

Integrating Battery Energy Storage into the Western Energy Imbalance Market

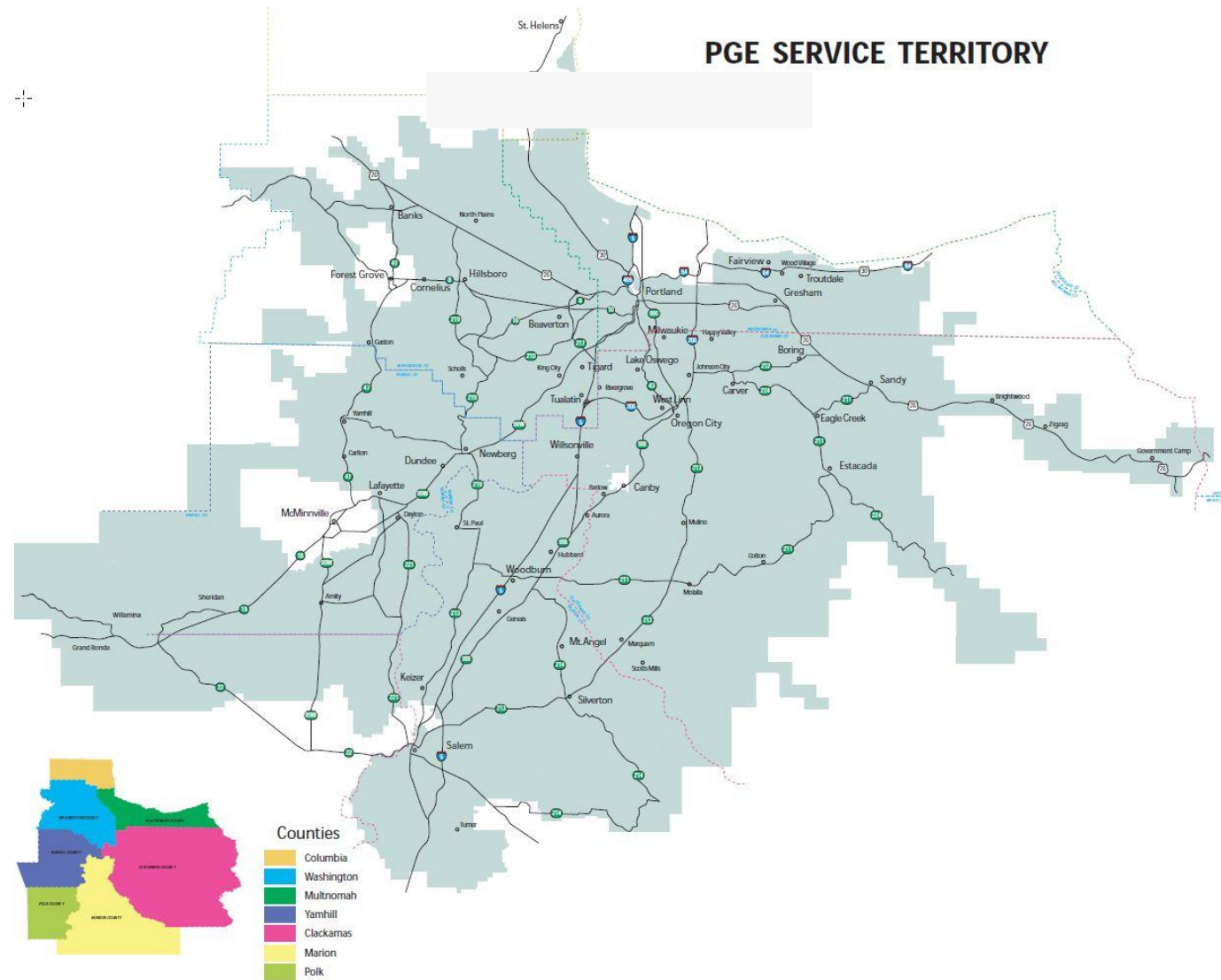
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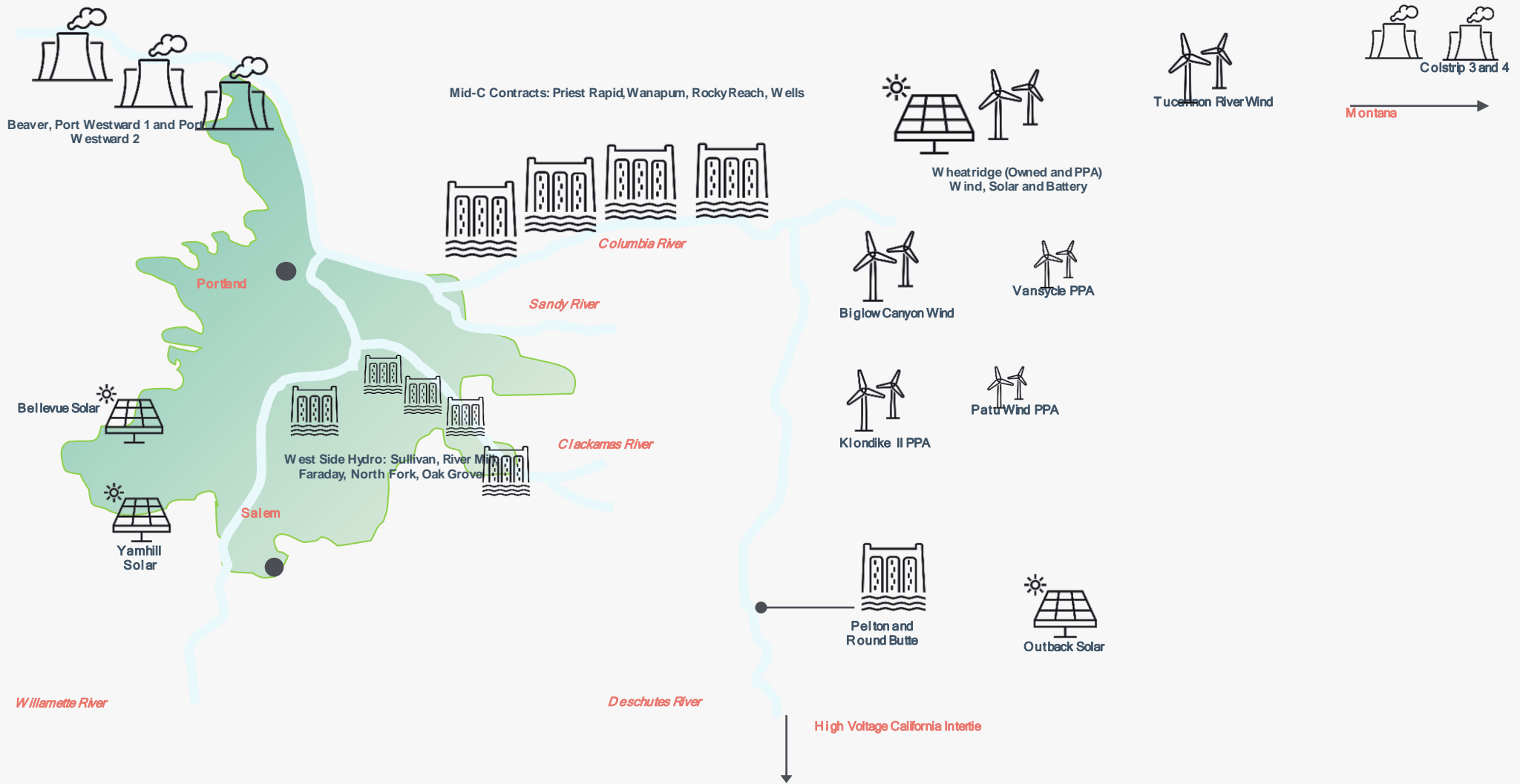
March, 2024 WEIM Regional Issues Forum



PGE At a Glance

- Population of ~ 1.9 Million
- ~ 4,000 Square Miles
- 4,447 MW 2021 Peak Load
- 27,457 Distribution Circuit Miles
- 1,167 Transmission Circuit Miles



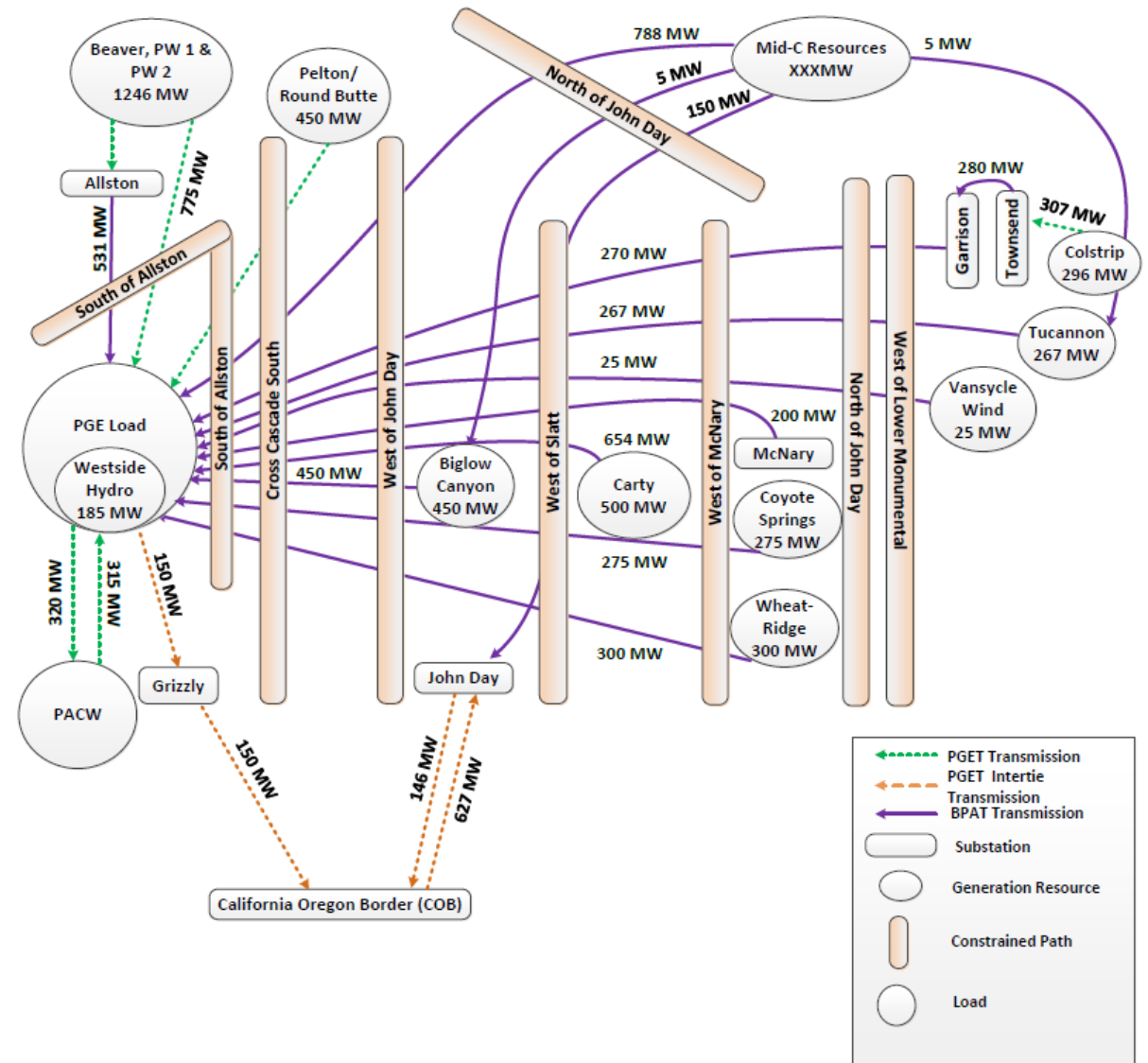


PGE import capability across BPA flowgates

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.

PGE is working with BPA to identify short-term options (before 2030) to increase the ability to import through BPA or through other paths.



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PGE enables customers to shift their power usage from peak times while providing clean, reliable, affordable energy



Virtual Power Plant

The orchestration of Distributed Energy Resources and Flexible Load, through technology platforms, to provide grid and power operations services.

Customer Programs	Distributed Solar	Distributed Thermal	Distributed Storage	Utility Storage
250 MW+	600 MW+	300 MW+	300 MW+	600 MW+

...grouped and dispatched to a substation-level, variable locational price via...

Technology Platforms

To achieve a 25% peak usage offset while serving 100% of customer energy needs
PGE is targeting 2,000 VPP-enabled megawatts by 2030

PGE's Storage Portfolio



Transmission Connected BESS

Constable BESS	75 MW	4-hour	Energizing in January 2025
Seaside BESS	200 MW	4-hour	Energizing in June 2025
Sundial BESS	200 MW	4-Hour	Energizing December, 2024
Wheatridge BESS	30 MW	4-Hour	Energized in November, 2020

Distribution Connected BESS

Salem Smart Power Center	5 MW	15-min	Energized in 2013, repower in Q4 2025
Coffee Creek BESS	17 MW	2-hour	Energizing in September 2024
Port Westward 2 BESS*	5 MW	2-hour	Energized in 2021

*distribution voltage but located at a generating facility

Behind the Meter BESS

Beaverton Public Safety Center	250 kW	4-hour	Energized in 2021
Anderson Readiness Center	500 kW	2-hour	Energized in 2023
Daimler Electric Island	750 kW	1.33-hour	Energizing in Q2 2024
PGE Operations Center	2 MW	2-hour	Energizing in Q2 2024

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Market Integration - Storage

PGE is currently bringing on a much smaller project that will be PGE's first battery storage project implemented with EIM.

- Coffee Creek is a 17 MW, 34 MWhr battery interconnected at the distribution level (13 kV), with a target energization/integration date this summer.
- It will be the test case for the three bigger projects.

General Approach:

- All storage projects are expected to be participating resources.
- The projects will be self-scheduled rather than bid in.
- After operating for a time, we will begin bidding them in.

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Market Integration - Storage

Integration Questions

- CAISO current requirements are focused on storage projects within the CAISO BA and do not address WEIM entities.
- New Resource Integration (NRI)
 - Resource Types are not always intuitive: there is a Battery resource type, but it does not accommodate charging.
- The Real-Time Market horizon is only looking ~4.5 hours in advance -- Difficult to maintain state of charge or manage battery cycle limits in that window.
- CAISO State of Charge Management is built into the process. PGE still determining how it will work for PGE and if any adjustments are needed.
- CAISO also has cycling tools available, but difficult to determine how it will work for PGE.
- Until such details are worked out and understood, PGE will be self-scheduling its storage resources.

Operational Benefits

- All PGE owned and contracted BESS projects are intended to be operated as part of PGE's Virtual Power Plant (VPP) platform.
- PGE will have full dispatch control of all three projects.
- Portfolio benefits include:

Resource Adequacy

Equivalent reliability contribution to approximately 300 MW gas turbines in 2025

Energy Arbitrage

Reduces power costs based on energy shaping value and market optimization

Ancillary Services and Integration

Increases portfolio value by reducing costs to meet frequency response, regulation, contingency reserve requirements and variable resource (wind, solar) integration (also enables thermal and hydro resources to provide higher value services in the market)