



Evolving Grid

Update on Transmission Commercial Activities

Sept. 14, 2023

Rates Hearing Room & Webex



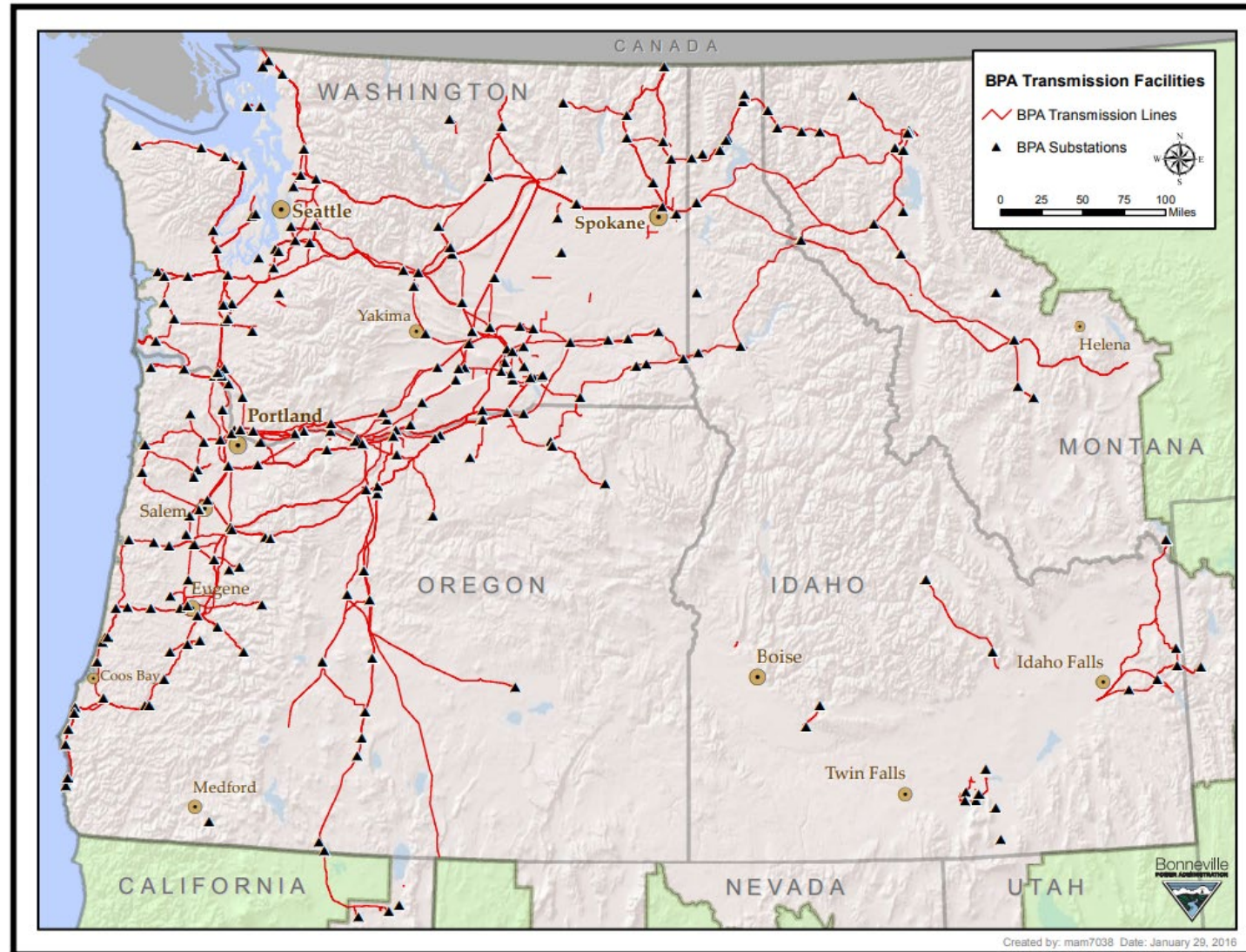
Agenda

1. Workshop Goal
2. BPA's Analysis working towards 2030 State Clean Energy Goals
3. 2019-2023 TSR Analysis & Cluster Study Update
4. Decarbonization Studies
5. Queue Management Updates
 1. Update on GI Settlement Reform
 2. Update on the Tier I Projects/Evolving Grid Projects
6. NT Service Updates
7. Agency Strategy & Next Steps

Today's Goal

A variety of factors are creating a need for a transformational shift in the Transmission industry. Bonneville Transmission wants to raise awareness of recent efforts, those underway, and what customers and the region can expect in the future as we navigate the changing landscape.

BPA Infrastructure



BPA's Analysis working towards 2030 State Clean Energy Goals: Transmission Planning Power Flow Studies and Assumptions

Transmission Planning



Rapidly Evolving NW Landscape

2000s

- California Energy Crisis, shutdown of aluminum industry
- Addition of 5.5 GW of natural gas plants in the NW
- Start of large scale wind integration



BPA Grand Coulee – Bell 500 kV
BPA Schultz – Wautoma 500 kV
BPA John Day, Rock Creek, Shepherd Flats,
Central Ferry wind hubs

2010s

- Large scale wind integration continues, reached 7 GW, then slowed down
- Anemic load growth



BPA Bakeoven 500 kV series capacitors
BPA Central Ferry – Lower Monumental 500 kV
BPA McNary – John Day 500 kV
BPA Big Eddy – Knight 500 kV
Pacific HVDC Intertie Celilo upgrade

2020s

- Progressive de-carbonization policies in states of WA and OR
- Accelerated need for carbon-free resources
- Load growth accelerating – high tech industries attracted to NW
- Climate change challenges - extreme temperatures and wildfires

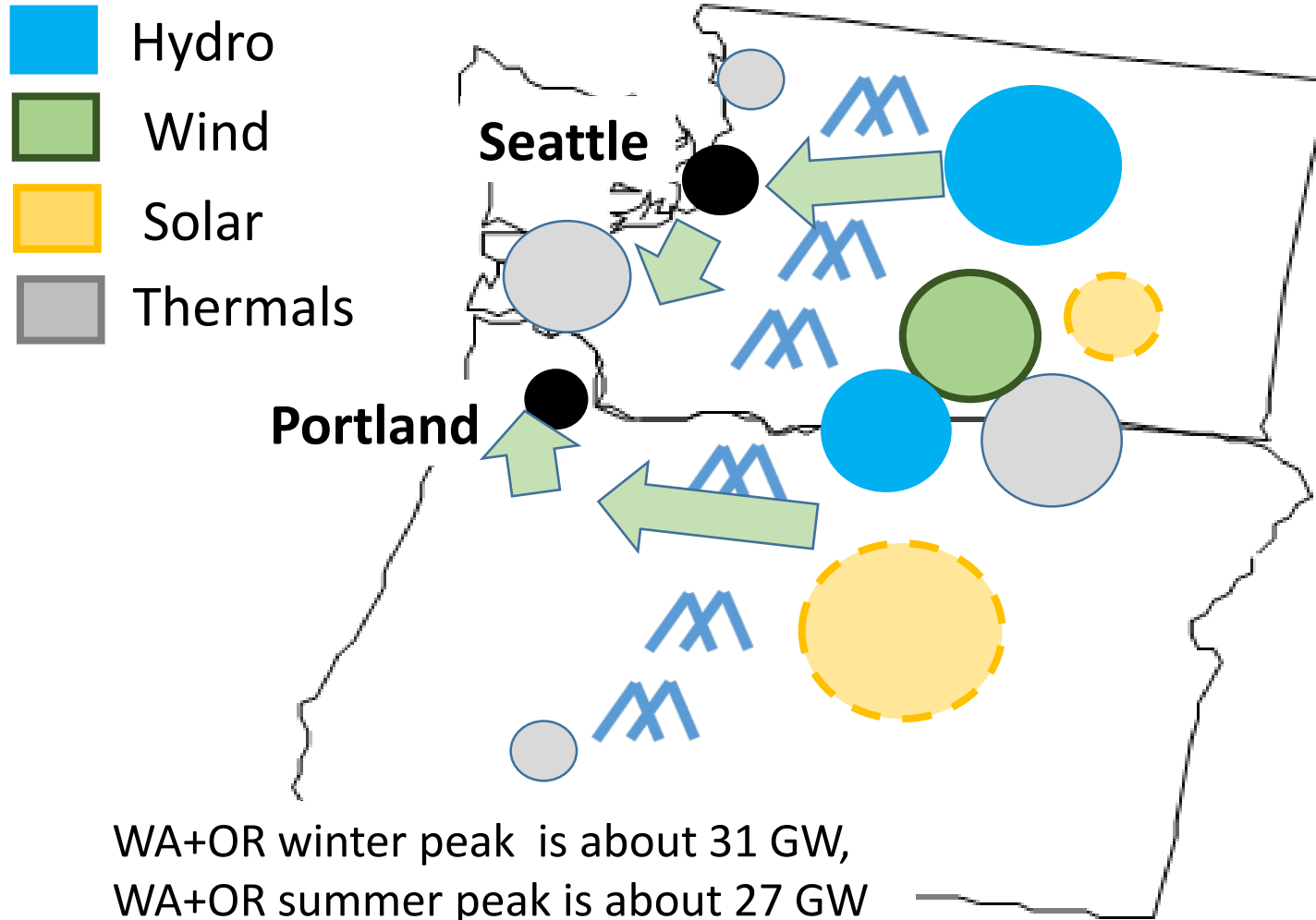


BPA Evolving Grid Projects

2030 Studies

- 2030 Decarbonization Milestones
 - State of Washington CETA – electric utilities in Washington must be greenhouse gas emissions neutral, which means they may use limited amounts of electricity generated from natural gas if it is offset by other actions
 - State of Oregon Clean Energy Bill – electric utilities to reduce greenhouse emissions by 80% below baseline levels
- Western Power Pool 2030 Extreme Weather Studies
 - Transmission adequacy -- Does the region have adequate transmission to serve extreme winter and summer peak loads?
 - Transmission resiliency -- Is transmission resilient to continue reliable operations during large wildfire events?
- 2030 BPA Decarbonization Studies
 - At what level can the Pacific Northwest loads can be served entirely with carbon-free resources (hydro, wind, solar and nuclear)?

Shift in Resource Locations

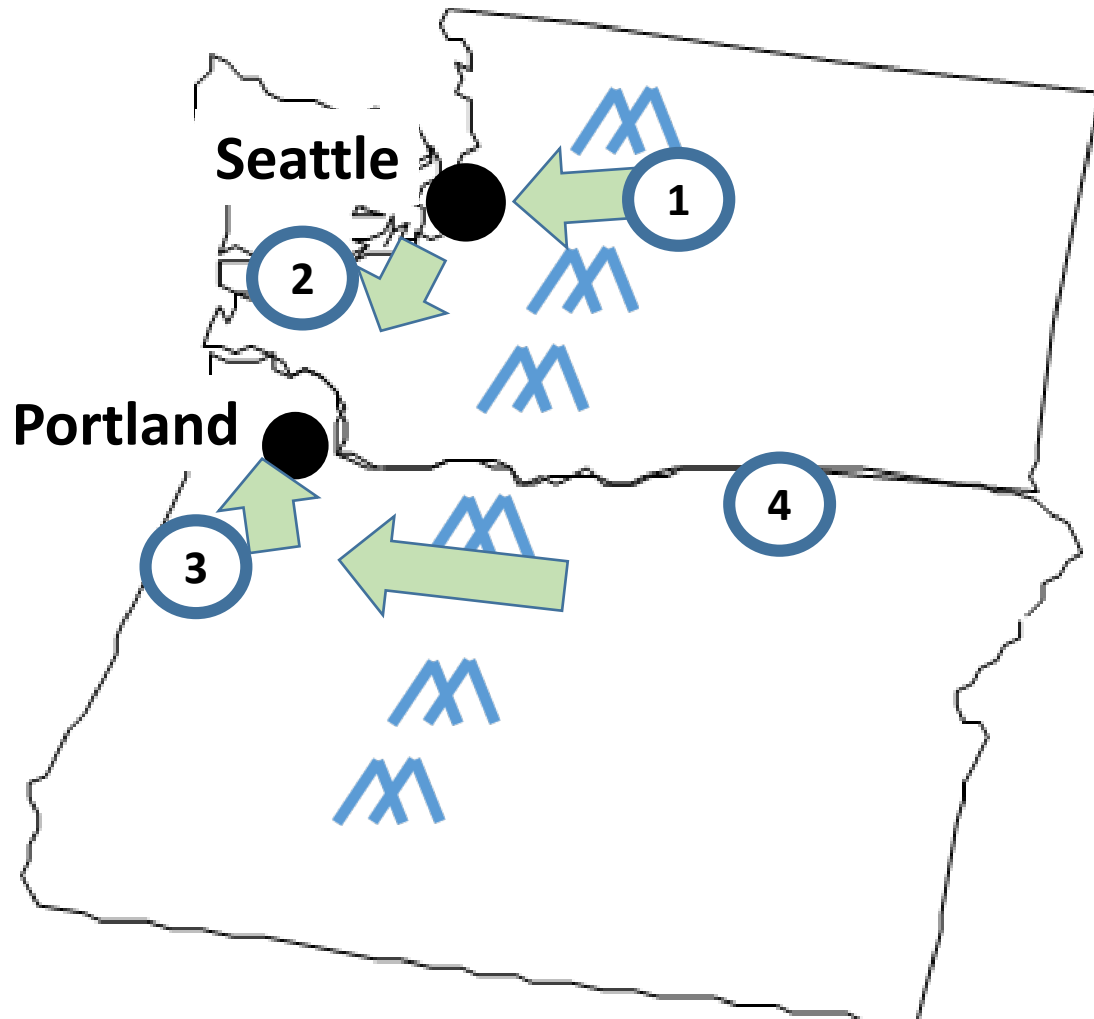


Oregon and Washington states have about 8 GW of thermal generators. About 5 GW is located on the west side of Cascades near Seattle and Portland load centers

Most of the existing and proposed renewables (wind and solar) are located on the east side of Cascades and require transmission infrastructure improvements to get to load centers on the west side:

- Cross-Cascades North
- Cross-Cascades South
- Raver-Paul
- North of Pearl

Major Transmission Projects by 2030



1. **West of Cascades North:** Schultz-Raver #3 and #4 500 kV lines reconductor and series capacitor upgrade, PSANI projects completed (Broad St. series reactors, Energize East)
2. **Raver-Paul:** Rebuild Cowlitz-Chehalis section of Covington-Chehalis 230-kV line
3. **North of Pearl:** Keeler substation and Pearl-Sherwood corridor upgrades, PGE north of Sherwood upgrades, PGE Harborton reliability project
4. Longhorn 500-kV substation

* Several proposed Line and Load interconnections will require additional projects on the west side

2030 Western Power Pool Extreme Weather Study

- The studies are in progress, the final report is scheduled to be released in Spring 2024
- Preliminary findings from extreme weather studies
 - Pacific Northwest needs to keep existing dispatchable resources to maintain reliable load service during extreme winter and summer peaks
 - With planned upgrades, the transmission system is adequate to serve winter and summer peaks in states of OR and WA
- Wildfire studies are in progress

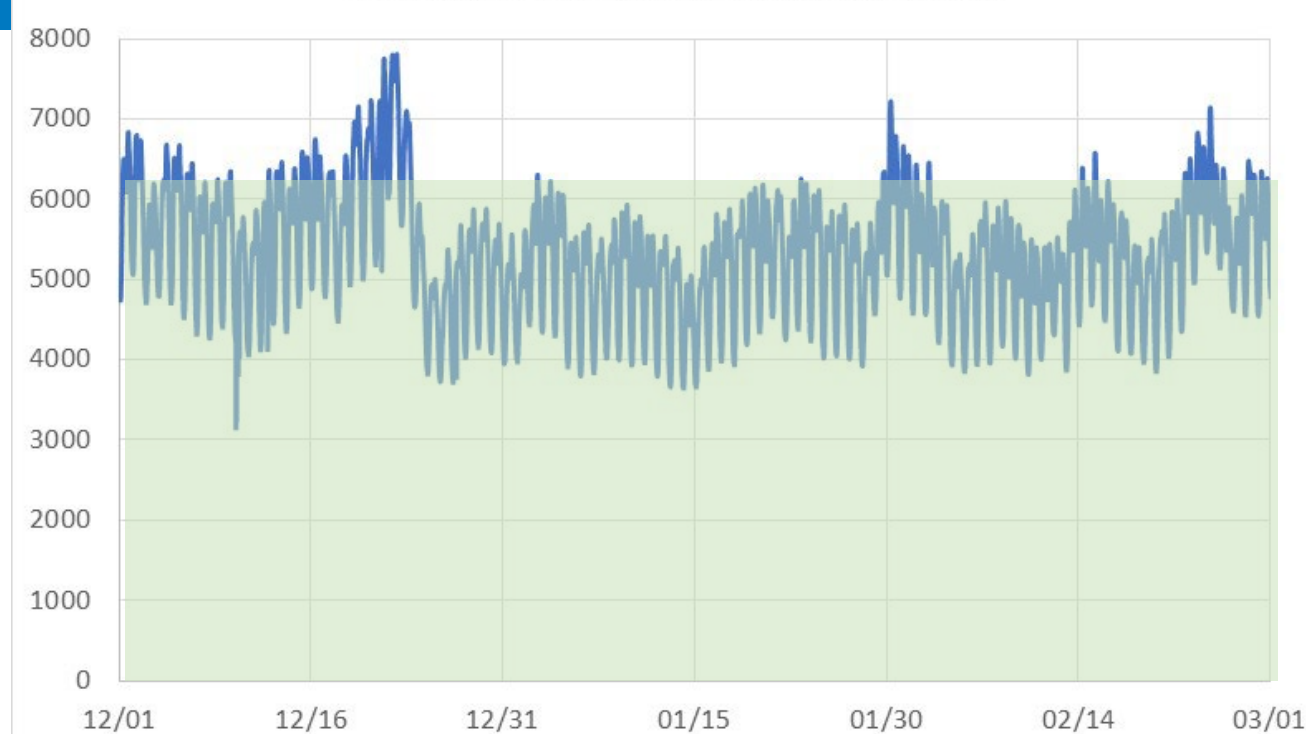
2030 Decarbonization Studies

- Puget Sound Area studies (winter peaking)
 - We were able to reliably serve up to 90th percentile winter loads in Puget Sound Area with carbon-free resources east of Cascades with planned system upgrades*
 - 1,500 MW of dispatchable resources were needed in Puget Sound during winter peak loads
- Portland Area studies (summer peaking)
 - We were able to serve up to 80th percentile of expected Portland Area loads
 - Load growth in Portland Area is very dynamic. Additional projects will likely be needed and those projects will be determined by LLIR studies.

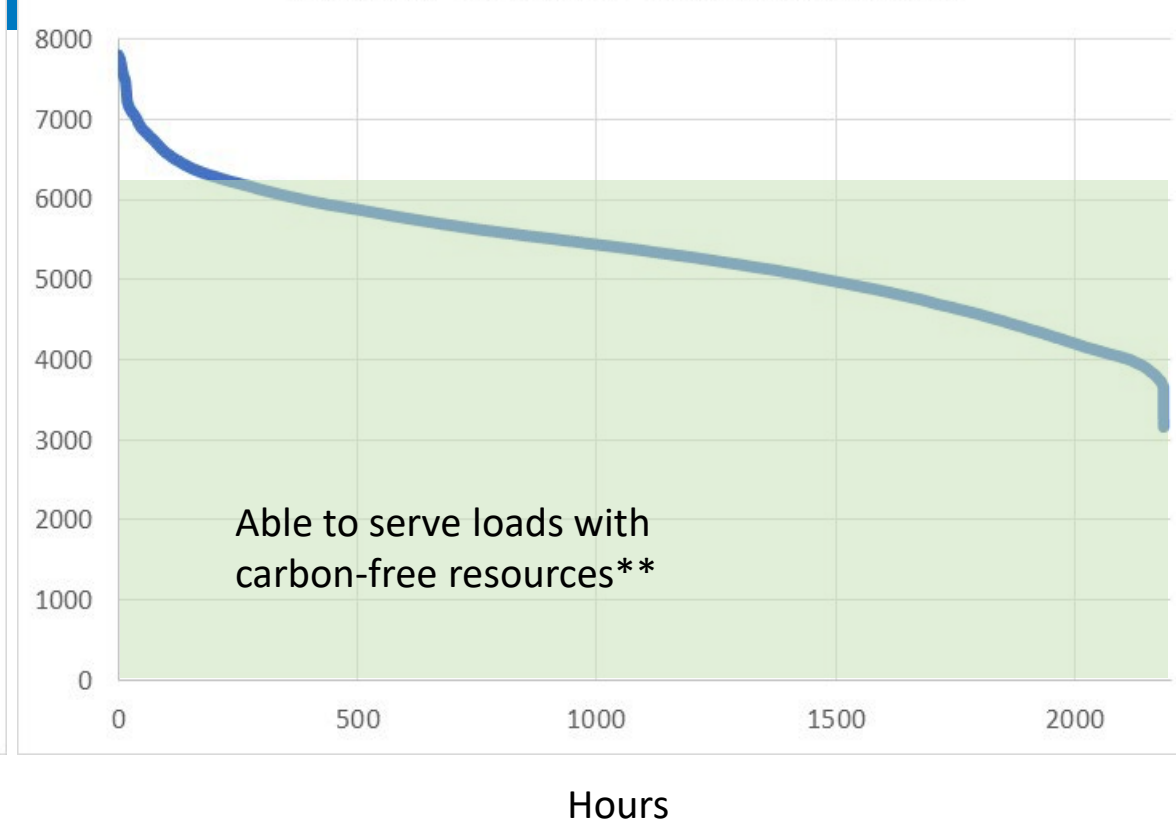
* Under all lines in service, additional local generation is likely needed under outage conditions

2030 Winter Decarbonization Studies

Estimated 2030 Puget Sound Load Profile



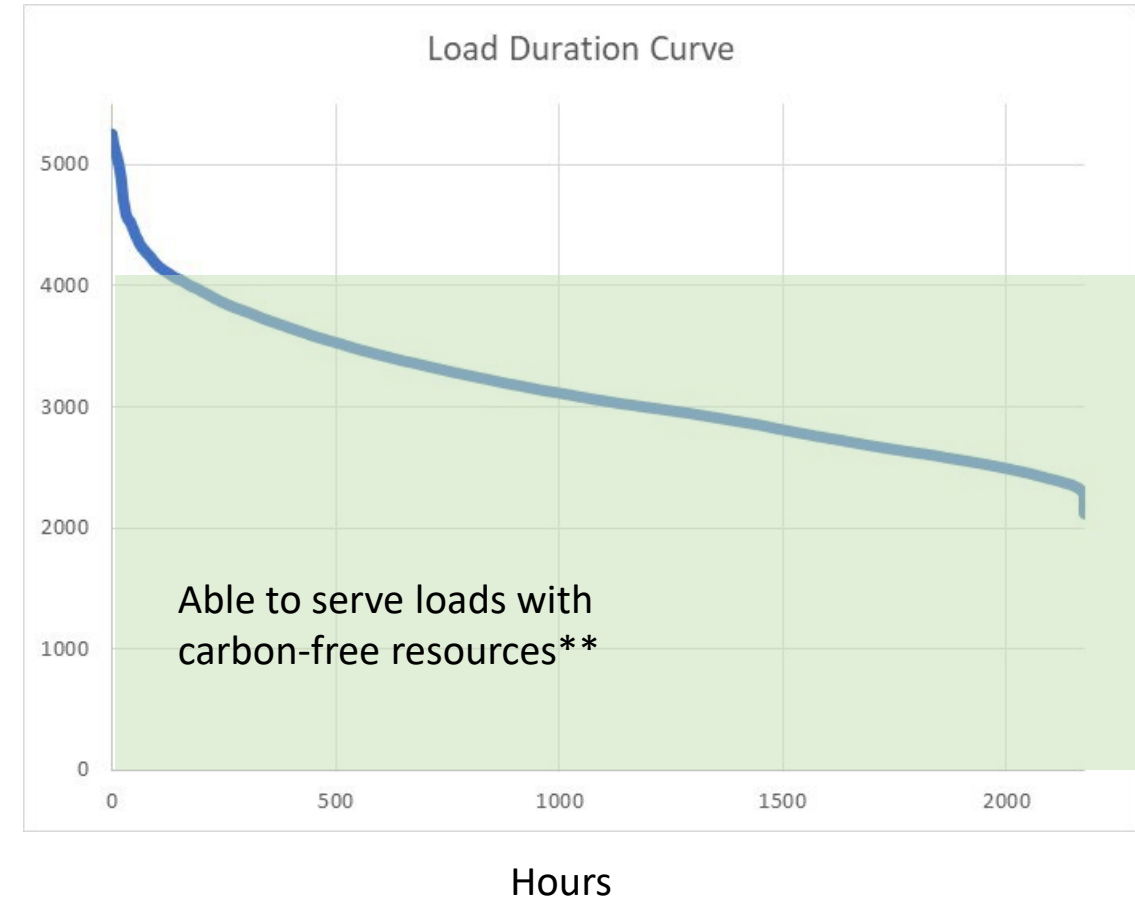
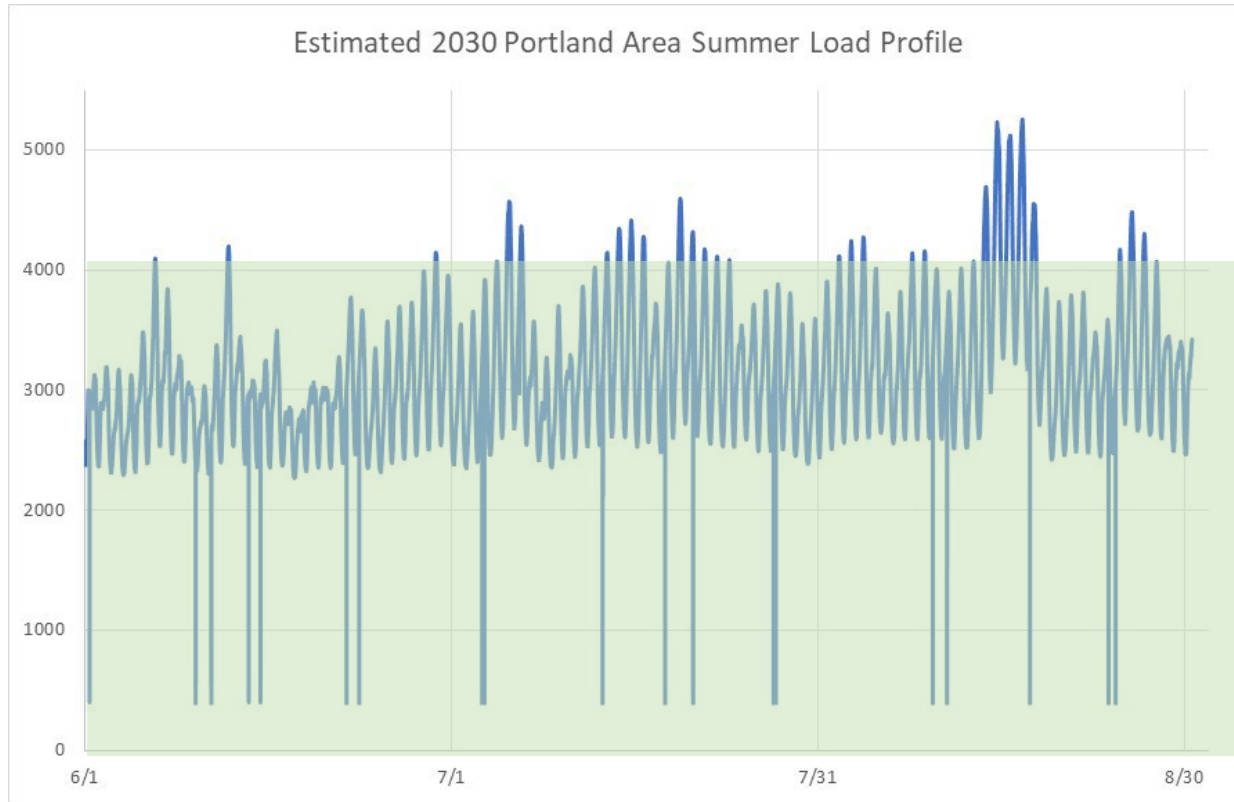
Estimated 2030 Winter Load Duration Curve



Estimated 2030 Puget Area Winter Load Profile
(2022-23 winter profile grew by 1% plus 240 MW baseload)

**under all lines in service, and assuming the renewable resources are generating, Canadian Entitlement return

Summer Decarbonization Studies



Estimated 2030 Portland Area Summer Load Profile
(2023 summer profile grew by 1% plus 400 MW baseload)

**under all lines in service, and assuming the resources are generating

Transmission Service Request (TSR) Analysis & TSEP Cluster Study Update

Transmission Planning



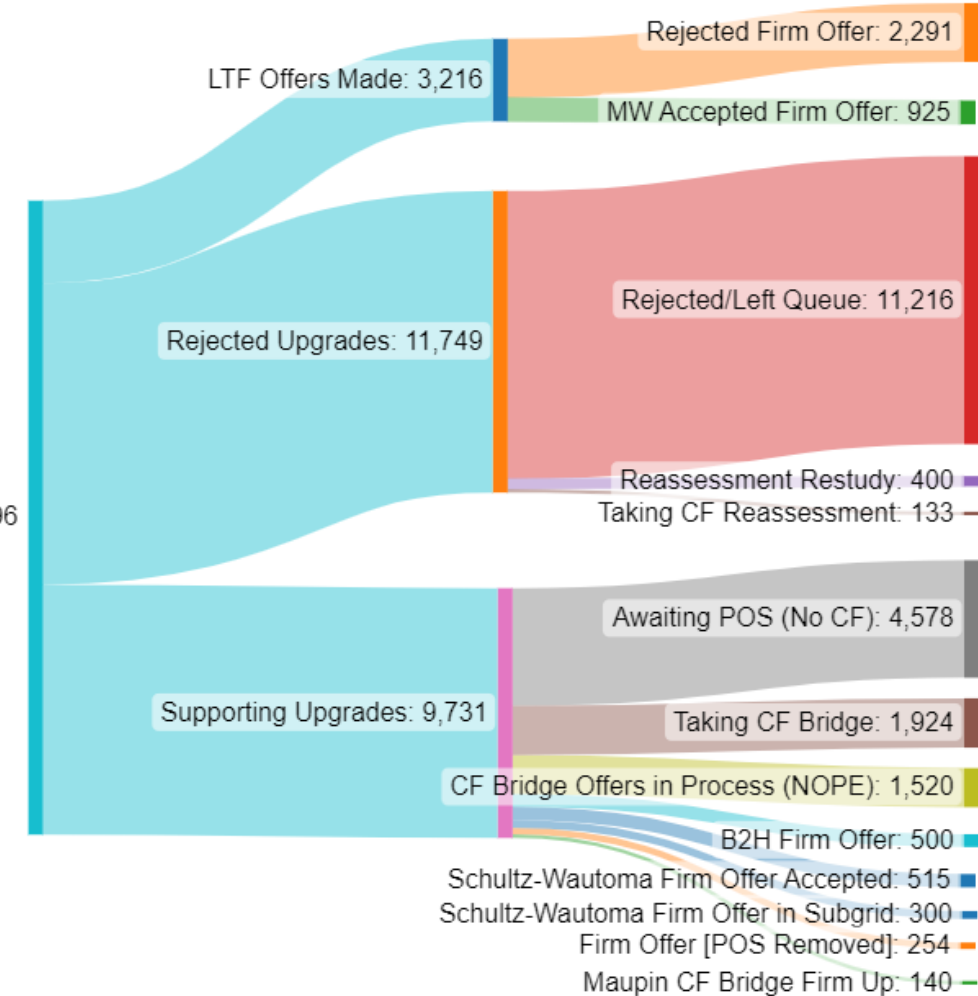
2019-2022 Cluster Study TSRs

Status	MW
Accepted Firm (No Plan of Service)	925
Awaiting POS - Not taking CF	4578
Taking CF Bridge	1924
CF Bridge Offers In Process (NOPE)	1520
B2H Firm Offer	500
Schultz-Wautoma Firm Offer Accepted	515
Schultz-Wautoma Firm Offer in Subgrid	300
Firm Offer (POS Removed)	254
Maupin CF Bridge Firm Up	140
Taking CF Reassessment	133
CF Reassessment Restudy	400
No Longer Pursuing Service	13507
Total	24696

Study Year	MW
2019	3965
2020	3871
2021	5742
2022	11118
Total	24696

**Note 2021 MW Studied Reduced by 100MW Restudied in 2022*

Total MW Studied: 24,696



Of the 11,189 MW that chose to remain in the queue:

- **55.5% Are taking service or have pending service offers**
 - 20.9% Accepted Firm Offers (2334 MW)
 - 17.2% Taking CF Bridge (1924 MW)
 - 13.6% Pending CF North of Pearl Bridge Offers (1520 MW)
 - 2.7% Schultz-Wautoma Offers in Subgrid (300 MW)
 - 1.1% Accepted Reassessment CF (133 MW)
- **40.9% Elected to receive a Preliminary Engineering Agreement only (4578 MW)**
- **3.6 % Reassessment CF Restudy (400 MW)**

2019-2022 Conditional Firm TSR Status

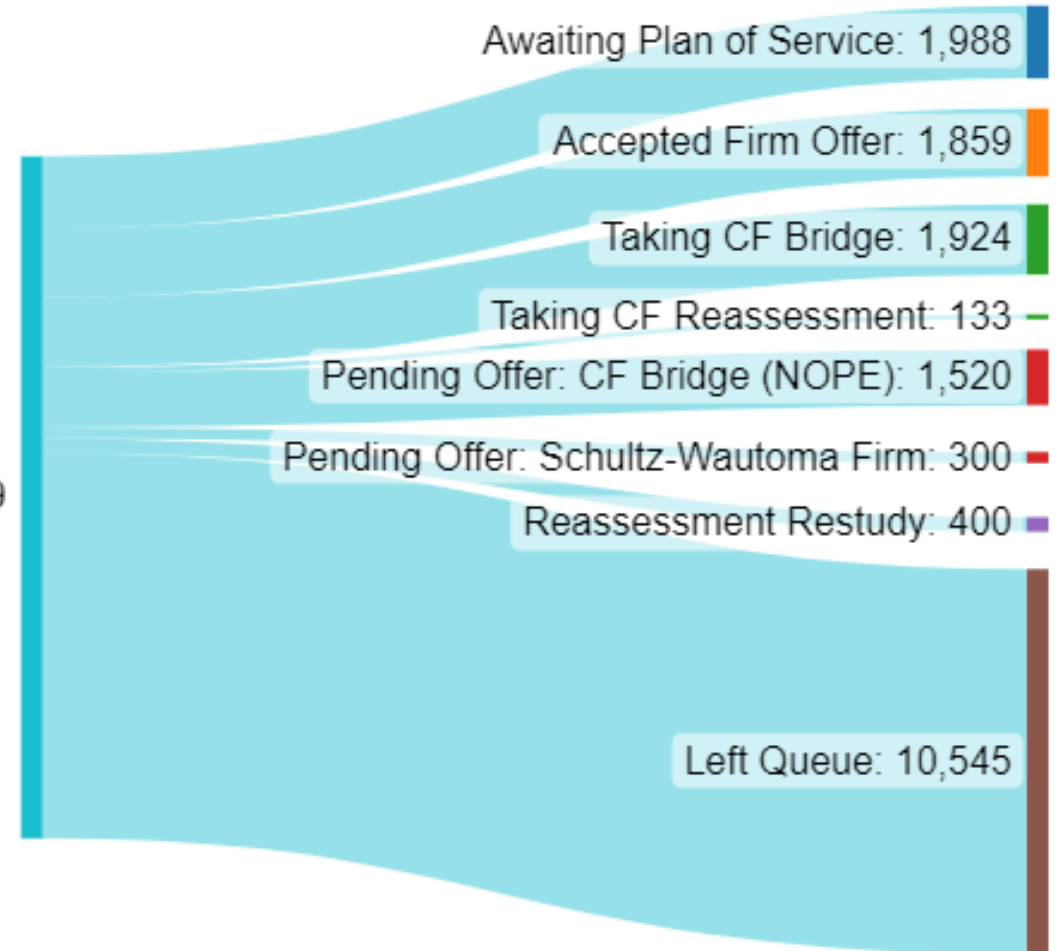
2020-2022 TSRs CF Eligible	MW
Awaiting Plan of Service	1988
Accepted Firm Offer	1859
Taking CF Bridge	1924
Taking Reassessment	133
Pending Offer: CF Bridge (NOPE)	1520
Pending Offer: Schultz-Wautoma Firm	300
Reassessment Restudy	400
Left Queue	10545
Total	18669

18,669 MW were eligible for CF Service

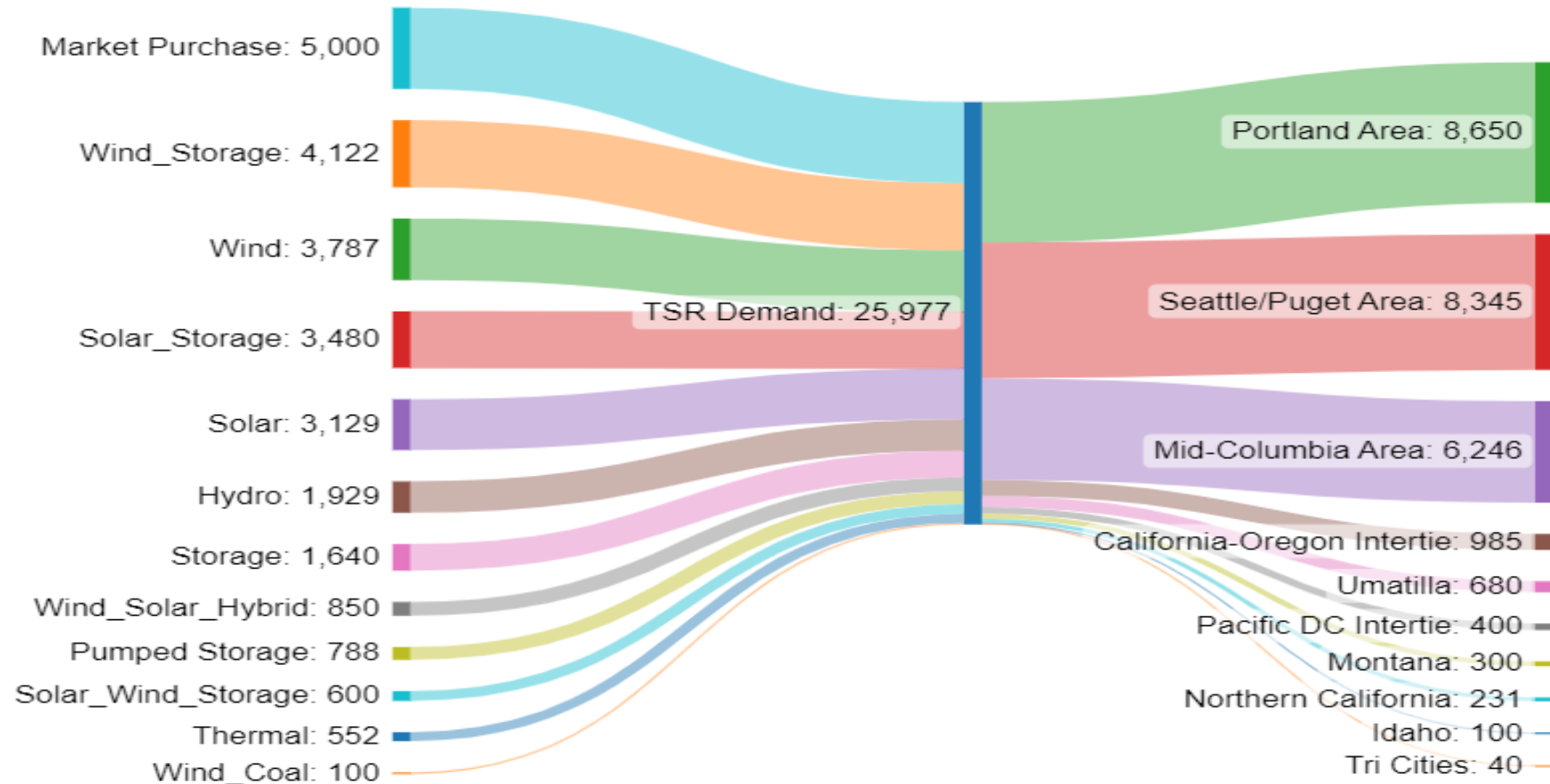
Of 8,124 MW that did not choose to leave queue

- 47.7% Currently taking CF or in CF offer process (3,952 MW)
 - 1,924 MW Taking CF Bridge/ Awaiting Plan of Service
 - 1,520 MW Pending North of Pearl CF Offer
 - 300 MW taking CF Bridge/Pending Schultz-Wautoma Firm Up
 - 133 MW Accepted CF Reassessment
- 22.9% *Accepted Firm Offers (1859 MW)*
 - *569 MW were taking CF Bridge before Firm Offer*
- 24.5% Awaiting Plan of Service (1988 MW)
- 4.9% Being studied for Reassessment CF (400 MW)

CF Eligible: 18,669



2019-2023 Cluster and Individual Study Demand of Resource Type to Geographic Sink



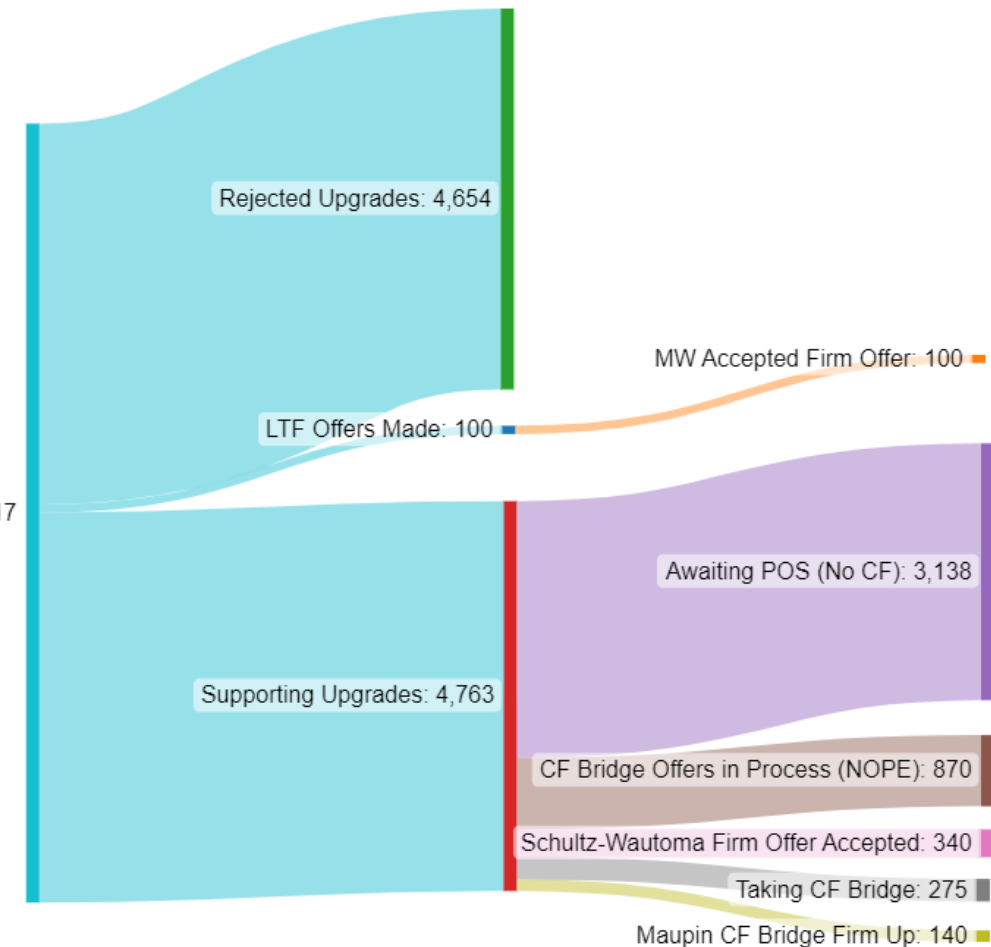
2019-2022 Cluster Study TSR Status to Portland Area Sinks

Status	MW
Accepted Firm (No Plan of Service)	100
Awaiting POS - Not taking CF	3138
Taking CF Bridge	275
CF Bridge Offers In Process (NOPE)	870
Schultz-Wautoma Firm Offer Accepted	340
Maupin CF Bridge Firm Up	140
No Longer Pursuing Service	4654
Total	9517

Of the 4,863 MW that did not choose to leave queue:

- 35.5% are taking service or being offered service (1,725 MW)
 - 580 MW accepted Firm offers or CF Firm Ups
 - 275 MW are taking CF Bridge
 - 870 MW are being offered CF Bridge (North of Pearl)
- 64.5% are awaiting a plan of service (3,138 MW)
 - Note this does NOT include 4,116 MW of TSRs in the current 2023 TSEP
- Total TSRs in Long-term Pending Queue for 2020-2023 sinking in Portland Area is 8,374MW
 - 2023: 4,116 MW
 - 2022: 3,270 MW
 - 2021: 800 MW
 - 2020: 188 MW

Total MW Studied: 9,517



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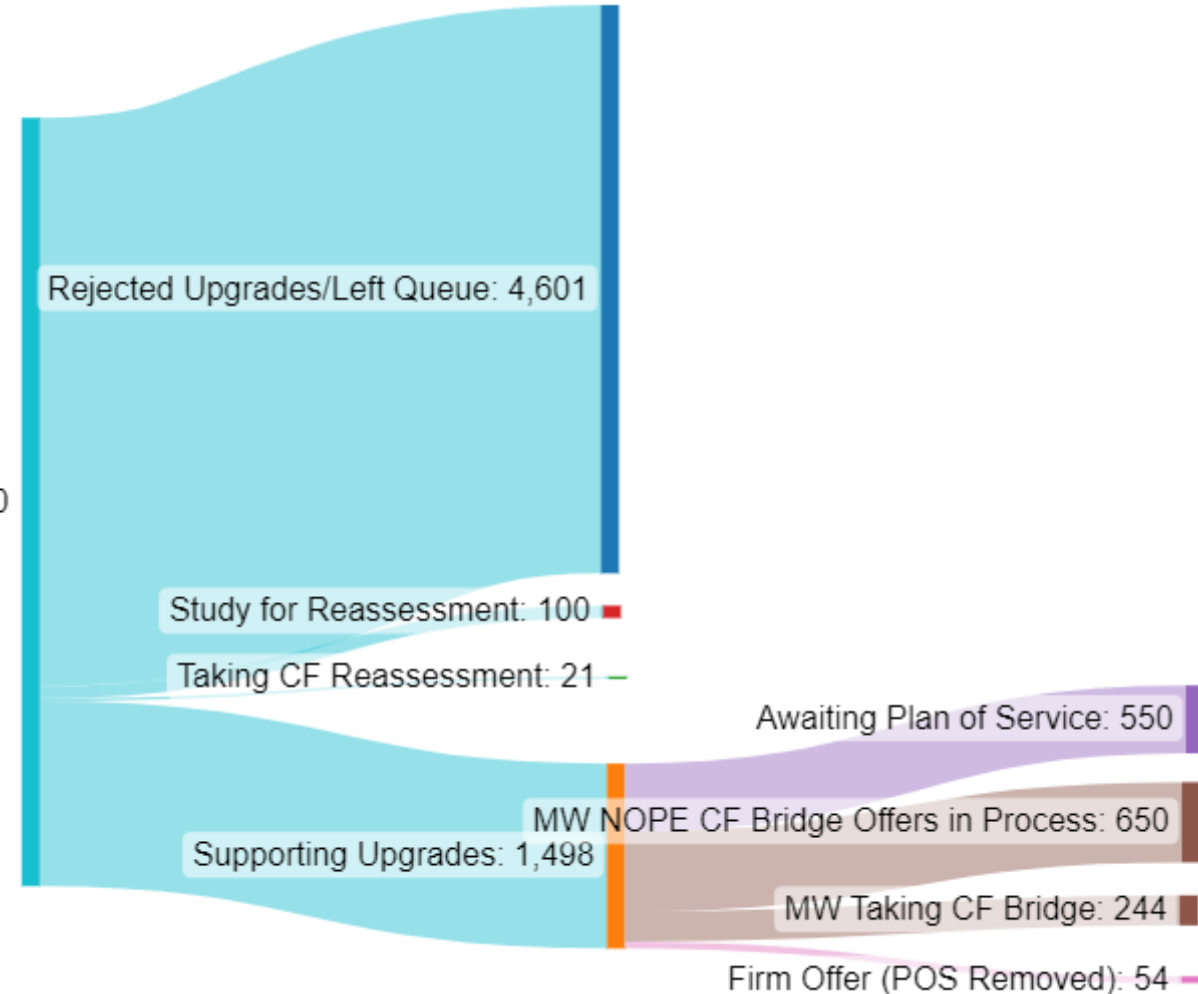
2019-2022 Cluster Study TSR Status to Puget Sound Area Sinks

Status	MW
Awaiting Plan of Service	550
CF Bridge Offers In Process (NOPE)	650
Taking CF Bridge	244
Firm Offer (POS Removed)	54
Study for Reassessment	100
Taking CF Reassessment	21
No Longer Pursuing Service	4601
Total	6220

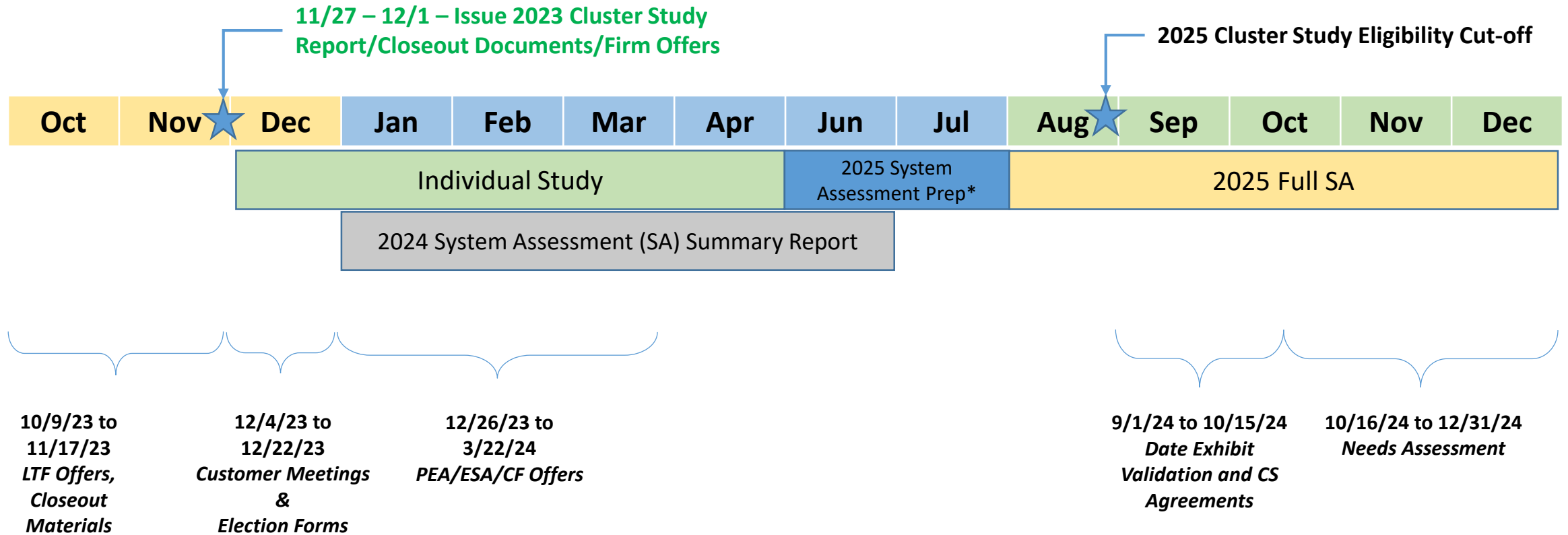
Total MW Studied: 6,220

Of the 1,619 MW that did not choose to leave queue:

- 59.8% are taking service or being offered service (1069 MW)
 - 650 MW are being offered CF Bridge (North of Pearl)
 - 244 MW are taking CF Bridge
 - 54 MW accepted CF Firm Up
 - 21 MW accepted CF Reassessment
- 34.0% are awaiting a plan of service (550 MW)
- 6.2% are being studied for CF Reassessment (100 MW)
- Note this does NOT include 5,826 MW of TSRs in the current 2023 TSEP or 490MW from Individual Studies to Puget Sound Area sinks



Queue Management: Cluster Study Schedule



Decarbonization Studies (Economic studies)

Transmission Planning



Decarbonization Studies (10-20 Years)

- Economic Studies using System Optimizer (LTCE*) and Production Cost Modeling (PCM)
 - Scenario based
 - LTCE – 20 year horizon
 - PCM – 10 year horizon
- Study based on All Lines in Service (ALIS)
- PCM Study based on WECC's 2030 Anchor Data Set (ADS)
 - Case modified to reflect load, resource, and topology to match the scenarios)

** Long-term Capacity Expansion*

Study Objectives

- Assess load and resource changes
 - Assess the potential impact on flows across major regional transmission constraints in the Pacific Northwest resulting from a range of plausible load and resource changes over the next two decades.
- Offer plausible expansion opportunities
 - Offer insights of anticipated transmission utilization and “least regrets” expansion opportunities from a regional perspective to complement other planning processes focused on narrower time horizons.
- Examine alternatives
 - Examine the impact of alternative end-use load scenarios on the regional transmission system using a range of scenario analysis factors.

Study Limitations

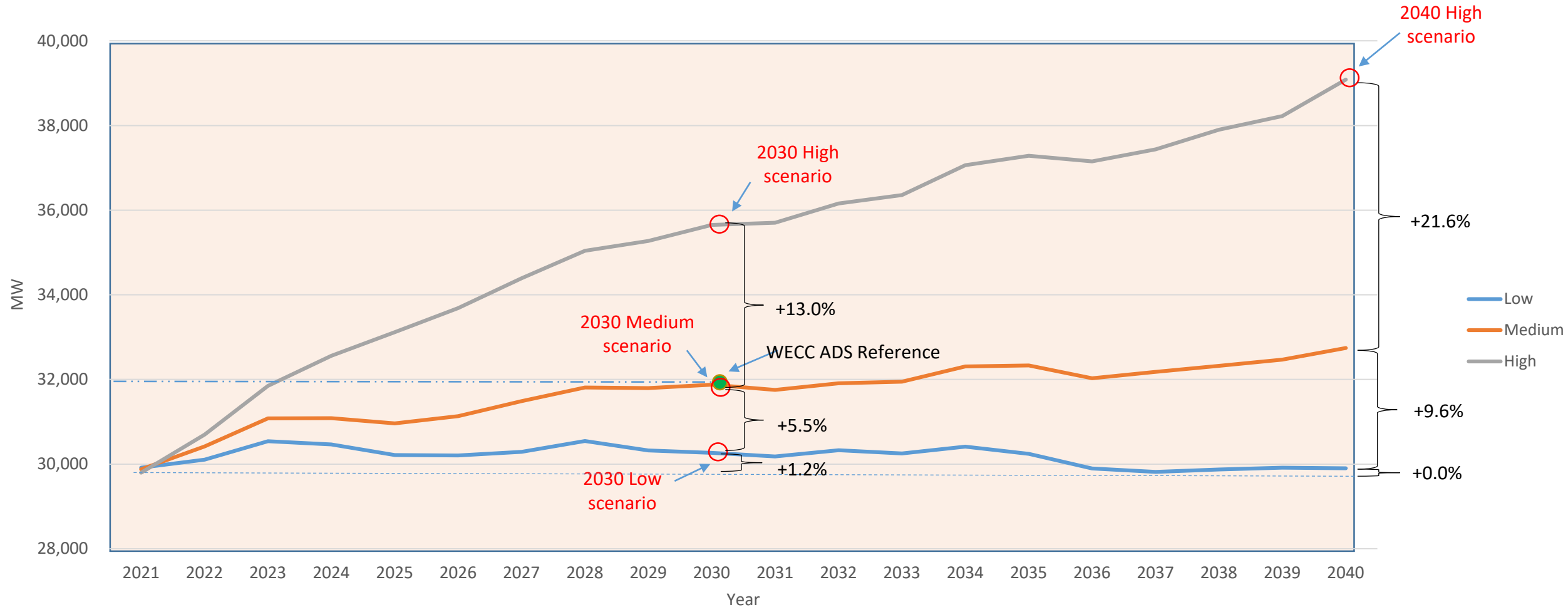
- Not an electrical Plan of Service
 - Long term scenario analysis does not modify or replace electrical plan of service requirements developed through formal BPA study processes related to transmission service requests, interconnection requests, or reliability assessments.
- Out of scope factors
 - Localized or factors such as environmental permitting processes, extreme weather, supply chains, and electric distribution systems.
- Data and modeling constraints
 - Regional load forecast has increased significantly since the completion of this study.

Methodology and Approach

- Develop portfolio optimization using LTCE to inform PCM studies
- Examine both energy and capacity requirements
- Study a 10 and 20-year planning horizon
- Map the region with a sub-regional zonal pattern
- Simulate selected years with more detail using the PCM model
- Determine resource commitments using economic dispatch
- Analyze a range of factors with scenario analysis
- Apply proxies to analyze GHG emission impacts

Scenario Load Forecast (PCM) – Peak (MW)

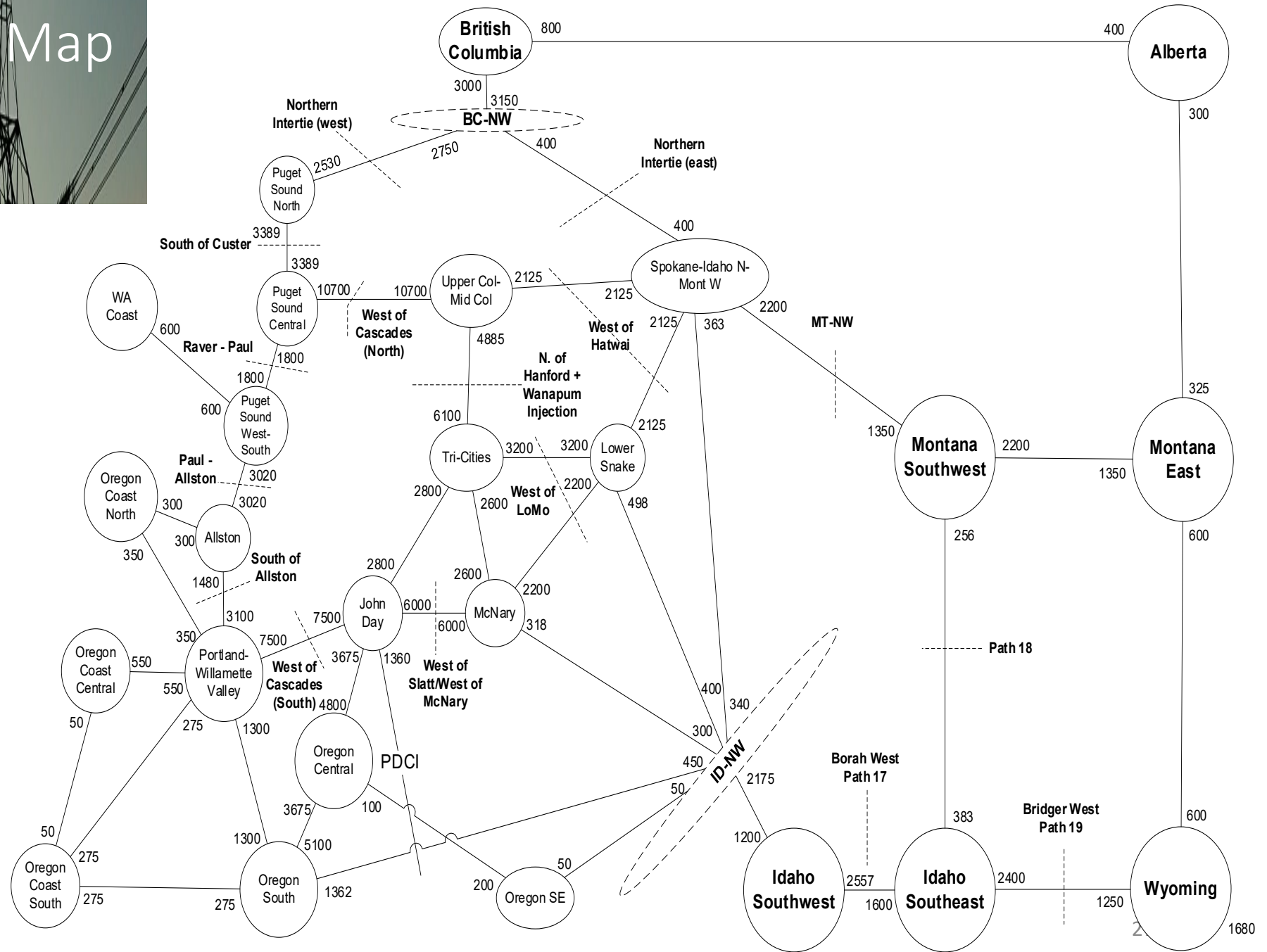
Peak Load Forecasts by Scenario



Regional Topology Map (LTCE)

Pacific Northwest Regional Topology Map

- Focuses on BPA's transmission footprint
- Accounts for the rest of the Western Interconnection



Key Takeaways – Resource Portfolio (LTCE)

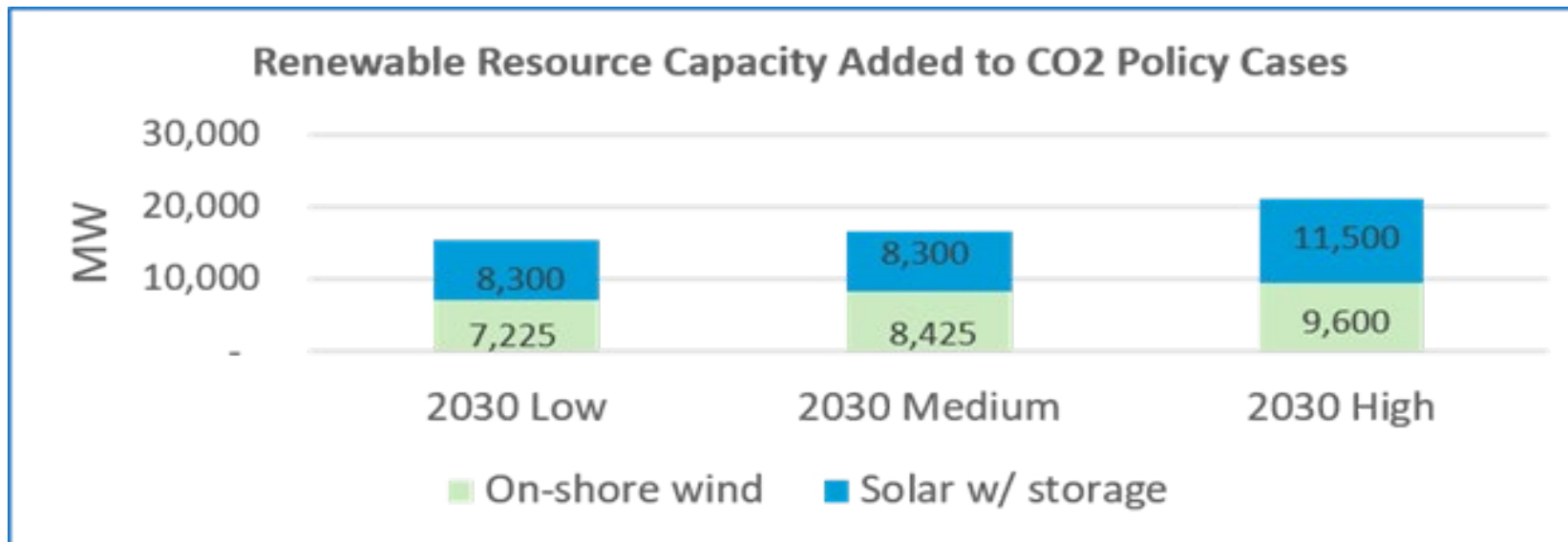
Resources

- Adds wind from MT and WY
- Adds solar PV with energy storage east of the Cascades (OR, WA, ID)
- Reduces utilization of natural gas power plants in OR and WA
- Considers adding more resources at the end of the 20 year horizon if the preferred resource expansion opportunities are exhausted, especially in the High Load Growth scenario
- Adds stand alone energy storage closer to load centers to mitigate transmission congestion as well as timing mismatches between loads and variable resources.

Transmission - Increasing transmission congestion is likely for some transmission constraints by 2030 and beyond due to load growth and resource shifts. These were out of scope for the LTCE model and was addressed in the PCM

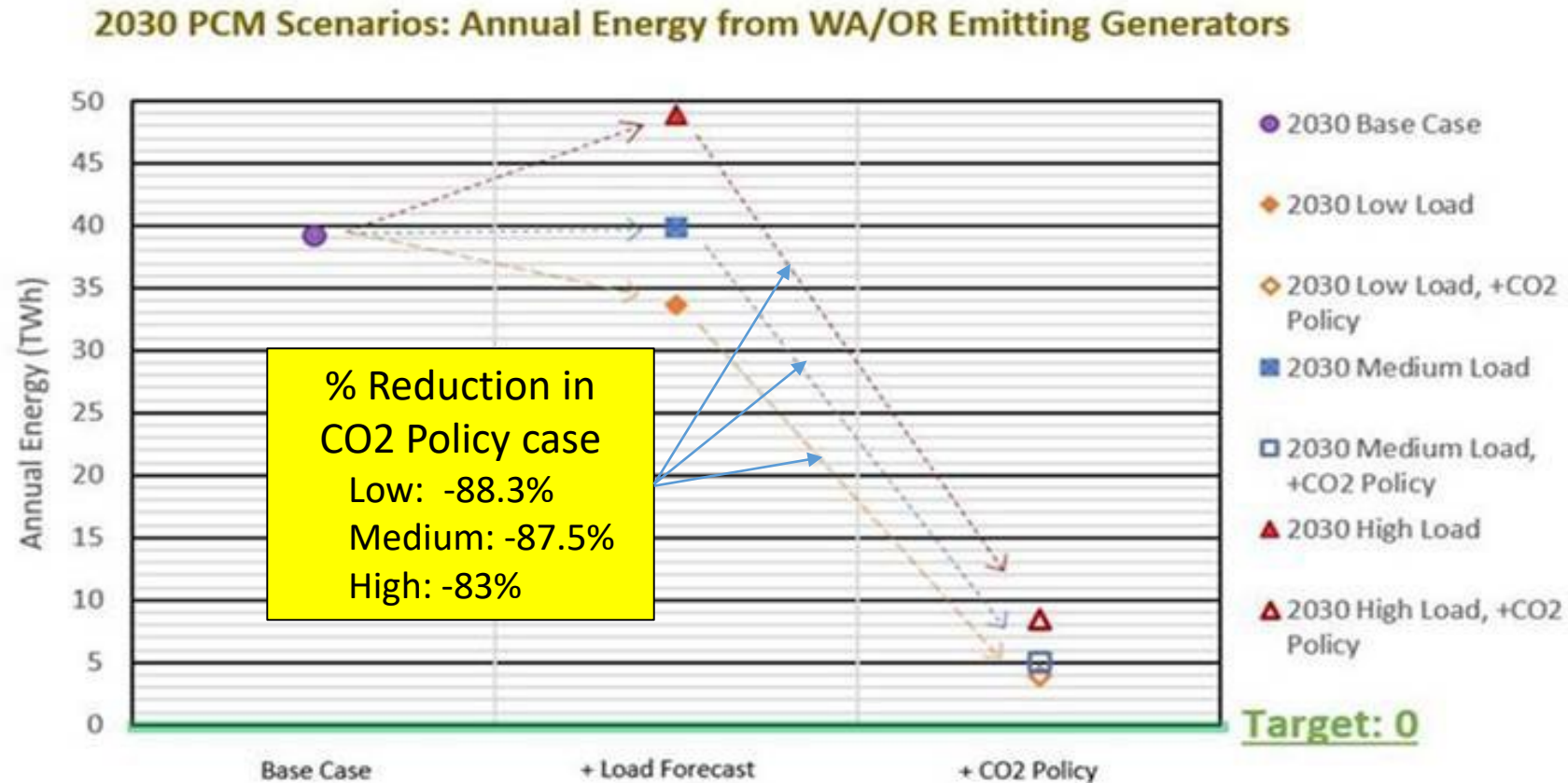
Key Assumptions – Non-emitting Resources (PCM)

- The LTCE model served as a guide for resource capacity expansion in the PCM model.
- Non-emitting resources were added to replace approximately the same amount of energy as emitting generation associated with OR and WA produced in a reference case.



Key Findings – Non-emitting Resources - PCM

- Achieving an 80% GHG reduction in WA and OR is possible if transmission upgrades are built to bring renewable energy to the load centers.



Key Takeaways (PCM)

- **10 Year Horizon:**

- Achieving an 80% reduction by 2030 is possible - Requires some transmission upgrades and reinforcements. These projects are already in flight.
- Variable resources, energy storage and elevated GHG emission prices reduced but did not eliminate the need for emitting dispatchable resources.

- **10-20 Year Horizon:**

- Achieving higher than 80% reduction in GHG emission will require major resource and transmission system expansions to bring non-emitting energy to the load centers.
- Additional transmission will be required to meet growing load and continued resource shifts.
- High variable cost dispatchable emitting resources operate when there is no other option to serve load.

Next Steps

- **Study additional trends:**
 - GHG emissions targets
 - Variable generation developments in ID, OR, MT and WY
 - Developments in adjacent regions of California, Desert Southwest and Canada.
 - Optimization of energy storage
- **Update and develop next set of resource and transmission portfolios to address higher projected load growth**
- **20-year planning scenarios using PCM**

Regional/Inter-regional Transmission Planning Discussions

Transmission Planning



Overview of Proposal

- BPA is in discussions with several regional and inter-regional entities to develop an effort that can better support future needs on a broader scale and scope:
 - Establish solutions to support a future clean energy grid
 - Address the long-term uncertainties and needs across diverse geographical regions of the western interconnection
 - Inter-regional footprint (beyond the Pacific Northwest/BPA Balancing Authority)
 - 10- 20 years outlook
- General Themes:
 - Different: Create a holistic and a creative approach that results in an actionable transmission plan for the western interconnect that considers a longer-term outlook under different plausible scenarios.
 - Expedient: Leverage existing tools, capabilities and other inter-regional resources in an agile approach (must balance with inclusivity)
 - Inclusive: Provide meaningful opportunities for stakeholders and regulators to provide input (must balance with expediency)

Next Steps

- The Western Power Pool will lead an informal engagement with a small set of stakeholders until a formal structure can be proposed.
 - At a minimum, the proposed structure would include an approach to engage with a broader set of stakeholders including state regulators or their representatives.
 - No detail proposal at this time but expect within weeks/month a straw proposal for the broad set of stakeholders to consider and provide input.
- Expected deliverables and milestones
 - Any formal structure would include specific deliverables and a roadmap/timeline.
 - Any deliverable will include an opportunity for regional consideration and input

Queue Management Updates: Generation Interconnection

Transmission Tariff, Rates & Products



Generator Interconnection Reform

- BPA and the region have been engaged in settlement discussions for TC-25, a special Terms & Conditions proceeding to address accelerating adoption of and execution of certain reforms to BPA's large generator interconnection process.
- TC-25 primarily based on FERC-approved reforms:
 - Cluster study approach (all eligible requests studied simultaneously)
 - First-come, First-serve approach
- BPA staff has issued its final settlement proposal and customers have until September 15 to notify BPA staff if they will plan to object to the settlement.
 - Settlement and supporting documents are posted to the [TC-25 Proceeding web page](#).
- Based on the customers responses, BPA staff will make a recommendation if they will propose to continue the settlement NLT September 22.

Queue Management: Tier I: Evolving Grid Project Updates

Transmission Engineering



Tier 1 Projects



Milestones

Cross-Cascades
North: Multiple
projects



Schultz-Raver Re-conductor & Reactive additions: PEAs have been signed (3,140MW), ISD 2030, \$196M

Cross-Cascades
South: Big Eddy –
Chemawa rebuild



PEAs have been signed (3,920MW), ISD 2030, \$233M

Portland Area:
Multiple projects



1) Pearl-Sherwood-McCloughlin (5,534MW), ISD 2026
2) Keeler-Horizon #2, ISD May 2024
3) Keeler Transformer addition, ISD 2028

Raver-Paul:
Impacted line
rebuild



PEAs have been signed (1,790MW), ISD 2028, \$35.4M

Ross River Gate
230 kV line
upgrade



PEAs have been signed (3,570MW), ISD 2030, \$109M

Rock Creek – John
Day line upgrade



PEAs have been signed (630MW), ISD 2028, \$39M

Projects of Interest



Milestones

West of Boardman
500/230 kV Sub



ISIS study complete, Business Case approved, Scoping phase has started, ISD 2027

Bonanza Sub
Initial 230/115 kV



ISIS study completed, Business Case approved, Scoping phase to start soon, ISD 2027

La Pine – Bonanza
230 kV Line



Plan of Service in development, ISD 2029

Buckley Sub
Rebuild



Scoping completed and Design has started. Business case has been approved, ISD 2028

Longhorn Sub
500/230 kV



Completed NEPA and started construction activities in May. Initial energization planned for December 2024.

NT Service Updates

NT Product Manager



NT Service Remains a Priority

- In late August, BPA provided FY 2024 load and resource forecasts (LaRC) to customers. Responses are due September 30.
- BPA is participating in NT workshops (both Customer and BPA led) to identify NT service issues and make product improvements. The last workshop was in July.
- BPA is starting work on NITS on OASIS phase II.
 - Modules pending implementation:
 - Scheduling rights Concomitant Requests
 - Secondary Service Auxiliary Services
- The FY 2024 Sustain Budget is \$277.6M (direct).

Strategic Updates and Next Steps

Transmission Services





Enhance the
value of products
and services



Mature asset
management



Invest in people



Sustain financial
strength



Modernize
business systems
and processes

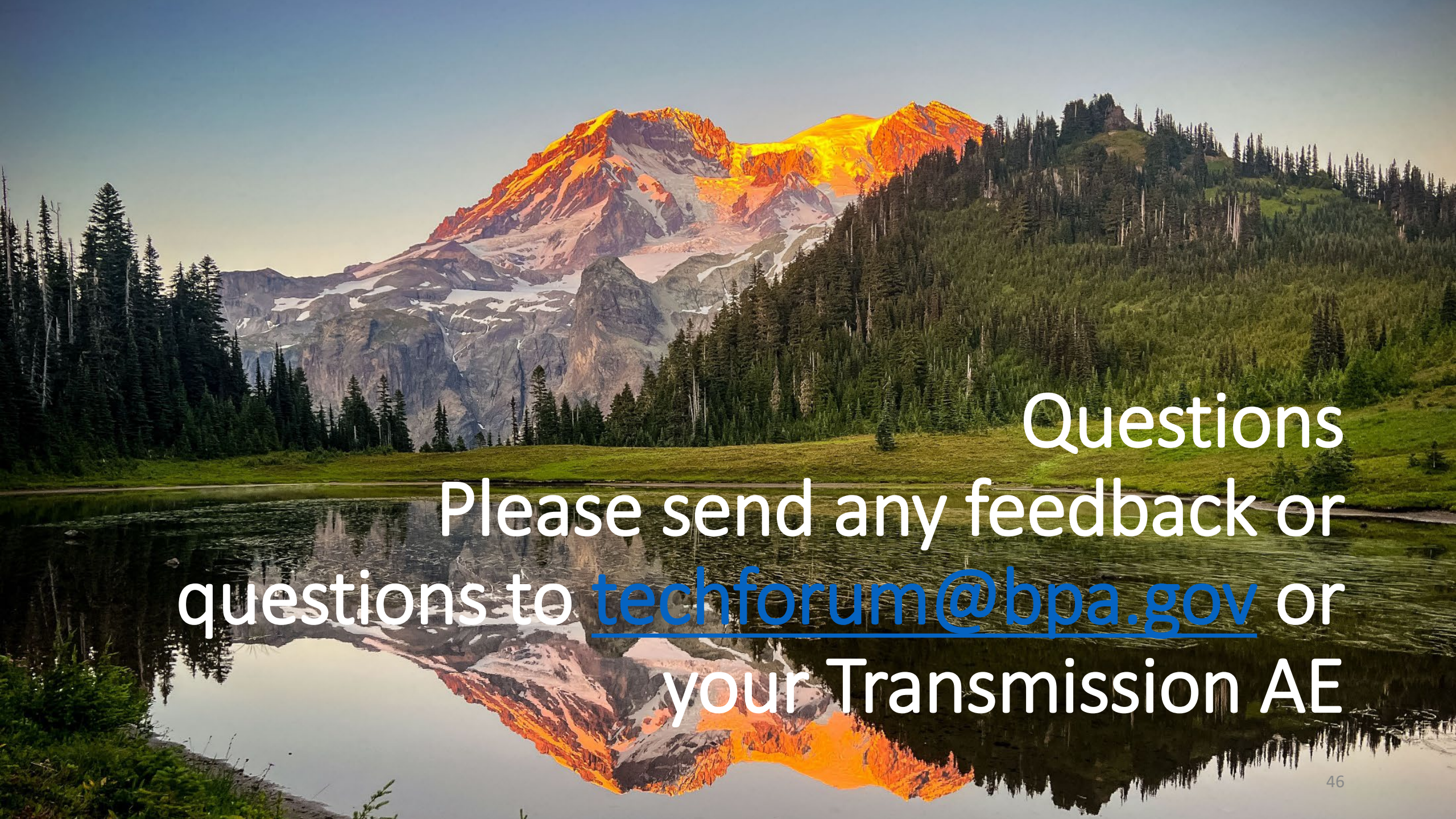


Preserve safe,
reliable system
operations

2024–2028 Strategic Goals

A glance into the year ahead

- BPA will continue to provide strategic updates through its Evolving Grid initiative through the coming year, including, but not limited to:
 - Overview on upcoming Regional Studies and Regional Planning efforts
 - Regular NT Outreach
 - Release of 2023 Cluster Study Results/individual customer meetings & Start of the 2025 Cluster Study
 - Release and engagement of the Transmission Business Model
 - GI Settlement and preparations for TC-26
- BPA expects to hold the next Evolving Grid workshop in FY24 Q2 (calendar year 2024)



Questions
Please send any feedback or
questions to techforum@bpa.gov or
your Transmission AE

Helpful BPA Links

BPA Transmission Plan: <https://www.bpa.gov/-/media/Aep/transmission/attachment-k/2022-bpa-transmission-plan.pdf>

Transmission Availability : <https://www.bpa.gov/energy-and-services/transmission/transmission-availability>

Becoming a BPA Customer: <https://www.bpa.gov/energy-and-services/transmission/becoming-a-transmission-services-customer>

- *For assistance in the BPA application process, call BPA Transmission Sales (360) 619-6016 and request the assignment of a BPA Transmission Services Account Executive.*

Interconnection: <https://www.bpa.gov/energy-and-services/transmission/interconnection>

Transmission Service Request Study: <https://www.bpa.gov/energy-and-services/transmission/acquiring-transmission/tsep>

Appendix



2030 Winter Decarbonization Studies

Flows (no West-Side Thermals)

	Path Flow (MW) per Percentile Temperature Scenario				<i>Path Rating</i> (MW)
	80% Case	90% Case	1-in-2 Peak	1-in-20 Peak	
West of Cascades North	9,884	11,157	12,203	12,677	10,700**
West of Cascades South	6,248	6,863	7,649	8,167	7,500
North of Echo Lake	2,418	2,571	2,906	3,174	2,800
Raver - Paul	1,324	1,540	1,545	1,498	1,636

* Near-Term Planning Horizon (2021-2026) Transfer Capability Limits

** WOCN TTC does not include series capacitors on Schultz-Raver #3 and #4 lines

2030 Winter Decarbonization Studies

Load Levels – by Customer

	WINTER Load (MW) per Percentile Temperature Scenario				Actual MW 12/22/2022	Actual MW 01/06/2017
	80% Case	90% Case	1-in-2 Peak	1-in-20 Peak		
PSE	3,958	4,453	5,181	5,336	5,160	4,747
SCL	1,511	1,700	1,904	1,999	1,894	1,856
TPWR (Native)	807	908	1,006	1,023	1,021	997
SNPD	1,164	1,309	1,400	1,670	n/a	n/a
PGE	4,024*	4,309*	4,376*	4,718*	4,159	3,818
Clark County, WA	834	912	986	1,134	n/a	n/a
Northwest	27,489	30,245	33,390	34,795	31,257	30,591