Reliability and *Economics* of New Resources to Meet *Clean Energy* Transformation Act Standards at PSE

Cuong Nguyen, *PhD, IEEE Senior Member*

Business Development Analytics, Puget Sound Energy

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cuong.nguyen@pse.com

Puget Sound Energy

- Service area: 6,000 square miles, primarily in Western Washington
- Over 1.2 million electric customers
- Nearly 900,000 natural gas customers
- 3,300 employees
- 6,656 MW of generation capacity (owned, operated, or under long-term contract)[1]
- 23,700 miles electric distribution system; 2,900 miles electric transmission[2] system
- 12,955 miles natural gas pipeline; 13,351 miles natural gas service lines

Data as of December 2022

1. Puget Energy Form 10K, Annual Report for the fiscal year ended December 31, 2022, page 15. https://www.pugetenergy.com/pages/filings.html
2. Includes jointly owned transmission

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Washington has enacted some of the most ambitious climate policies in the country

Clean Energy Transformation Act
(SB 5116)

Passed in 2019 and commits WA state to a carbon-neutral electric supply by 2030 and 100% clean electricity by 2045

Climate Commitment Act
(SB 5126 - "Cap & Invest")

Passed in 2021 and establishes a program aimed at capping and reducing GHGs from the largest emitting sources and industries, to work towards the state's greenhouse gas limits set in state law

Clean Fuel Standard
(HB 1091)

Passed in 2021 to curb pollution from the transportation sector, which accounts for almost 45% of state GHG emissions

Clean Buildings Act
(HB 1257)

Passed in 2019 and adopts a new energy performance standard for existing commercial buildings over 50,000 sq. ft.

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We’re making progress towards these goals

- By the end of 2025, our electric supply will be coal free and we’re targeting nearly **63% renewable energy** in our portfolio.
- In 2022, about **43%** of our electricity came from **non-emitting resources**, up from 34% in 2020.
- We’re **aggressively pursuing** renewable energy resources, from large generation projects to energy produced locally in our neighborhoods and communities.

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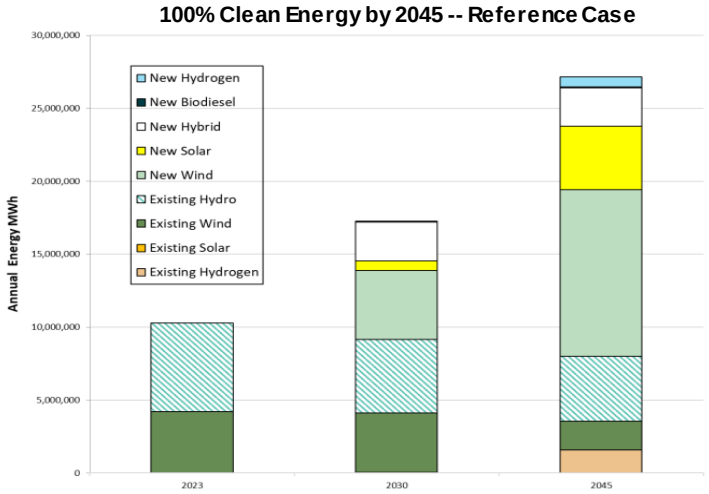
PSE needs to integrate sufficient clean energy resources to meet CETA goals

CETA Compliant Totals –

- Over 10 million MWh in 2023
- Over 17 million MWh in 2030
- Over 27 million MWh in 2045

Source: 2023 PSE Electric Progress Report (https://www.pse.com/en/IRP/Past-IRPs/2023-IRP)



Mathematically, what do we mean by "meet specific CETA targets"

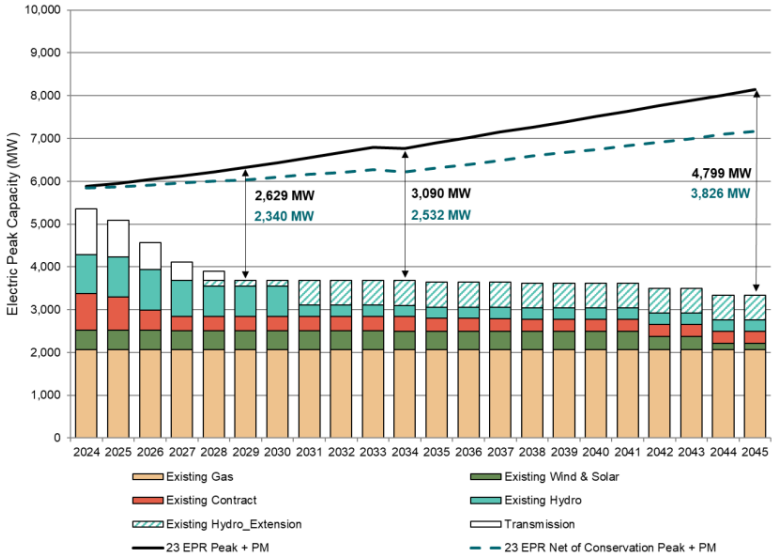
$$\sum_i CETA\ Gen_i + CETA\_Shortage \geq CETA\ Target\ (MWh)$$

PSE PUGET SOUND ENERGY

PSE needs to integrate adequate capacity resources to meet reliability standards

- Winter peak > summer peak through 2045
- For example, 2,629 MW is needed to achieve 5% loss of load probability in 2029
- Renewable and energy storage peak capacity in the summer
- New renewable and non-emitting resources will meet summer but not winter peaks
- New reliable capacity resources are needed

Source: 2023 PSE Electric Progress Report (https://www.pse.com/en/IRP/Past-IRPs/2023-IRP)



Mathematically, what do we mean by "meet specific reliability standards"

$$\sum_i ELCC_i + ELCC\_Shortage \geq ELCC\ Target\ (MW)$$

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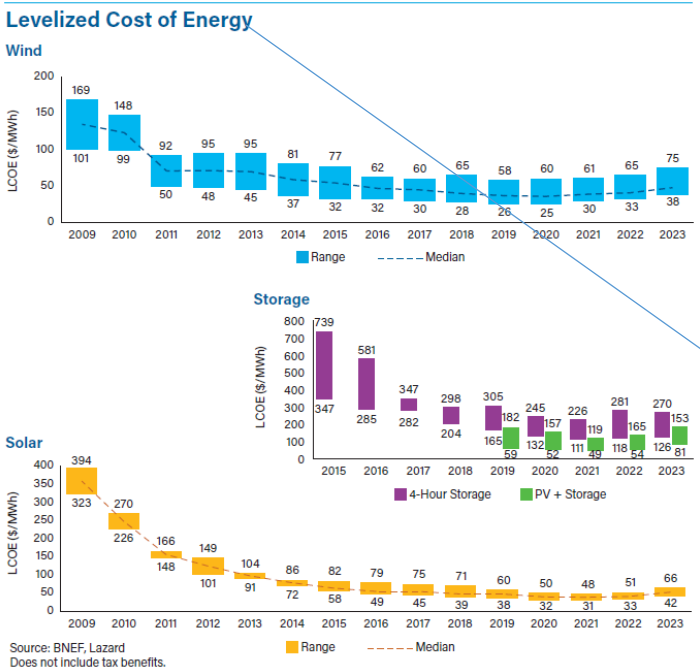
PSE needs to maintain reliability and meet CETA at the lowest reasonable cost



Source: Clean Power Annual Market Report 2023 (https://cleanpower.org/)

PDF **RCW 19.405.090**

Compliance, enforcement, and penalties—Alternatives.

(1)(a) An electric utility or an affected market customer that fails to meet the standards established under RCW **19.405.030**(1) and **19.405.040**(1) must pay an administrative penalty to the state of Washington in the amount of one hundred dollars, times the following multipliers, for each megawatt-hour of electric generation used to meet load that is not electricity from a renewable resource or nonemitting electric generation:

(i) 1.5 for coal-fired resources;

(ii) 0.84 for gas-fired peaking power plants; and

(iii) 0.60 for gas-fired combined-cycle power plants.

Source: https://app.leg.wa.gov/RCW/default.aspx?cite=19.405.090

Proposed Approach

CONE Value

Below are inputs to the CONE calculation, which results in an Annual CONE of **$91.81 per kW-Year.** The CONE value will be re-evaluated on a yearly basis to ensure that it is still an accurate proxy for the cost of replacement capacity.

Source: https://www.westernpowerpool.org/private-media/documents/2022-02-10__CONE_Penalty_Proposal.pdf

Mathematically, what do we mean by "most economics way"

$$Minimize \sum_i Cost_i \times Resource_i$$

$$+ CETA\_Penalty \times CETA\_Shortage$$

$$+ ELCC\_Penalty \times ELCC\_Shortage$$

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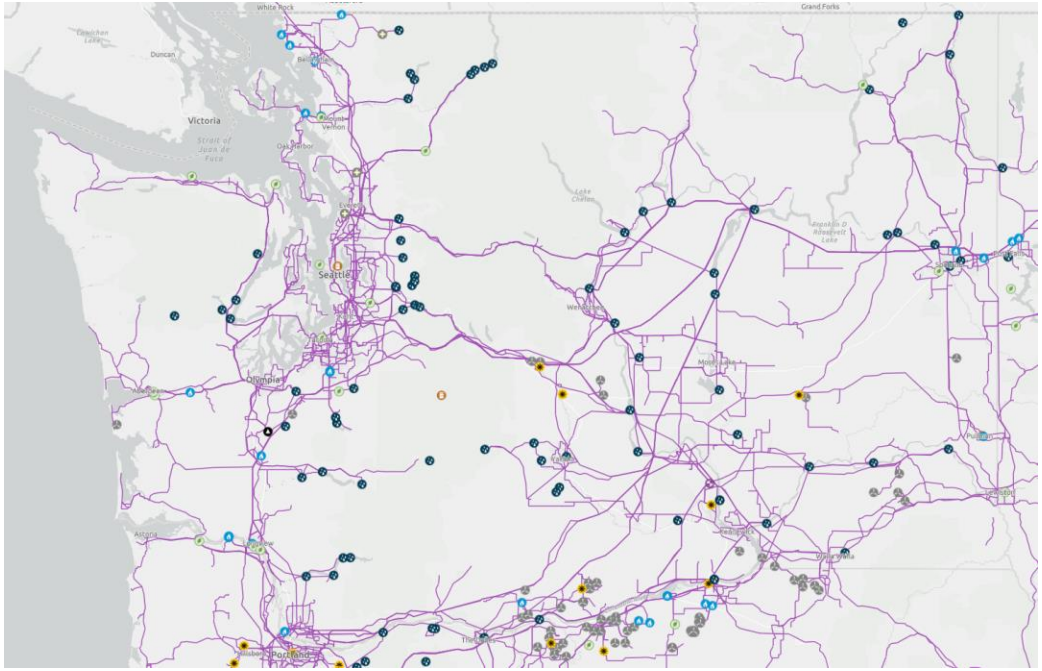
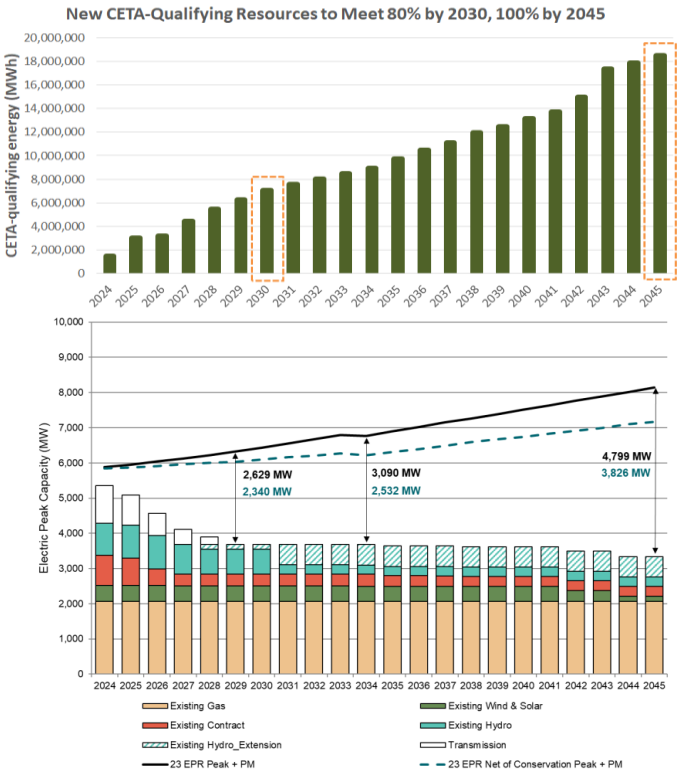
Putting it all together: RFPs are a key tool to identify and evaluate resources to meet reliability and CETA needs



Source: atlas updated as of April 2023 available at https://atlas.eia.gov/. New resources are for illustration purpose only

- CETA target, and reliable capacity target are usually set by Integrated Resource Planning [*Constraint*]



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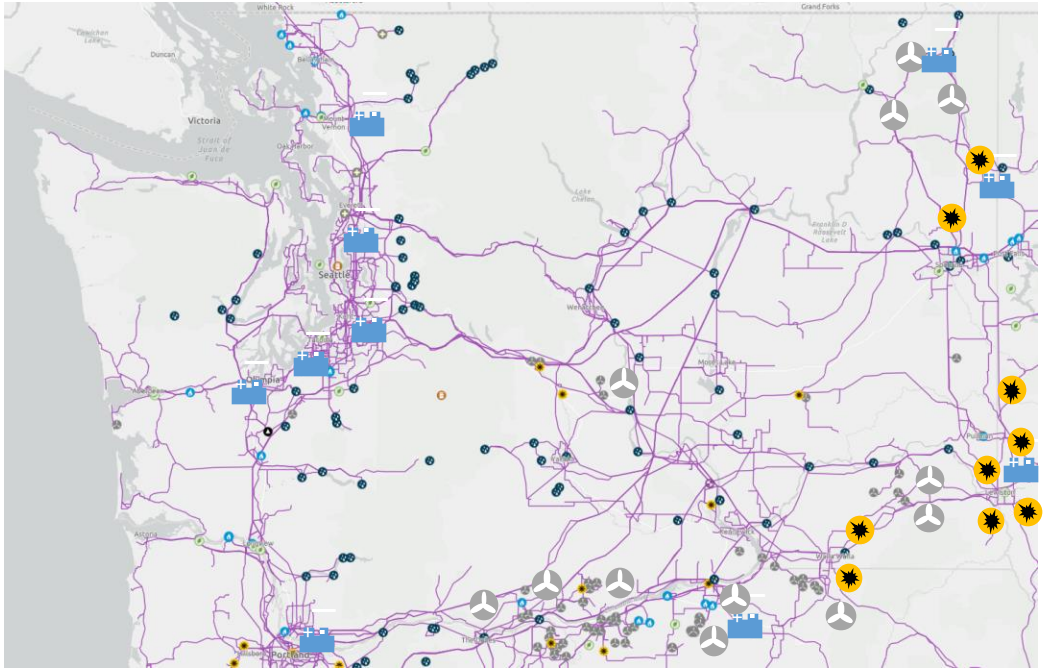

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- CETA target, and reliable capacity target are usually set by Integrated Planning exercise [*Constraint*]
- Based on planning targets, utilities issue request for proposals to look for new resources in the market. Below are examples of ongoing RFP in the region. [*Decision Variables*]
- PSE 2021 All-Source RFP, seeking 1,660 GWh of CETA-eligible resources, 1,506 MW of capacity resources (https://www.pse.com/en/pages/energy-supply/acquiring-energy/2021-All-Source-RFP)
- PGE issued 2023 All-Source RFP, seeking new 250 MWa annually through 2030 (https://portlandgeneral.com/about/who-we-are/resource-planning/procuring-clean-energy)
- PacifiCorp issued 2024 Renewable Energy Credits (RECs), seeking for 2, 5, or 10 -year RECs strips (https://www.pacificorp.com/suppliers/rfps/2024-recs-rfp.html)

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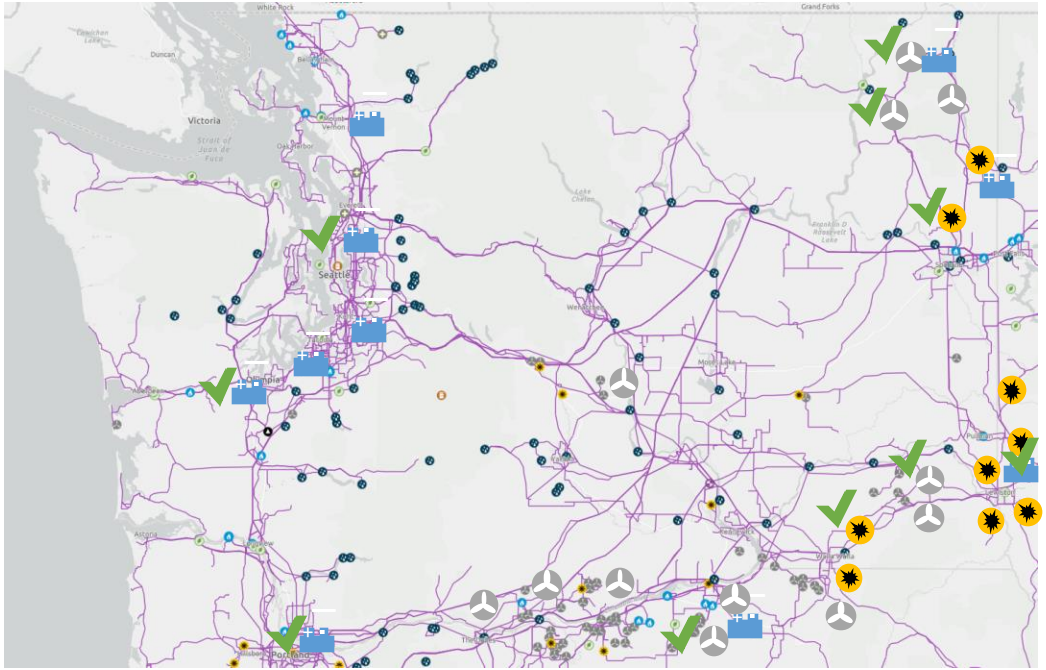
Putting it all together: RFPs are a key tool to identify and evaluate resources to meet reliability and CETA needs



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- CETA target, and reliable capacity target are usually set by Integrated Resource Planning exercise [*Constraint*]
- Based on planning targets, utilities ~~would~~ issue request for proposals to look for new resource options in the market. [*Decision variables*]
- In addition to a parallel rigorous qualitative evaluation, resources are evaluated quantitatively using Long Term Capacity Expansion optimization model [*LT capacity expansion*]

$$\textbf{Minimize} \sum_i Cost_i \times Resource_i + CETA\_Penalty \times CETA\_Shortage + ELCC\_Penalty \times ELCC\_Shortage$$

$$\textbf{Subject to}$$

$$\sum_i CETA\ Gen_i + CETA\_Shortage \geq CETA\ Target\ (MWh)$$

$$\sum_i ELCC_i + ELCC\_Shortage \geq ELCC\ Target\ (MW)$$

$$Other\ constraints$$

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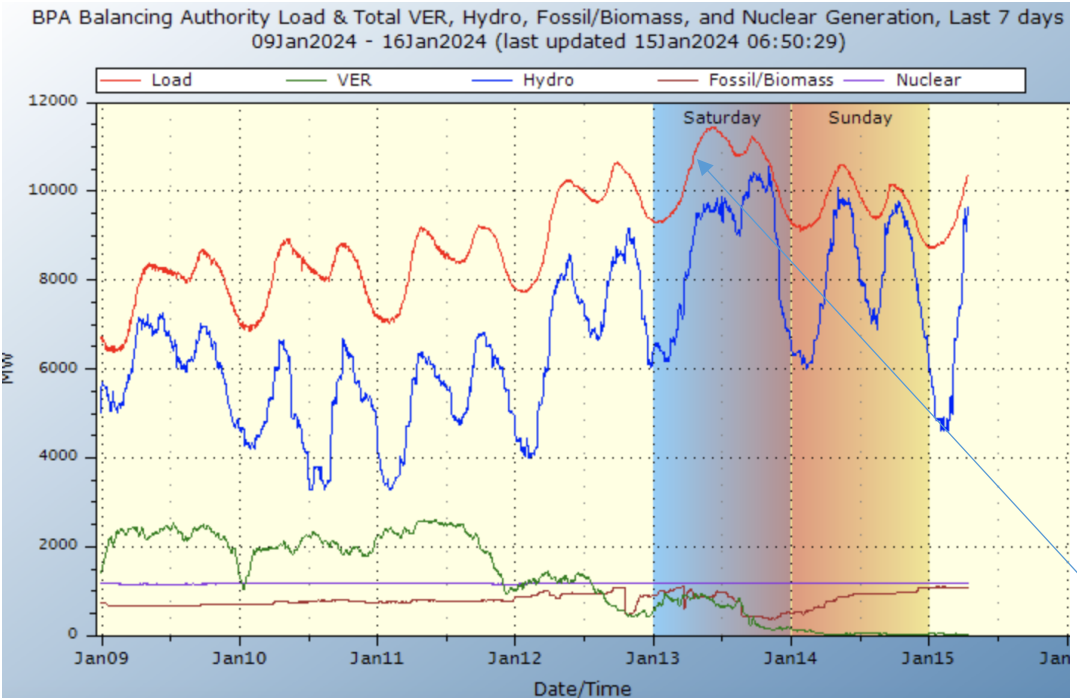
Operational analysis will be increasingly important as utility resource portfolios are reshaped



Source: https://cliffmass.blogspot.com/2024/01/the-cold-truth-about-renewable-energy.html

- Potential resource selections will need to be evaluated together with existing portfolio at greater operational details to ensure a reliable day-to-day operations
  - ✓ Low probability extreme weather
  - ✓ Local transmission congestion
  - ✓ Transient stability, system protection
  - ✓ Operational flexibility
- Root cause analysis Mid-August 2020 Extreme Heat Wave (https://www.caiso.com/Documents/Final-Root-Cause-Analysis-Mid-August-2020-Extreme-Heat-Wave.pdf).
- Extreme cold event January 2024

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