

Integrated Resource Planning

ROUNDTABLE 22-8
SEPTEMBER 2022



MEETING LOGISTICS



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All attendees will be muted; to unmute yourself via computer, click on the microphone that appears on the screen when you move your mouse



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If you call in using your phone in addition to joining via the online link, please make sure to **mute your computer audio**



Use the chat feature to share your comments and questions.



Raise your hand icon to let us know you have a question

Interaction Agreements



We will ask for comments and questions along the way



Please be polite and respect all participants on the webinar



Please stay on topic; we may interrupt or shorten questions to meet the time commitment of the meeting

AGENDA

9:00 – 9:10 Welcome and Introductions

9:10 – 9:15 Safety moment

9:15 – 9:30 Clean Energy Plan Community Workshop Update

9:30 – 9:40 Inflation Reduction Act

9:40 – 12:00 Transmission

SAFETY MOMENT

Common home hazards



Choking— learn the Heimlich maneuver



Electrical shock— check plugs and cords regularly, and get malfunctioning electrical appliances and equipment repaired



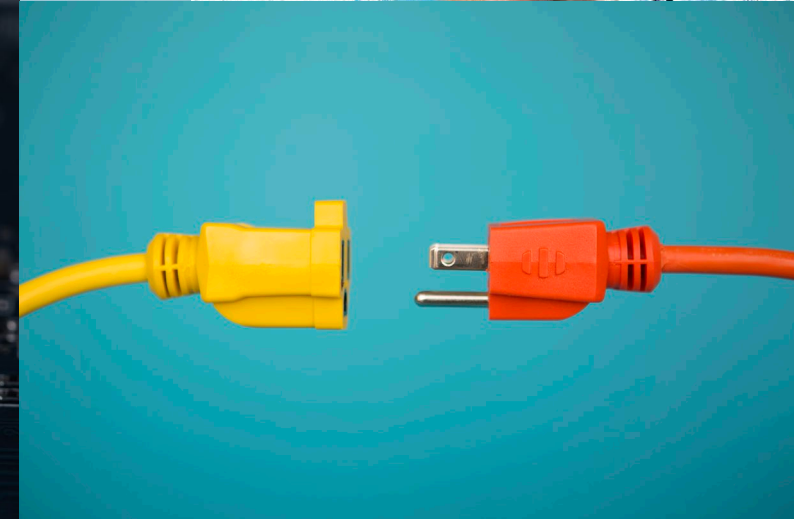
Hot substances or steam— be careful and teach children not to touch



Firearms— keep them locked up and lock up ammunition separately



Drowning— never leave young children unattended in the bath and supervise children of all ages in backyard pools

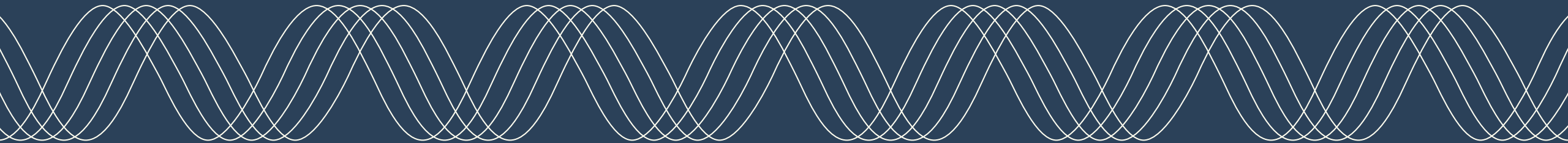


Clean Energy Plan

Community-Focused Workshop

Presenters:

Samantha Thompson, Energy Equity Partner



CLEAN ENERGY PLAN KICK-OFF

Provided purpose of workshop & intended audience

Discussed the Clean Energy Plan (CEP) & how it relates to other plans and processes

Provided an introduction of the IRP

Shared PGE's community engagement & CBIAG strategies

Currently collecting feedback from partners for future CEP community engagement

NEXT STEPS & CLOSING REMARKS



Set up meet-n-greets with community partners



Schedule upcoming community engagement meetings



Create topics for future Learning Labs



For more information or if you have questions, please email us
at CEP@pgn.com

INFLATION REDUCTION ACT

SETH WIGGINS

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INFLATION REDUCTION ACT

The Inflation Reduction Act (IRA) was signed into law in August 2022

Section 13701 Clean Energy Tax Provisions of the IRA focus on addressing climate change through:

- Federal funding
- Extending and expanding clean energy tax credits, the **Production Tax Credit (PTC)** and **Investment Tax Credit (ITC)**
- Providing other incentives for transportation electrification

Today's discussion gives attention to the modeling updates in the PGE IRP that will reflect these legislative changes

IRP MODELING UPDATES FROM IRA

Legislative Changes

Implications for IRP Modeling

The ITC and PTC are extended through December 2024. After December 2024, Technology-Neutral Tax Credits will apply. Investment-based (48D, like ITC), and Production-based (45Y, like PTC) options become available.

→ The availability of tax credits for qualified non-emitting resources are extended in the revenue requirement model, LUCAS, through the end of the planning horizon (2043). ROSE-E will make decisions based on these costs

Standalone storage is now eligible for existing ITC and technology-neutral credits

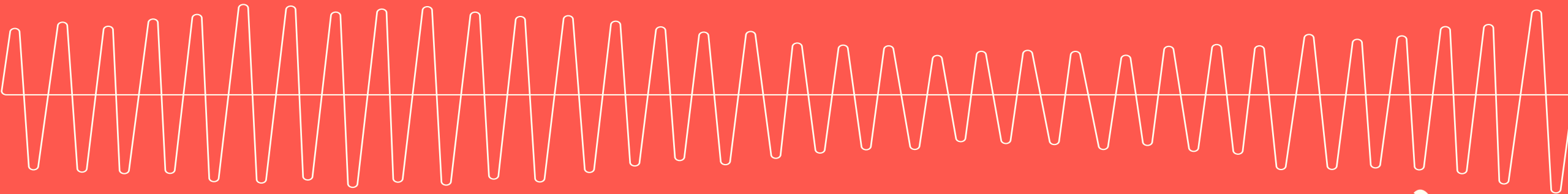
→ Tax credit for standalone storage resources is now modeled as ITC in LUCAS.

Solar is now eligible for existing PTC and technology-neutral credits

→ Tax credit for solar resources is now modeled as PTC in LUCAS.

TRANSMISSION

SHAUN FOSTER, LYNN LATENDRESSE, JACOB GOODSPEED
ROUNDTABLE 22-8



TRANSMISSION IS AN ESSENTIAL RESOURCE TO GET TO 2030 RELIABLY AND AFFORDABLY

THEN

PGE has planned for transmission on a limited basis centered around NERC requirements.

BPA firm transmission was available to bring resources home.

Resource development zones located near existing transmission footprint.

NOW

BPA transmission system fully subscribed.

PGE is forecasting 3-4 GW of new resource need to meet the HB 2021 decarbonization target.

Additional transmission rights are needed to ensure reliable and affordable service.

FUTURE

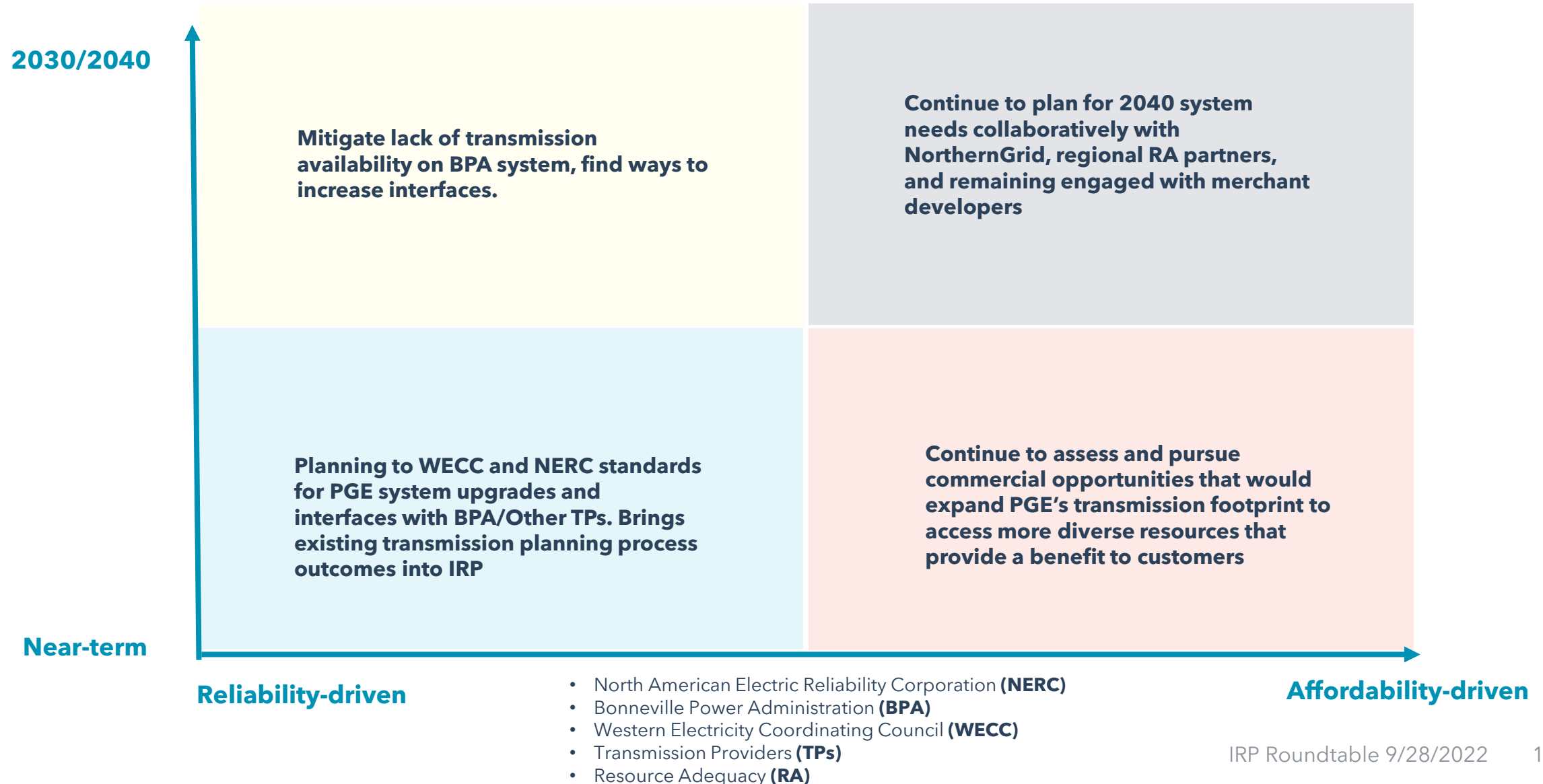
Increased focus on expanding BPA/PGE interface and preparing PGE transmission assets for additional resources.

Seek transmission paths that supplement BPA service and on-system distributed resources.

Address transmission constraints to enable rapid decarbonization per HB 2021.

- North American Electric Reliability Corporation (**NERC**)
- Bonneville Power Administration (**BPA**)

LONG-TERM TRANSMISSION PLANNING



PGE OASIS POSTED PATHS

PGE heavily interconnected to BPA with capacity of at least 4,500 MW. BPA encompasses most of PGE's full BA, and transfer capability used to meet PGE load.

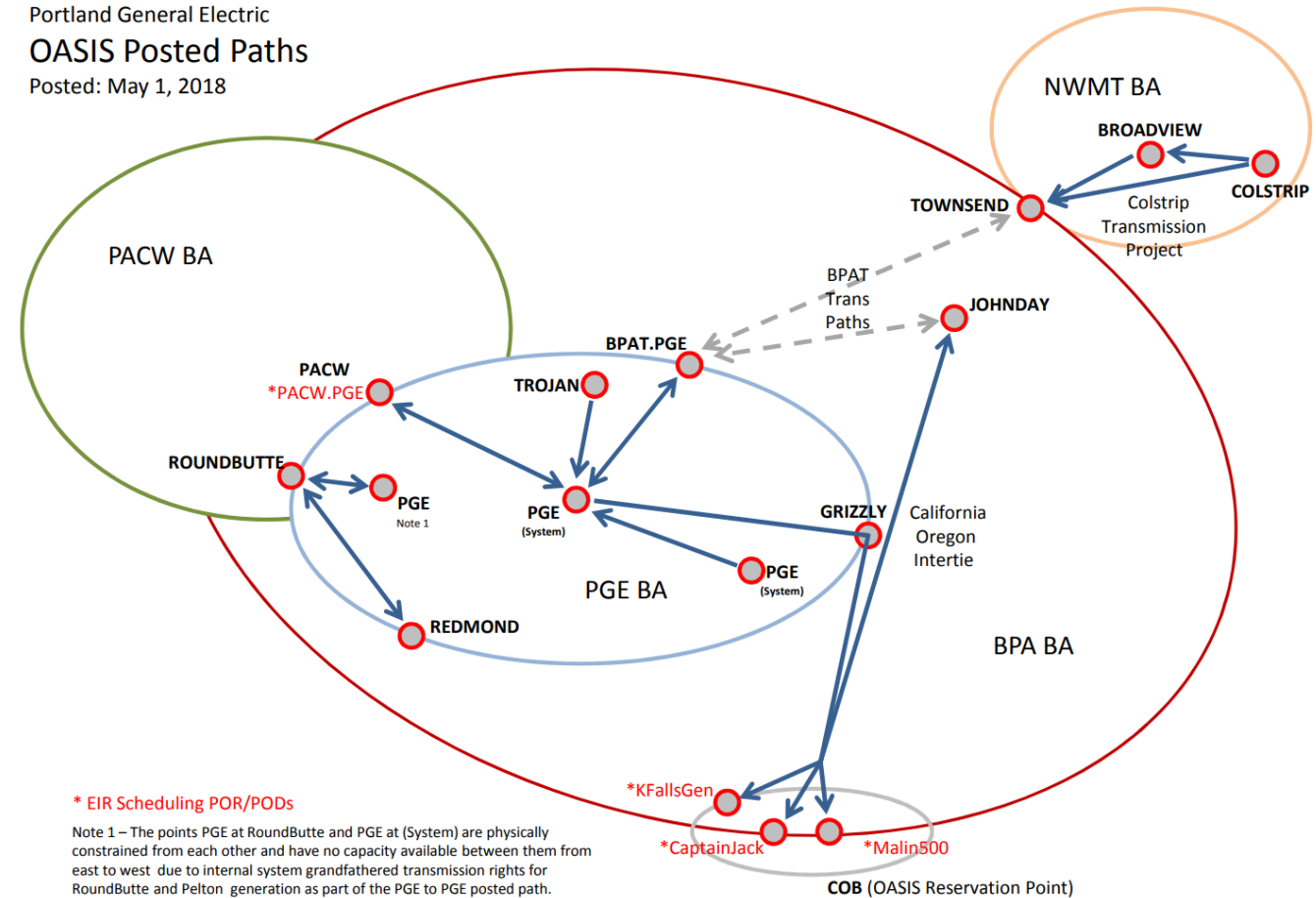
Interconnected to PacifiCorp West, but with much lower capacity (approximately 300-400 MW). Full capacity used for EIM participation.

Interconnected at various voltages with Salem Electric, Eugene Water and Electric, Forest Grove Light and Power, and several other Public Utility Districts.

Joint owner of South of Allston (approx. 26%)

Joint owner of California-Oregon Intertie (approx. 20%).

Portland General Electric
OASIS Posted Paths
Posted: May 1, 2018

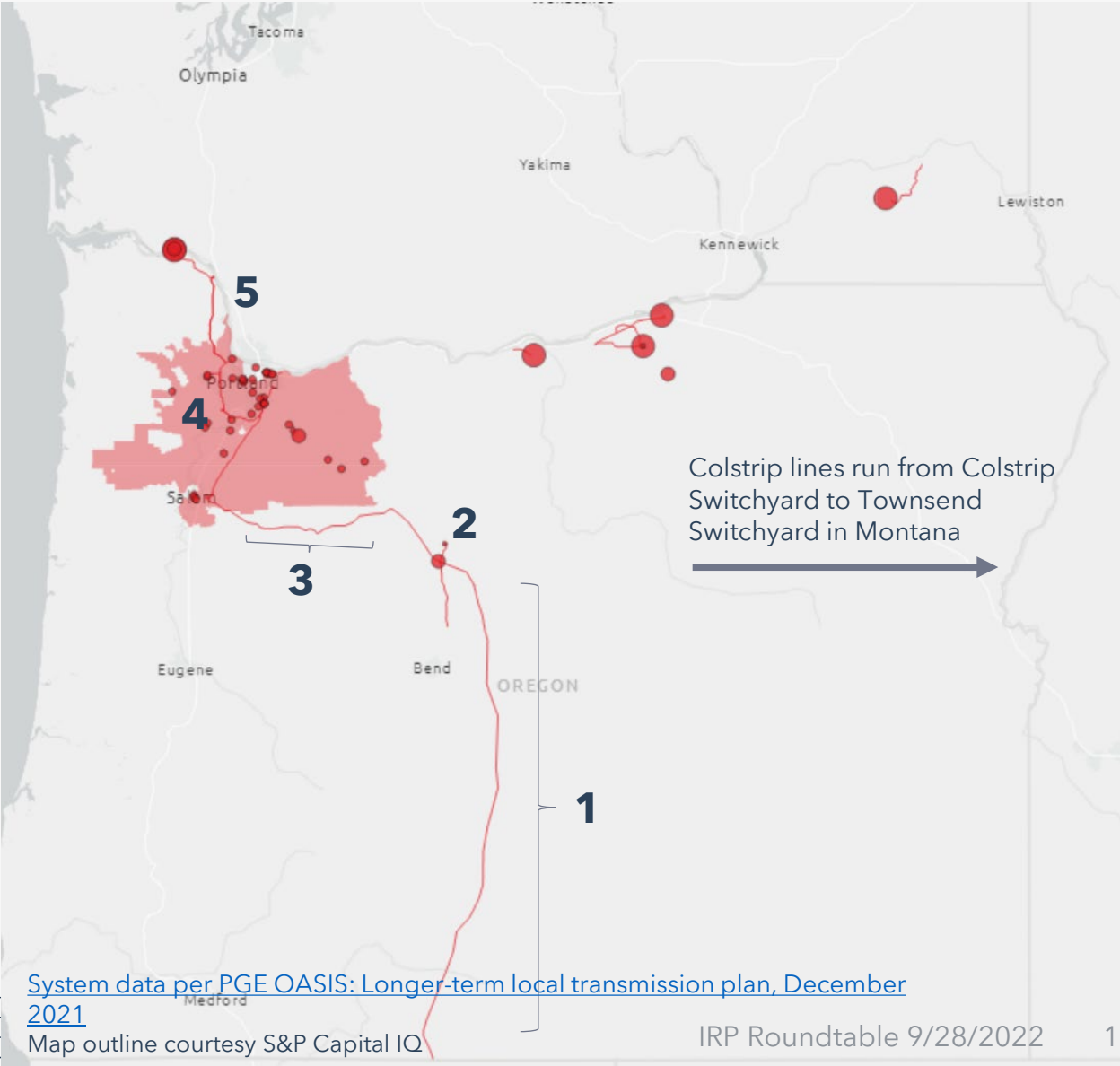


PGE TRANSMISSION REACH

Transmission reach is extremely limited and primarily along a north/south axis within the state of Oregon. PGE will likely need to expand to meet 2030 resource needs.

	Transmission Circuit	Miles	Path
1	Grizzly-Malin 500 kV	179	COI ¹
2	Grizzly-Round Butte 500 kV	16	
3	Bethel-Round Butte 230 kV	99	WOCS ²
4	Horizon-St. Mary's-Trojan 230kV	46	SOA ³
5	Harborton-Trojan #1 230 kV	35	SOA
	Colstrip-Broadview-Townsend #1 500 kV	250	

- 1 California-Oregon Intertie
- 2 West of Cascades South
- 3 South of Allston



TRANSMISSION IN 2023 IRP

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PGE reliability upgrades

- NERC system planning
- Study methodology and results

Key finding: PGE's transmission study has identified key near-term upgrades needed for reliability and increased interface with BPA.

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BPA system interaction & inventory

- Current inventory and modeling in IRP
- TSEP results and interaction with PGE's system

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Regional transmission options

- 2030 system needs and climate zone diversity
- Assessment of regional projects that could provide benefit

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Regional planning toward 2040

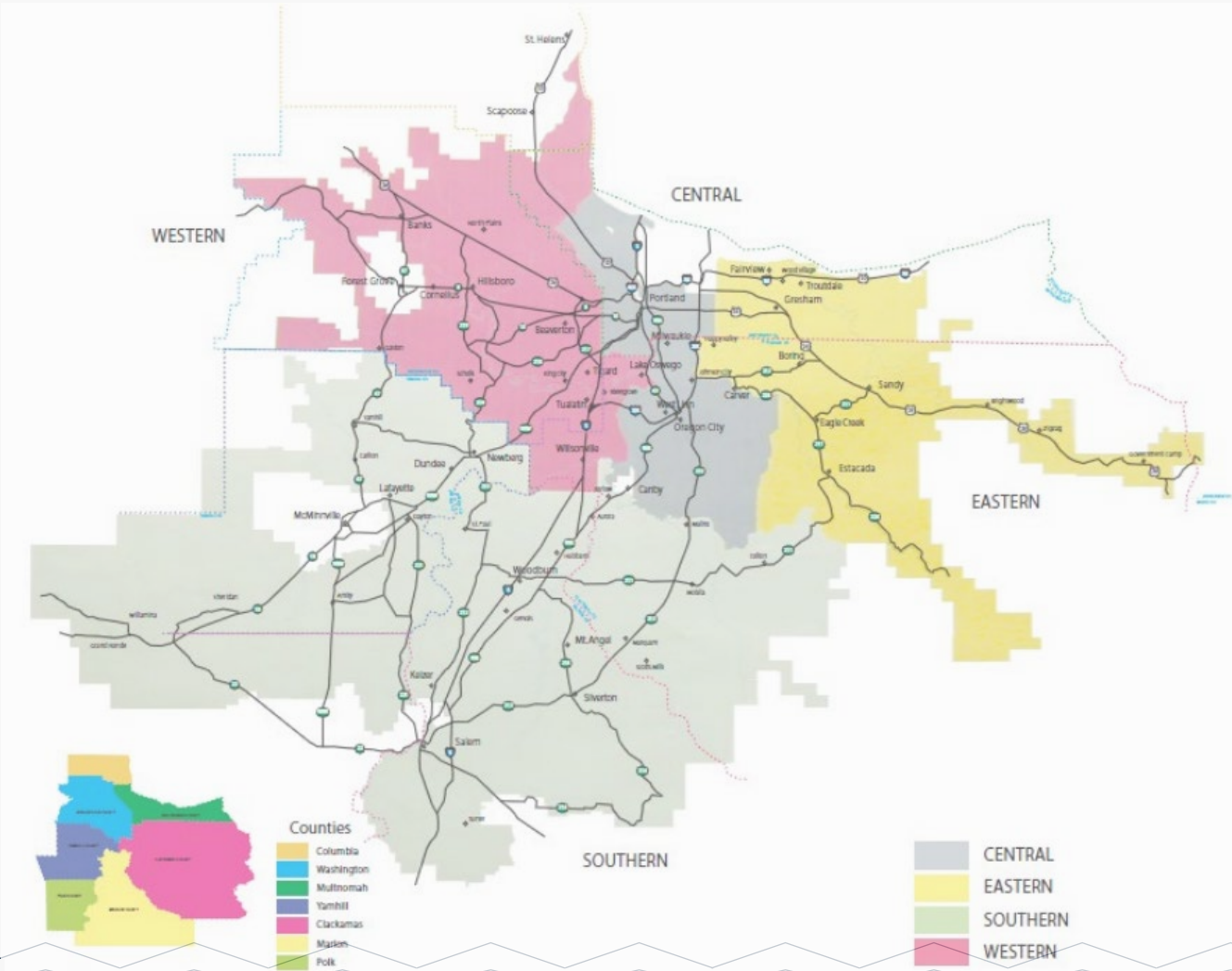
- NorthernGrid planning process
- Ongoing discussions and regional approaches to 2040

PGE TRANSMISSION SYSTEM

PGE serves approximately 4,000 square miles of service area, with 1,630 circuit miles of sub transmission and transmission voltage (ranging from 57-500 kV).

This system is generally used to deliver electricity wheeled via BPA.

Voltage	Circuit Miles
500 kV	268
230 kV	329
115 kV	570
57 kV	463



PGE TRANSMISSION PLANNING STUDY PROCESS

PGE's Transmission System is required to supply projected Firm Transmission Services over the range of forecast system demands.

Studies are performed annually to evaluate where transmission upgrades may be needed to meet the performance requirements per NERC and WECC standards.

Studies incorporate load forecast, forecasted resources, economic studies, public policy, stakeholder feedback.

PGE 2021 TPL-001 Transmission Planning Base Cases

		Study Year	Origin WECC Base Case	PGE Case Name	PGE System Load (MW)
SUMMER	Year One/Two Case	2023	2023 HS3	23 HS PLANNING	4270
	Year Five Case	2026	2026 HS2	26 HS PLANNING	4732
	Year One/Two Sensitivity	2023	2023 HS3	23 HS SENSITIVITY	4570
	Year Five Sensitivity	2026	2026 HS2	26 HS SENSITIVITY	5032
	Long Term Case	2031	2031 HS1	31 HS PLANNING	5192
WINTER	Year One/Two Case	2023-24	2022-23 HW2	23-24 HW PLANNING	4143
	Year Five Case	2026-27	2026-27 HW2	26-27 HW PLANNING	4543
	Year One/Two Sensitivity	2023-24	2022-23 HW2	23-24 HW SENSITIVITY	4443
	Year Five Sensitivity	2026-27	2026-27 HW2	26-27 HW SENSITIVITY	4843
	Long Term Case	2031-32	2030-31 HW1	31-32 HW PLANNING	4905
SPRING	Year One/Two Off Peak Case	2023	2024 LSP1	23 LSP PLANNING	2273
	Year Five Off Peak Case	2026	2024 LSP1	26 LSP PLANNING	2693
	Year One/Two Off Peak Sensitivity	2023	2024 LSP1	23 LSP SENSITIVITY	2273
	Year Five Off Peak Sensitivity	2026	2024 LSP1	26 LSP SENSITIVITY	2693

[Info per PGE OASIS: Local Transmission Plan, December 2021](#)

PGE UPGRADES PLANNED

Transmission planning process is focused on increasing interface with BPA, addressing overdutied assets, and seeking to alleviate future risk.

PGE will increasingly pair the on-system planning process with opportunities to expand transmission reach within BPA's system and across the West.

Project	Purpose	Online
Horizon-Keeler #2 230kV Line	Adds BPA interface capacity	2024
Sunset Bus Reconfiguration	Address overdutied breakers at Sunset substation	2027
Pearl BPA-Sherwood Capacity Upgrade	Increased capacity between Pearl BPA and Sherwood to eliminate thermal overload concerns	2027
Hillsboro Reliability Project	Increased system reliability in Hillsboro area, address overdutied breakers at Orenco Substation	2027
Willamette Valley Resiliency Project	Increased system reliability in Willamette Valley area	2027
Murrayhill-Sherwood #1 and #2 230kV Reconductor	Increase 230kV line capacity to eliminate thermal overload concerns	2027
Beaverton-Tektronix and Murrayhill-Reedville 115kV Reconductor	Increase capacity to eliminate thermal overload concerns	2027
Horizon-Keeler BPA #1 230kV Reconductor	Increase capacity to eliminate thermal overload concerns	2028
Dayton Reliability Project	Increase reliability in McMinnville area	2028
Evergreen-Harborton 230kV Reconductor	Increase capacity to eliminate thermal overload concerns	2029
SE Portland Conversion	Increased capacity in southeast Portland area	2029
Evergreen Third Bulk Power Transformer	Eliminate thermal overload concerns on the Horizon bulk power transformers	2030
Evergreen-Sherwood 230kV Line	Address loading concerns by adding another 230 kV source	TBD

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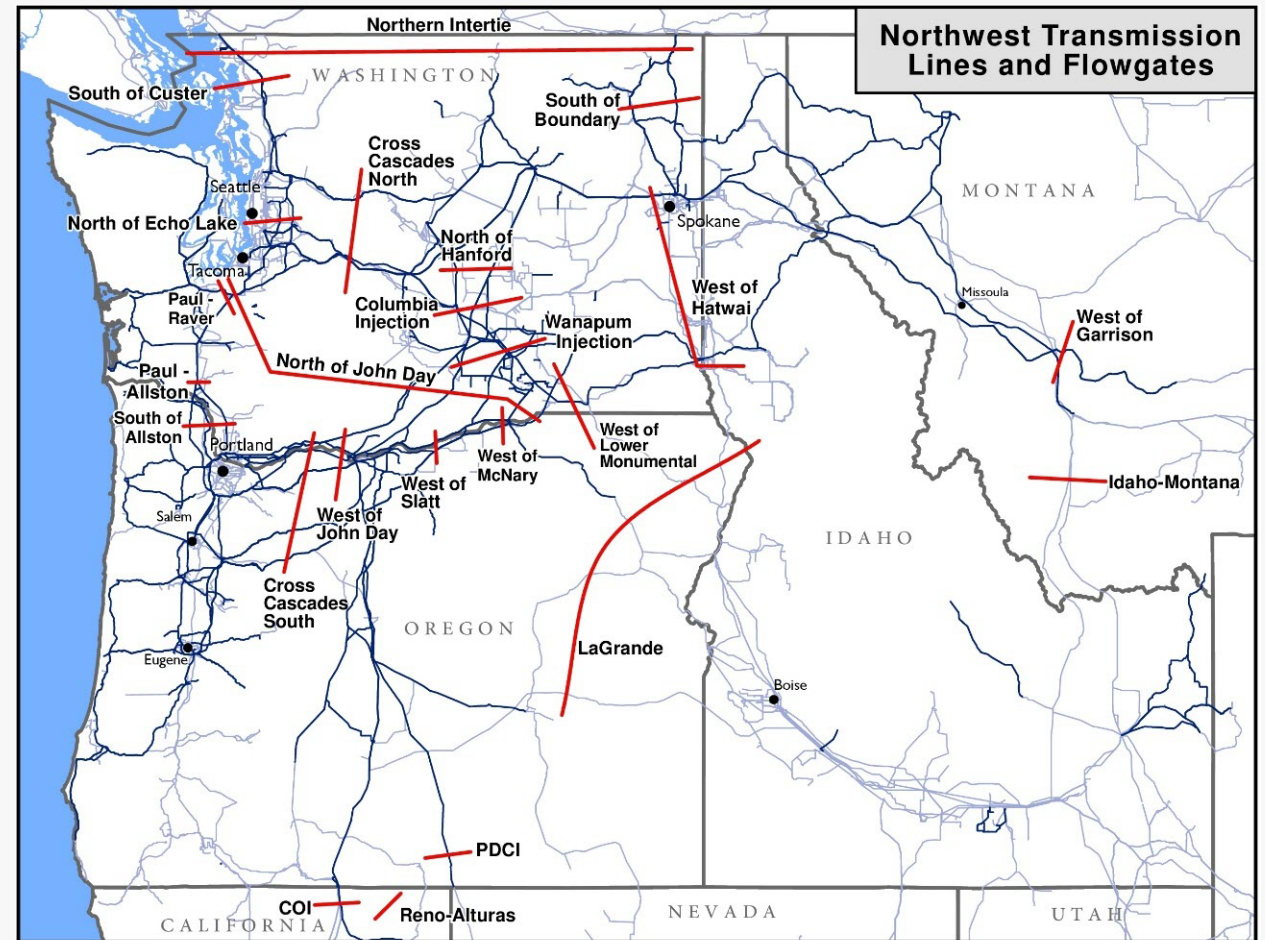
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BPA FLOWGATES

BPA manages 18 flowgates, which govern the amount of power that can reliably be transferred over the bulk transmission system.

Nearly all generation locations in the Northwest impact the South of Allston flowgate when delivering to PGE.

During September 20, 2022 ATC methodology update, BPA noted that they are at **near full-subscription all over the existing BPA system.**



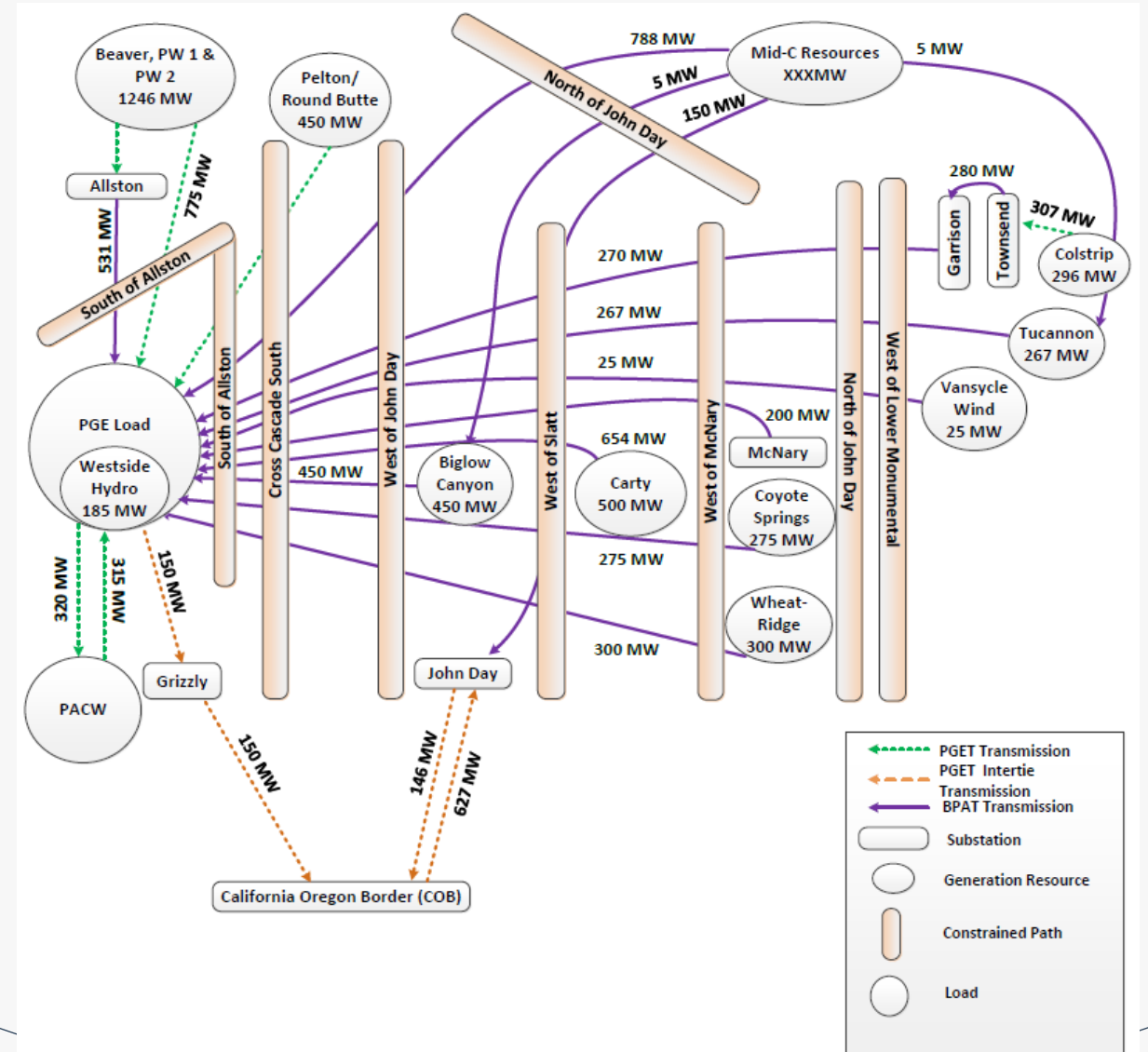
GIS Analyst: RLW Map Production Date: 6/23/2015

PGE MERCHANT RIGHTS

PGE relies heavily on BPA transmission to serve load. BPA import capability calculated in aggregate across the BPA/PGE interface. PGE forecasts extremely limited ability to increase flowgate capacity.

PacifiCorp West (PACW) to PGE interface is contractually constrained and increasing interface capacity is challenging.

In this IRP, PGE is examining what options exist to increase the ability to import through BPA or through other paths.



BPA AVAILABLE TRANSFER CAPABILITY

BPA's current available transfer capability is fully subscribed in key paths for PGE:

- South of Allston
- Cross Cascades South
- Raver-Paul

In their September 20, 2022, TSEP update, BPA noted increased resource diversity and an increasing need to rely on conditional firm service.

		LONG-TERM FIRM AVAILABLE TRANSFER CAPABILITY (ATC)									
PATH NAME	TTC MW	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
South of Allston N>S	2,115	1,787	223	212	200	193	185	178	170	162	154
Cross Cascades North E>W	10,250	224	219	271	352	436	519	601	683	764	844
West of Lomo E>W	4,200	648	304	306	306	302	305	307	309	182	184
Cross Cascades South E>W	7,500	418	189	142	122	103	89	76	50	37	24
North of Hanford N>S	4,450	3,594	912	935	1,038	1,057	1,075	1,098	1,119	1,138	1,156
Raver-Paul N>S	1,450	602	49	47	44	36	33	30	27	24	20
West of McNary E>W	5,230	1,837	1,790	1,798	1,809	1,824	1,817	1,806	1,765	1,754	1,743
West of Slatt E>W	4,670	1,615	990	1,006	1,008	1,008	994	982	970	941	929
West of John Day E>W	4,530	454	241	135	121	96	73	50	11	0	0
South of Custer N>S	900	908	0	0	0	0	0	0	0	0	0
West of Hatwai E>W	3,650	2,092	84	93	101	109	117	125	133	0	0
North of Echo Lake S>N	2,800	0	0	0	0	6	45	85	125	165	204
PATH NAME	TTC MW	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Northern Intertie N>S	2,150	65	65	65	65	65	65	65	65	65	65
Northern Intertie S>N	1,120	0	0	0	0	0	0	0	0	0	0
Montana Intertie E>W	1,930	112	112	112	144	144	144	144	144	144	144
John Day Wind Gen	1,255	224	224	224	174	174	174	174	174	174	174
Rock Creek Wind Gen	1,200	301	301	301	301	301	302	302	302	302	389
West of Garrison E>W	1,618	0	0	0	0	0	0	0	0	0	0
West of Garrison W>E	931	120	279	278	276	275	275	275	275	275	275

Pending queue per BPA data accessed 8/25/2022

BPA ATC MINUS PENDING QUEUE

When pending queue is considered against available ATC, the transmission capacity deficit across the BPA system is evident.

		LONG-TERM FIRM AVAILABLE TRANSFER CAPABILITY (ATC) LESS PENDING QUEUE									
PATH NAME	TTC MW	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
South of Allston N>S	2,115	-1,162	-379	-576	-986	-1,250	-1,456	-1,572	-1,668	-1,880	-1,993
Cross Cascades North E>W	10,250	-2,419	-2,146	-4,060	-5,025	-5,711	-5,899	-6,463	-6,523	-6,501	-6,501
West of Lomo E>W	4,200	445	-96	-94	-323	-519	-516	-514	-512	-639	-637
Cross Cascades South E>W	7,500	-1,220	-2,266	-3,946	-5,270	-5,884	-6,813	-7,823	-7,885	-8,133	-8,133
North of Hanford N>S	4,450	-194	548	587	219	215	233	256	277	296	314
Raver-Paul N>S	1,450	48	-166	-268	-557	-700	-753	-825	-931	-986	-1,074
West of McNary E>W	5,230	985	547	-382	-1,532	-1,739	-1,980	-1,991	-2,032	-2,043	-2,043
West of Slatt E>W	4,670	663	523	176	-505	-932	-1,055	-1,067	-1,079	-1,108	-1,120
West of John Day E>W	4,530	-231	-858	-1,592	-2,523	-3,157	-3,612	-4,375	-4,456	-4,787	-4,787
South of Custer N>S	900	-1,728	-1,057	-1,058	-970	-972	-973	-974	-975	-976	-977
West of Hatwai E>W	3,650	-265	-416	-420	-1,022	-1,026	-1,018	-1,010	-1,002	-1,238	-1,230
North of Echo Lake S>N	2,800	-500	-58	-621	-912	-1,154	-1,114	-1,114	-1,074	-1,034	-995
PATH NAME	TTC MW	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Northern Intertie N>S	2,150	65	-385	-385	-385	-385	-385	-385	-385	-385	-385
Northern Intertie S>N	1,120	0	-50	-50	-50	-50	-50	-50	-50	-50	-50
Montana Intertie E>W	1,930	112	112	112	144	144	144	144	144	144	144
John Day Wind Gen	1,255	149	149	99	99	99	99	99	99	99	99
Rock Creek Wind Gen	1,200	201	176	176	176	176	177	177	177	264	264
West of Garrison E>W	1,618	-764	-764	-1,459	-1,459	-1,490	-1,490	-1,490	-1,490	-1,490	-1,490
West of Garrison W>E	931	-573	-410	-315	-24	-25	-25	-25	-25	-25	-25

Pending queue per BPA data accessed 8/25/2022

IRP Roundtable 9/28/2022

25

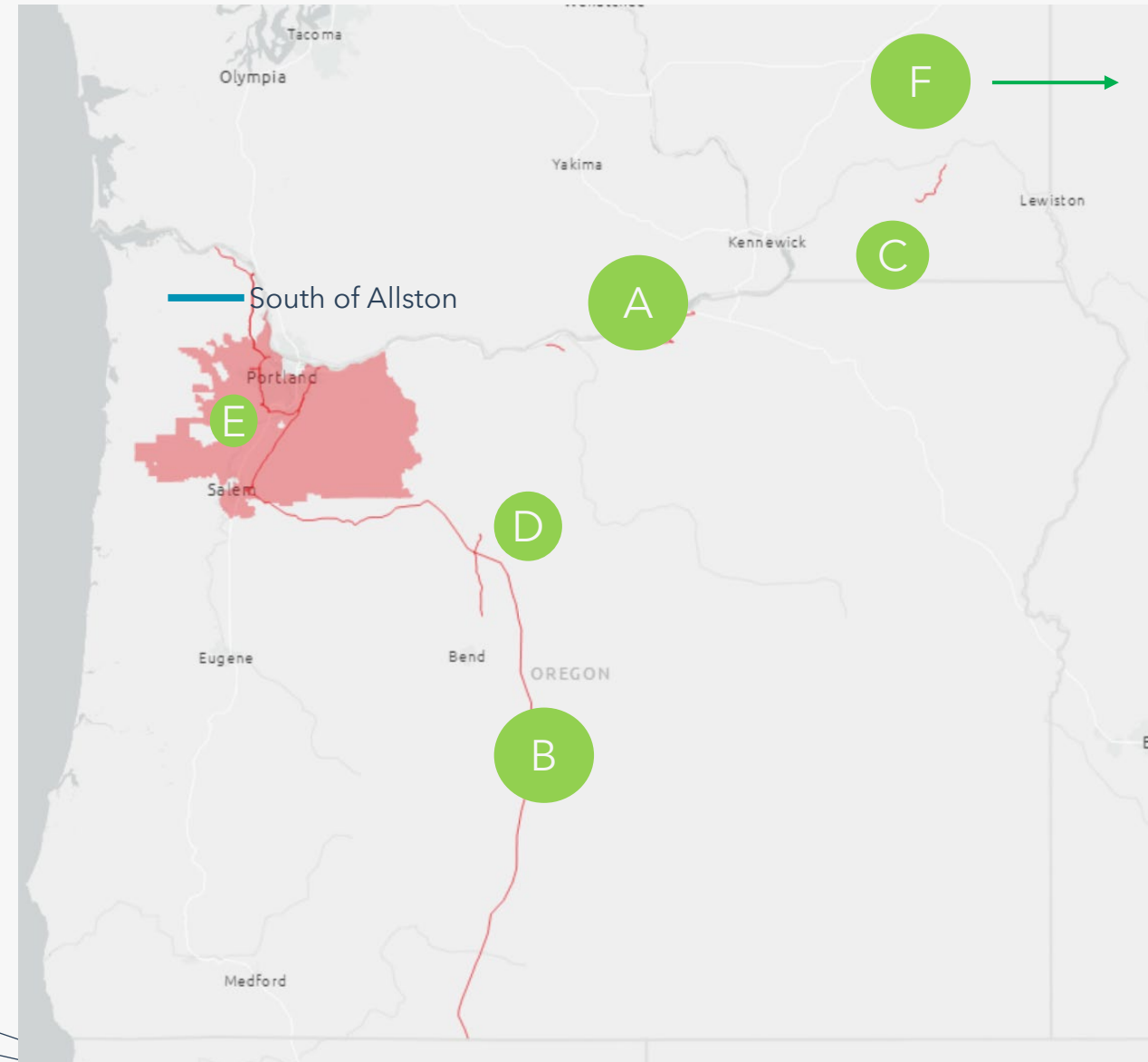
TRANSMISSION SERVICE REQUESTS TO PGE'S SYSTEM

- A. Gorge wind** – 190 MW confirmed, 248 MW study (2019-2021 TSEP)
- B. Christmas Valley solar** – 490 MW confirmed (2019-2021 TSEP)
- C. SE Washington wind** – 150 MW study (2020 TSEP)
- D. Maupin solar** – 140 MW study (2019 TSEP)
- E. Willamette Valley** – 10 MW confirmed (2021 TSEP)
- F. Montana Renewables** – 100 MW study (2016 TSEP)

3,790 MW of renewables to PGE as part of 2022 TSEP, including 2,200 MW of offshore wind.

All 2022 TSEP requests are conditioned on BPA system upgrades - additional service cannot be granted without significant upgrades to South of Allston and Raver-Paul.

Needed upgrades unlikely before 2030.



Map outline courtesy S&P Capital IQ

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- 2030 system needs and climate zone diversity
- Assessment of regional projects that could provide benefit

Key finding: PGE must engage with regional peers to ensure sufficient transmission rights to meet the 2030 decarbonization targets. Expanding transmission reach beyond BPA system should be analyzed to determine risk/benefit.

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Regional planning toward 2040

- NorthernGrid planning process
- Ongoing discussions and regional approaches to 2040

PGE's 2030 Clean Energy Targets

8.1
MMTCO₂e
(2010-2012
baseline)

What we're already doing

- ✓ Boardman Closure (-518 MW)
- ✓ 2021 RFP (+375-500 MW)
- ✓ Green Future Impact (+750 MW)
- ✓ Douglas PPA (+160 MW)
- ✓ Hydro Renewals (+224 MW)
- ✓ Energy Efficiency (+220 MW)

2021 emissions - 6.24
MMTCO₂e

What we're planning

- ☐ Clean energy through future RFPs
- ☐ Flexible loads
- ☐ Community renewables and resiliency
- ☐ Energy Storage
- ☐ Regional Partnerships
- ☐ Colstrip exit

Reduction of 80% by 2030

1.62
MMTCO₂e

Baseline
Emissions

Known
Actions

Planned
Actions

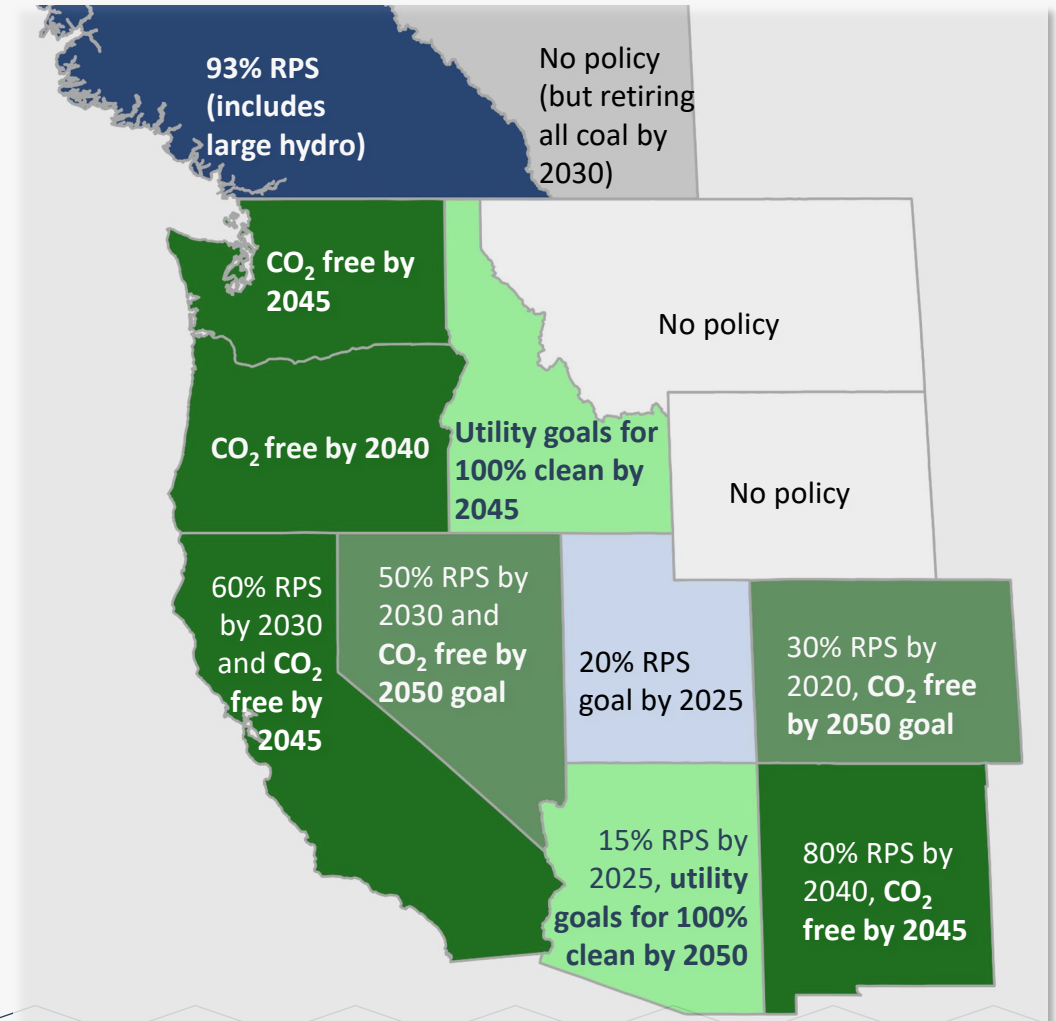
2030 Emissions
Target

DECARBONIZATION IN THE WEST

Decarbonization efforts throughout the West will lead to unprecedented generation and transmission development.

States across the West have a commitment to decarbonize electricity supply.

States with no policy are served by utilities that have publicly communicated their intent to decarbonize.



REGIONAL VARIABLE ENERGY RESOURCE NEED

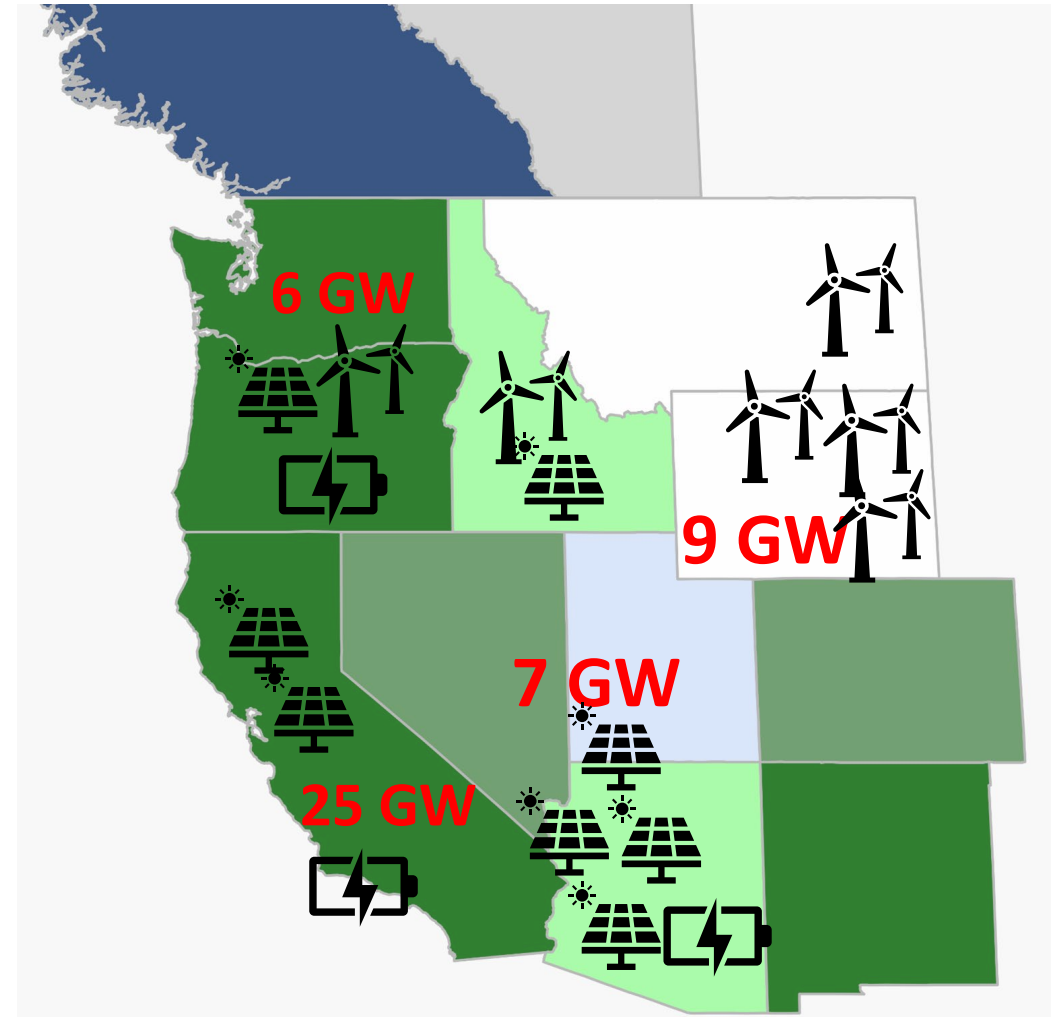
Pacific Northwest to add approximately 6 GW of variable resources and 3 GW of supporting capacity by 2035

CAISO to add 25 GW of variable energy resources by 2032

Desert Southwest to add 7 GW of variable resources by 2040

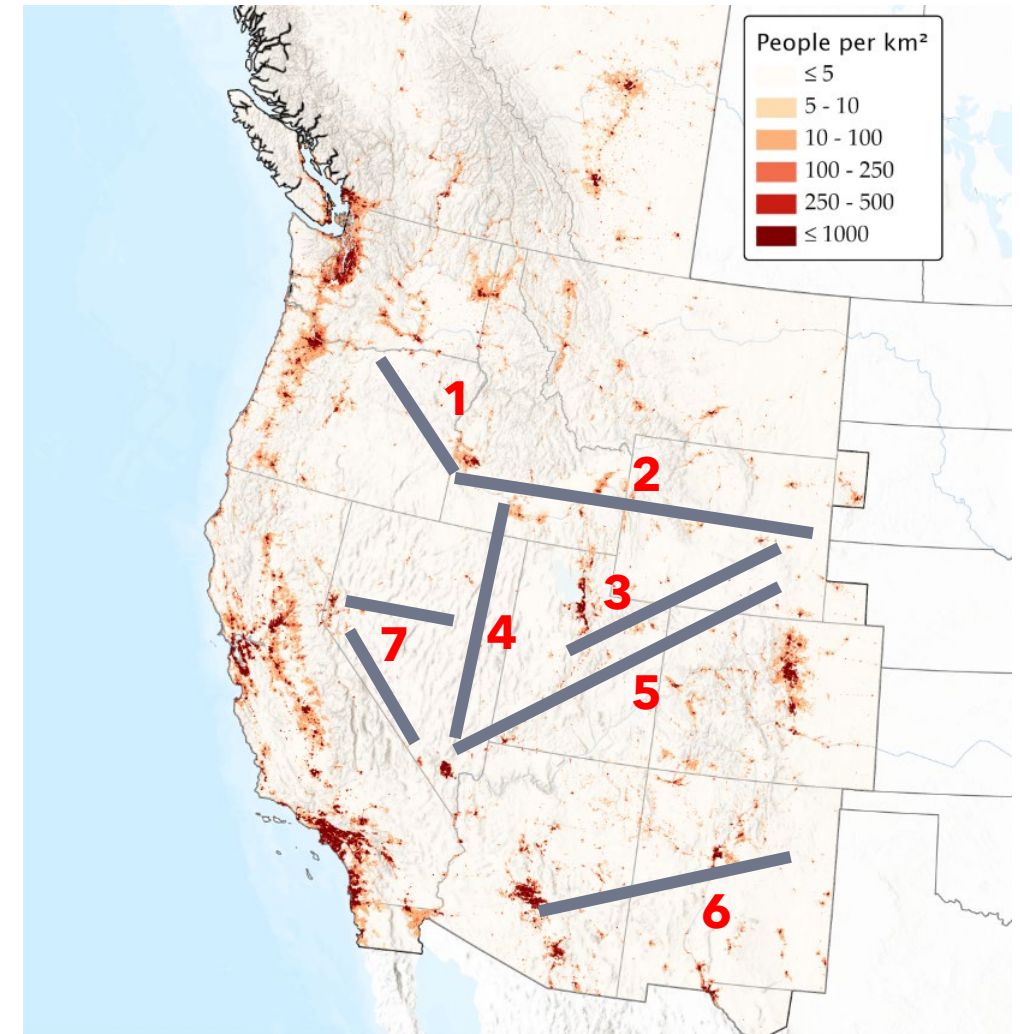
Intermountain West to add 9 GW of variable resources and 5 GW of new non-emitting capacity by 2040

Region-wide, the West could realize significant climate-zone diversity for new clean resources, and partnerships could promote affordability and reliability for PGE customers as we continue to add resources locally



INTER-REGIONAL INFRASTRUCTURE BUILD

- 1 Boardman to Hemingway** 500 kV transmission line that runs 290 miles across Central Oregon and Eastern Idaho terminating near Boardman, OR.
- 2 Gateway West** Approximately 1,000 miles of new high-voltage transmission that runs from Windstar, Wyoming to Hemingway, Idaho.
- 3 Gateway South** provides additional transmission from Aeolus, WY to Mona, UT.
- 4 SWIP N/DesertLink/OnLine** will provide 1,000 MW of bidirectional capacity from the Las Vegas area to Midpoint, ID.
- 5 TransWest Express** 3,000 MW of capacity from Rawlins, WY to Mead (Las Vegas)
- 6 SunZia** SW 4,500 MW of East to West transmission from New Mexico to Arizona, terminating just south of Phoenix
- 7 GreenLink** Nevada represents 4,000 MW of transfer capability between Las Vegas, Reno, and Robinson Summit (terminating near SWIP N).



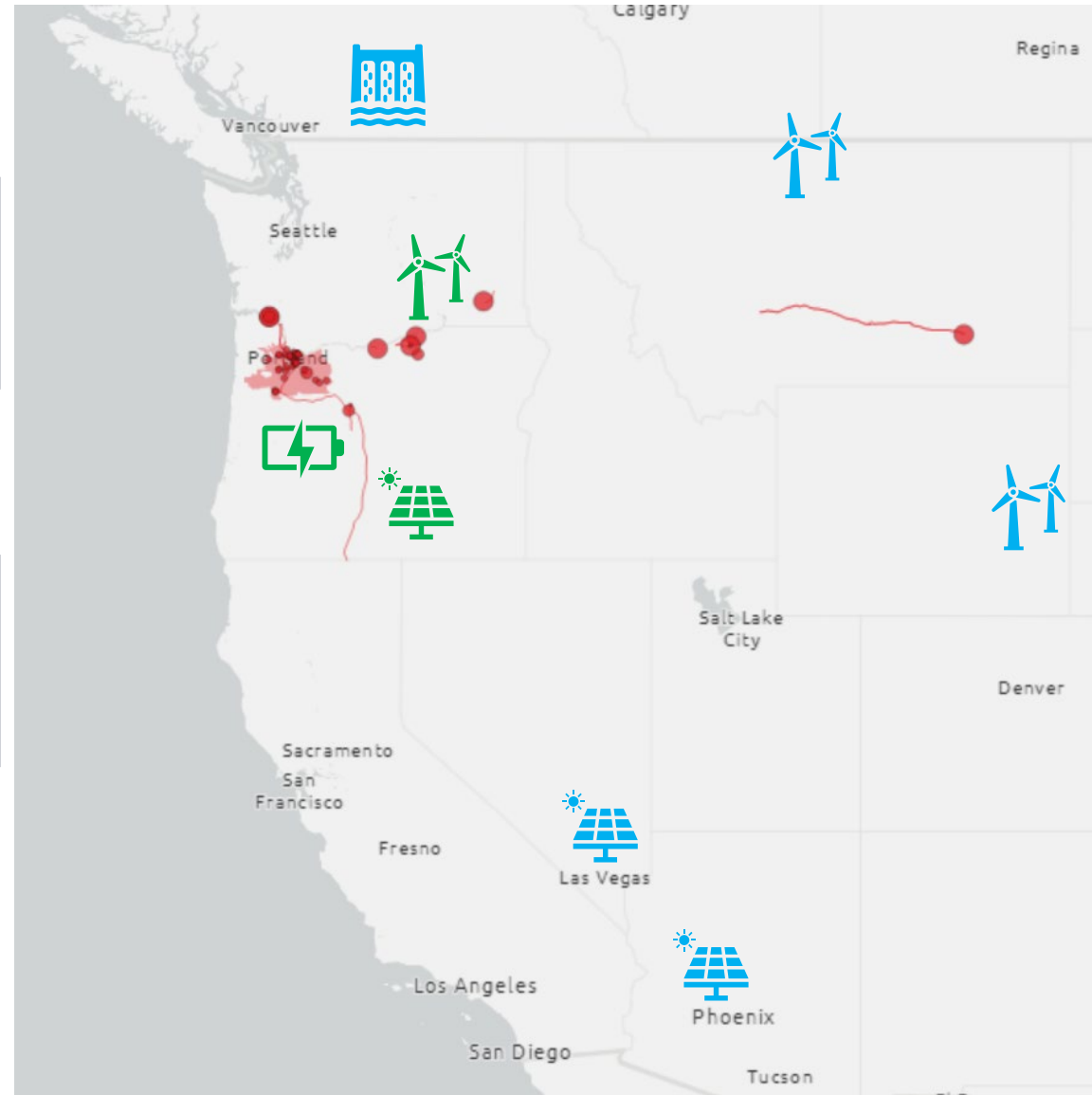
Map outline courtesy WECC

ENSURING PRUDENT INVESTMENT

The IRP will include transmission as a capacity expansion option as part of modeling.

Where we currently analyze the proxy value of resources within PGE's footprint, we will now also evaluate the opportunities that could be created from expanding PGE's transmission network

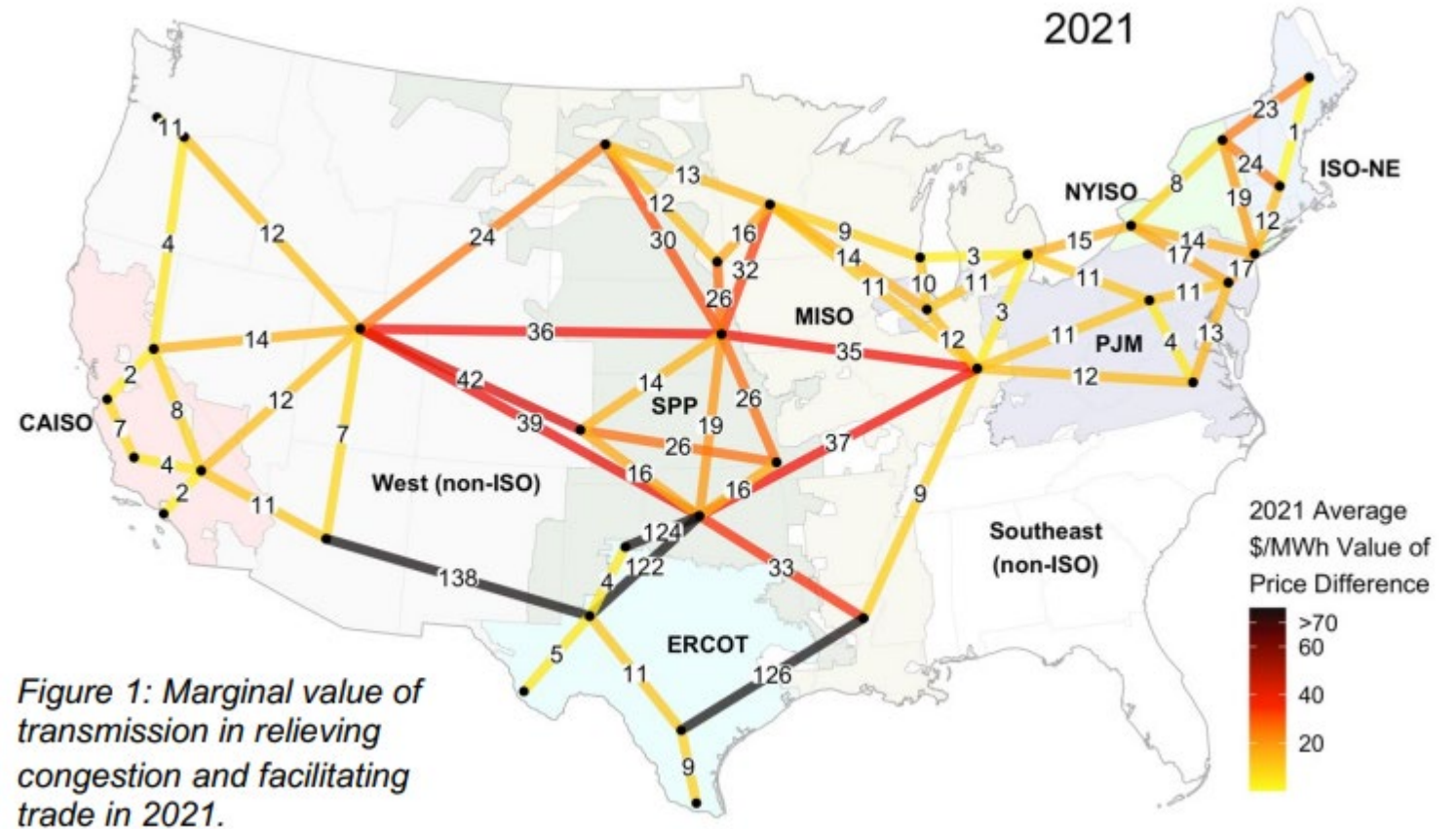
The difference in value will help PGE both continue to add local resources in Oregon while exploring whether transmission could provide value for customers.



VALUE OF REGIONAL ACCESS

LBNL's recent study shows significant value in inter-regional transmission resources derived from relieving congestion.

PGE will additionally model the difference in value for multiple climate zones, with the delta informing potential transmission value within the portfolio.



Graphic courtesy Lawrence Berkely National Lab

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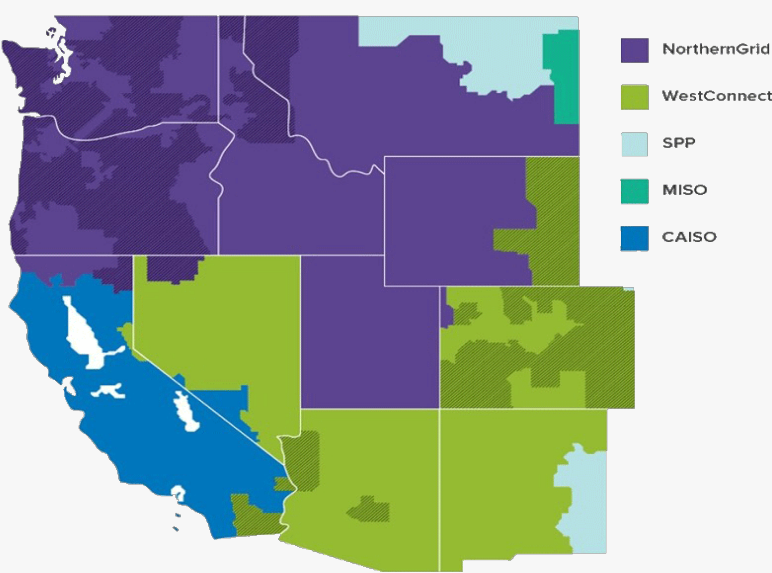
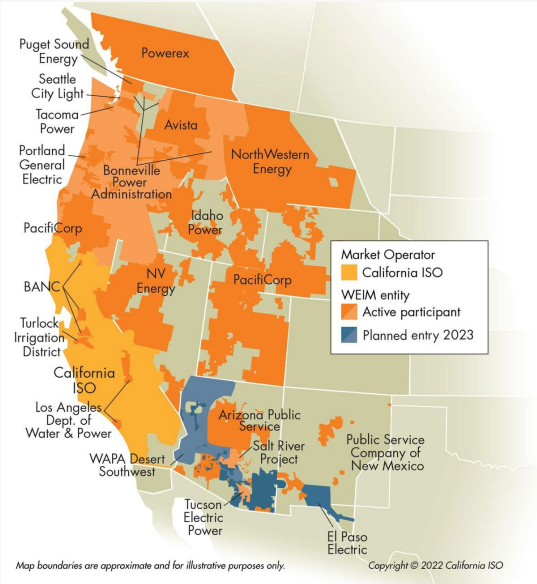
Regional planning toward 2040

- NorthernGrid planning process
- Ongoing discussions and regional approaches to 2040

Key finding: PGE must work with regional entities to ensure sufficient transmission capability to operate a carbon-free system beginning in 2040.

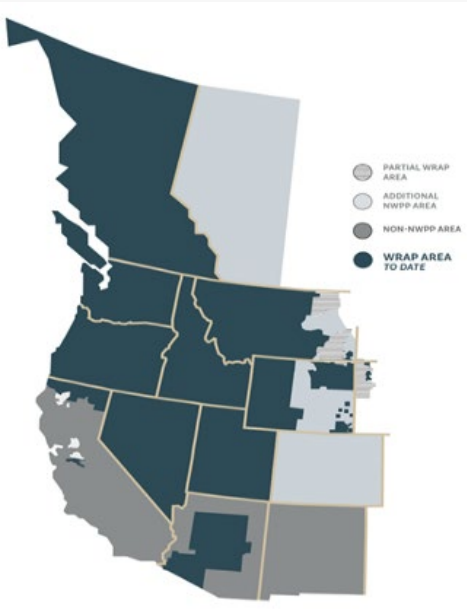
CURRENT REGIONAL EFFORTS

*Markets!
(WEIM)*



*Transmission Planning!
(NorthernGrid)*

*RA!
(WRAP)*

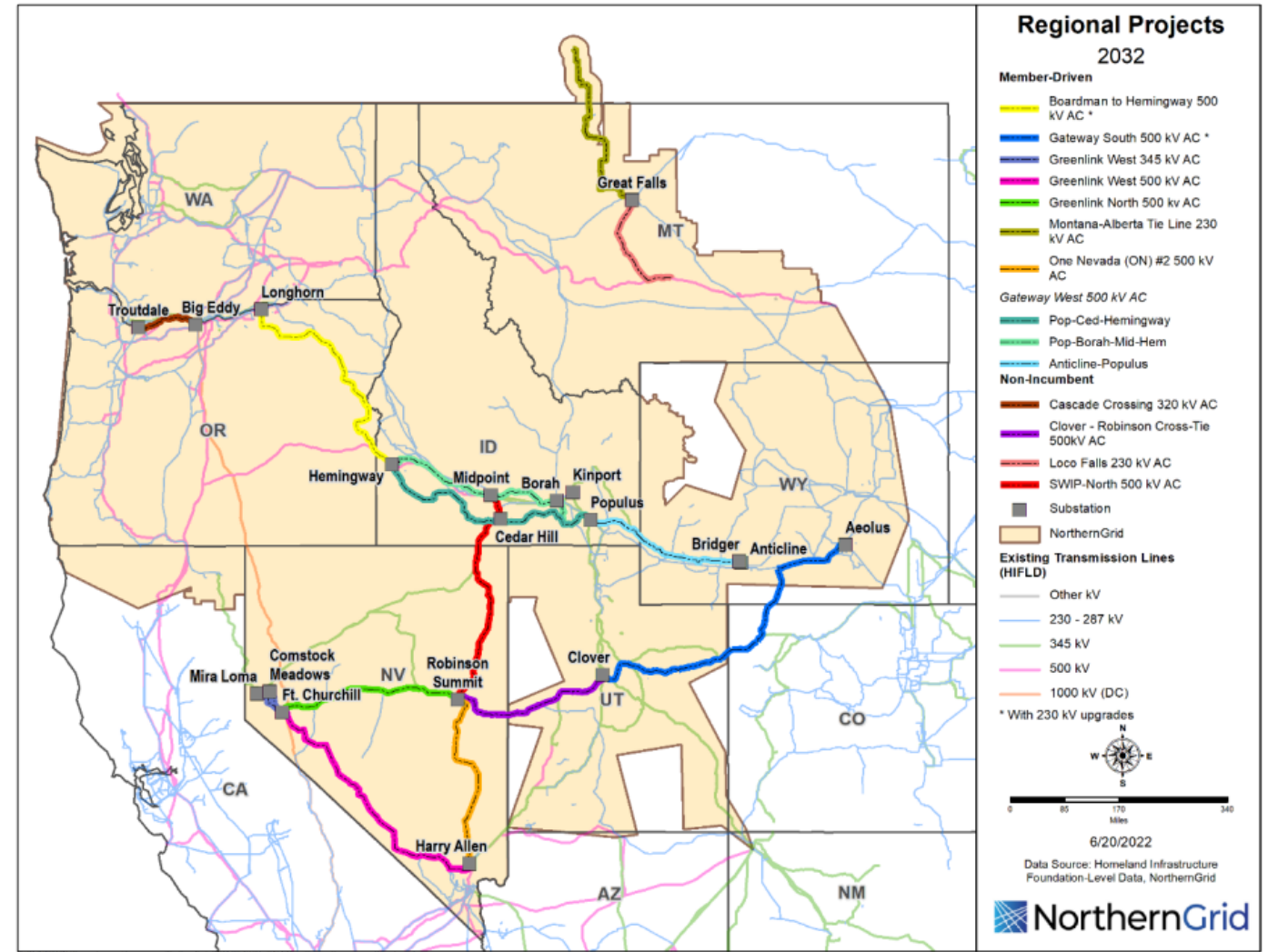


NORTHERNGRID REACH & PROJECTS

NorthernGrid has 14 members with service territory in 8 western states, mostly located in the Pacific NW and Intermountain regions.

Membership is comprised of 1 federal entity, 7 IOUs, and 6 municipally owned public utilities.

In the current biennial planning cycle, both members and independent transmission developers have submitted 17 projects for evaluation.



QUESTIONS/ DISCUSSION?



NEXT STEPS

A recording from today's webinar will be available in one week

Upcoming Roundtables:

- October TBD
- November 16
- December 15



THANK YOU

CONTACT US AT:
IRP@PGN.COM

TSEP TSR Summary

TSEP	Resource Zones	PGE POD	Start Date	Total MW Requested	Status	BPA Path	Upgrade(s) Required BPA 2022 TSEP	(Cost \$M)	Estimated Energization Date
2016	Montana Renewable	Pearl_230	2026	100	Study	1.West of Garrison E>W	1. M2W	1.\$1.2B	1. 2030
2019	Christmas Valley Solar	Pearl_230	2020-2025	340	Confirmed	N/A	N/A	N/A	N/A
2019	Gorge Wind	PGE_CNTGS	2019-2020	90	Confirmed	N/A	N/A	N/A	N/A
2019	Maupin		2021	140	Study	South of Allston & Raver-Paul	1. Schultz-Wautoma Series Capacitor Project	N/A	2024
2020	Gorge Wind	PGE_CNTGS	2023	100	Confirmed	N/A	N/A	N/A	N/A
2020	Gorge Wind	PGE_CNTGS	2020-2023	88	Study	South of Allston & Raver-Paul	1. Schultz-Wautoma Series Capacitor Project 2. Raver-Paul Series Capacitor Project 3. Double Check if there is a Jones Canyon Subgrid issue	N/A	2024
2020	SE WA Wind	Pearl_230	2021	150	Study	South of Allston & Raver-Paul	1. Schultz-Wautoma Series Capacitor Project 2. Raver-Paul Series Capacitor Project	N/A	2025
2021	Willamette Valley	PGE_CNTGS	2022	10	Confirmed	N/A	N/A	N/A	N/A

CHRISTMAS VALLEY SOLAR RESOURCE ZONE & UPGRADES

BPA path	Upgrades required	Cost estimate	COD
South of Allston and Raver-Paul	Schultz-Wautoma Series Capacitor Project	N/A	2024
South of Allston	Ross-Rivergate 230 kV Rebuild	~\$110M	2030
Cross Cascades North	Cross Cascades North Reinforcement	~\$200M	2030
Cross Cascades South	Big-Eddy-Chemawa 500 kV rebuild	~\$233M	2030
Subgrid Portland-Pearl-Keeler	Pearl-Sherwood-McCloughlin reinforcement	~\$10M	TBD
Subgrid - Central Oregon South	Central Oregon South 500 kV project	~\$380M	2033
Third-party impact: PacifiCorp PGE Intertie	TBD	TBD	TBD
Third-party impact: PacifiCorp South Oregon	TBD	TBD	TBD
Third-party impact: PGE North of Sherwood	TBD	TBD	TBD

GORGE WIND RESOURCE ZONE AND UPGRADES

BPA path	Upgrades required	Cost estimate	COD
South of Allston and Raver-Paul	Schultz-Wautoma Series Capacitor Project	N/A	2024
South of Allston	Ross-Rivergate 230 kV Rebuild	~\$110M	2030
Cross Cascades North	Cross Cascades North Reinforcement	~\$200M	2030
Cross Cascades South	Big-Eddy-Chemawa 500 kV rebuild	~\$233M	2030
Subgrid Portland-Pearl-Keeler	Pearl-Sherwood-Mcloughlin reinforcement	~\$10M	TBD
Raver-Paul	BPA Chehalis to Cowlitz tap 230 kV Rebuild	~\$35M	2033
Third-party impact: PGE North of Sherwood	TBD	TBD	TBD

SE WASHINGTON WIND RESOURCE ZONE & UPGRADES

BPA path	Upgrades required	Cost estimate	COD
South of Allston and Raver-Paul	Schultz-Wautoma Series Capacitor Project	N/A	2024
South of Allston	Ross-Rivergate 230 kV Rebuild	~\$110M	2030
Cross Cascades North	Cross Cascades North Reinforcement	~\$200M	2030
Cross Cascades South	Big-Eddy-Chemawa 500 kV rebuild	~\$233M	2030
Subgrid Portland-Pearl-Keeler	Pearl-Sherwood-Mcloughlin reinforcement	~\$10M	TBD
Raver-Paul	BPA Chehalis to Cowlitz tap 230 kV Rebuild	~\$35M	2033
Third-party impact: PGE North of Sherwood	TBD	TBD	TBD

OFFSHORE WIND RESOURCE ZONE & UPGRADES

BPA path	Upgrades required	Cost estimate	COD
South of Allston and Raver-Paul	Schultz-Wautoma Series Capacitor Project	N/A	2024
South of Allston	Ross-Rivergate 230 kV Rebuild	~\$110M	2030
Cross Cascades North	Cross Cascades North Reinforcement	~\$200M	2030
Cross Cascades South	Big-Eddy-Chemawa 500 kV rebuild	~\$233M	2030
Subgrid South Oregon Coast	Southern Oregon Coast Reinforcement Project	~\$900M	2033
Third-party impact: PGE Santiam-Bethel and PGE North of Sherwood	TBD	TBD	TBD

MONTANA RENEWABLE RESOURCE ZONE & UPGRADES

BPA path	Upgrades required	Cost estimate	COD
West of Garrison East to West	M2W	\$1.2B	2030