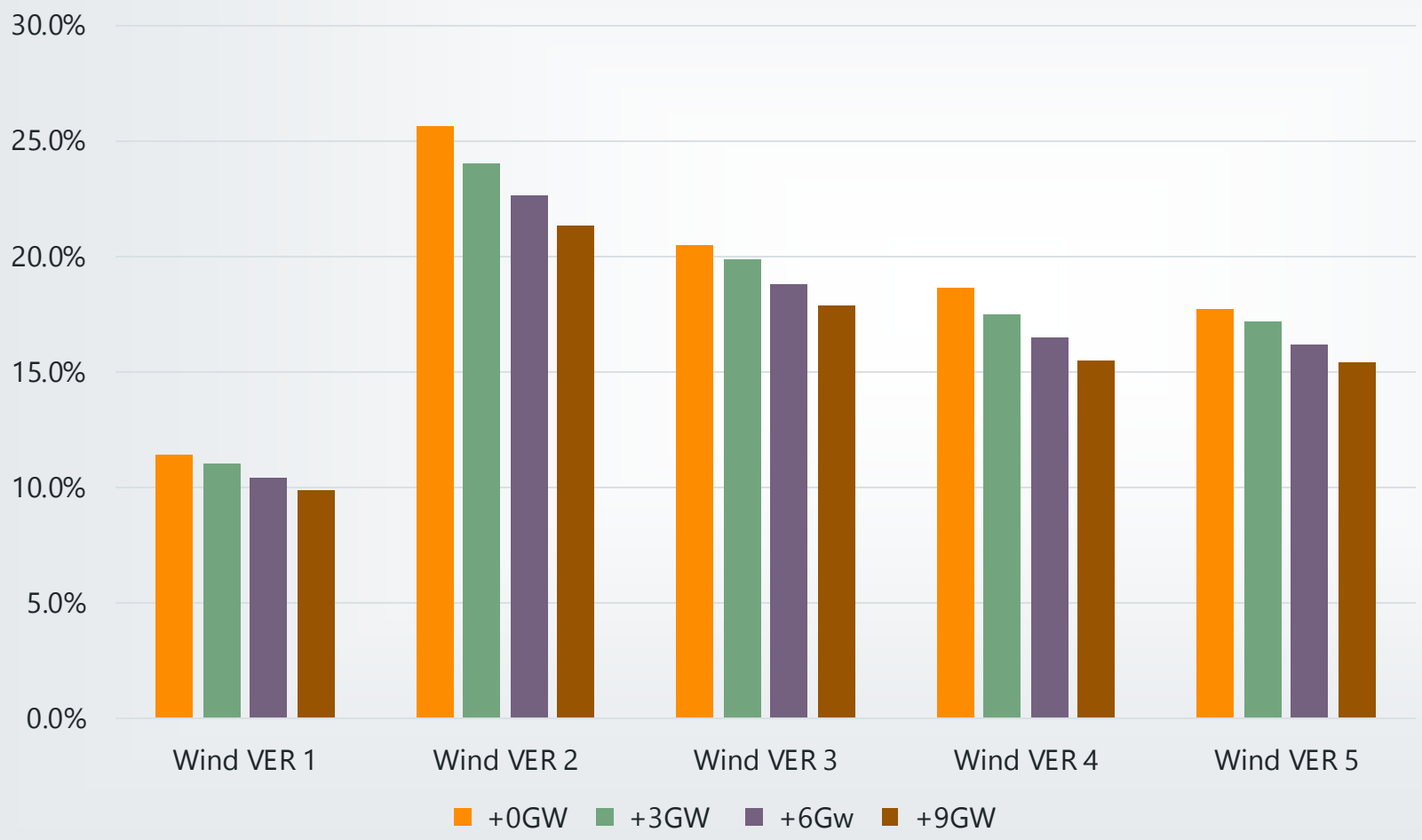
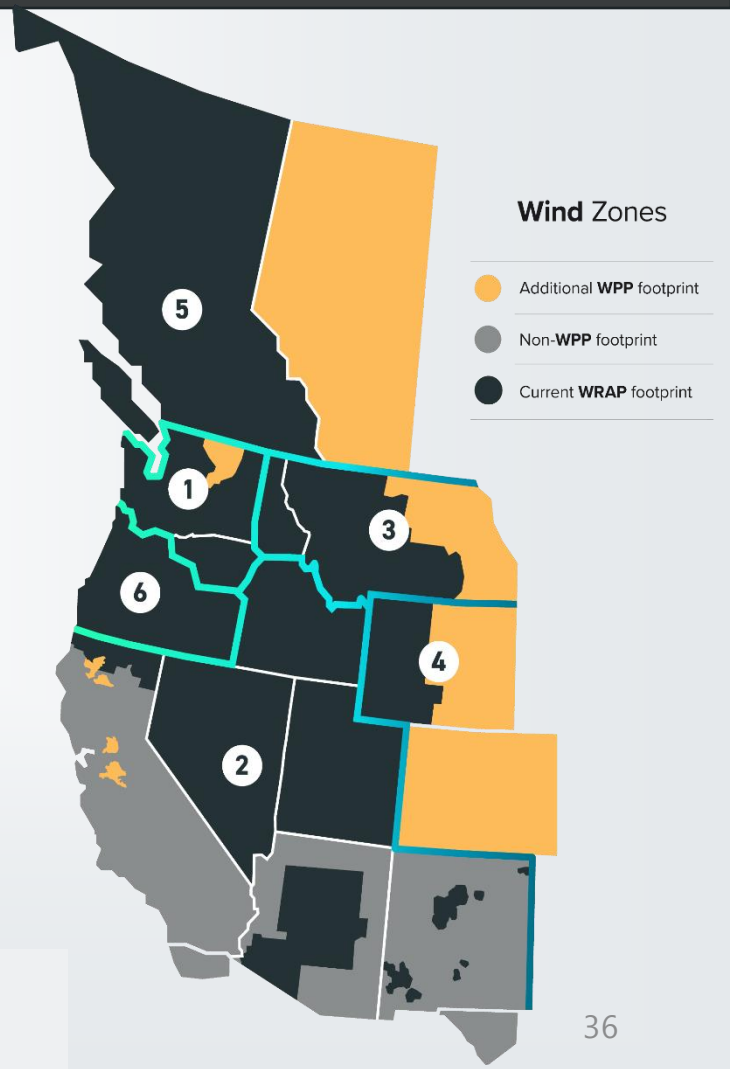
Wind ELCC

Wind at Incremental GW Installations





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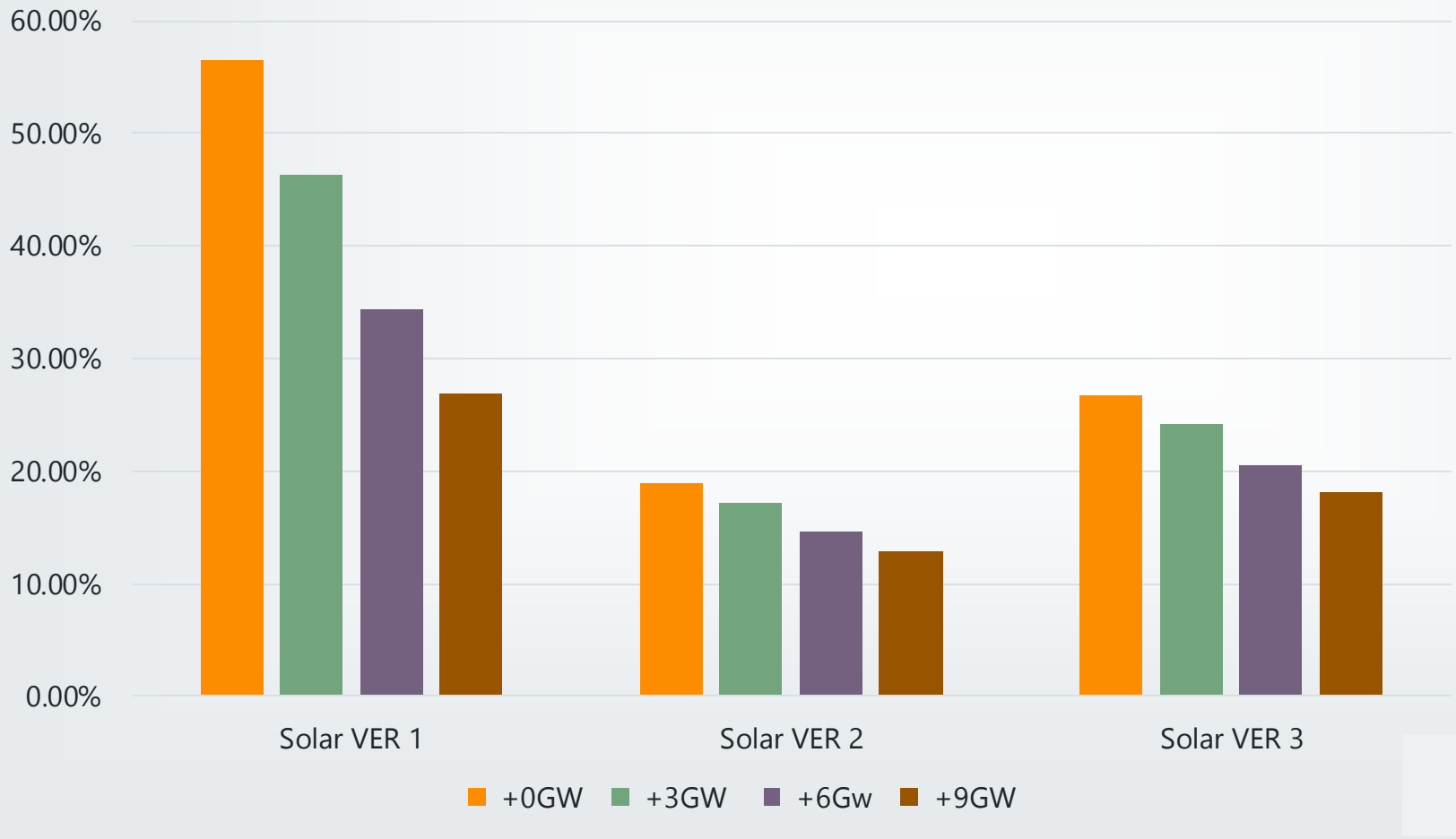
Solar ELCC

Solar at Incremental GW Installations



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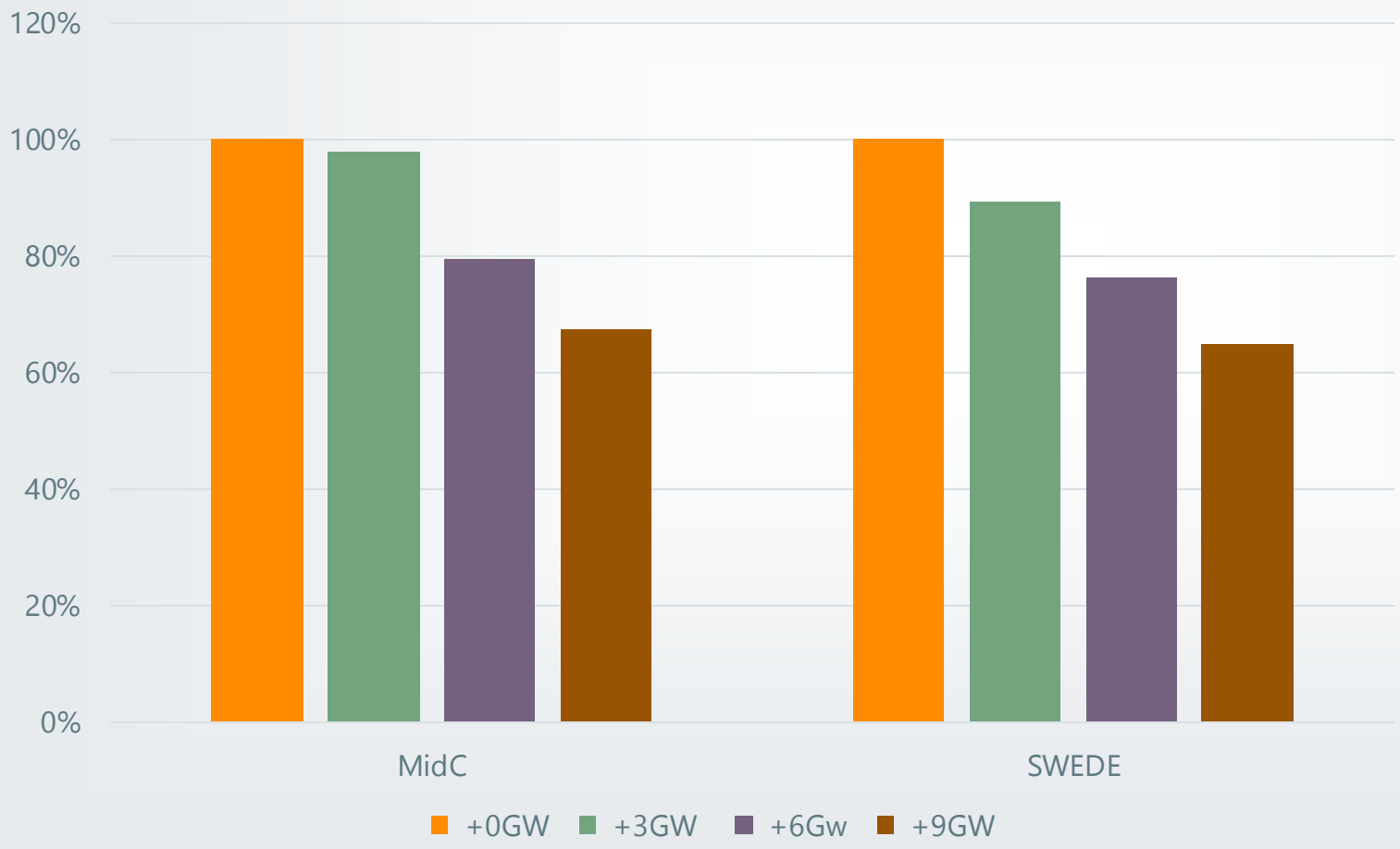
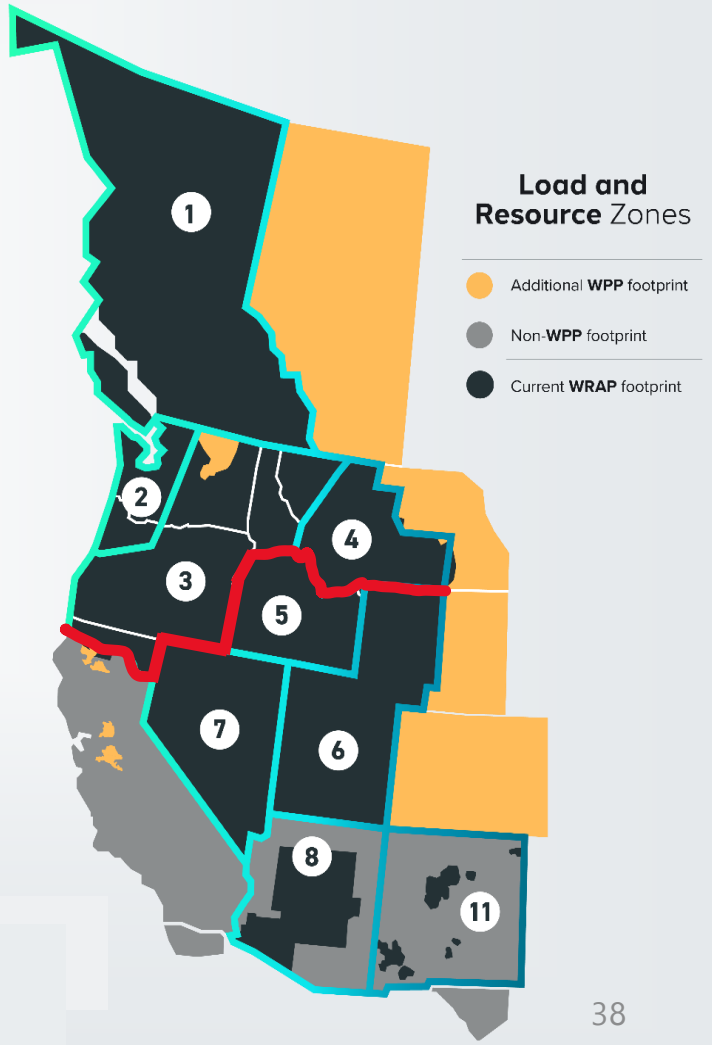
ESR ELCC

ESR at Incremental GW Installations





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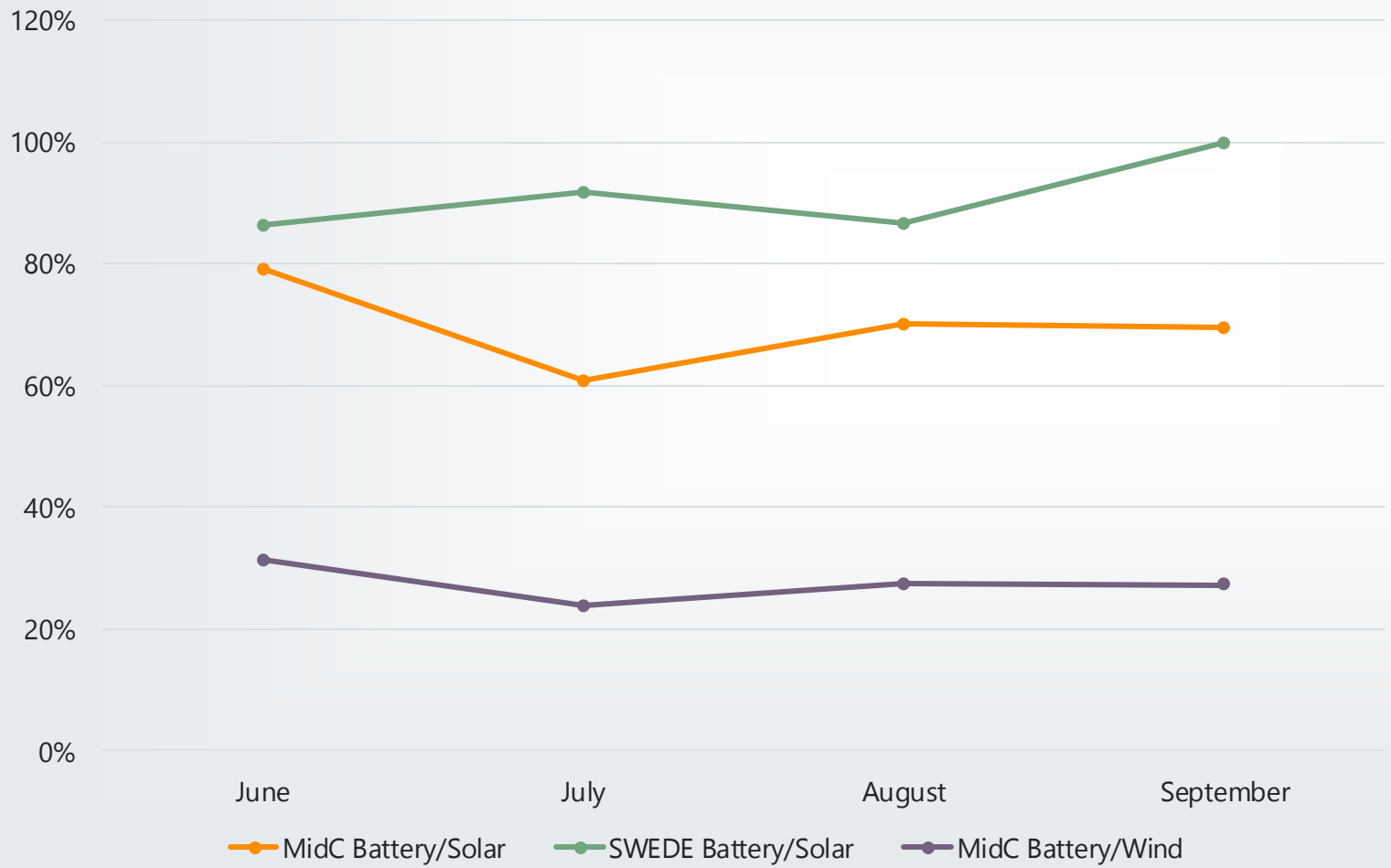
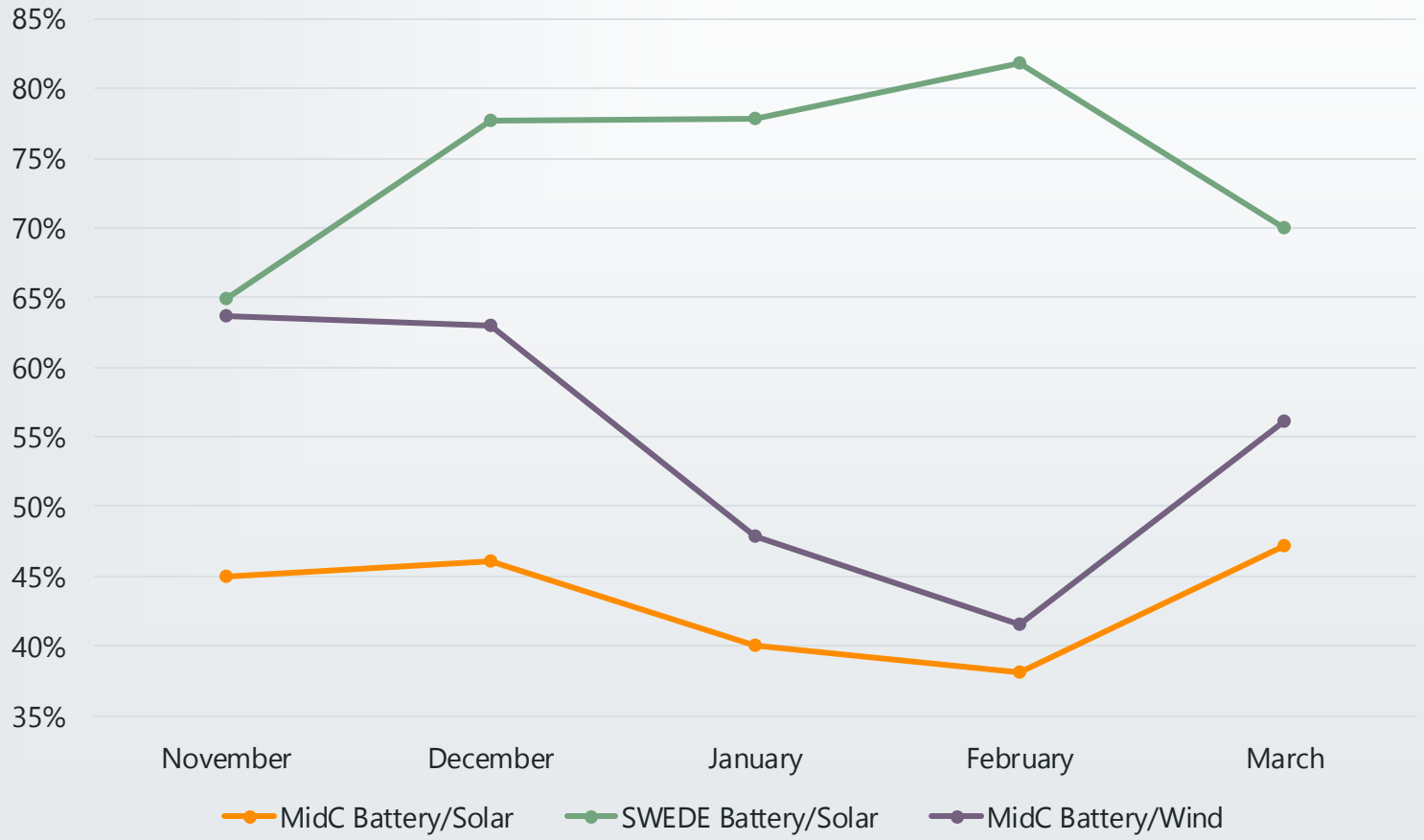
Hybrid Resource QCC



Number of installed pairings

	MidC	SWEDE
Battery/ Solar	4	36
Battery/ Wind	4	0

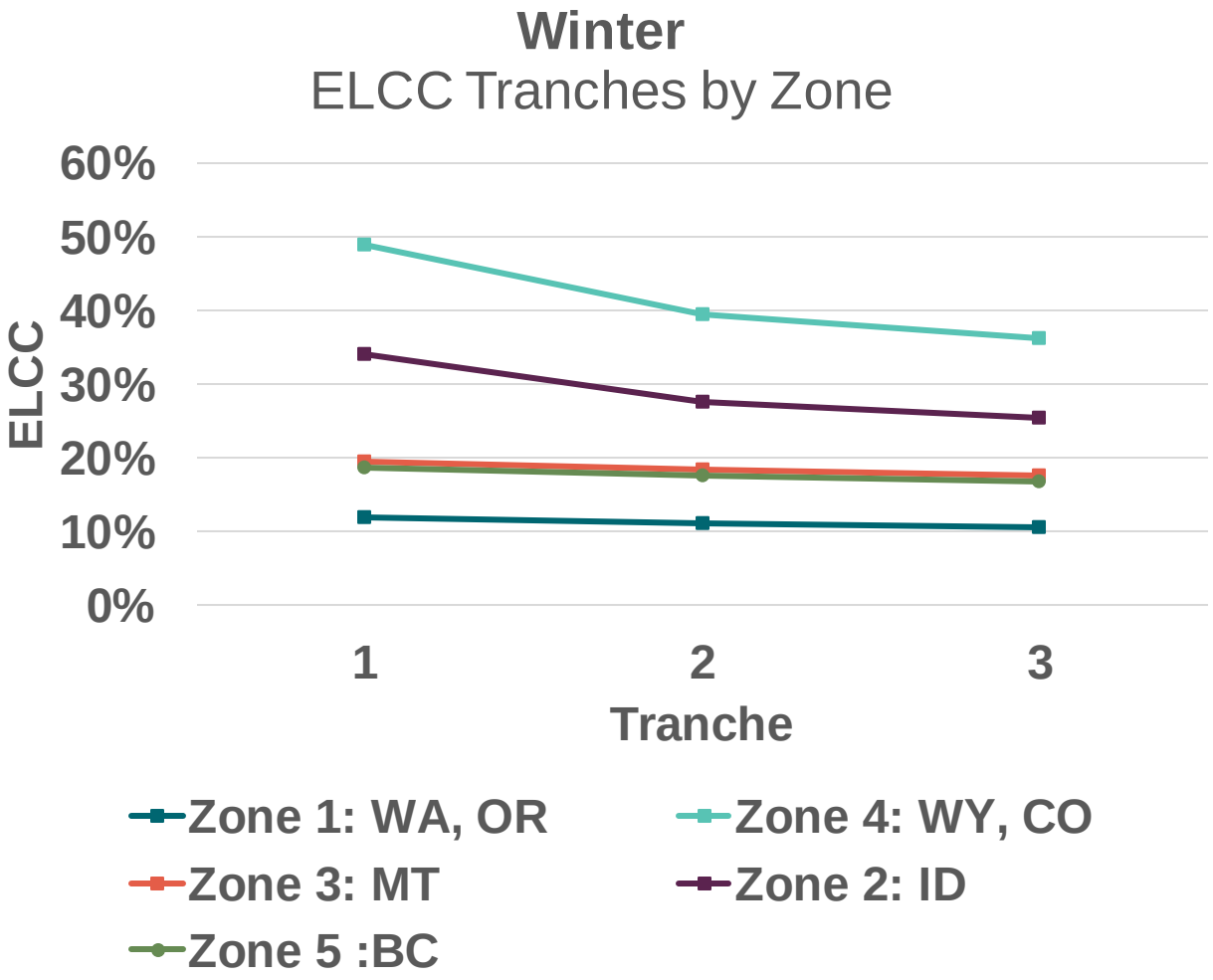
Hybrid Resource QCC

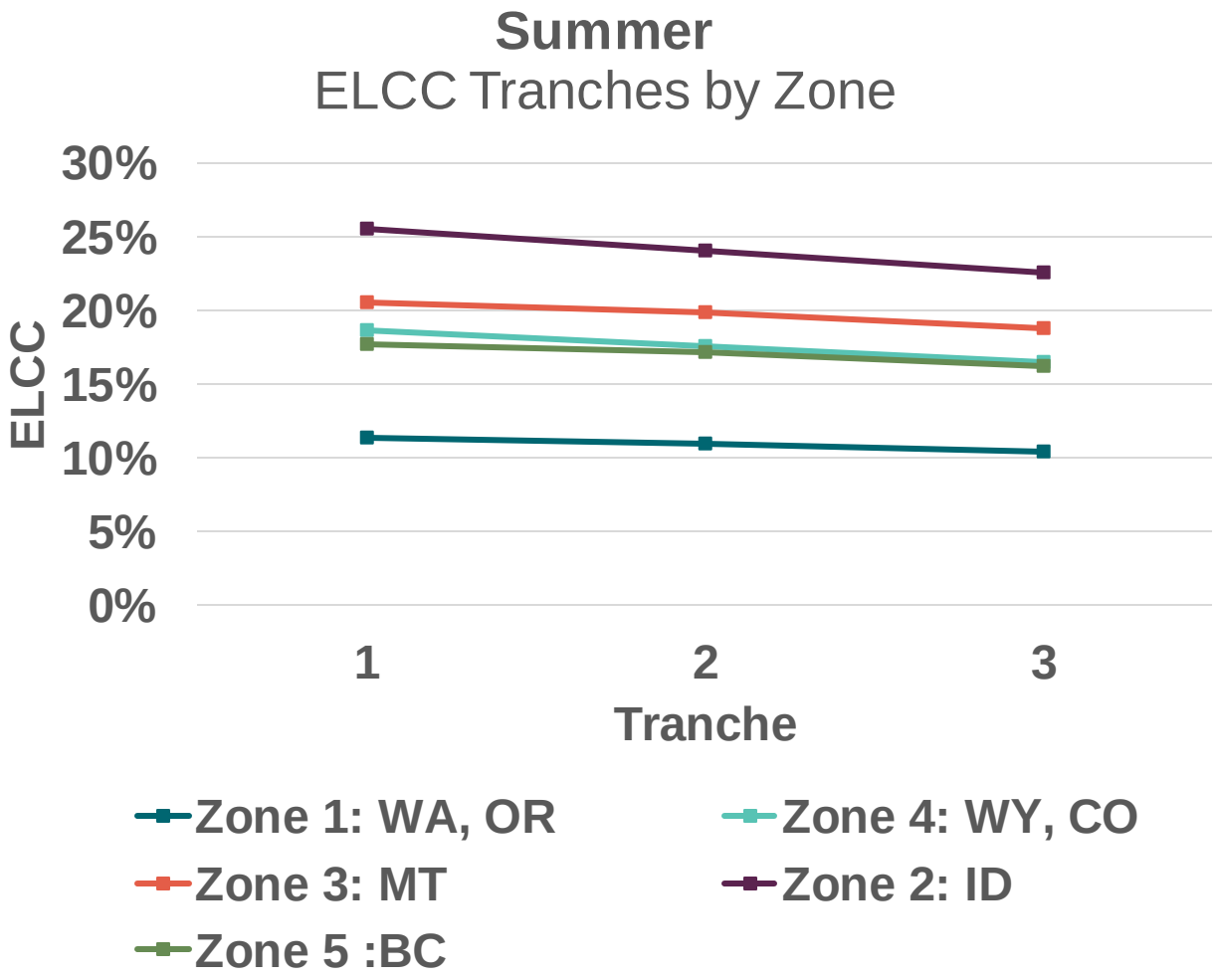


Number of installed pairings

	MidC	SWEDE
Battery/ Solar	4	30
Battery/ Wind	4	0

Wind curves





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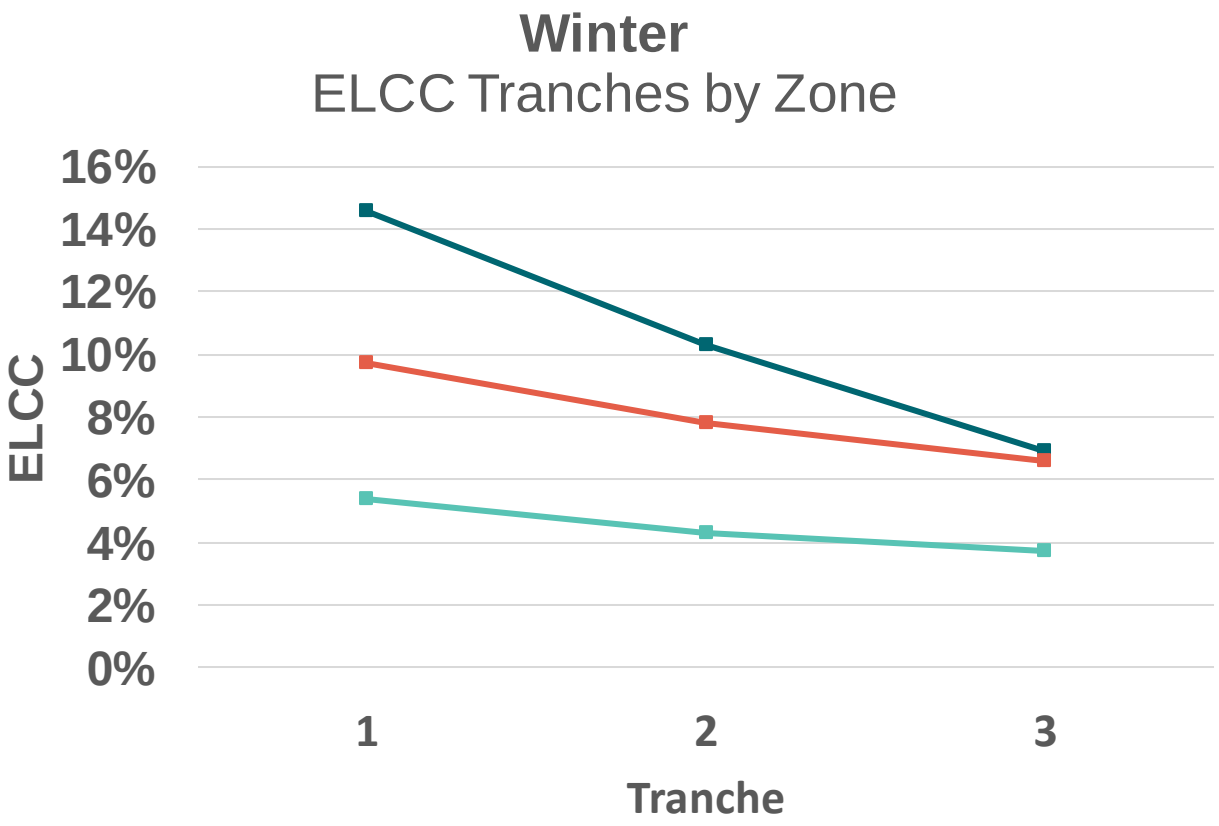
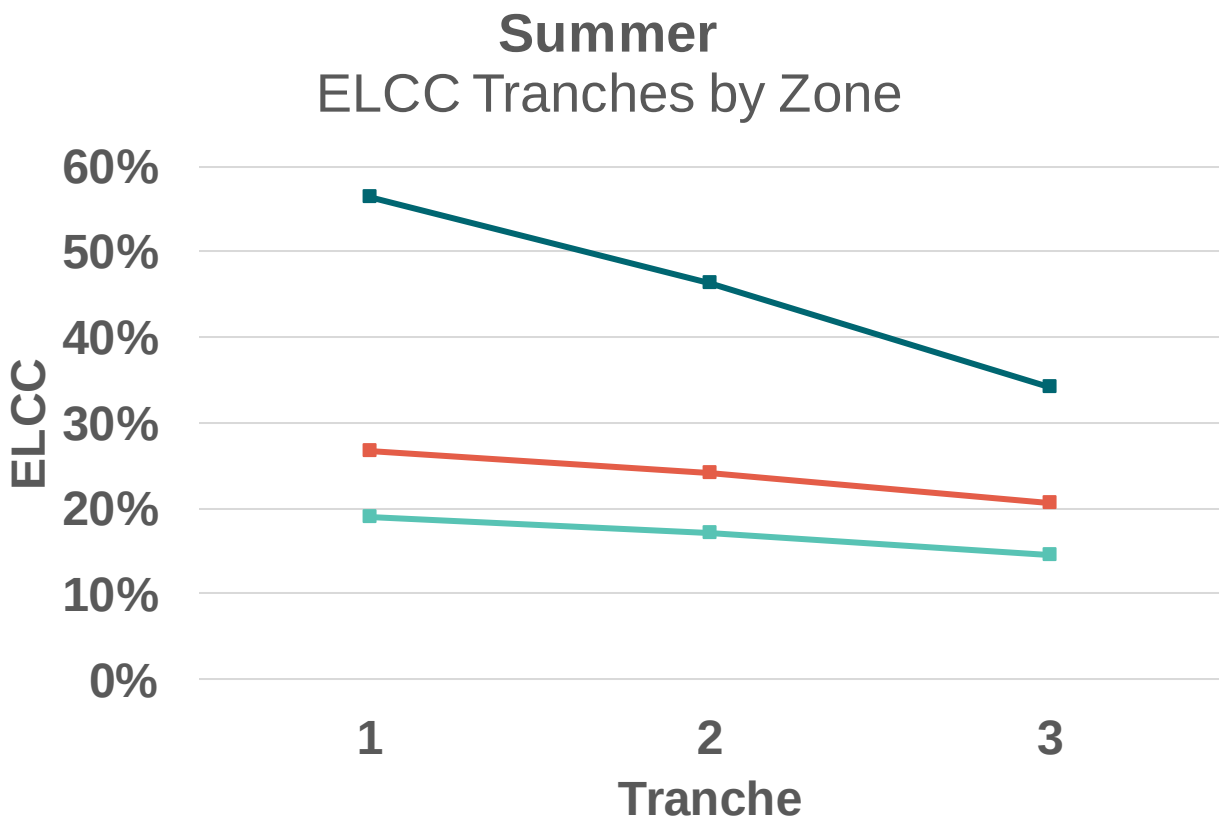
Solar curves





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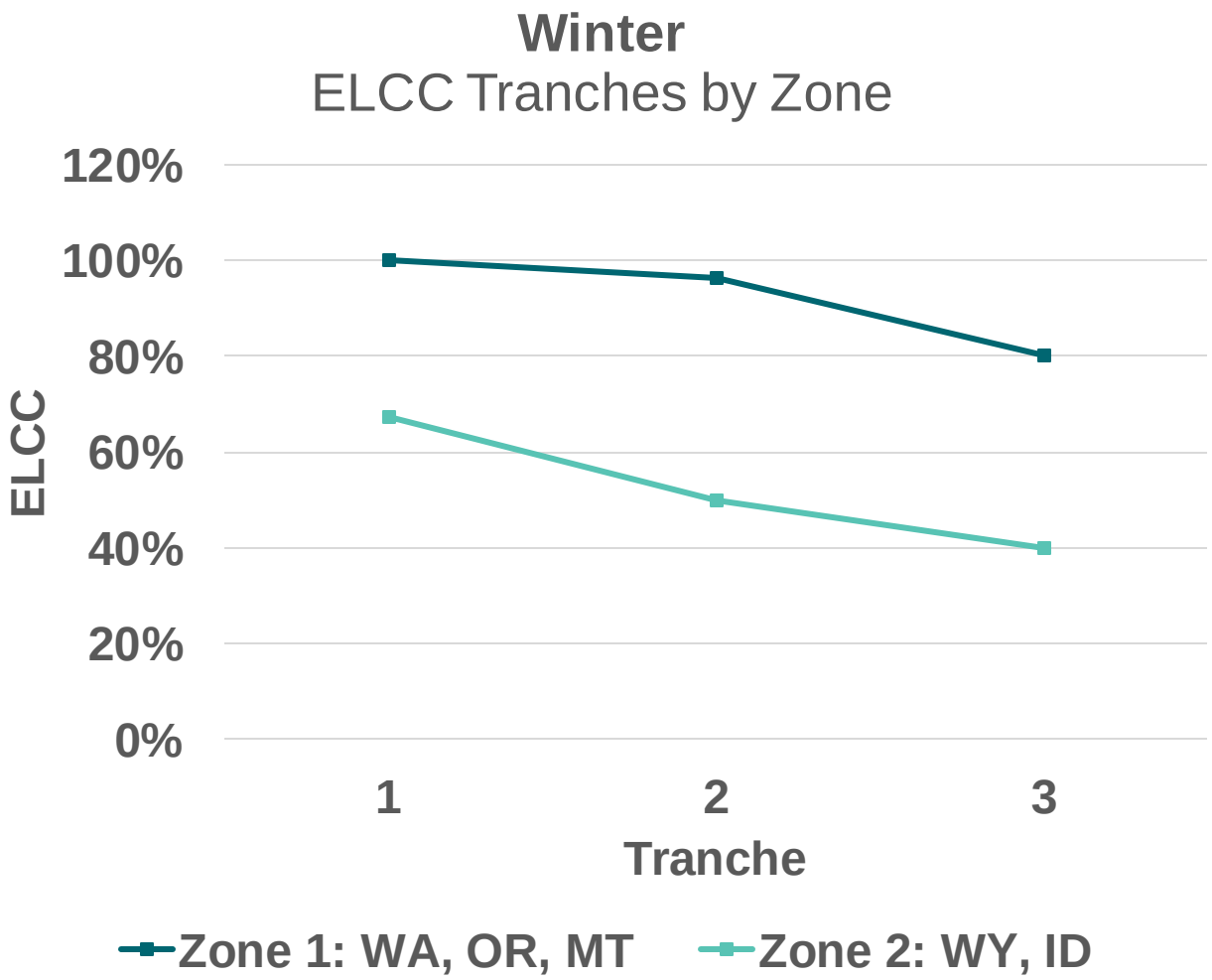
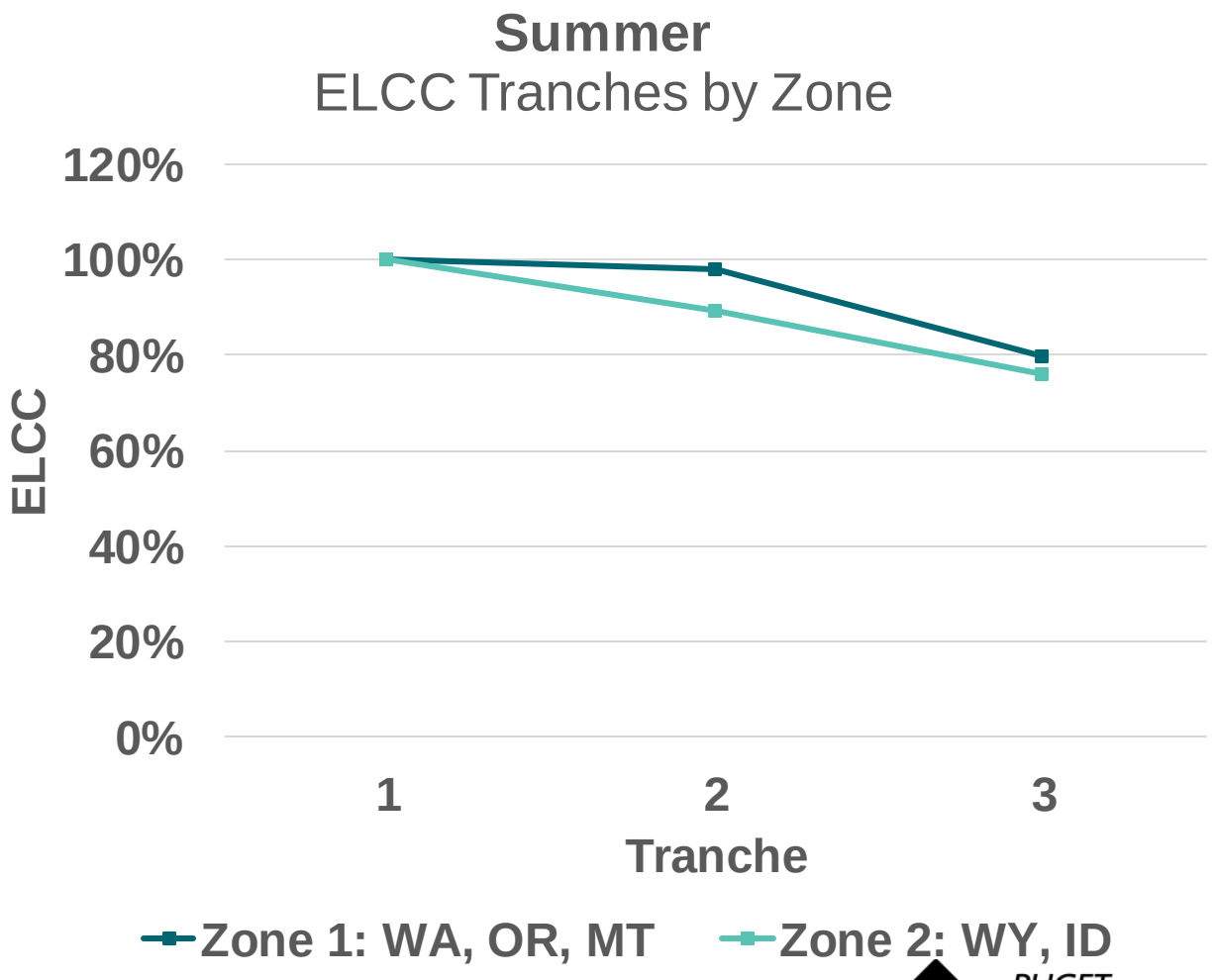
Storage curves (ESR)





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Comparing ELCCs from PSE's RA analysis to the WRAP sensitivity ELCCs

ELCC Comparison 100 MW					
		Winter		Summer	
Zone/Description	Location	PSE	WRAP	PSE	WRAP
Wind Zone 1	Eastern WA, OR	14%	11.8%	***6.0%***	***11.4%***
Wind Zone 2	Idaho	***13%***	***34.1%***	***19.0%***	***25.6%***
Wind Zone 3	Montana	***31%***	***19.5%***	21.0%	20.5%
Wind Zone 4	Wyoming	44%	48.8%	***36.0%***	***18.6%***
Wind Zone 5	British Columbia	***39%***	***18.6%***	15.0%	17.7%
Solar Zone 1	Western WA, NW OR	***4%***	***14.6%***	***51.0%***	***56.6%***
Solar Zone 1	Eastern WA, SW OR	***2%***	***14.6%***	***48.0%***	***56.6%***
Solar Zone 1A	Wyoming	2%	5.4%	22%	18.9%
Solar Zone 2	Idaho	2%	5.4%	***30%***	***18.9%***
Battery Wind Hybrid	Mid - C Region	***61%***	***54.7%***	***79.0%***	***28.1%***
Battery Solar Hybrid	Mid - C Region	***50%***	***43.4%***	***54.0%***	***70.8%***
DER Battery	Mid - C Region	98%	100.0%	97.0%	100.0%
Short Duration Storage	Mid - C Region	98%	100.0%	98.0%	100.0%
Medium Duration Storage	Mid - C Region	99%	100.0%	99.0%	100.0%
Long Duration Storage	Mid - C Region	97%	100.0%	97.0%	100.0%

- *Note: Offshore wind resources which don't currently have a QCC from WRAP aren't shown. ELCCs range from 35% - 38% across seasons*
- ***BOLD:** highlights variations of greater than 5%*

Discussion

Phillip Popoff, PSE

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Discussion and poll

How supportive are you of PSE using PSEs WRAP forecast approach moving forward?

What concerns do you have about moving forward with either method?

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Next steps

Sophie Glass, Triangle Associates

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Upcoming activities

Date	Activity
May 21, 2024	Feedback form for this meeting closes
May 31, 2024	RPAG meeting: electric modeling process

Email us at irp@pse.com

Register for email updates

Visit our website at pse.com/irp

Leave a voice message at 425-818-2051

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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Acronyms

Acronym	Meaning
CAISO	California Independent System Operator
CCH	Capacity critical hours
DER	Distributed energy resource
DLC	Direct load control
EAG	Equity Advisory Group
EFOF	Equivalent forced outage factor
ELCC	Effective load carrying capacity
ESR	Energy Storage Resource
IRP	Integrated resource plan
FSPRM	Forward showing planning reserve margin
LOLE	Loss of load expectation
LRZ	Load and resource zones
Mid-C	Mid Columbia market

Acronyms

Acronym	Meaning
Mid-C	Mid-Columbia market
NERC	North American Electric Reliability Company
NRF	Northwest Regional Forecast
PA	Program administrator
PO	Program operator
PRM	Planning Reserve Margin
QCC	Qualified capacity contribution
RA	Resource adequacy
RoR	Run-of-river
RPAG	Resource Planning Advisory Group
SPP	Southwest Power Pool
VER	Variable energy resource (wind and solar)
WPP	Western Power Pool
WRAP	Western Resource Adequacy Program