

The Evolving Grid

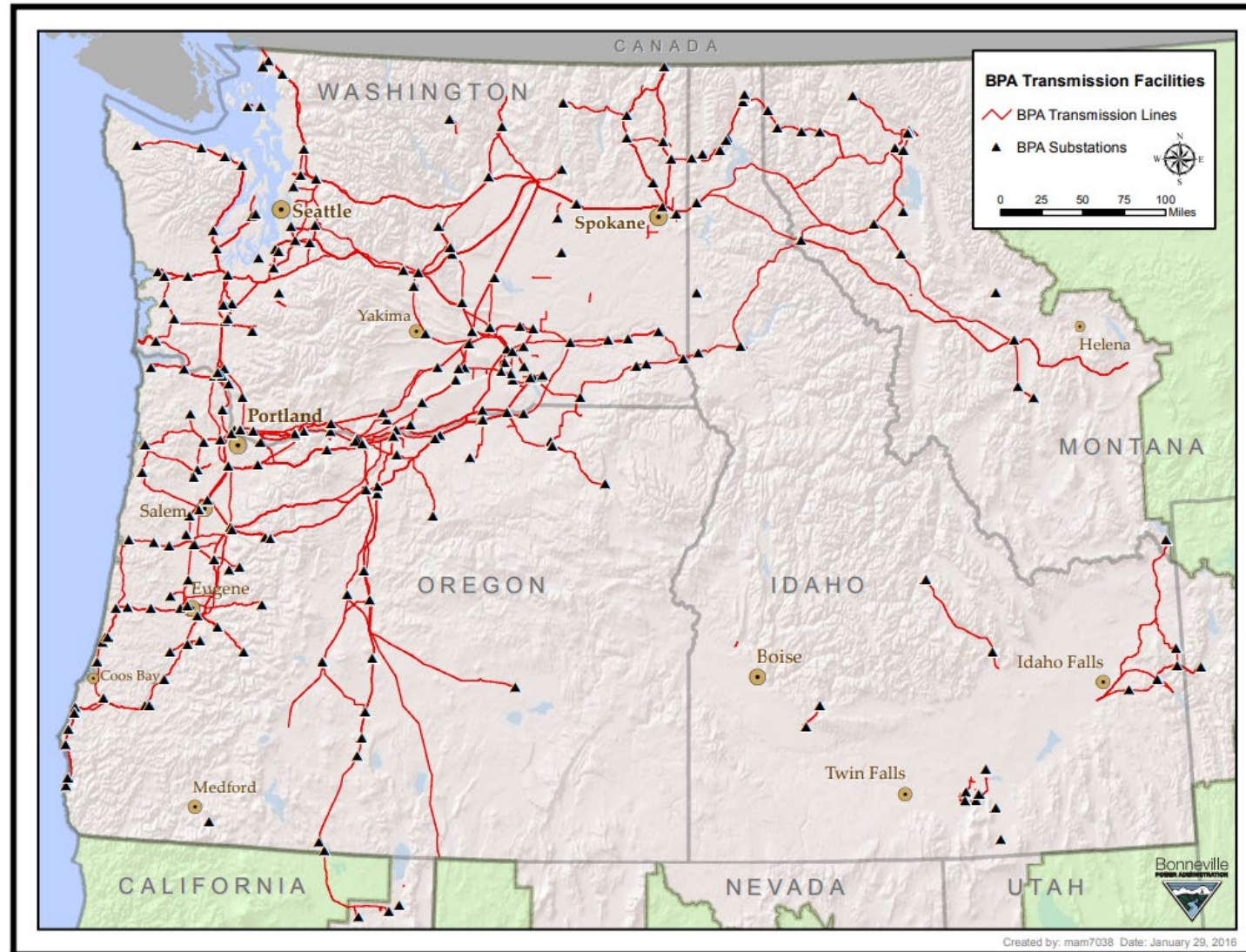
Update on the State of Transmission

April 27, 2023

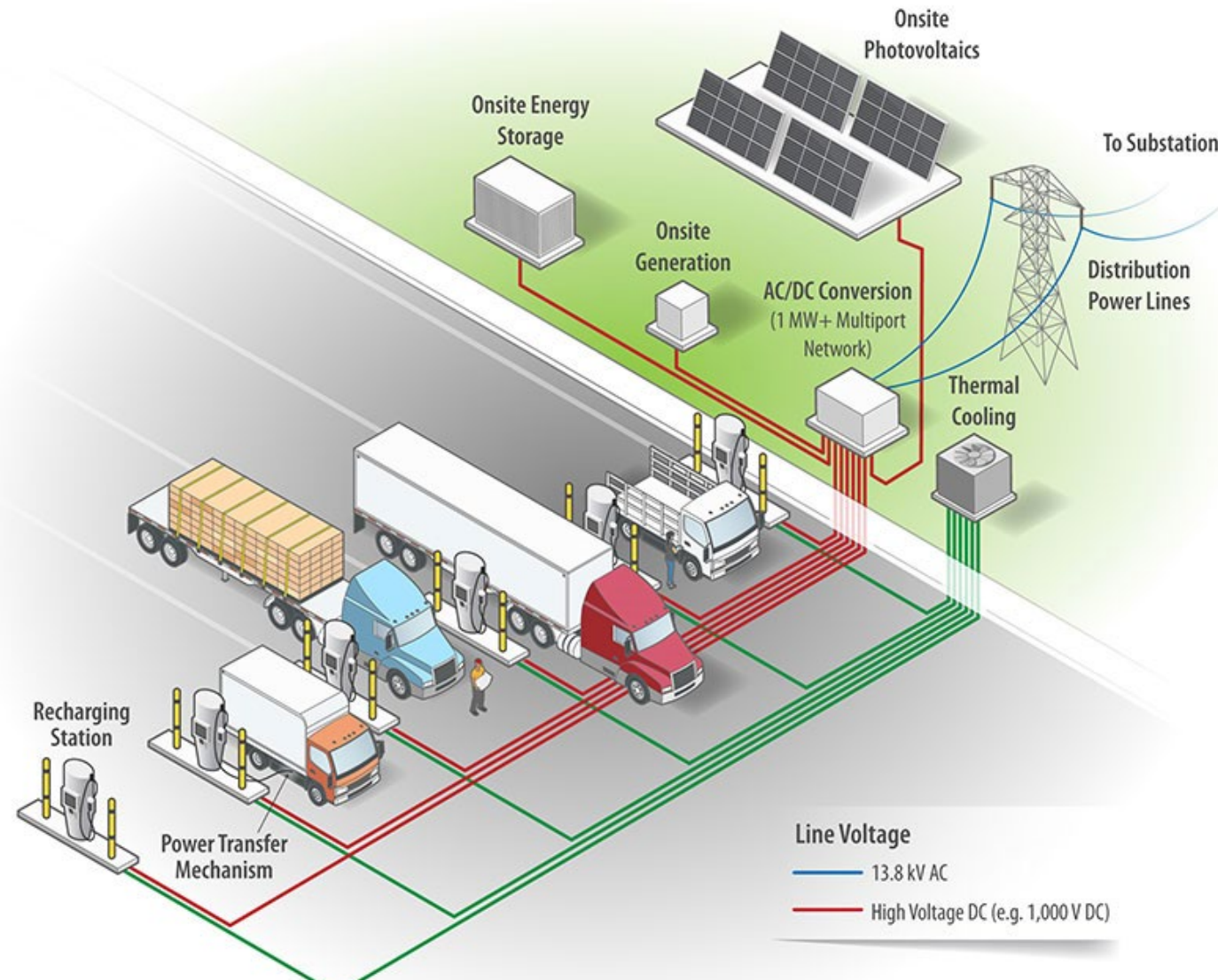
Virtual Only



BPA Infrastructure



Workshop Agenda: Why are we here?



Uncertainties

With new funding, Washington State Ferries ramps up electric ferry plans

Ukraine pleads for help to fix energy grid hit by Russian bomb raids

Oregon lawmakers approve ambitious carbon-reduction goals for state energy grid

Facebook announces 10th and 11th data centers at Prineville, Oregon campus amid renewable energy fight

Apple Quietly Builds Its Prineville Data Center

AWS planning at least four more data centers in Morrow County, Oregon

Innovative Renewable Energy Project in Oregon Combines Wind, Solar and Battery Storage

Oregon's Obsidian Renewables unveils \$10B PNW proposal in US 'Hydrogen Hub' competition

Insurance companies are dropping home coverage in Oregon due to wildfire risk

US government launches US\$350 million long-duration energy storage demonstration funding

Are We Saying Goodbye to the Gas Stove?

Crypto mine in U.S. gets conditional use permit from Pend Oreille County; opponents appeal

Google investing \$50M in Oregon data centers, offices

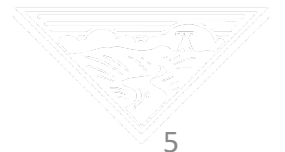
The fight for a national clean energy transmission system emerges on three fronts

DOE Opens Applications for \$6B in Grid Funding

Federal auction jumpstarts floating, offshore wind power off California with Oregon slated for next year

The Powerful Policy Ripples of Washington State's CETA

Key Influences and Drivers



WA & OR Regional Clean Energy Targets & Policies

2030

National: Net greenhouse gas emissions to 50-52% below 2005 levels in 2030
Washington: All electric utilities greenhouse gas neutral
Oregon: 80% below baseline

2040

Oregon: 100% below baseline

2050

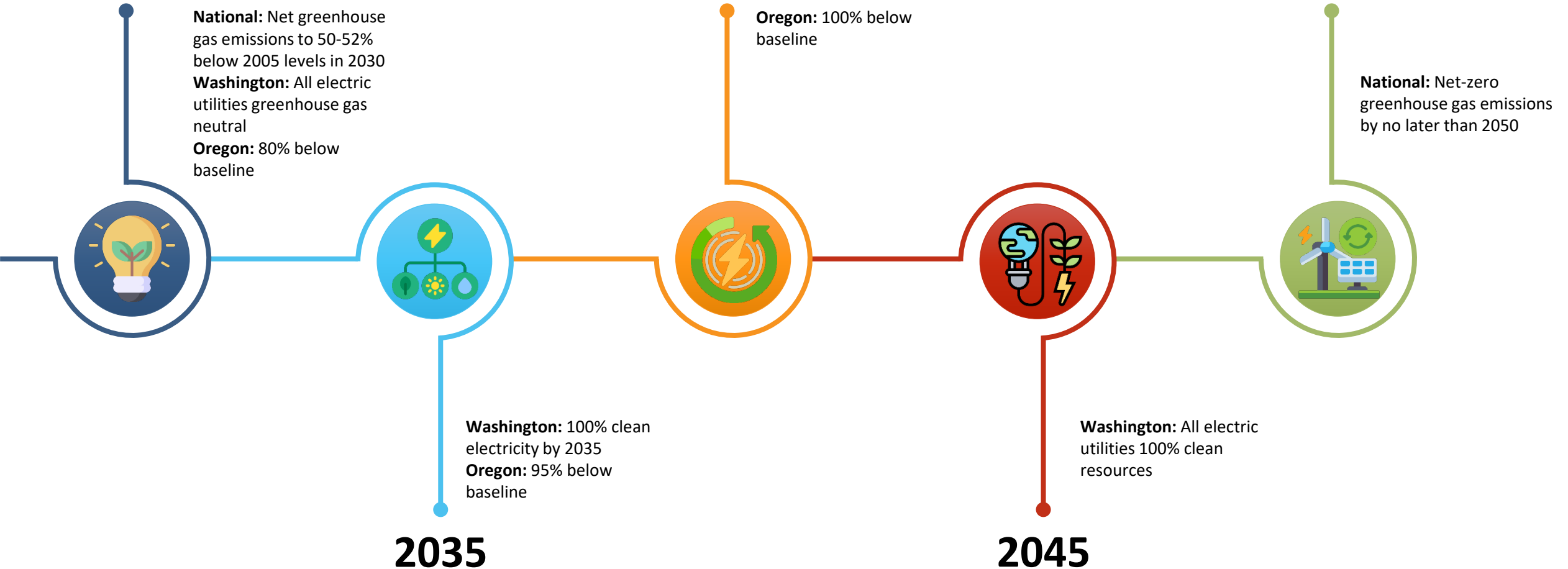
National: Net-zero greenhouse gas emissions by no later than 2050

2035

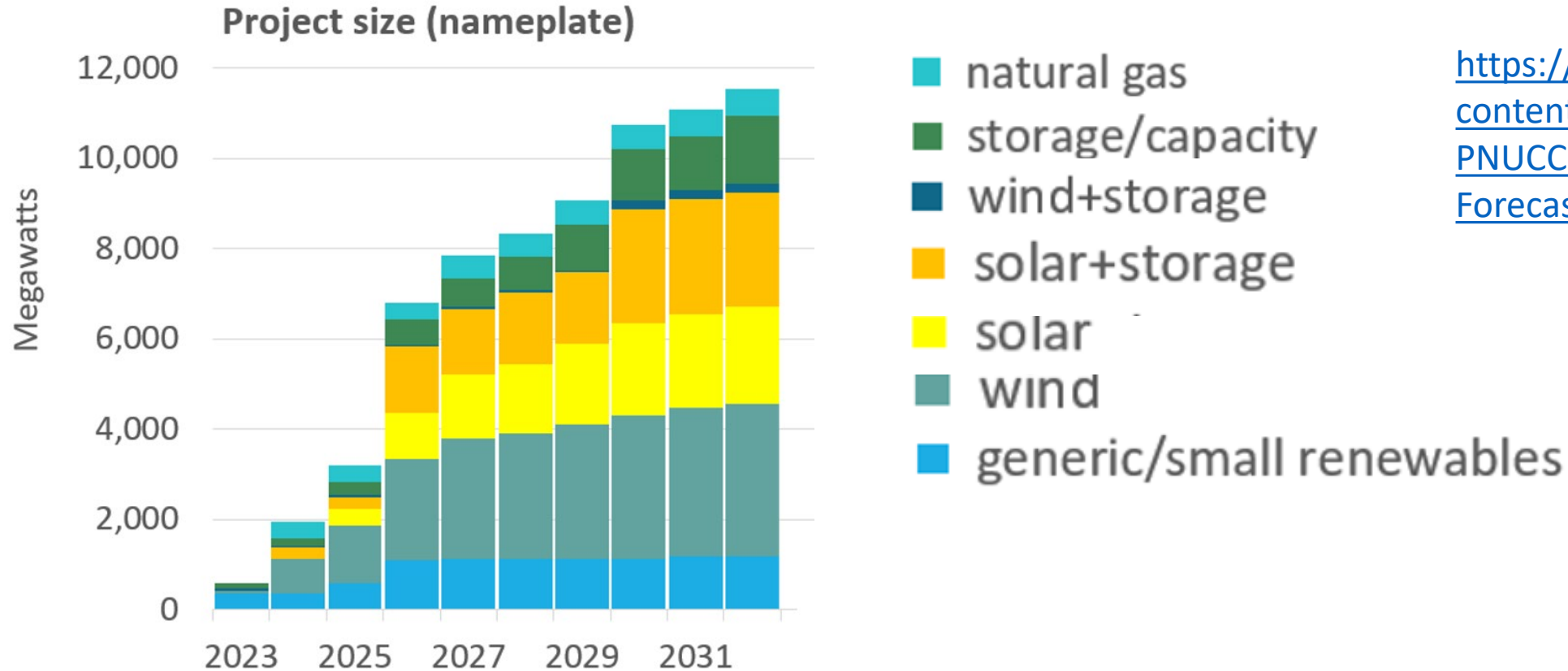
Washington: 100% clean electricity by 2035
Oregon: 95% below baseline

2045

Washington: All electric utilities 100% clean resources



Expected NW Resource Additions (PNUCC)



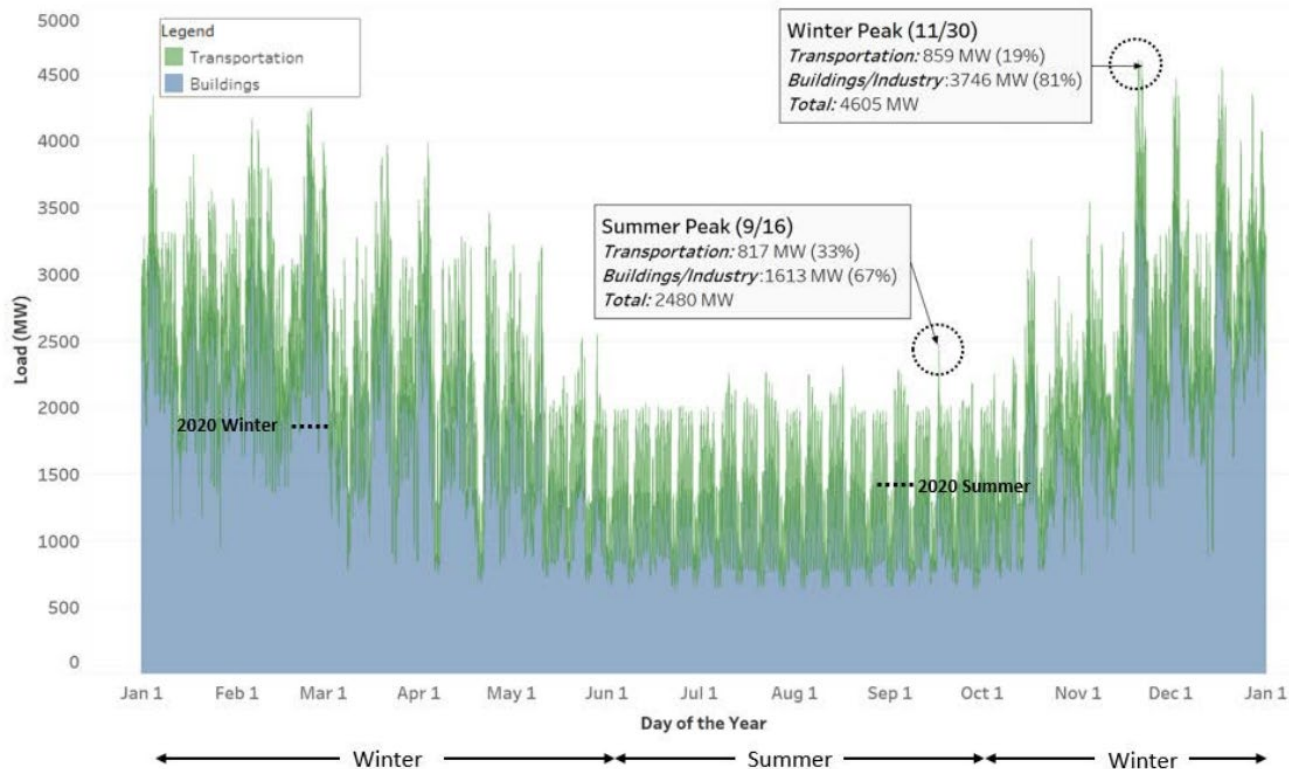
<https://www.pnucc.org/wp-content/uploads/2022-PNUCC-Northwest-Regional-Forecast-final.pdf>

Pacific Northwest has more than 7 GW of wind and solar generation interconnected today
Additional 10+ GW of new resources are expected to be interconnected in the next decade

Electrification and Resiliency

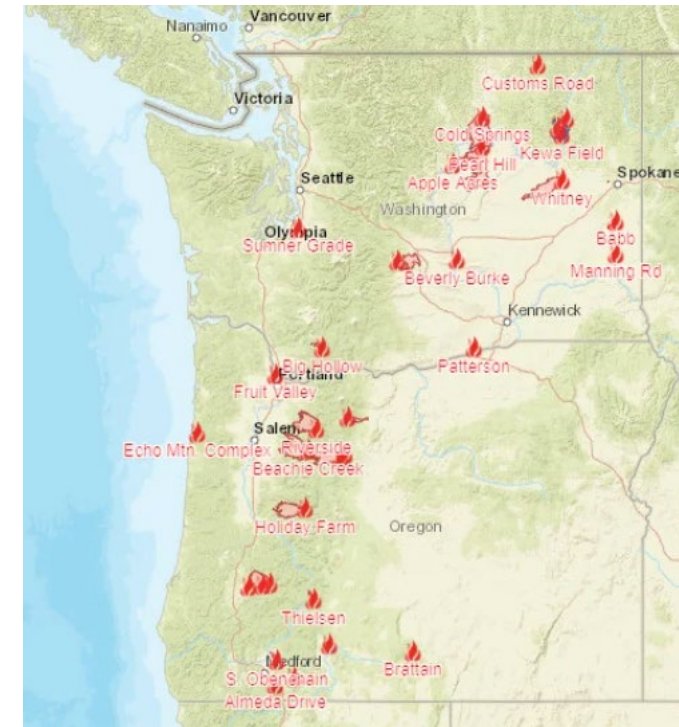
Studies show that impacts of full electrification adoption could be significant for load service – up to 75% increase in summer, 260% increase in winter

Source: EPRI - SCL Electrification Assessment



As sectors electrify, dependence on reliable and quality service increases, especially during extreme weather events.

WA AG Calls for Banning Power Shut-offs¹ during heat waves

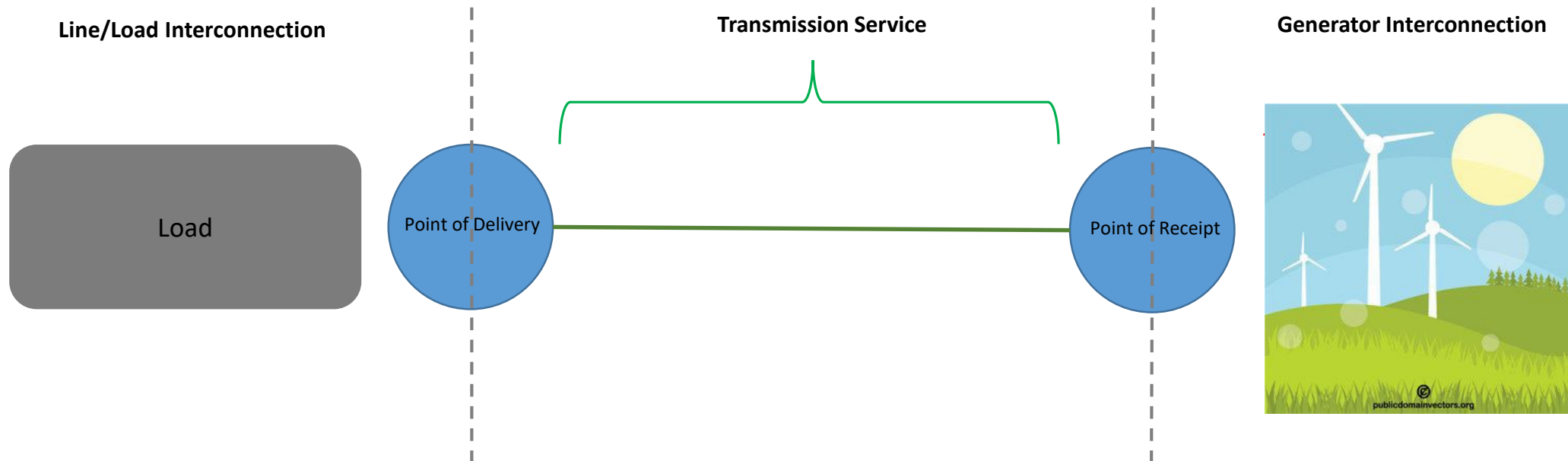


1 – Shut-offs refer to actions taken against delinquent accounts

Transmission Picture

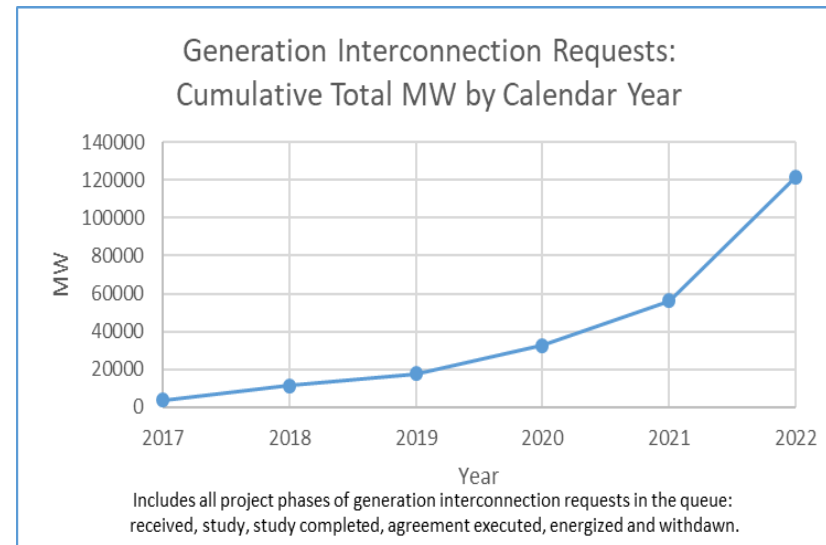
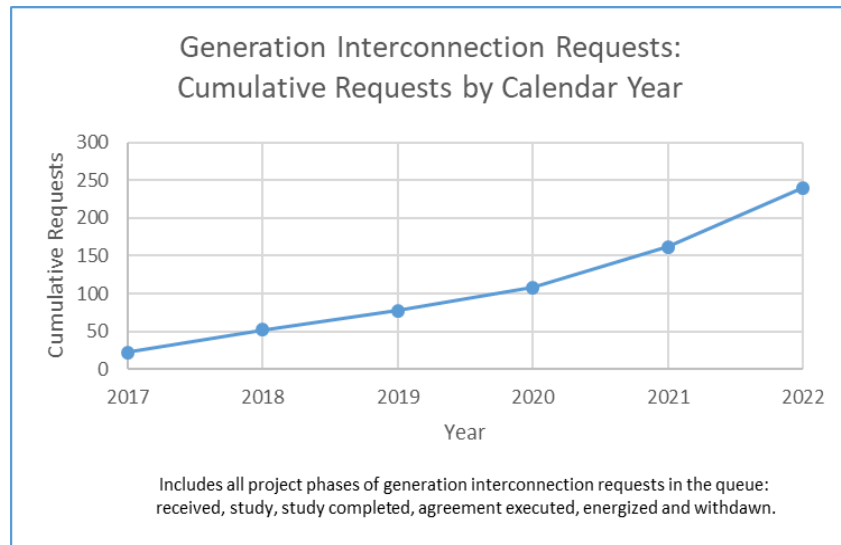
BPA administers three Queues as a part of the Planning process:

- Line/Load Interconnection
- Transmission Service
- Generator Interconnection



Generation Interconnection

- Traditionally, 10-15% of Generation interconnection requests follow through to energization
- BPA has a proven track record and successfully integrated 7 GW of wind and 525 MWs of Solar, in part through successful builds of Coulee-Bell, Kangley-Echo Lake, Schultz-Wautoma, Big Eddy-Knight, McNary-John Day, Central Ferry – Lomo
- BPA's Generation Interconnection Queue is experiencing a significant increase in requests with no signs of easing
 - Majority of the requests are in the Central Oregon, Tri-Cities, Mid-C and Umatilla areas
- Washington CETA, Oregon HB2021, BIL and IRA likely to keep demand high for sometime
- FERC issued a Noticed of Proposed Rulemaking that takes aim at this nationwide problem.



BPA Generation Interconnection Queue

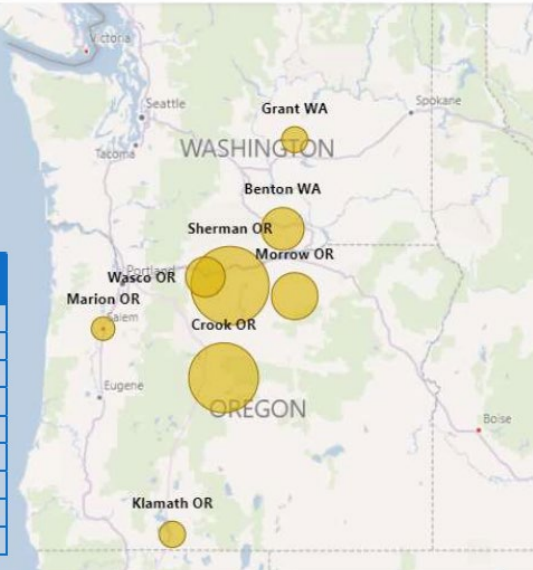
Photovoltaic

Fuel Source ● Solar

Total
49.4
Gigawatts

Top Counties

County	GW
Sherman	8.0
Crook	7.3
Morrow	4.9
Benton	4.5
Wasco	4.2
Klamath	2.9
Grant	2.9
Marion	2.7



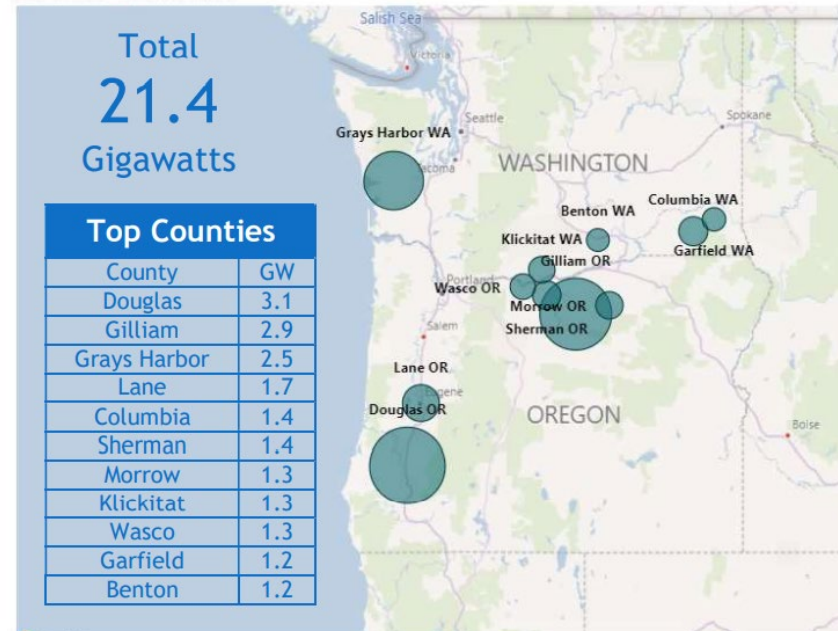
Wind Turbine

Fuel Source ● Wind Turbine

Total
21.4
Gigawatts

Top Counties

County	GW
Douglas	3.1
Gilliam	2.9
Grays Harbor	2.5
Lane	1.7
Columbia	1.4
Sherman	1.4
Morrow	1.3
Klickitat	1.3
Wasco	1.3
Garfield	1.2
Benton	1.2



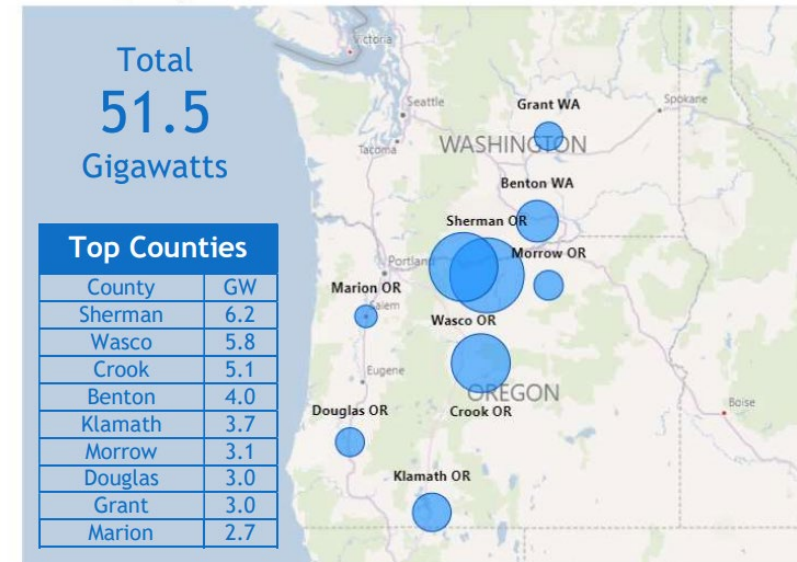
Energy Storage

Fuel Source ● Battery

Total
51.5
Gigawatts

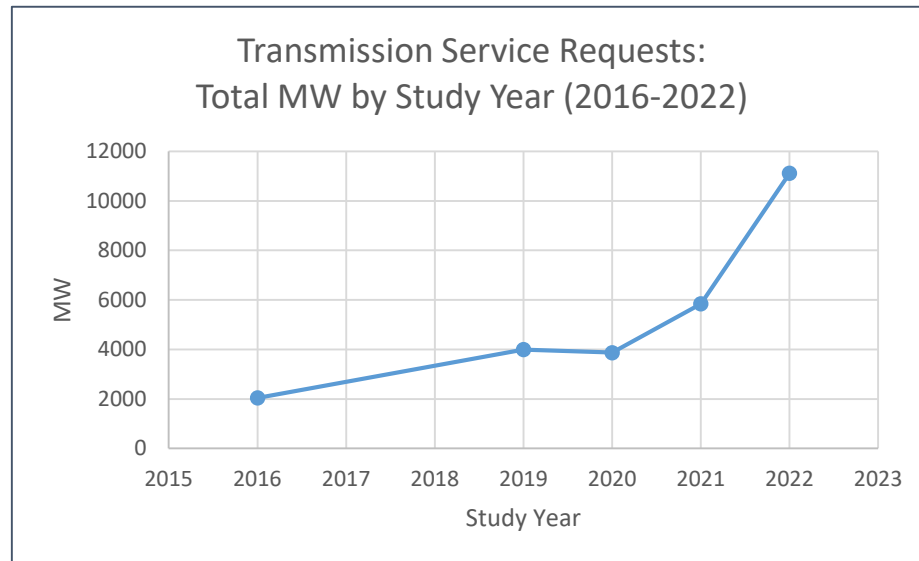
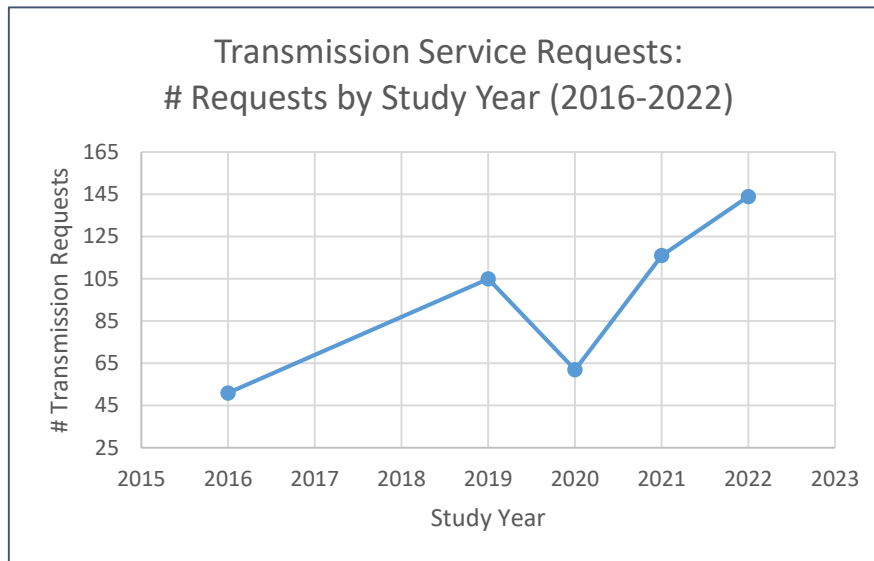
Top Counties

County	GW
Sherman	6.2
Wasco	5.8
Crook	5.1
Benton	4.0
Klamath	3.7
Morrow	3.1
Douglas	3.0
Grant	3.0
Marion	2.7

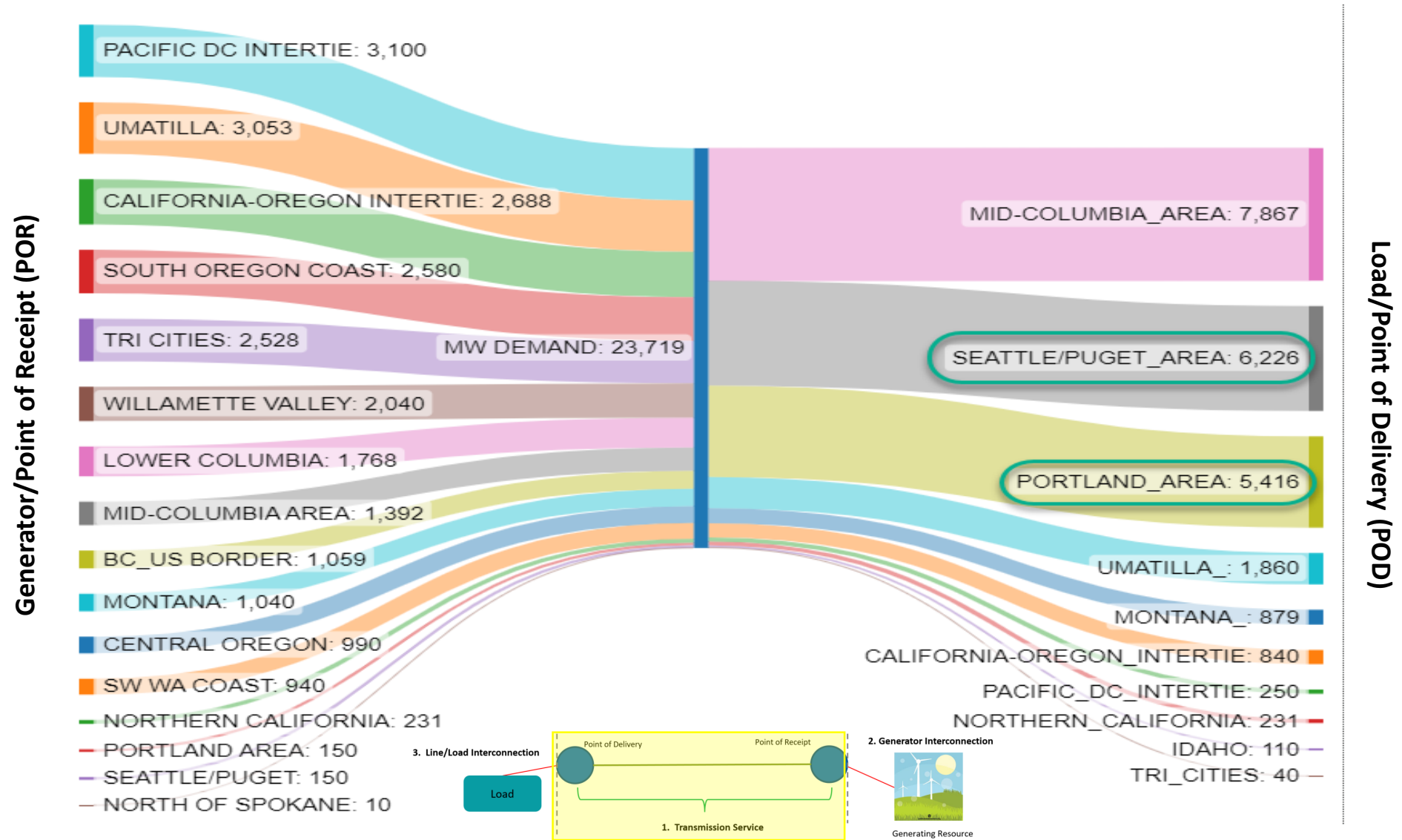


Transmission Service Requests

- WA & OR Clean Energy policies are driving an increase in TSR submittals
 - Since 2019, BPA has studied over 17,000 MW of requested transmission service primarily delivering to the Portland metro area or the Seattle/Puget Sound area
 - According to recent IRP data, the clean resource need to serve these regions is expected to be around 6,000 MW in total by 2030
 - The 2022 Cluster Study had more requested demand (~11.1 GW) than the 2020 and 2021 studies combined (~10 GW).
 - The 2023 Cluster Study will include ~17 GW of requests.
 - The requested transmission service is far outpacing the regional demand

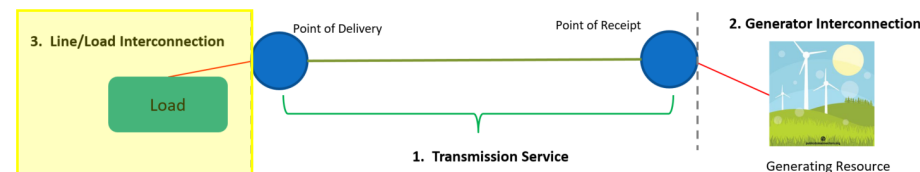
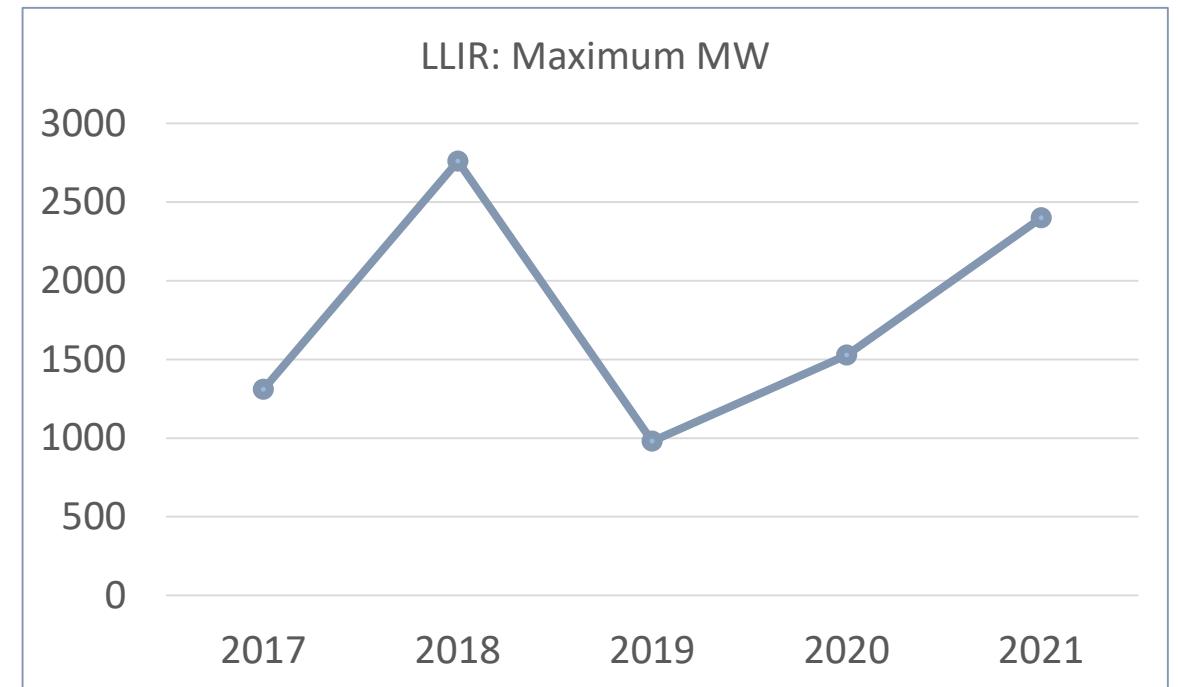
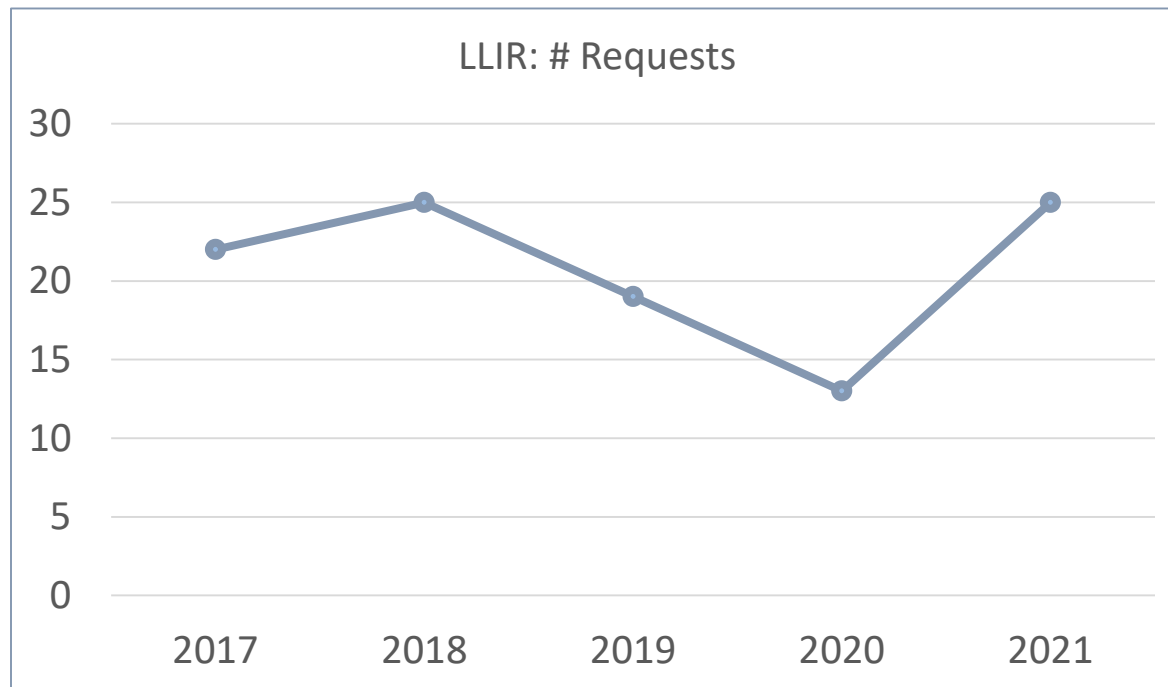


2023 Cluster Study Transmission Queue Details



Line & Load Interconnection Queue Activity

- Largest demand for growth around the system include Central Oregon, Umatilla, Pend Oreille, Hillsboro/Forest Grove, Longview/Cowlitz, Tri-Cities



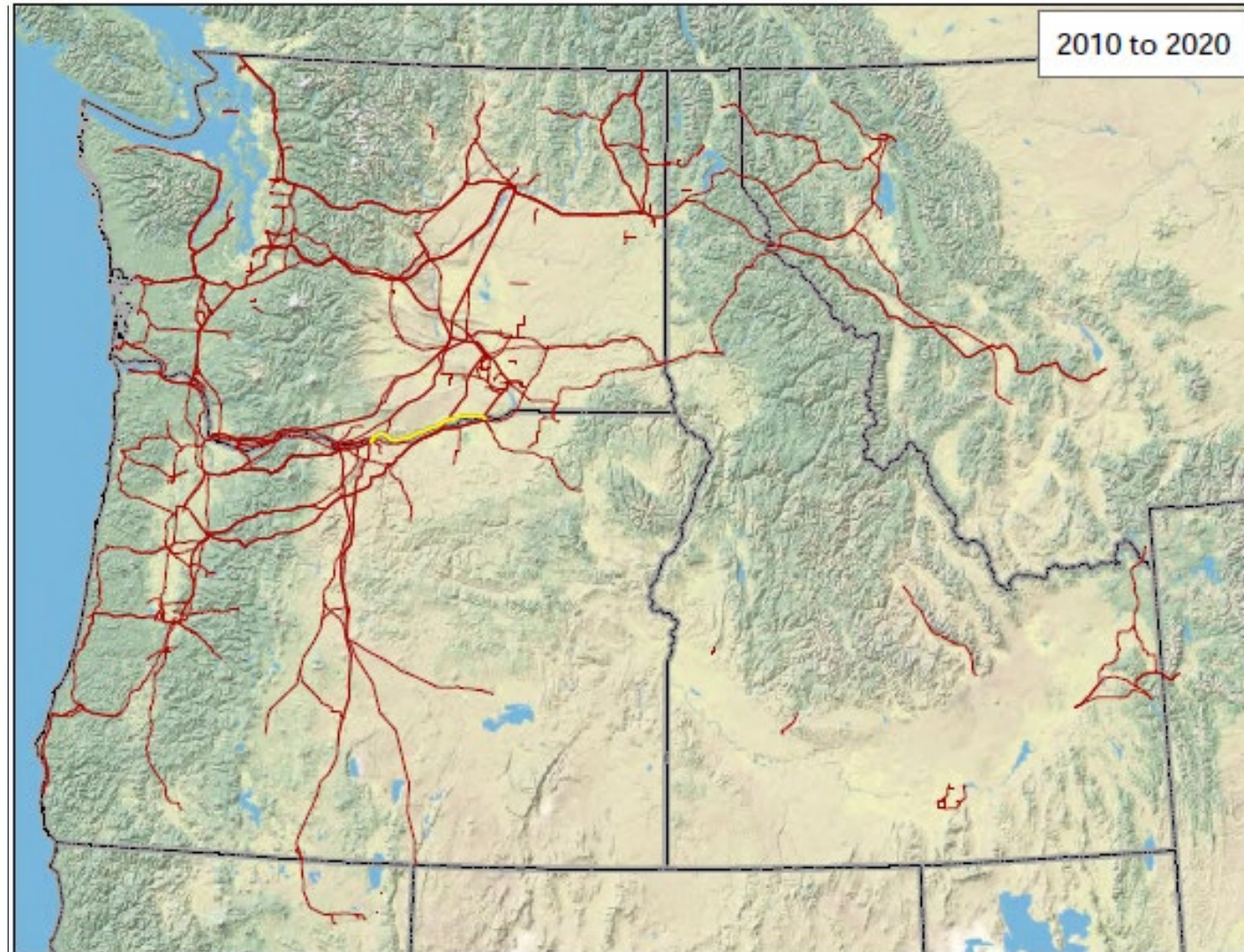
Load & Queue Growth

- Based on NT customer load forecasts growth is heavily concentrated in a few areas
 - 5 customers are forecasting 10-year load growth between 100% - 375%
 - Data center development is driving most of this growth
 - The majority of NT customers are forecasting slow or no load growth

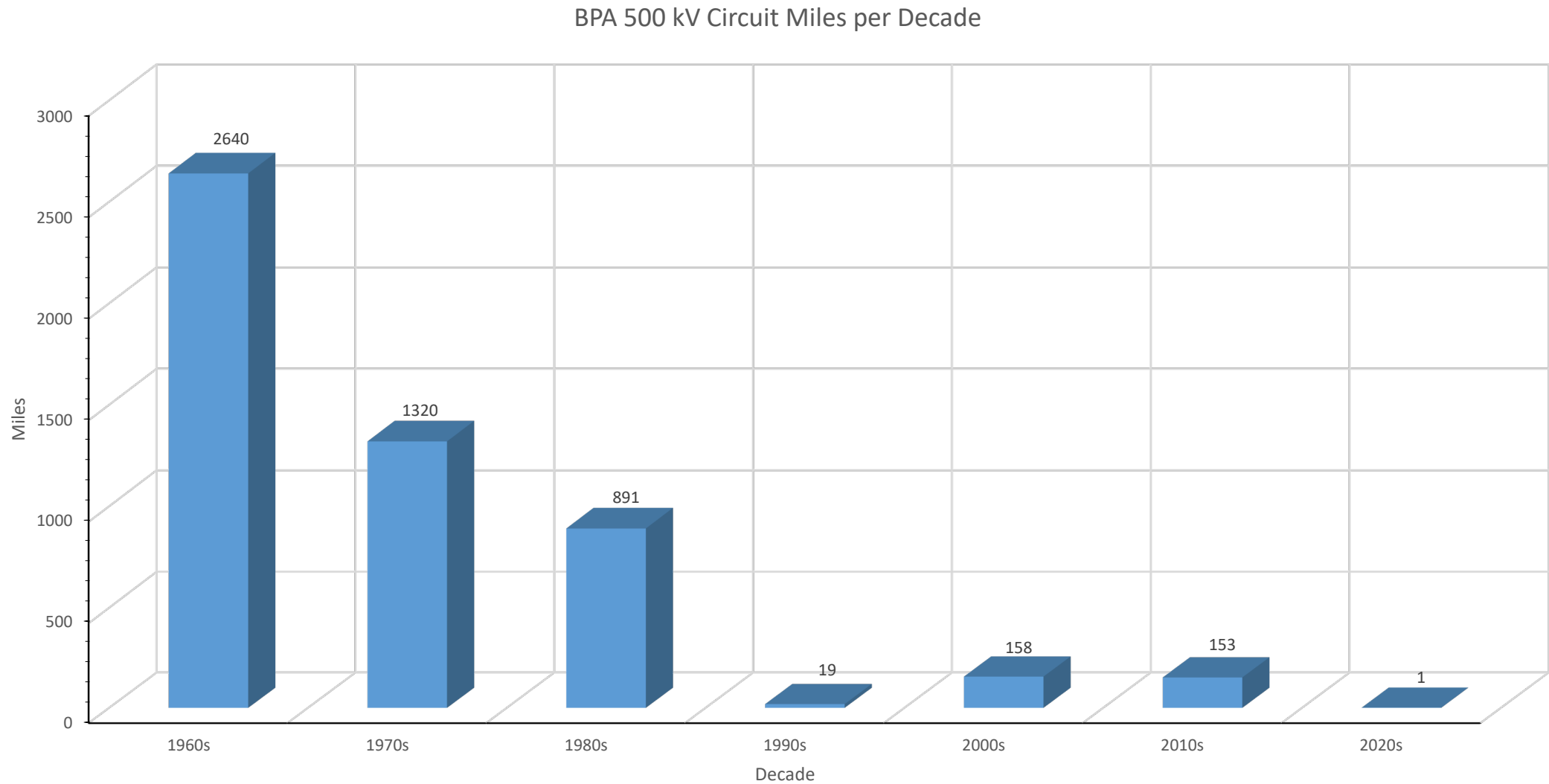
Bonneville Transmission Build Out



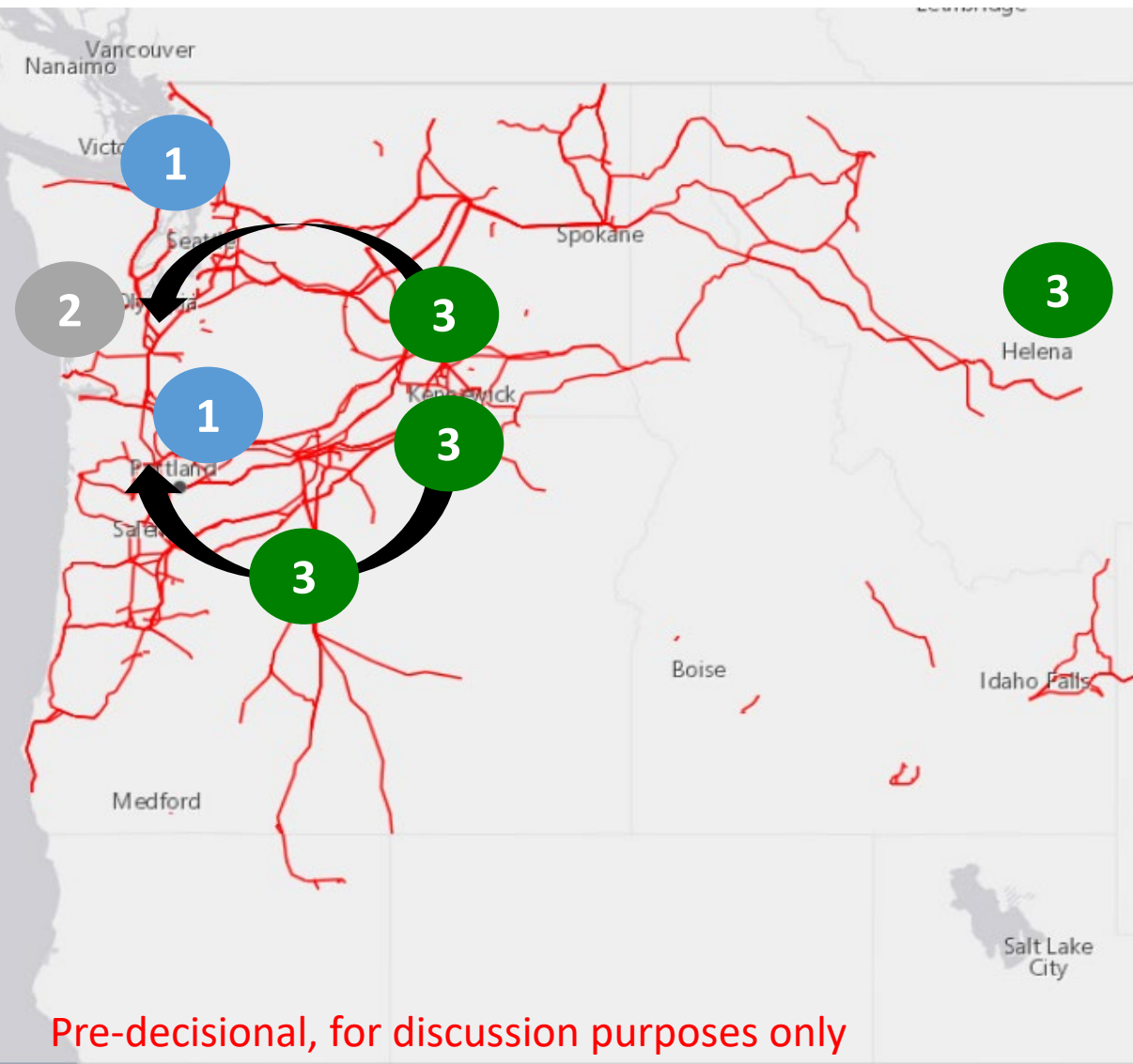
Bonneville Transmission Build Out



PNW Transmission Build Out



Landscape Overview



The following factors:

1. Load growth in Portland and Seattle – driven by high tech industry, transportation and building electrification
2. Reduced operation of 4.5 GW of carbon emitting generators on the west side along the I5 corridor
3. Replacement wind and solar resources are located east of the Cascades

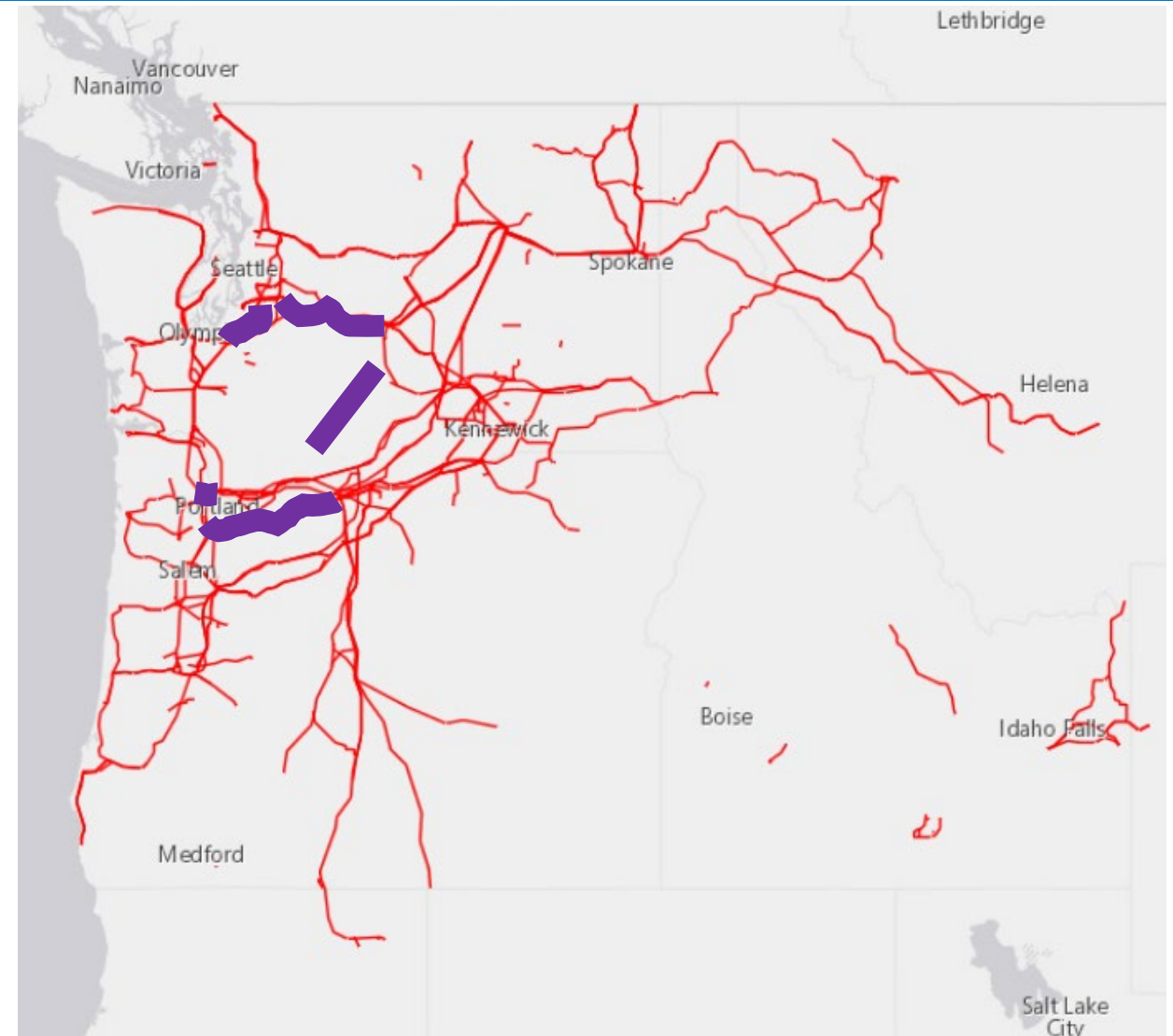
Will increase flows on cross-Cascades transmission paths and throughout the load centers

TSEP Results Project Summary

The following projects are needed in many future scenarios for reliability, expanded load service, and as renewable resources seek delivery to load:

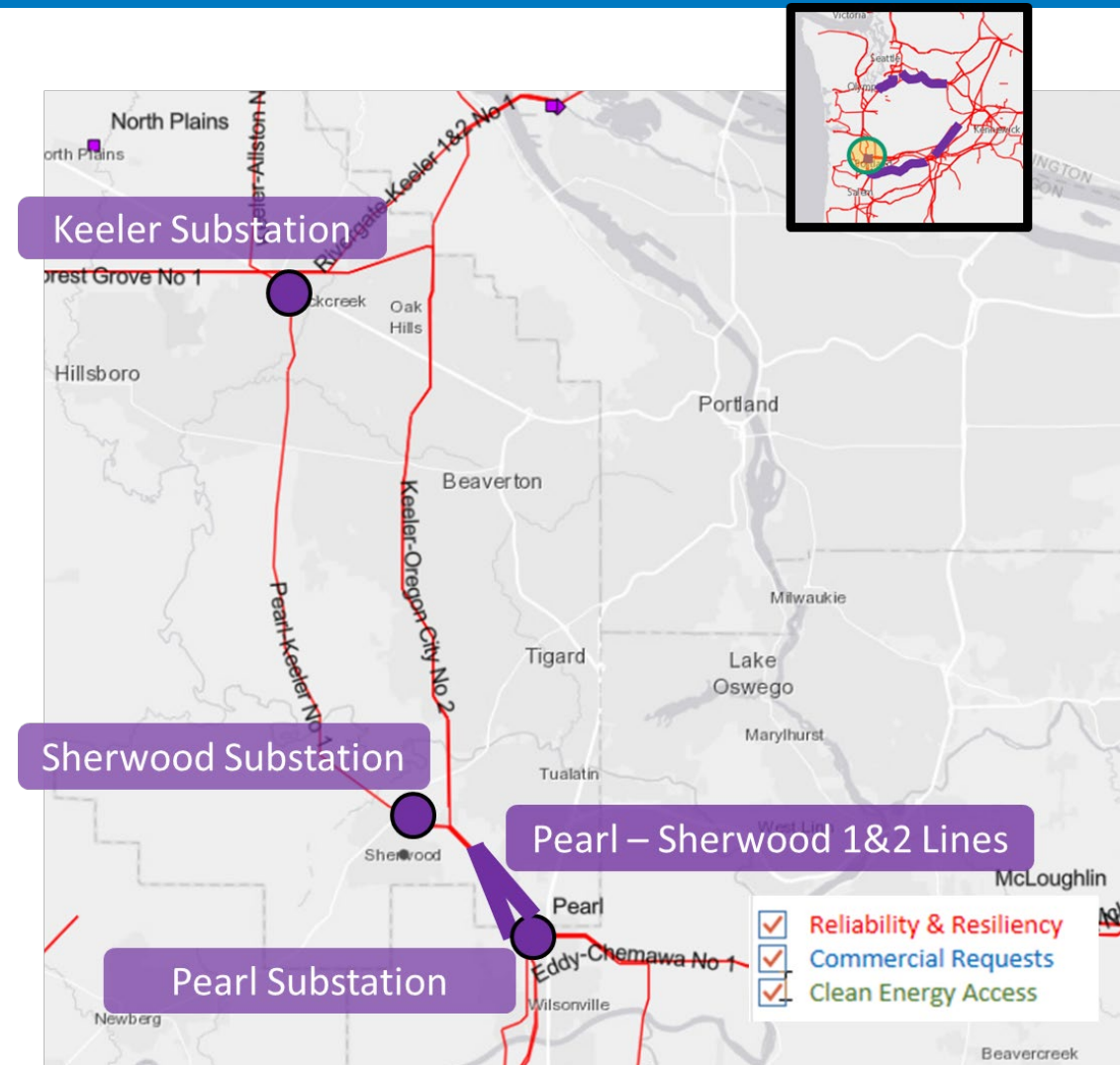
1. Portland Area Reinforcement
2. Cross-Cascades South (Big Eddy-Chemawa 500 kV Rebuild)
3. Chehalis-Cowlitz Tap 230 kV Rebuild
4. Cross-Cascades North Reinforcement
5. Ross – Rivergate 230 kV Rebuild
6. Rock Creek-John Day 500 kV Rebuild

Pre-decisional, for discussion purposes only



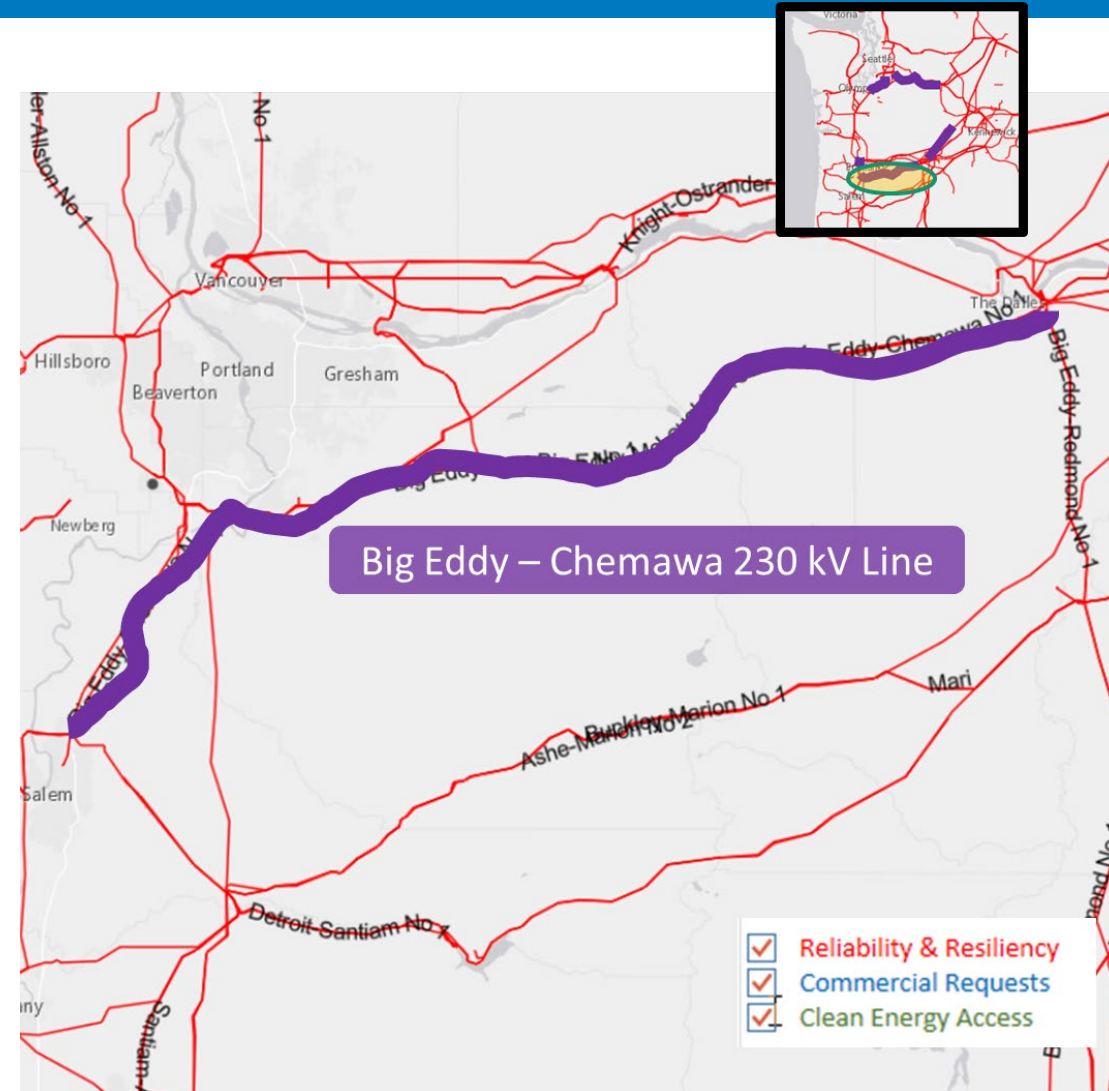
Portland Area

- Description:
 - Add second 500/230-kV transformer at Keeler substation
 - Develop Keeler 500-kV bus into breaker and half configuration
 - Re-termination and upgrades to Pearl – Sherwood 230-kV lines
- Estimated Cost: TBD
- Drivers:
 - TPL-001 Reliability Compliance
 - Rapid Load growth in Hillsboro
 - Enabling delivery of renewable resources to Portland
- Status:
 - Identified in 2021 and 2022 System Assessments
 - Preliminary Scoping



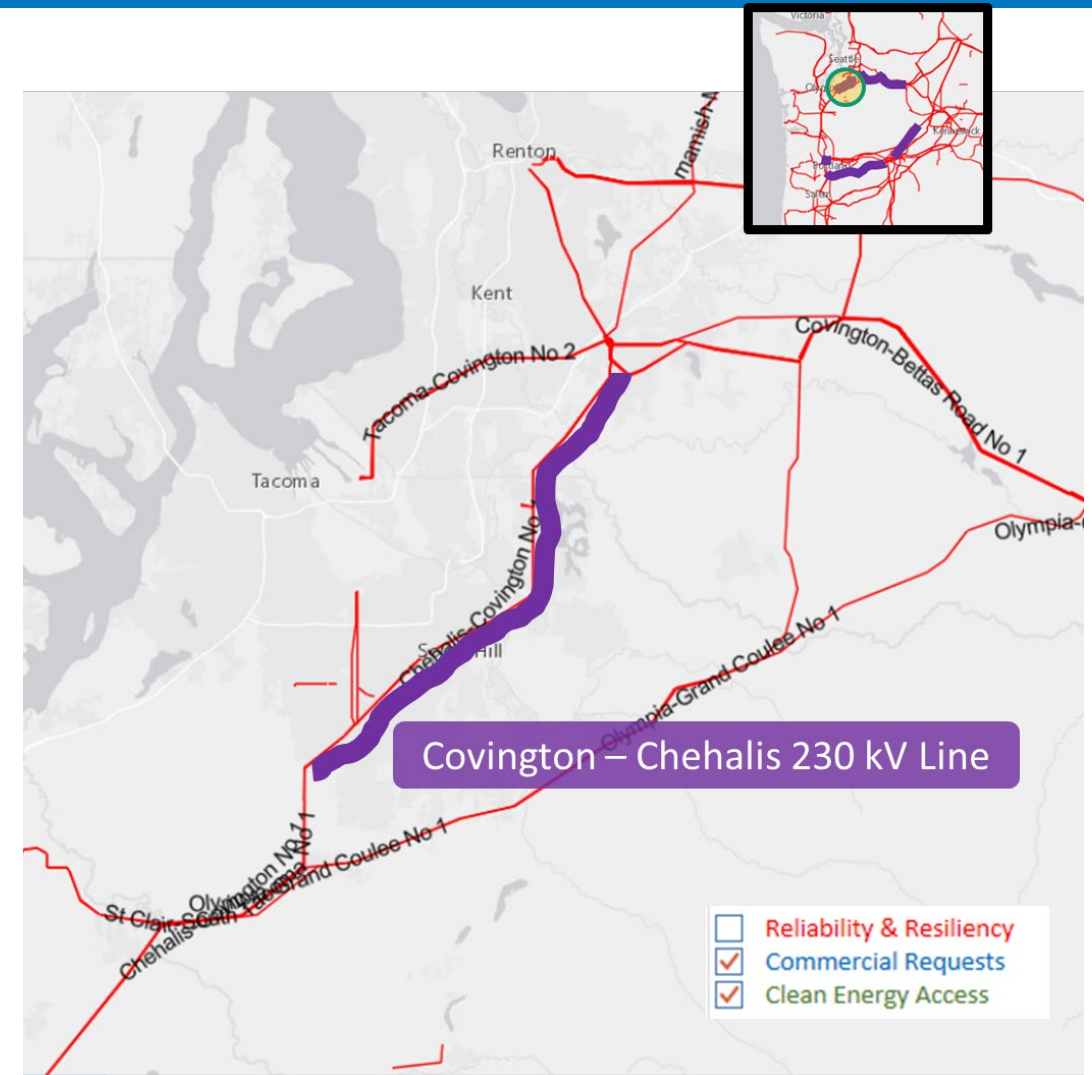
Cross-Cascades South Reinforcement

- Description:
 - Rebuild existing Big Eddy-Chemawa 230kV line as Big Eddy-Ostrander 500kV (70 mi), Ostrander-Pearl 500kV (20 mi), re-terminate the Pearl – Chemawa 230kV
- Estimated Cost: \$233M (Direct)
- Drivers:
 - Enabling delivery of renewable resources to Portland
 - Resiliency of load service in Portland Area
- Status:
 - Identified by 2022 Transmission Service Expansion Process



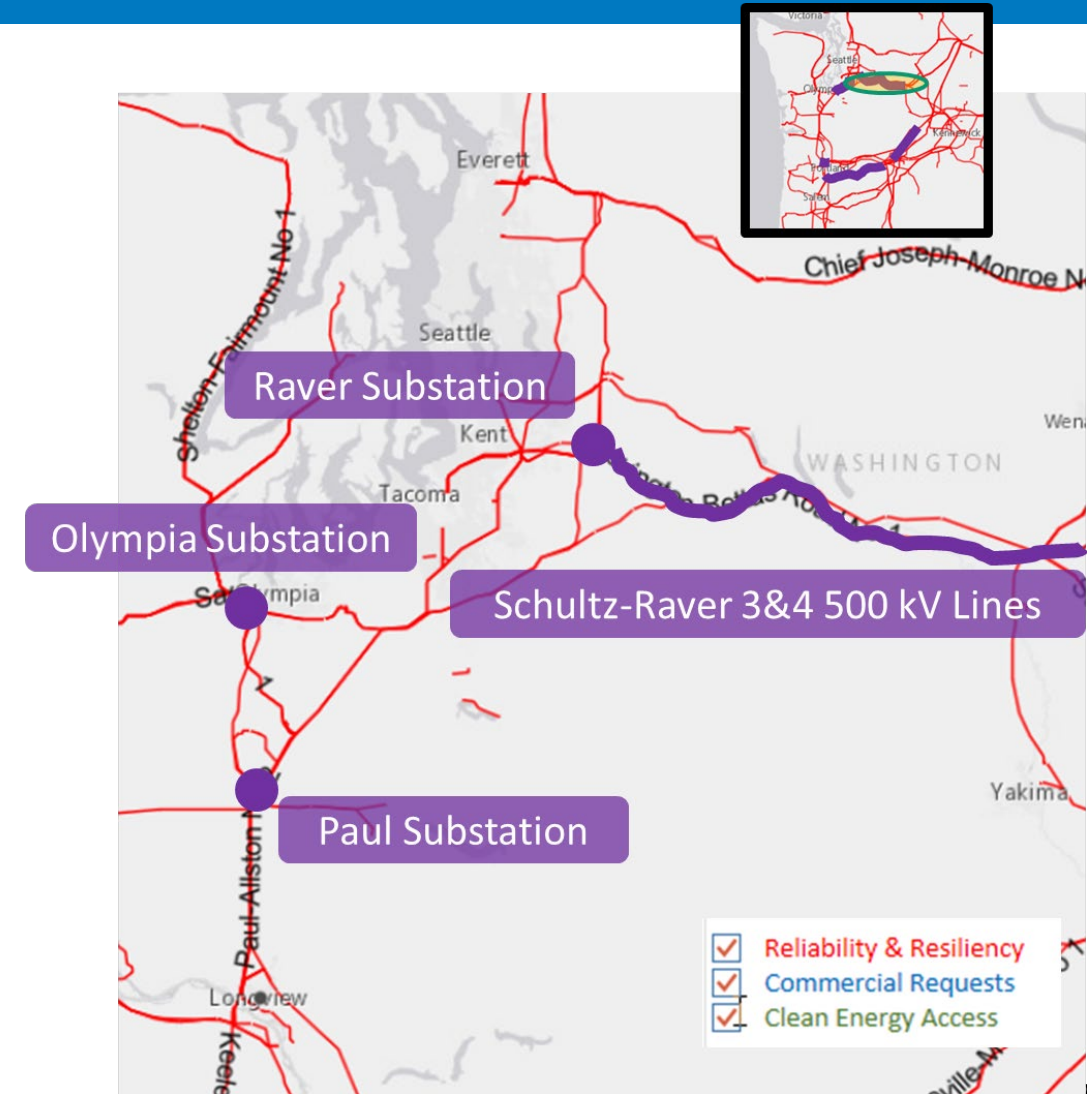
Raver-Paul Reinforcement

- Description:
 - Rebuild 53 miles of Cowlitz-Chehalis section of Covington-Chehalis 230kV line
- Estimated Cost: \$35M (Direct)
- Drivers:
 - Enabling delivery of renewable resources to Portland
 - Mitigate impact of I5 gas generation retirement
- Status:
 - Identified by 2022 Transmission Service Expansion Process



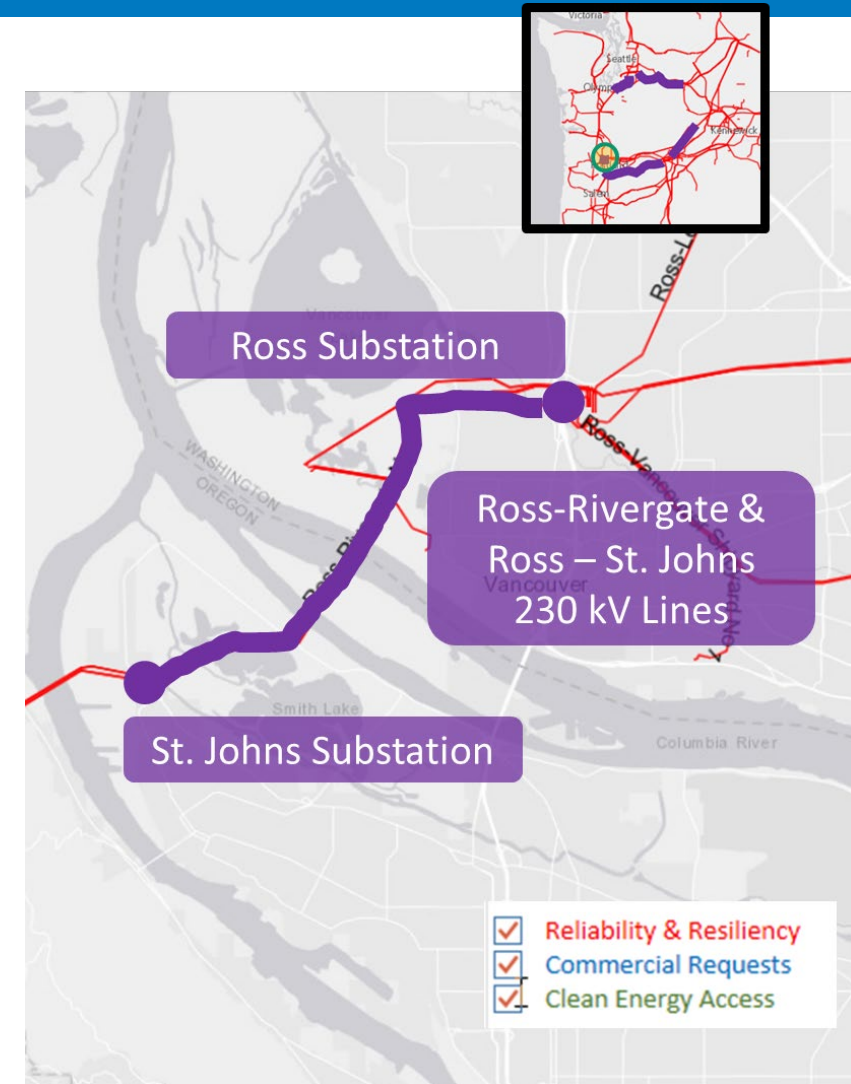
Cross-Cascades North Reinforcement

- Description:
 - Reconductor Schultz-Raver 3 & 4 500kV lines (100 mi total)
 - Schultz-Raver #4 500kV series capacitor upgrade (Phase 2)
 - Olympia 230kV 350 MVAR Statcom addition
 - Paul 500kV 221MVAR shunt capacitor addition
- Estimated Cost: \$196M (Direct)
- Drivers:
 - Enabling delivery of renewable resources to Puget Sound
 - Resiliency of load service in Puget Sound and Olympic Peninsula
- Status:
 - Identified by 2022 Transmission Service Expansion Process



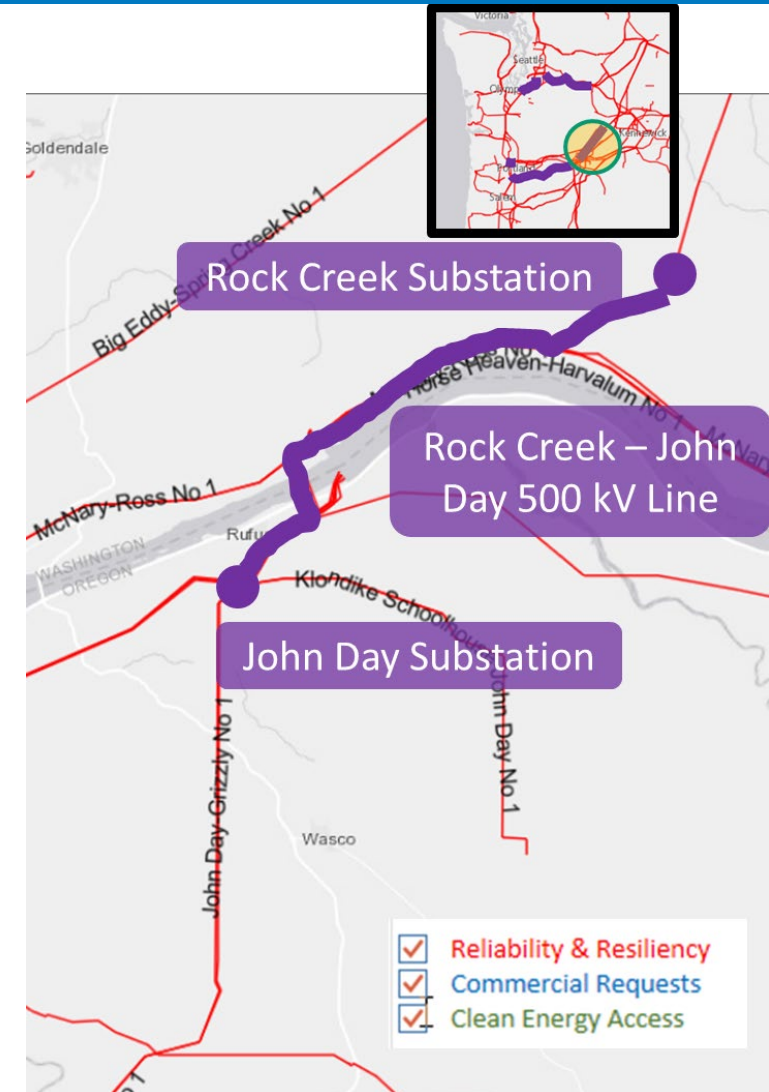
Ross-Rivergate

- Description:
 - Rebuild Ross – Rivergate / Ross – St. Johns 230kV line (7.5 mi)
- Estimated Cost: \$149M (Direct)
- Drivers:
 - Enabling delivery of renewable resources to Portland
 - Resiliency of load service in Portland
- Status:
 - First identified in 2017 SOA no-build ADF
 - Identified by 2022 Transmission Service Expansion Process



South of Rock Creek Reinforcement

- Description:
 - Rebuild Rock Creek – John Day 500kV line (20 mi)
- Estimated Cost: \$39M (Direct)
- Drivers:
 - Enabling integration of renewable resources in Central Washington
 - Economical upgrade to the heart of the 500kV system, enabling overall capacity.
- Status:
 - Identified by 2022 Transmission Service Expansion Process



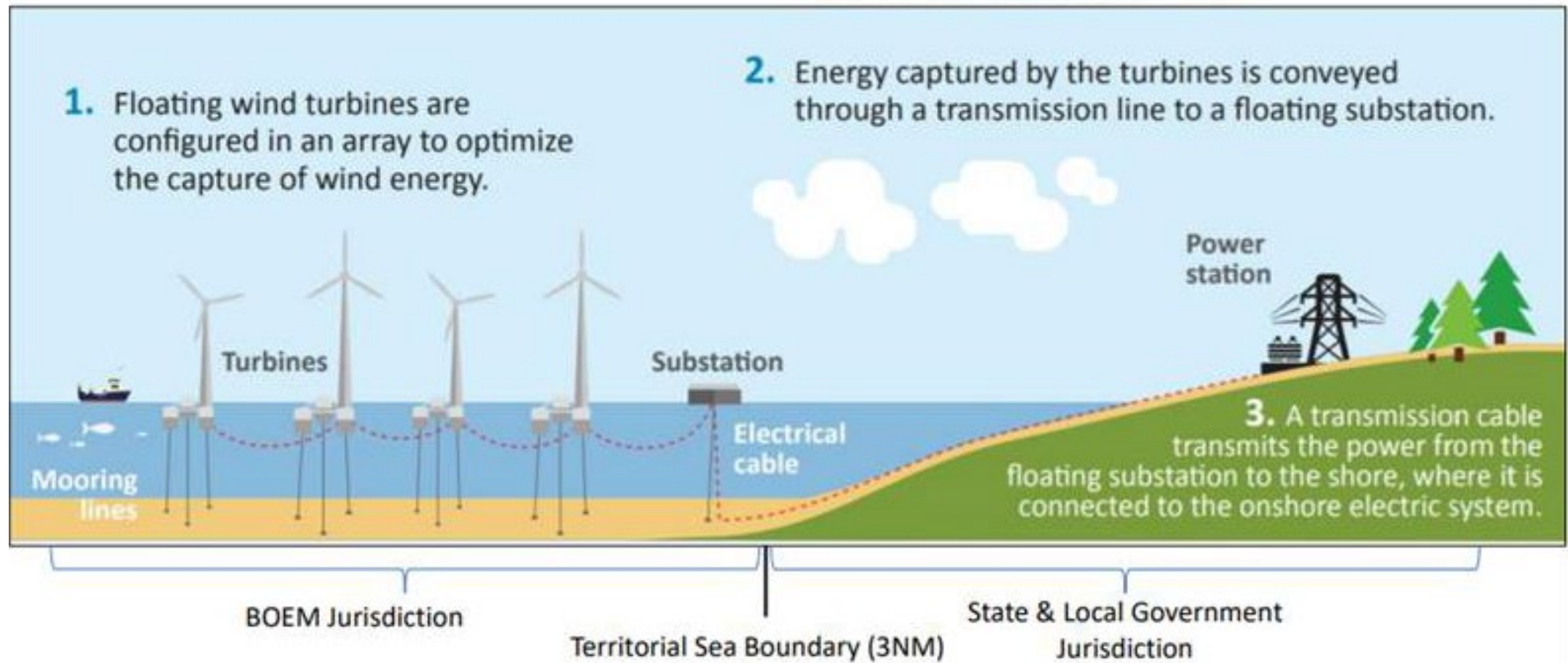
Service Enabled by Projects - Cumulative

Projects as a Portfolio			
Upgrade	MW Enabled	Est. Project Cost (Direct)	Revenue Estimate (Annual) @ Current Rates (\$000)
WOCS + WOCN	400	\$429,000,000.00	\$0.00
WOCS + WOCN + PDX	1,690	\$429,000,000.00	\$14,141.00
WOCS + WOCN + PDX + RO-RV	1,930	\$538,200,000.00	\$16,026.00
WOCS + WOCN + PDX + RO-RV + R-P	3,150	\$573,200,000.00	\$41,715.00
WOCS + WOCN + PDX + RO-RV + R-P + Rock Creek	4,260	\$612,200,000.00	\$56,563.00

- Revenue based on subscription of 2022 TSEP participants who executed PEAs
- TSRs tied with 3rd party project and 3rd party impacts are not included in the numbers above.

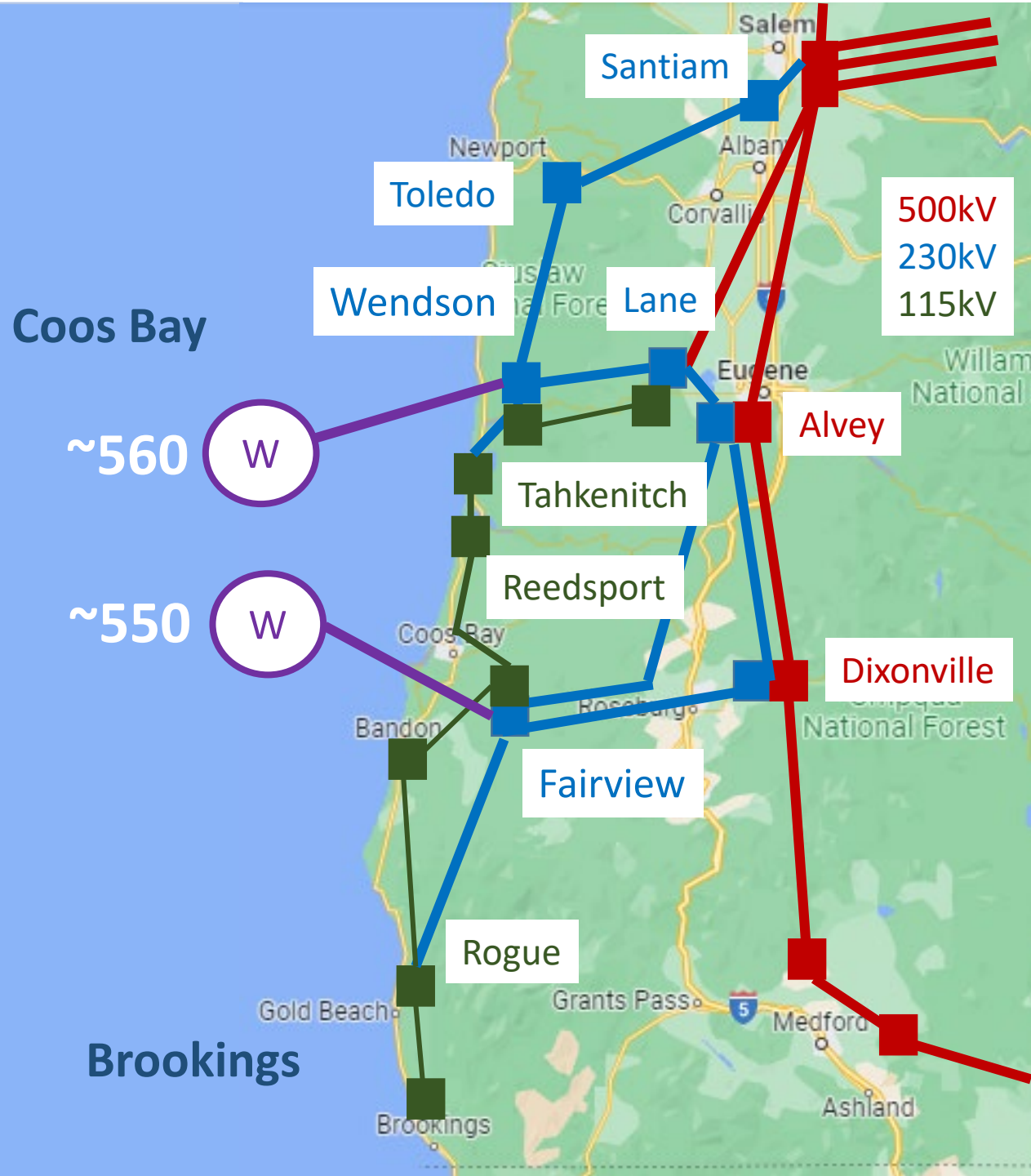
Emerging Technologies

Off-Shore Floating Wind Power



*NREL estimates 1,300 meters is the current cost-effective depth limit.
Bottom-fixed offshore wind projects are limited to water depths less than 60 meters.

Offshore Wind Capabilities



- 1) Roughly **1 GW** of off-shore wind can be interconnected in **Coos Bay Area** at Wendson and Fairview substations with relatively modest system upgrades (no new lines)
- 2) **Brookings Area** has superior wind power density, but exporting generation from Brookings' wind will require major transmission reinforcements, likely a 500-kV build directly to the I5 corridor
- 3) Coastal transmission was designed for load service. Additional system upgrades are required around Eugene and Roseburg, as well as along the I5 corridor to deliver power to load centers
- 4) Oregon Department of Energy goal is **3GW**

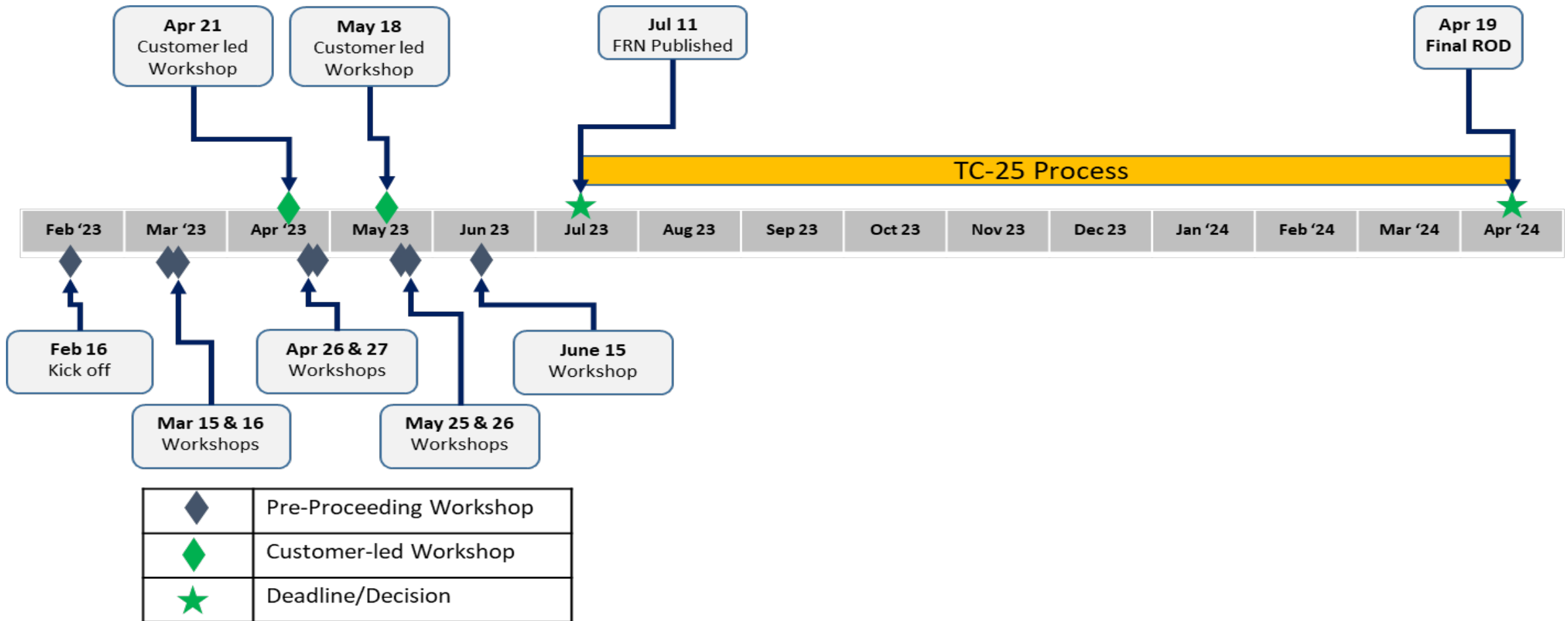
Integrating Offshore Wind

- The costal transmission system was designed for load service, and there has been limited load growth
- The transmission system will require **major** upgrades to integrate GWs of off-shore wind
- Several reliability studies are either completed recently or in progress
 - BPA internal validation of NREL publication
 - BPA transmission service and generation interconnection requests by developers
 - PacifiCorp studies (requested by Oregon PUC)
 - Northern Grid for 3 GW off-shore wind integration (requested by Oregon PUC and DOE)
 - Pacific Northwest National Labs study



Transmission Policy in Flight

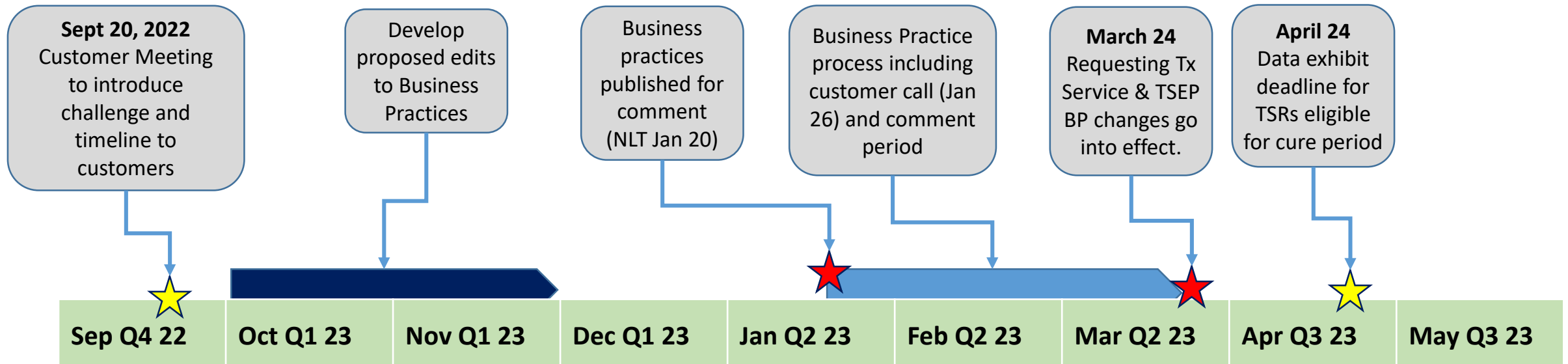
Generator Interconnection – TC-25 Process



Procedural Schedule dates are draft only
Internal Use Only

Pre-Decisional. For Discussion Purposes Only.

Transmission Services Request Queue



- Successful Implementation of Data Exhibit Requirements for Long-term TSRs.
- Enables BPA to run higher quality, actionable Cluster Studies and future LARP commercial power flow studies.
- Allows for future sustainable, robust, repeatable TSEP Cluster Study cycles
- Requests validated up front

Line Load Queue

- TC-24 Settlement Obligation:
 - Before the TC-26 proceeding, BPA will hold a stakeholder workshop to discuss BPA's line and load interconnection procedures and potential reforms to the load interconnection queue.
- Streamlined Interconnection Facilities Study (FAS) Process
 - Consulting with Engineering to provide right size scoping
 - Anticipate significant reduction in FAS duration

NT Policies & Projects in Flight

- NITS on OASIS (automated processes, industry standards)
- Education on Load Growth planned in June 2023
- Increased focus on forecasting in order to plan for future load
 - BPA needs to know both resources and load to effectively plan
 - Customers should communicate changes to 10-year forecasts early and often
 - Evaluation of market purchase resource forecasting policy
 - Evaluation of current Designation of Network Resource timing requirements
 - “NT Customers must make a long-term designation of Network Resources, including a designation of a forecasted Network Resource for which the customer has a CONFIRMED FTSR, no later than 60 Calendar Days prior to service commencement date.” (NITS BP E.4)

Where Transmission is Heading

Evolving Markets



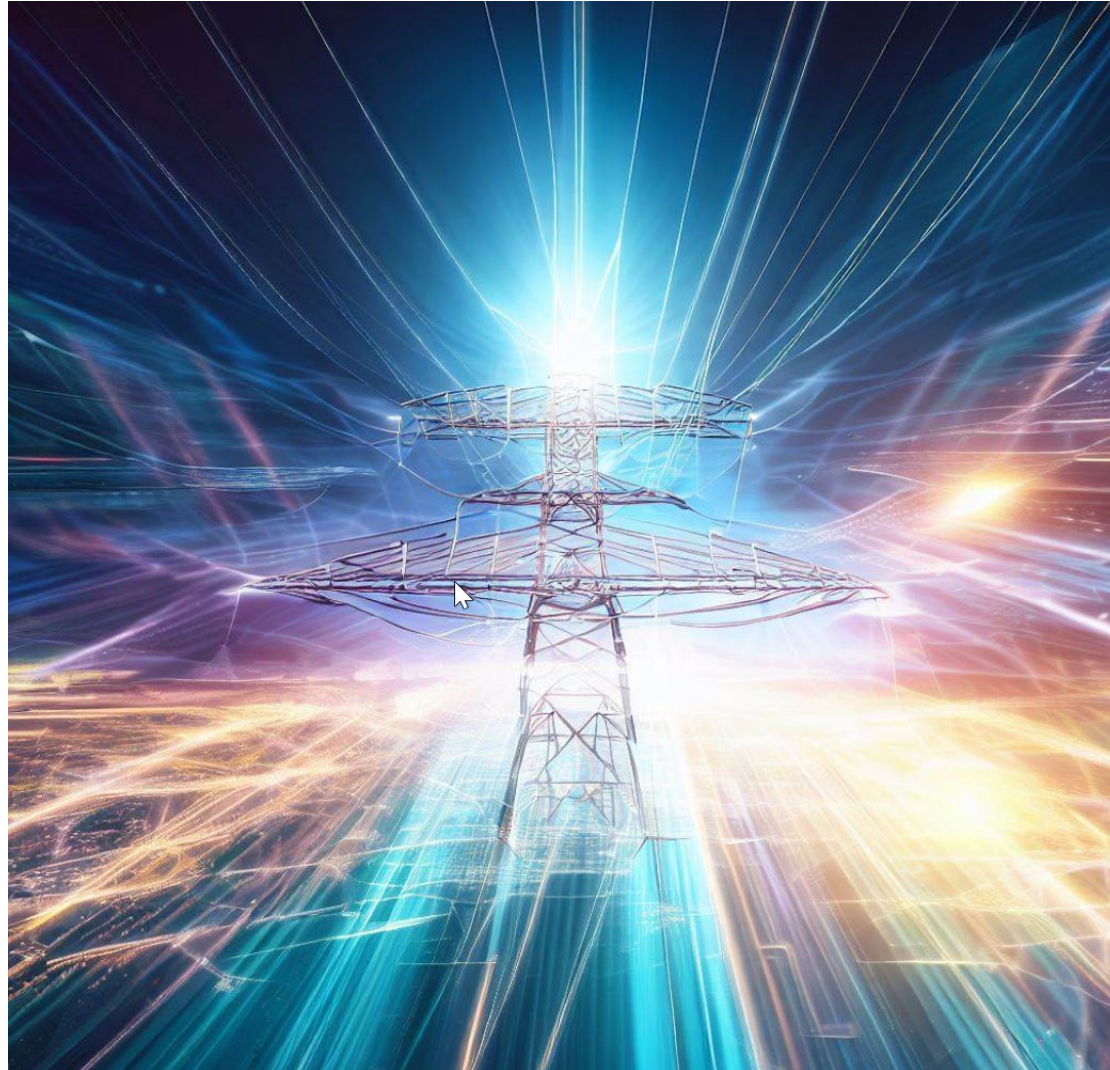
Deliberate Strategy

- The agency will be sharing its updated strategy refresh in the coming months.
- Transmission will be updating its Transmission Business Model to align with the agency's update
- Customer and Stakeholder input will be vital to ensuring Transmission's strategic development is representative of and responsive to the region.

On the Horizon

- GI queue reform via TC-25 and resulting implementation updating BPA tariff, policies, business practices and further markets evaluation
- Customer/Stakeholder Collaborating with the region on refreshing the Transmission Business Model
 - The transmission lead team is currently working on an update to the Transmission Business Model in alignment with the Agency Strategy and expects to release this update in the coming months.

The Evolving Grid





Questions

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>