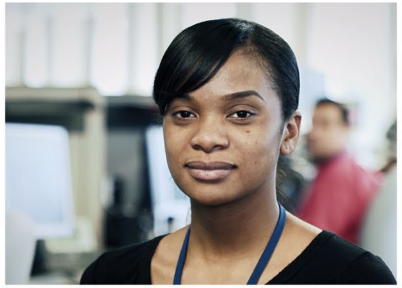
2027 Integrated Resource Plan
Public Input Meeting
November 12, 2025

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Purpose Statement

The primary focus is the customer

- Transparency
  - Assumptions & constraints
- Completeness
  - Topics discussed early and often
- Dynamic planning and implementation
- Agnostic to technology
  - Cost driver
  - Reliability driver

Multi-State Approach

- Stakeholder feedback for quality and relevance
- Delivery milestones follow the most restrictive state timing
- Abide by all state policies

Agenda

– This meeting will be recorded and made publicly available –

November 12 Schedule*	Agenda
9:00am – 9:15am	Introduction
9:15am – 9:30am	2025 IRP Status
9:30am – 9:40am	Demand-Side Resources Update
9:40am – 10:40am	Supply-Side Resource Development
10:40am – 11:00am	Planning Environment Updates
11:00am – 11:30am	Modeling and Data Development
11:30am – 12:15pm	Break
12:45pm – 1:30pm	Resource Adequacy
1:30pm – 2:00pm	Optimization Modeling Overview
2:00pm – 2:30pm	2025 IRP Update Assumptions
2:30pm - 2:45pm	Stakeholder Feedback
2:45pm – 3:00pm	Next Steps / Wrap-up

* Timing and arrangement are approximate and subject to change.

2025 IRP Status

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2025 IRP Filing Update

Idaho Case Number PAC E-25-12

- Commission Staff comments posted October 7, 2025
- PacifiCorp reply comments filed October 21, 2025

Oregon Docket LC-85

- IRP presentation to the Commission held April 15, 2025
- CEP filed June 30, 2025
- CEP presentation to the Commission held July 8, 2025
- Opening stakeholder comments posted July 29, 2025
- PacifiCorp reply opening comments filed August 26, 2025
- Round 2 stakeholder comments posted October 9, 2025
- Special Public Meeting for Commission workshop October 16, 2025
- PacifiCorp Round 2 reply comments filed November 6, 2025

2025 IRP Filing Update (continued)

Utah Docket 25-035-22

- Technical Conference held July 22, 2025
- Stakeholder comments posted September 26, 2025
- PacifiCorp reply comments due November 25, 2025

Washington Docket UE-230812 (2025 IRP) and UE-250617 (2025 CEIP)

- Draft 2025 CEIP filed August 15, 2025
- Final 2025 CEIP filed October 01, 2025
- 2027 IRP Workplan in development
- CEIP public comments due December 1, 2025

Wyoming Docket 20000-676-EA-24

- New administrative rules regarding IRPs went into effect September 11, 2025
- Schedule is yet to be determined

Demand-Side Resources Update

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2027 Conservation Potential Assessment

- As in prior cycles, PacifiCorp is publishing the workplan for the 2027 CPA for public review and input.
- Stakeholders are invited to offer feedback at this stage.
  - Feedback forms can be located at: [IRP Stakeholder Feedback (pacificpower.net)]
- In the Dec 2025 IRP PIM, PacifiCorp will provide further updates on the CPA, as well as the Distributed Generation Study.


November, 2025
Work Plan
PacifiCorp 2027 Conservation Potential Assessment

Submitted to:
PacifiCorp
825 NE Multnomah St, Ste 300
Portland, OR 97232

Submitted by:
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ICF

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Supply-Side Resource Development

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Supply-Side Resource Presentation Planning

Recap from October 1, 2025, PIM

- Supply-side resources table challenges:
  - Readability
  - Comparability
  - Quality control
- Chapter 7 resource options simplified format (2026 dollars)
- Supply-side resource appendix expanded detail
  - Expanded narrative
  - Modeling/Implementation details
  - Additional graphics for visualization

Today's Topics

- Data Sources and References
- Technologies Under Consideration
- Details on Selected Technologies
  - Hydrogen and Ammonia
  - Geothermal
  - Biomass

Data Sources and References

Publicly available reference examples

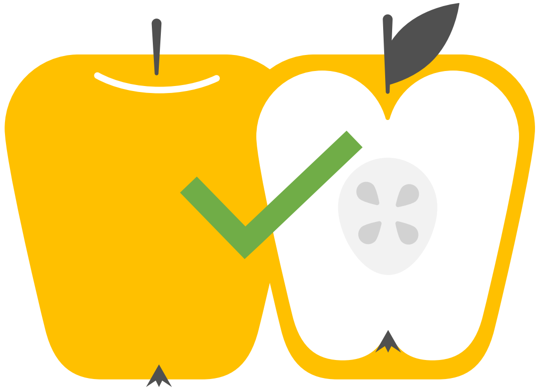
- NREL Annual Technology Baseline (ATB)
- EIA
- Lazard

Developers / OEM's

- Geothermal: Fervo, Sage, others?
- CAES: HydroStor, RESC
- Energy storage other than lithium ion: Form
- Hydrogen powered generators: CT OEM's, Mainspring
- Advanced Nuclear: TerraPower, NuScale, X-energy

Consultant Studies

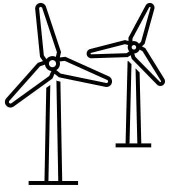
- CCUS FEED Study



Technologies Under Consideration

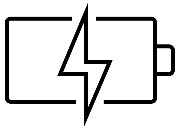
Today’s Meeting

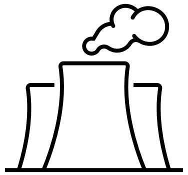
- Hydrogen powered generators
- Geothermal
- Biomass



December 17, 2025, Public Input Meeting

- Wind: on-shore and off-shore
- Solar
- Energy Storage: lithium ion, iron-air, CAES, gravity
- Carbon capture for coal and gas
- Nuclear





Power & Energy

Capacity

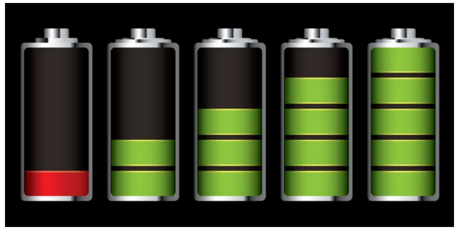
- Merriam-Webster:
  - The potential or suitability for holding, storing, or accommodating.
  - The maximum amount or number that can be contained or accommodated.
- Power Sector jargon
  - Electrical power, typically measured in watts (kilo or mega, depending on scale).

Power

- Merriam-Webster:
  - the time rate at which work is done or energy emitted or transferred.
- Typically measured in horsepower or megawatts.

Energy

- Britannica:
  - the capacity for doing work
- typically measured in megawatt-hours, megajoules, or British Thermal Units (btu’s)



Fuel Use In Perspective

Average annual home heating

- EIA: Average U.S. Home – 49 MMBtu (2015)
- AGA: Mountain – 58 MMBtu (2020)
- AGA: Pacific – 37 MMBtu (2020)

Lakeside generating facility

- Block 1 – 3,956 MMBtu/hour = 65.9 MMBtu/minute
- Block 2 – 4,696 MMBtu/hour = 78.3 MMBtu/minute
- Total:
  - 114.2 MMBtu/minute
  - 8,652 MMBtu/hour
  - ~6,647 GWh/year

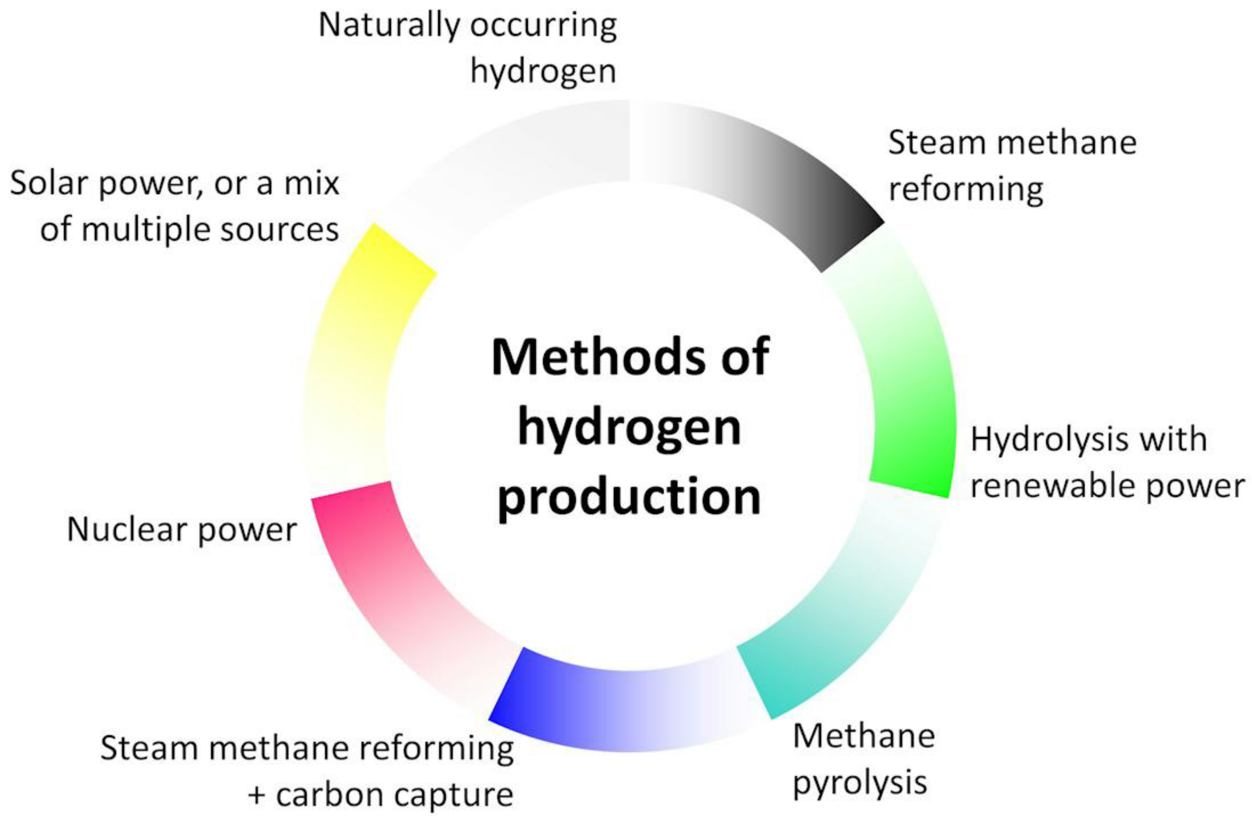
Use of energy in homes - U.S. Energy Information Administration (EIA)
2022 Gas Facts Entire Document.pdf (aga.org)

Hydrogen and Ammonia

Hydrogen Sources

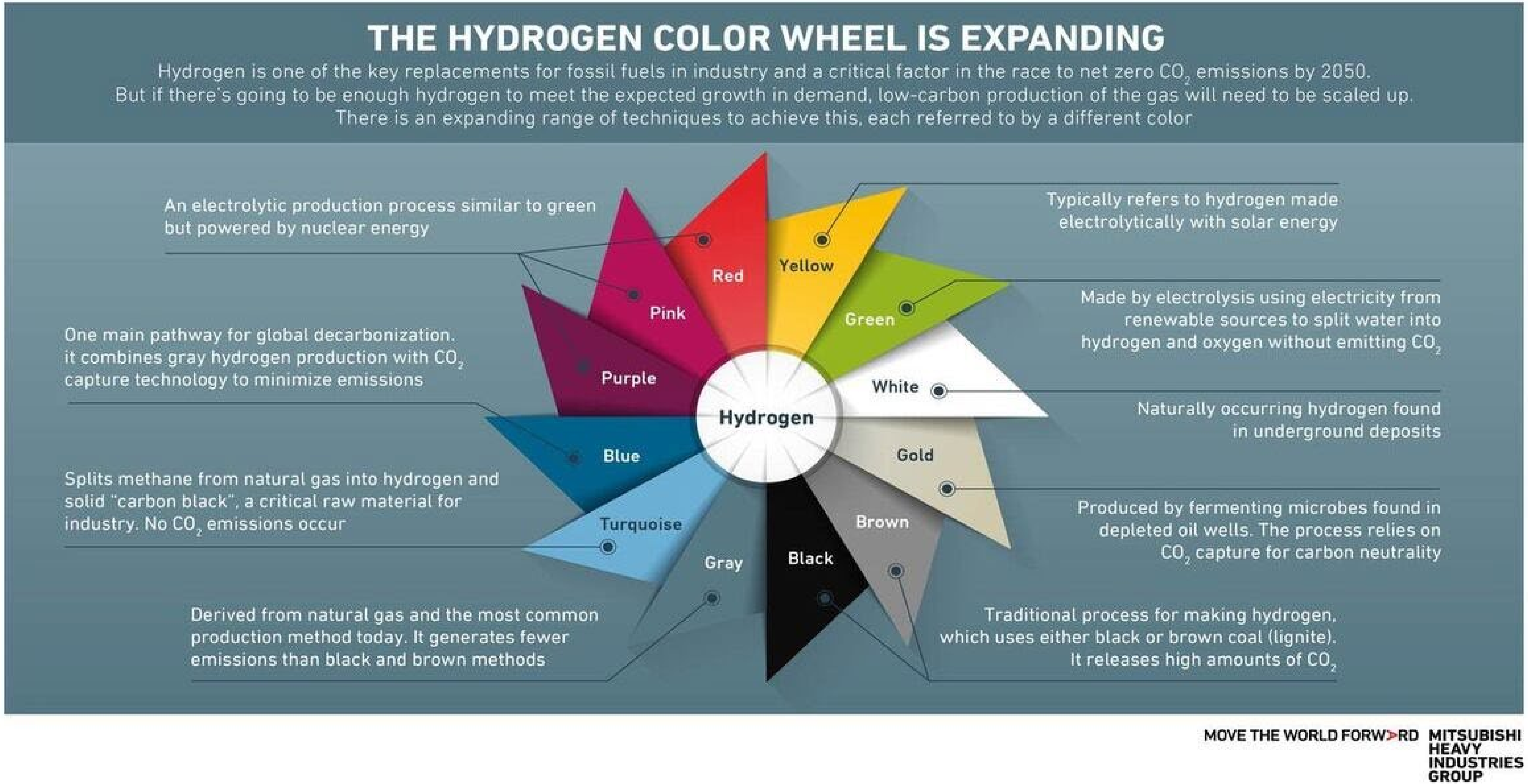
Hydrogen powered generators

- Technology: gas turbines, reciprocating engines, fuel cells
- 100% Hydrogen Capable
- Renewable Hydrogen Supply
  - Electrolysis with liquid storage, or compressed gas storage; or Ammonia synthesis and cracking
  - Transport
  - Storage



Explainer: the many shades of hydrogen, Liang Lei
https://www.eco-business.com/news/explainer-the-many-shades-of-hydrogen/

Colors of Hydrogen



Green Hydrogen Process

Excess renewable energy

Grid - Customers

Electrical transmission

Water

Generating Unit

HHV of H2:
142 MJ/kg

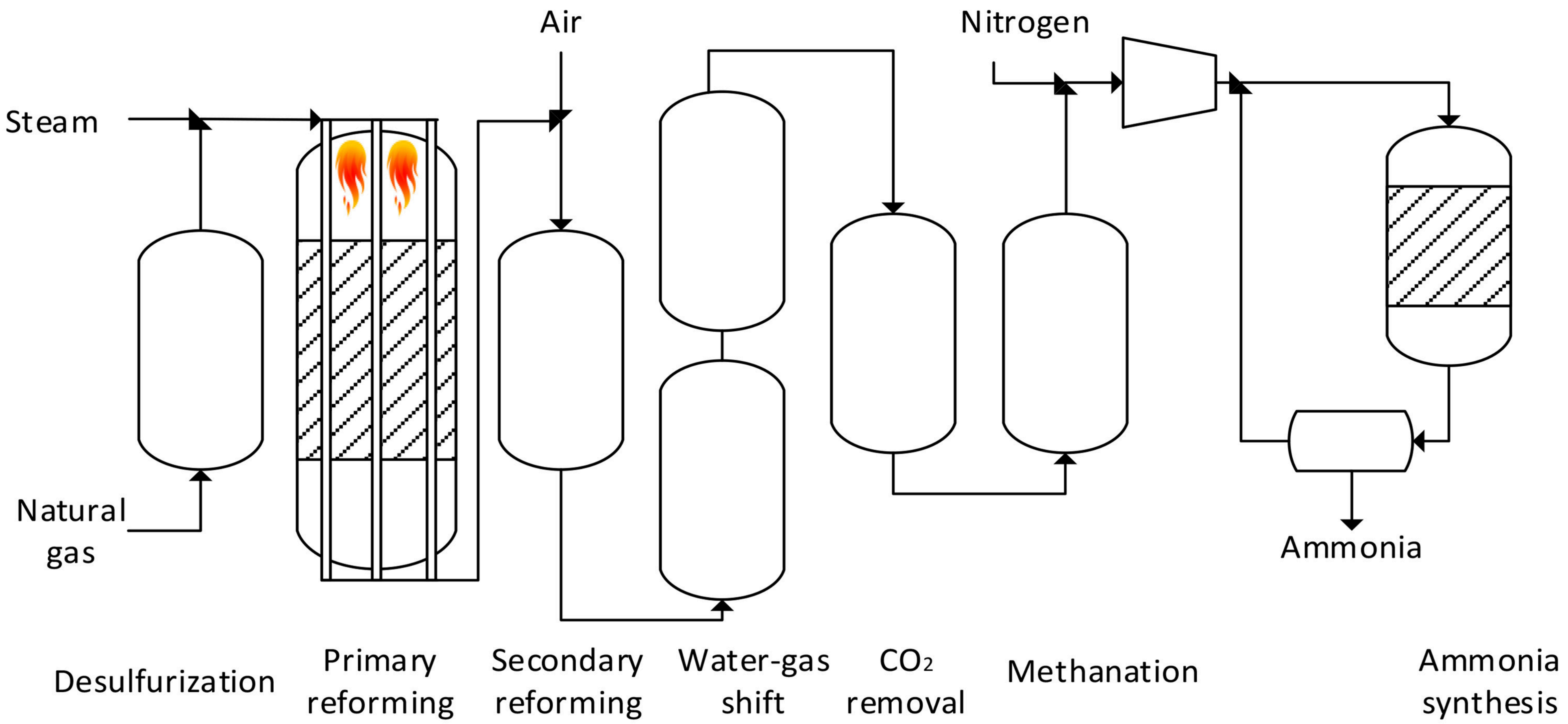
Electrolysis:
~90 MJ/kg
(~63% loss)

Electrolysis → Compression → Transport → Storage

DoE Pathways to Commercial Liftoff: Clean Hydrogen

Compression to 500 bar:
~18 MJ/kg (~13% loss)
Ammonia synthesis & cracking: ~30 MJ/kg (~21% loss)
Liquefaction:
~43 MJ/kg (~30% loss)

Haber-Bosch Ammonia Synthesis



[Recent advances and intensifications in Haber-Bosch ammonia synthesis process - ScienceDirect]

Navid Erfani: Writing – review & editing, Writing – original draft, Visualization, Investigation, Formal analysis, Data curation, Conceptualization. **Luqmanulhakim Baharudin:** Writing – review & editing, Writing – original draft, Visualization, Investigation, Formal analysis, Data curation, Conceptualization. **Matthew Watson:** Writing – review & editing, Supervision, Funding acquisition, Conceptualization. J.R. Jennings, Catalytic ammonia synthesis: fundamentals and practice, Springer Science & Business Media (1991)

Round Trip Efficiency

Hydrogen as an energy storage medium

- Green hydrogen (electrolysis) – 18% to 46% [1]
- Lithium-Ion batteries – 80% to 93%
- Pumped-storage hydroelectric – 70% to 80% [1]
- Flow batteries – 60% to 80% [1]
- Compressed air energy storage (CAES) – 42% to 67% [1]
- Iron based batteries – 25% to 50%

1 - DiChristopher, T. (24 June 2021) Hydrogen technology faces efficiency disadvantage in power storage race, S&P Global Market Intelligence. https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/hydrogen-technology-faces-efficiency-disadvantage-in-power-storage-race-65162028

Green Hydrogen

Advantages

- Combustion emissions are mostly oxygen and water
- Transportable
- Potential storage medium for mobile applications
- Can make use of otherwise curtailed renewable energy
- Long-term Storage

Disadvantages

- Low production, transport and storage capacity
- Low volumetric energy density requires large pipes & storage, or energy intensive compression or synthesis
- Slightly increased NO_X emissions treatment
- Requires a supply of excess renewable energy
- Low energy storage round-trip efficiency

Green Ammonia

Advantages

- Higher volumetric energy density than hydrogen
  - Easier to store and transport
  - Better potential for mobile applications
- Use of otherwise curtailed renewable energy
- Long-term Storage

Disadvantages

- Low technology maturity level
- Increase NO_X emissions treatment
- Requires a supply of excess renewable energy
- Low round-trip efficiency
- Hazardous chemical management (PSM / RMP)

Hydrogen Hubs

Pacific Northwest - CANCELED by the U.S. Department of Energy

- ~~Washington, Oregon, and Montana~~
- ~~Federal Cost Share: up to $1 billion~~
- ~~8,050 construction jobs and 350 permanent jobs~~
- ~~Annual production TBD~~

Advanced Clean Energy Storage Site (ACES), Delta, Utah

- Title 17 Federal Loan Guarantee: $504.4 million
- 400 construction jobs and 25 permanent jobs
- 220 MW alkaline electrolysis
- 2 or more 4.5 million barrel salt caverns to store clean hydrogen

www.energy.gov/oced/regional-clean-hydrogen-hubs-selections-award-negotiations

Geothermal

Geothermal

Configuration
- Near Field (<4km) or Deep (>4km) Enhanced Geothermal System (EGS), Flash or Binary

Power capacity
- Moderate case: 40 MW
- Advanced case: 100 MW

Variation by location
- Ground thermal and hydrology properties.
- Likely sites have been identified in Utah, Oregon, Idaho and northern California

Design life
- 30 years

Operating characteristics
- Capacity factor (CF): 90%

Decommissioning
- Escalated from 2023 IRP

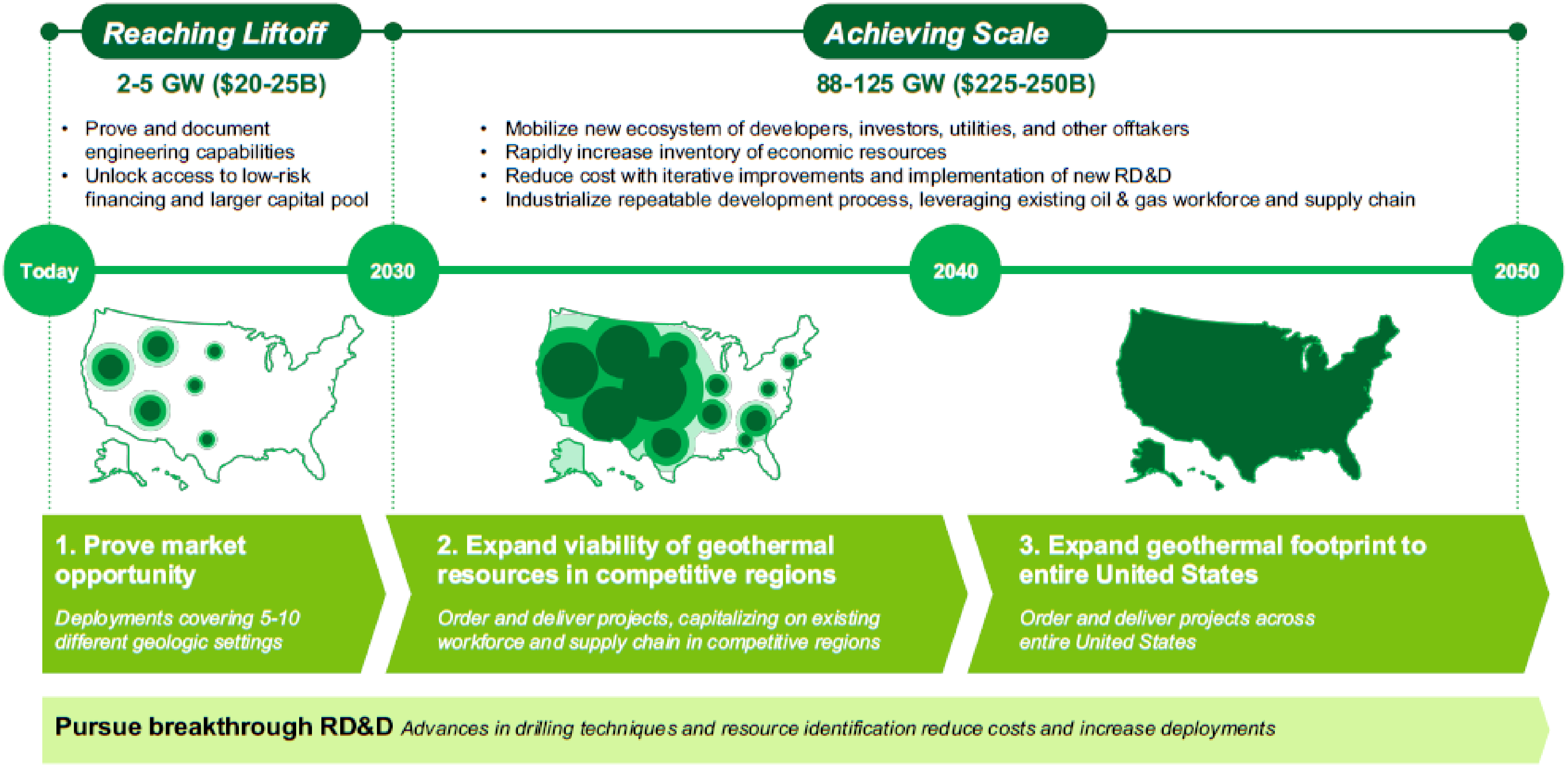
Deployment
- Technology is currently under contract with other utilities
- Construction duration: 36 months
- Soonest commercial operation date possible: 2030

Limitations
- Requires significant site investigation
- Costs depend heavily on the resource temperature, well productivity, and depth.
- Assumed to operate as traditional baseload

Sources: numerous references on the ATB website

Geothermal

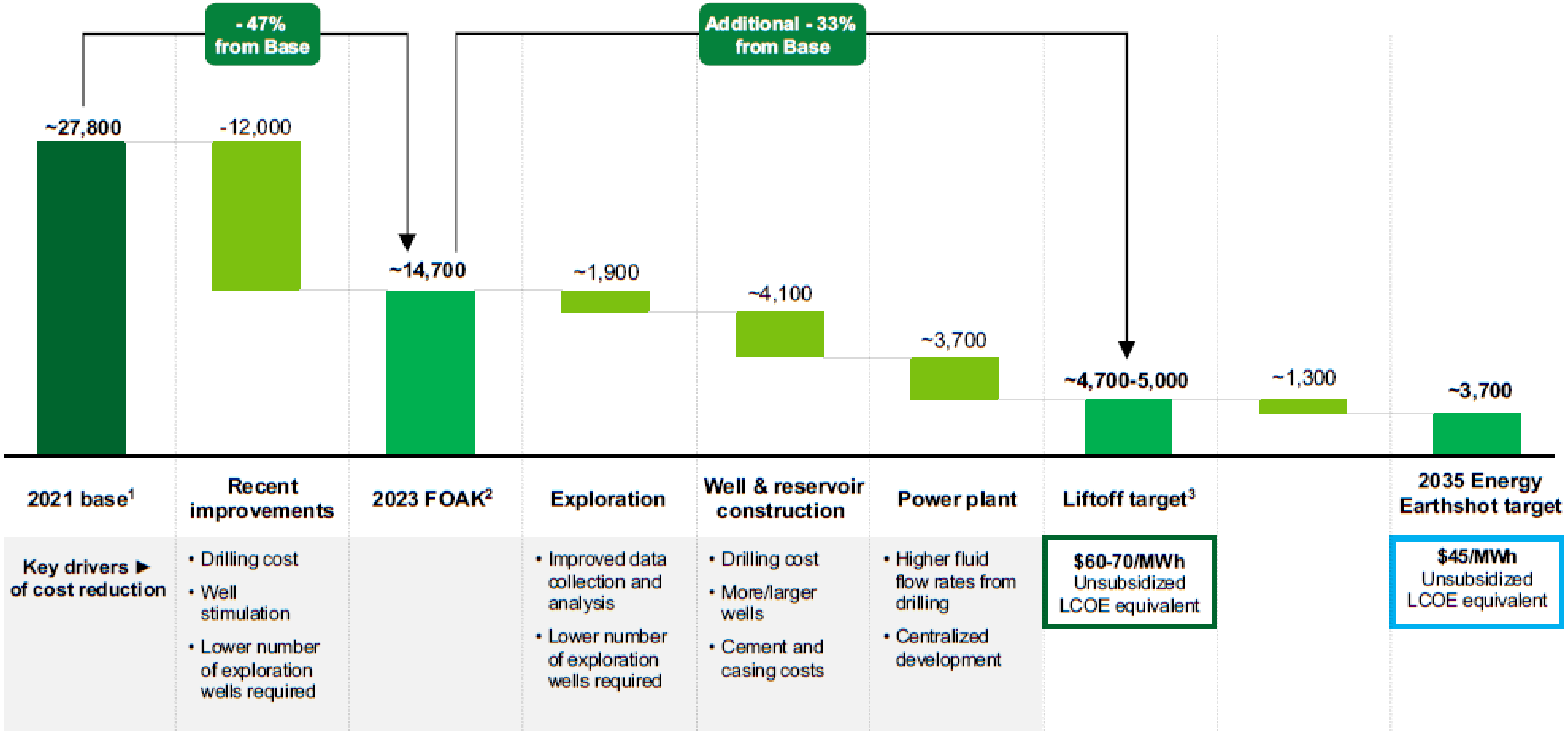
Pathway to commercial liftoff and scale for next-generation geothermal power



U.S. Department of Energy, Pathways to Commercial Liftoff: Next-Generation Geothermal Power, March 2024

Geothermal

Potential reduction in national average overnight capital costs for Enhanced Geothermal Systems, $/kW



U.S. Department of Energy, Pathways to Commercial Liftoff: Next-Generation Geothermal Power, March 2024

Biomass

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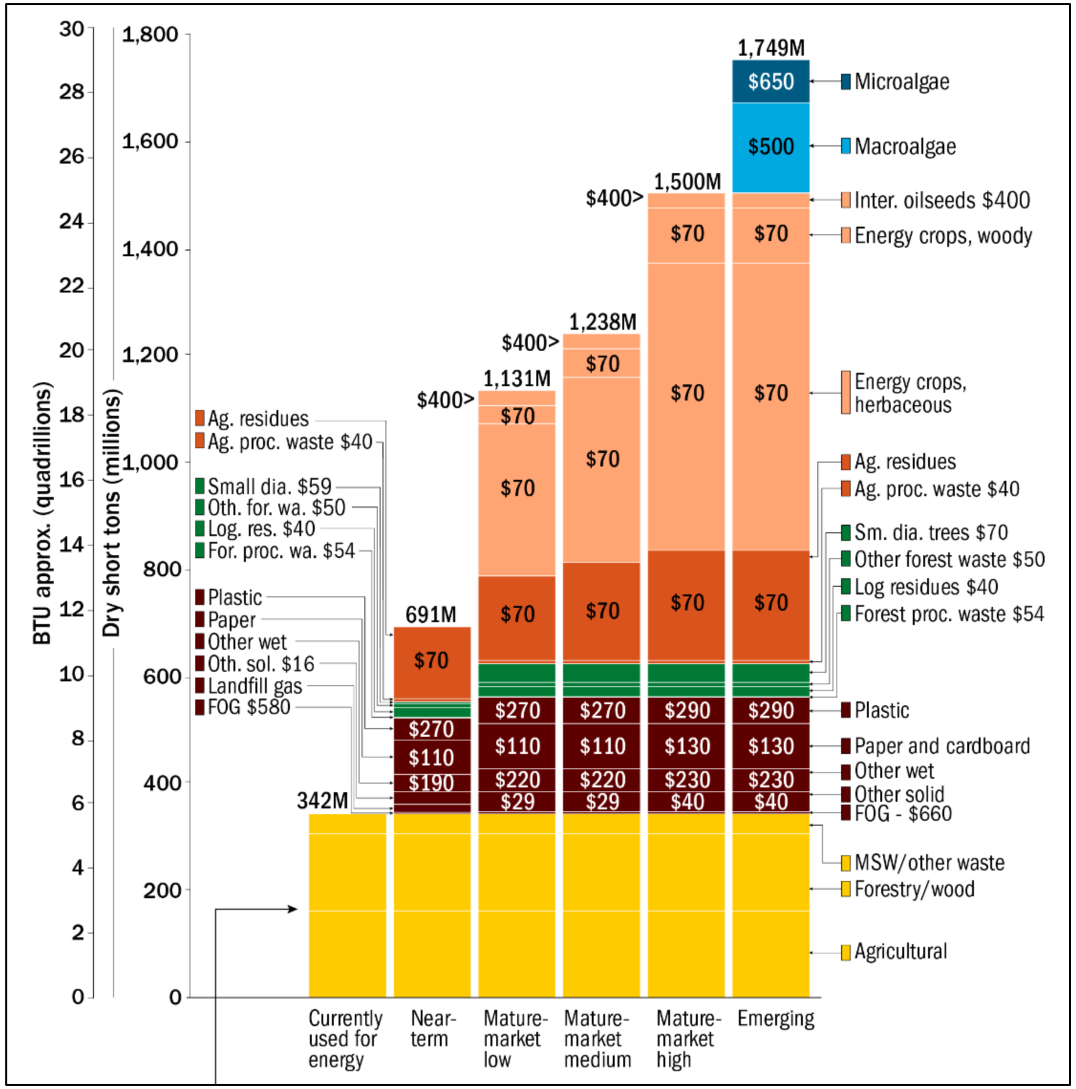
Biomass



Advantages

- Use with coal can reduce some emissions
- Reduces waste
- May use existing generating equipment

Disadvantages

- Threatens forests, if they are not protected
- Not as clean as natural gas, hydrogen or ammonia
- High and/or volatile costs
- Requires consistent supply
- Compatibility with existing generating equipment

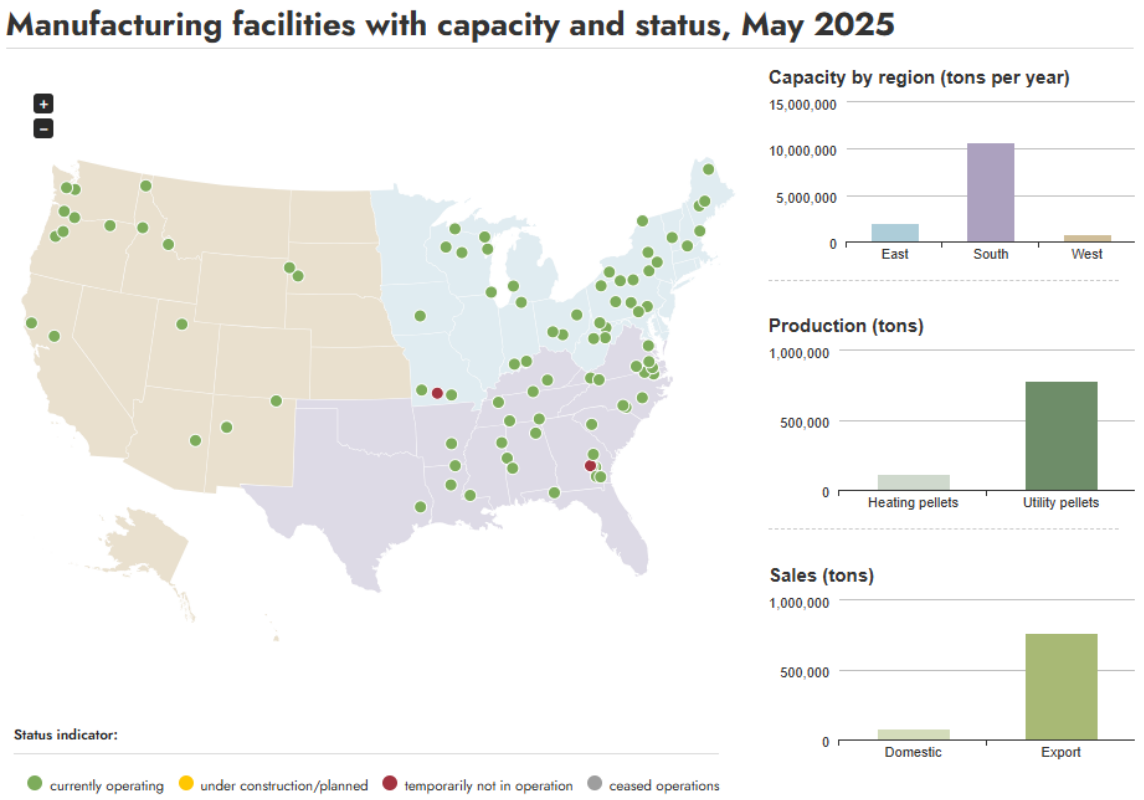
U.S. Department of Energy. 2024. *2023 Billion-Ton Report: An Assessment of U.S. Renewable Carbon Resources*. M. H. Langholtz (Lead). Oak Ridge, TN: Oak Ridge National Laboratory. ORNL/SPR-2024/3103. doi: 10.23720/BT2023/2316165.

Biomass

Densified Biomass Production Capacity in PacifiCorp States

- Recall that Lakeside Plant can produce up to about 11,758 GWh/year
- The GWh/year in the table below are typical production capability of a coal plant burning biomass pellets

State	Tons/year	GWh/year
Idaho	73,900	115
Oregon	277,340	431
Utah	9,500	15
Washington	100,000	156
TOTAL:	**460,740**	**717**



https://www.eia.gov/biofuels/biomass/

Next Steps

December 17, 2025, Public Input Meeting

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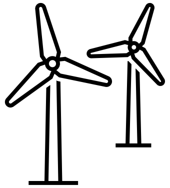
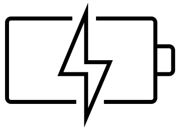
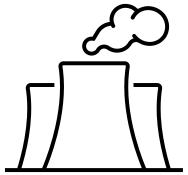
- Solar
- Energy Storage: lithium ion, iron-air, CAES, gravity
- Carbon capture for coal and gas
- Nuclear







Planning Environment Updates

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State Policy Divergence

Examples of divergent state policies across the Company's six-state service territory

- Wyoming House Bill ("HB") 200 (2020)[1] requires that a portion of load in the state to be served by carbon capture technology by July 1, 2033;
- Wyoming HB 166 (2021)[2] establishes a rebuttable presumption against coal or gas fueled plant retirement;
- Oregon's HB 2021 (2021)[3] and Senate Bill ("SB")_1547 (2016)[4] set resource and emissions targets starting in 2030;
- Utah SB 224 (2024)[5] establishes a preference for dispatchable generation;
- Utah HB 411 (2019)[6] allows for Utah communities to opt-in to programs to reach 100 percent renewable generation by 2030;
- Washington SB 5116 (2019)[7], the Clean Energy Transformation Act, requires greenhouse gas neutrality by 2030 and carbon free retail electricity by 2045;
- Washington HB 2528 (2020)[8] the CCA, requires the purchase of allowances for emissions from various sources in the state.

[1]https://www.wyoleg.gov/Legislation/2020/HB0200
[2]https://www.wyoleg.gov/Legislation/2021/HB0166
[3]https://olis.oregonlegislature.gov/liz/2021R1/Measures/Overview/HB2021
[4]https://olis.oregonlegislature.gov/liz/2021R1/Measures/Overview/HB2021
[5]https://le.utah.gov/~2024/bills/static/SB0224.html
[6]https://le.utah.gov/~2019/bills/static/HB0411.html
[7]https://app.leg.wa.gov/billsummary?BillNumber=5116&Year=2019
[8]https://app.leg.wa.gov/billsummary/?BillNumber=2528&Year=2019

Utah Community Renewable Program (HB 411)

Overview

- Created an opt-out program with a goal of being 100% net renewable by 2030.
- Cities and communities elect to participate on behalf of their residents. Customers within a participating community may opt out of the program and maintain existing rates.
- The legislation prohibits cost shifting to other non-participating customers.

Timeline

- April 2019 – Utah passes HB 411
- December 2019
  - 23 Utah communities pass a resolution to be 100% renewable by 2030 as required by the statute for participation. 18 of the 23 eligible communities have officially taken the next step in their participation by signing the Governance Agreement.
  - The Utah Public Service Commission adopts administrative rules to facilitate the program
- January 2022 – December 2024 PacifiCorp/communities worked on program design
- November 2024 – PacifiCorp filed for approval of the solicitation process for the program resource, which was approved by the Commission on May 13, 2024 and the communities issued the RFP.
- January 2025 – PacifiCorp filed for approval of the program with the Utah Commission. A hearing is scheduled for December 2025 and a Commission order is expected in early 2026.

Wyoming House Bill 200

Overview:

- Required the Wyoming Public Service Commission (WPSC) to establish administrative rules requiring public utilities to develop low-carbon energy portfolio standards utilizing carbon capture, utilization and storage (CCUS) by 2033.
- House Bill 200 (HB 200) authorizes utilities to implement a surcharge to recover prudently incurred incremental costs associated with complying with HB 200 requirements. The surcharge is capped at two percent to limit the impact on Wyoming customers.

Timeline:

- WY HB 200 was created in 2020 (enacted July 1, 2020 as Wyo. Stat. 37-18-101 and –102, which were amended by Senate File 42 in 2024).
- The WPSC's administrative rules to implement HB 200 became effective on January 3, 2022.
- Public utilities must comply with HB 200 no later than July 1, 2033.
- PacifiCorp filed its initial application on March 31, 2022, and requested to issue a request for proposal (RFP) to retrofit Jim Bridger Units 3 and 4 and Dave Johnston Unit 4 for amine liquid solvent-based carbon capture technology. The RFP was issued in the fall of 2022.
  - The WPSC approved the initial application in a written order issued on September 6, 2023, which required an RFP progress report and a revision to the RFP process by allowing proposals for additional carbon capture technologies and for other coal units.
- The Company filed its Final Plan on March 29, 2024 that requested to conduct a FEED study for amine-based carbon capture retrofit for Jim Bridger Units 3 and 4 and a pre-FEED study for an AFC project at the Dave Johnston or Wyodak plants and maintain a zero percent portfolio standard pending further analysis once the FEED study is complete.
  - The WPSC approved the Final Plan in a written order issued on January 23, 2025 that included additional reporting requirements.
- The Company filed the annual update on March 31, 2025 that provided information on the FEED study and pre-FEED study progress but did not request any changes to the Final Plan. The WPSC is currently processing the update.

Updates: Oregon Clean Energy Plan (HB 2021)

Overview

- Requires retail electricity providers to reduce GHG emission associated with electricity sold to Oregon consumers by:
- 80% below baseline emissions levels by 2030;
- 90% below baseline emissions levels by 2035; and
- 100% below baseline emissions levels by 2040

Timeline

- July 2021 – HB 2021 signed into law, effective September 25, 2021
- January 2022 and ongoing UM 2225 Staff’s Investigation into clean energy plans (CEPs)
- January 2023 and ongoing UM 2273 Staff's Investigation into HB 2021 implementation issues, currently working on cost cap implementation issues
- May 2023 – PacifiCorp filed first CEP, based on the 2023 IRP
- April 2024 – PacifiCorp filed its CEP Supplement with the 2023 IRP Update
- June 2025 – PacifiCorp filed its 2025 CEP, based on the 2025 IRP

Updates: Washington Clean Energy Transformation Act (2019)

Overview

- Created several state decarbonization policies for electric utilities, including:
- Eliminating coal-fired resources from Washington retail rates by the end of 2025;
- Requiring greenhouse gas-neutral retail electricity in Washington by 2030;
- Requiring carbon-free retail electricity in Washington by 2045.

Timeline

- May 2019 – CETA signed into law
- June 2019 through December 2021 – CETA stakeholder discussions and Commission rulemakings
- December 2021 – PacifiCorp filed inaugural 2021 Clean Energy Implementation Plan (CEIP)
- March 2023 – PacifiCorp filed a Revised 2021 CEIP, which is ultimately acknowledged with conditions
- November 2023 – PacifiCorp filed the 2023 Biennial CEIP Update for the interim targets for years 2024-2025, which was ultimately rejected by the commission
- October 2025 – PacifiCorp filed the 2025 CEIP, focused on the next four-year planning period 2026-2029

Updates: WRAP

Overview

- On May 8, 2024, OPUC issued Oregon Order No. 24-133[1] in Docket No. AR 660 adopting new rules related to resource adequacy requirements for regulated utilities
    - A regulated entity must submit data directly to the OPUC that complies with the "State Program" requirements, or must participate in a "Qualified Regional Program"

Updates

- PacifiCorp has participated in the WRAP development phase leading up to the deadline for all participants to decide if they will participate in the financially binding WRAP by October 31, 2025
- On September 30, 2025, PacifiCorp sent a request to the WPP Board of Directors to defer the decision for PacifiCorp to become a financially binding participant in WRAP by at least one year (Winter 2027/2028 to Winter 2028/2029 or beyond)
    - PacifiCorp's request highlights significant changes under active consideration warranting the deferral which include market alignment with day ahead markets, new methodologies for planning reserve margins and mechanisms for deficiency charge deferral
- On October 8, 2025, Western Power Pool Board Chair Bill Drummond responded to PacifiCorp's request, rejecting the deferral
- On October 30, 2025, PacifiCorp notified WRAP of its withdrawal from the program. PacifiCorp indicated it would continue to engage with the program for the duration of the two-year Withdrawal Period and could possibly reenter the program by September 2026 ahead of the first financially binding program season in November 2027

[1]https://apps.puc.state.or.us/orders/2024ords/24-133.pdf

Modeling and Data Development

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Modeling Updates: LT Chronology

Driven by stakeholder feedback, testing LT chronology

- Custom Partial Chronology (Used in 2025 IRP)
- Sampled Chronology (Testing)

Sampled Chronology better represents hourly net load than partial chronology

- Partial chronology does not capture any hourly granularity

The focus is on reducing the time it takes to identify a portfolio that performs best in the short-term (ST) model.

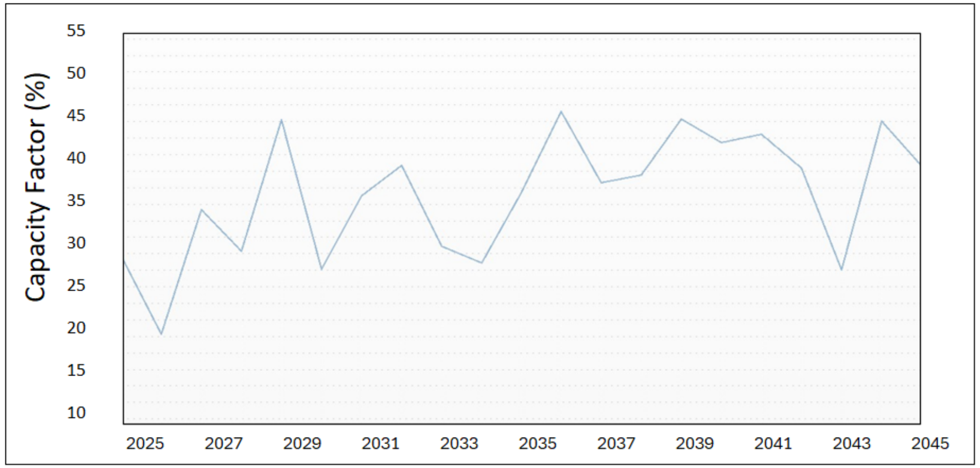
Sampled Chronology Renewable Shapes

YEAR	Actual	10 dy	10 dy Adjusted	14 dy	14 dy Adjusted
2025	29.5%	26.4%	26.6%	27.7%	26.9%
2026	29.4%	16.1%	26.7%	18.2%	27.3%
2027	29.5%	41.8%	28.8%	33.3%	28.4%
2028	29.4%	34.5%	30.1%	28.3%	30.1%
2029	29.5%	46.8%	29.0%	44.2%	29.9%
2030	29.5%	33.8%	26.0%	26.1%	25.6%
2031	29.5%	37.4%	28.0%	34.9%	27.6%
2032	29.4%	33.5%	27.5%	38.7%	27.4%
2033	29.5%	32.5%	28.9%	28.9%	28.3%
2034	29.5%	21.5%	28.1%	26.8%	27.5%
2035	29.5%	45.0%	27.5%	35.3%	27.5%
2036	29.4%	46.8%	28.0%	45.1%	27.8%
2037	29.4%	37.8%	26.8%	36.6%	27.2%
2038	29.5%	34.3%	28.4%	37.5%	28.8%
2039	29.5%	47.6%	29.8%	44.3%	29.3%
2040	29.4%	38.1%	28.7%	41.4%	27.9%
2041	29.5%	46.9%	26.8%	42.4%	27.5%
2042	29.5%	40.5%	27.1%	38.3%	27.1%
2043	29.4%	20.4%	31.0%	26.0%	30.3%
2044	29.4%	46.1%	29.2%	44.0%	28.3%
2045	29.5%	43.5%	27.6%	38.6%	27.5%

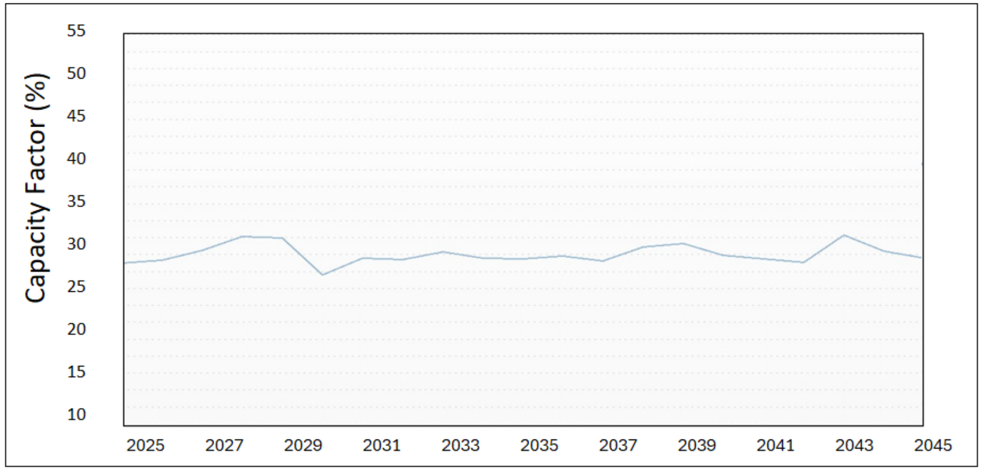
- Table shows annual average capacity factor (%) for existing wind resource in LT model run with sampled chronology
- The “sampled” columns represent a sampled LT run where a new generation profile was fed into the model accounting for the sampling used in the LT model
  - Sampled chronology misrepresents the annual average capacity factor for wind and solar resources because of the hours sampled
  - The new generation profile maintains the weekly shape and the annual average capacity factor from the actual generation profile
- Cells highlighted red show reported annual average capacity factors 5% higher or lower than the actual annual average capacity factor in that year

Sampled Chronology Renewable Shapes (Capacity Factor)

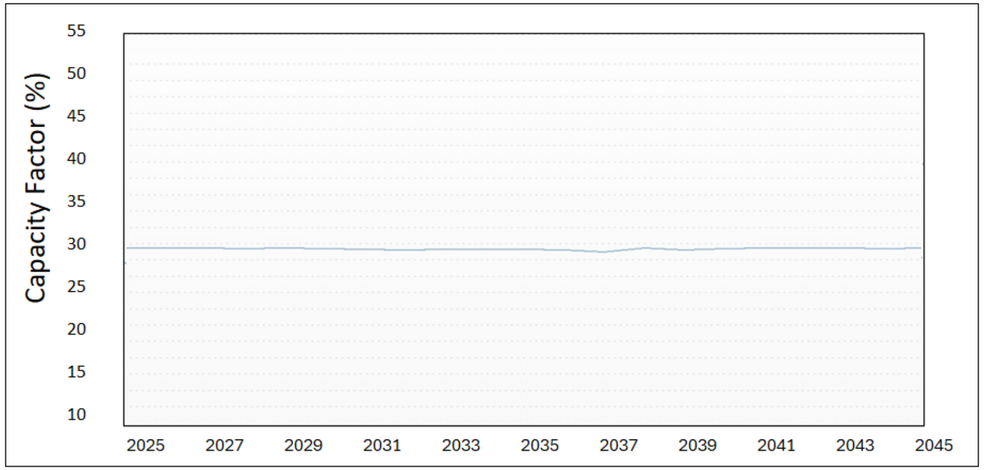
Sampled LT without generation profile adjustment



Sampled LT with generation profile adjustment

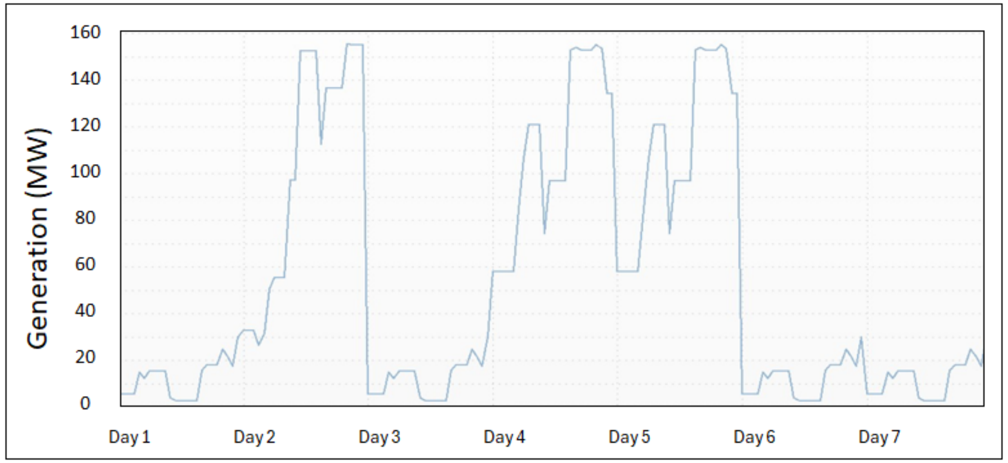


4 blocks per month LT without generation profile adjustment

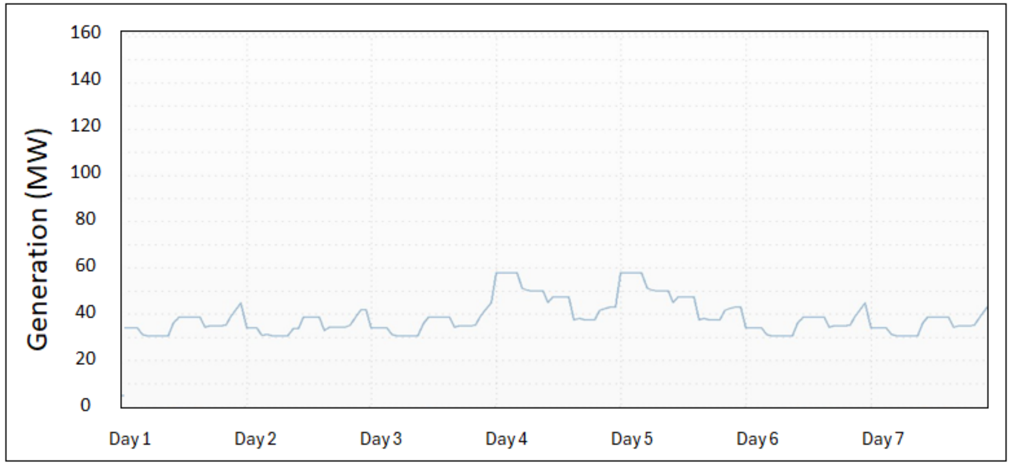


Sampled Chronology Renewable Shapes (Generation)

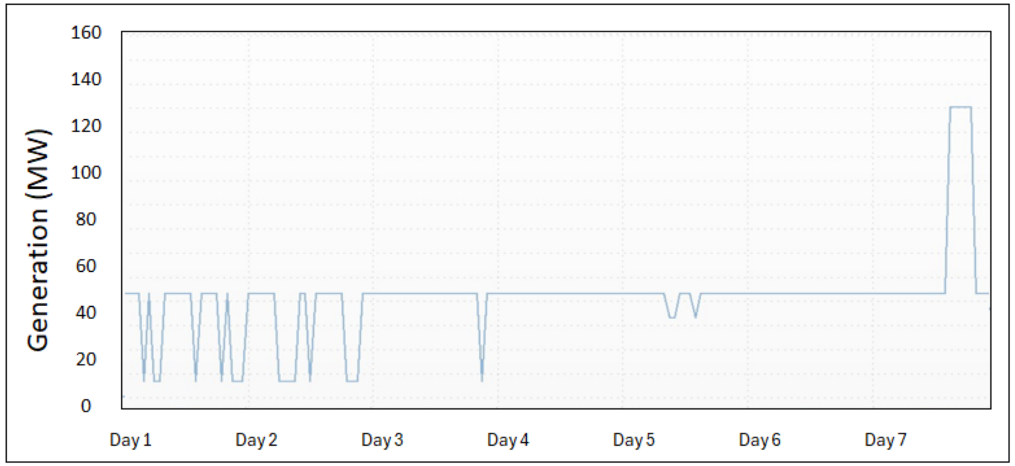
Sampled LT without generation profile adjustment



Sampled LT with generation profile adjustment



4 blocks per month LT without generation profile adjustment



Sampled Chronology Test Runs

- Testing parameters
- Challenges
- Efficacy

Input Considerations

What kind of conditions do we need to consider on our system over ten years?

- No shortfalls on 3,651 days out of 3,652 is 99.97%, so…basically all possible conditions.

Do conditions vary over ten years?

- Yes. A lot.

And "conditions" actually means lots of different load and resource data streams?

- Yes. A lot.

And those load resource data streams interact or correlate with each other?

- Yes. A lot.

Multiple conditions must be considered

- **Load:** growth over time, energy efficiency, rooftop solar, etc.
- **Resources:** renewable availability, fuel supply, emissions limits, etc.
- **Markets & System Operations:** power prices, natural gas prices, ancillary services/operating reserves, etc.

These data series interact

- **Weather:** temperature, wind, precipitation, hydro, etc.
- **Transmission System:** imports/exports, distributed resources, system balancing/reliability, etc.

Core Assumptions Subject to Revision in the 2027 IRP

Core assumption changes in the 2025 IRP

- Hourly shapes for wind, solar, energy efficiency and demand response (March 2024 PIM slides 15-17, July 2024 PIM slides 80-81, August 2024 PIM slide 54, February 2025 PIM slides 9, 17-31)
- Stochastics (March 2024 PIM slides 17-18, July 2024 PIM slides 45-49, January 2025 PIM slides 32-37, February 2025 PIM slides 17-31)
- Reserve Requirements (March 2024 PIM slides 19-20, June 2024 PIM slides 63-67,)
- Market Prices and Volumes (July 2024 PIM slides 38-43, August 2024 PIM slides 51-54, January 2025 PIM slides 84-86, February 2025 PIM slides 17-31)

Core assumption changes anticipated for the 2027 IRP

- Modeling of state-specific requirements
- Proxy resource costs
- Market prices and volumes
- QCC values and PRM
- Load Forecast

Lunch Break
Returning 12:15/1:15 PM PT/MT

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Resource Adequacy

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Resource Adequacy (RA)

- The Western Electricity Coordinating Council (WECC) defines resource adequacy as ensuring the system has enough reserves and resources to meet energy and capacity need.
- Western Resource Advocates defines resource adequacy as “the ability of energy resources to meet load…across the bulk power system, except in the most extreme circumstances”
- The US Environmental Protection Agency defines resource adequacy as “the provision for adequate generating resources to meet projected load and reserves requirements”
- Key components of adequacy include available generation capacity, transmission infrastructure and reliability measurements
- Both the existing resource mix, and future selections impact system adequacy, and how different jurisdictions participate in resources impacts a jurisdictional view of current and future adequacy needs

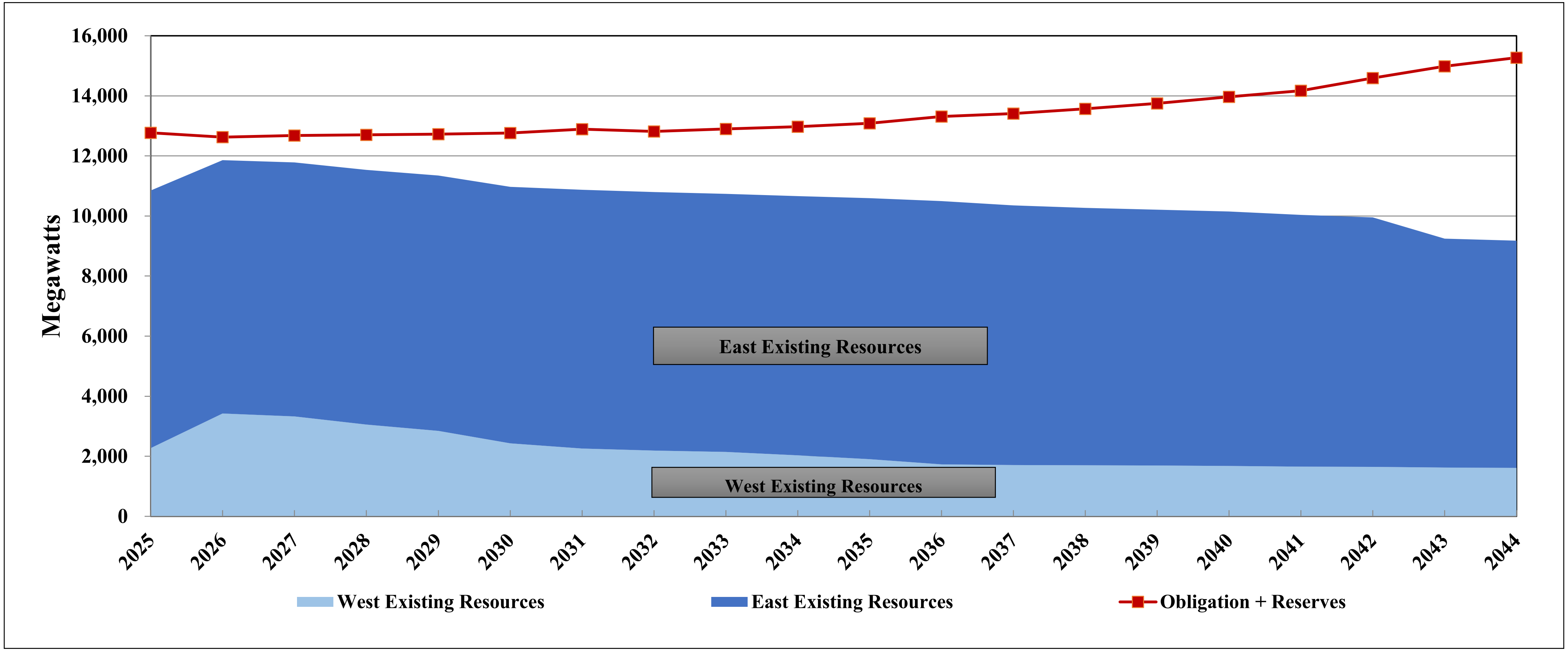
How does adequacy relate to allocation, modeling and procurement

- The IRP is not a cost allocation exercise, however current and future allocation of resources is a critical modeling input
- It is imperative that PacifiCorp understand how state policies and sharing of resources impacts procurement needs and decisions
- Needs dictated by a change in the currently agreed upon operation of the PacifiCorp system are important to understand and evaluate
- The IRP must identify the directional procurement needs and strategy of PacifiCorp, and ignoring how current and future selections may impact state policies (or be impacted by state policies) would be imprudent and present significant risk to PacifiCorp and its customers.

PacifiCorp Existing Position

- The load and resource (L&R) balance position, considering existing resources and allocations, is very clear.
- The following slides explores various positions related to summer peak demand using existing resources and existing, proposed or implied future allocation. This view does not take into consideration new resources or alternative allocation methodologies.
- With existing resources, there is a system gap starting in 2028.
- Assuming the Rocky Mountain Power states are allocated all coal beginning 2030, the east side of the system has very low resource needs.
- A jurisdictional view of the L&R shows that the exit from coal leaves Oregon and Washington with a significant resource adequacy shortfall.
- If Oregon were to remain in thermal resources, the gap would be lower, and the system L&R view would be applicable to all jurisdictional planning.

Existing Resources Summer L&R



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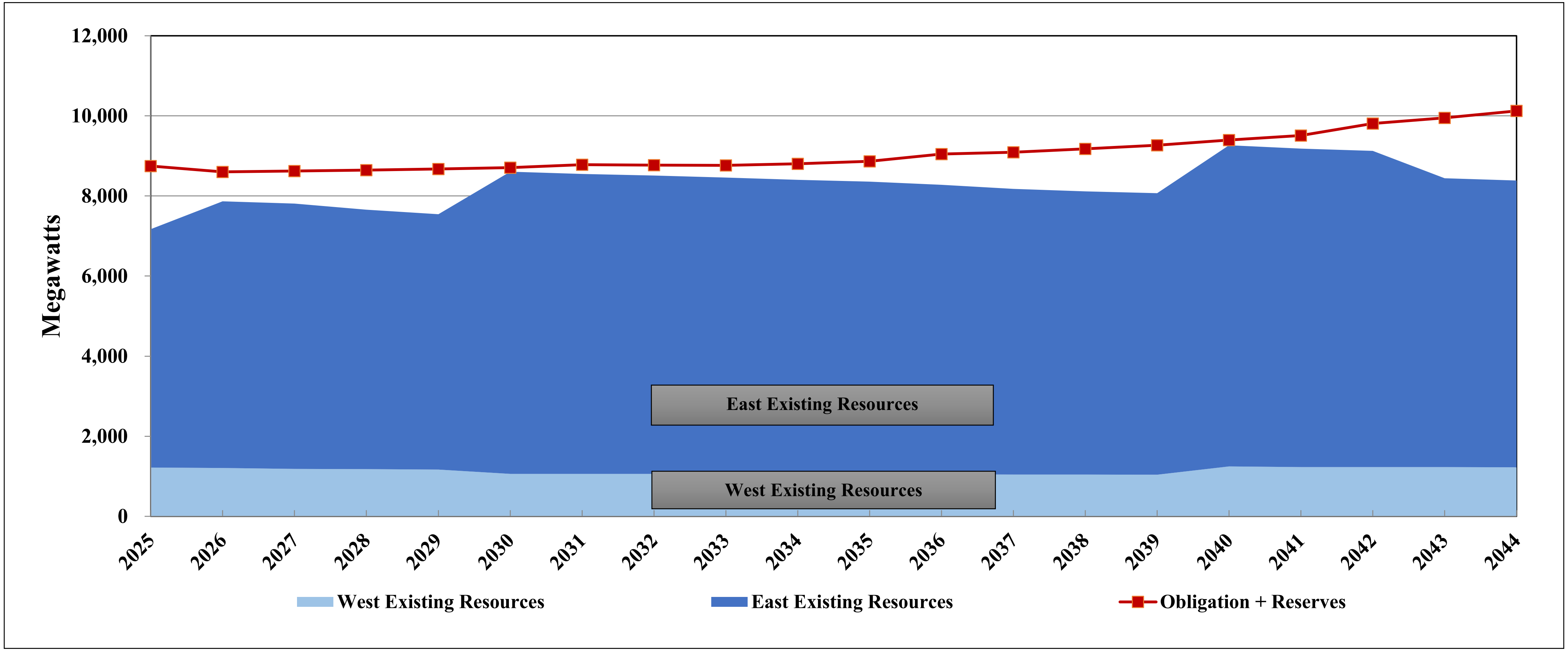
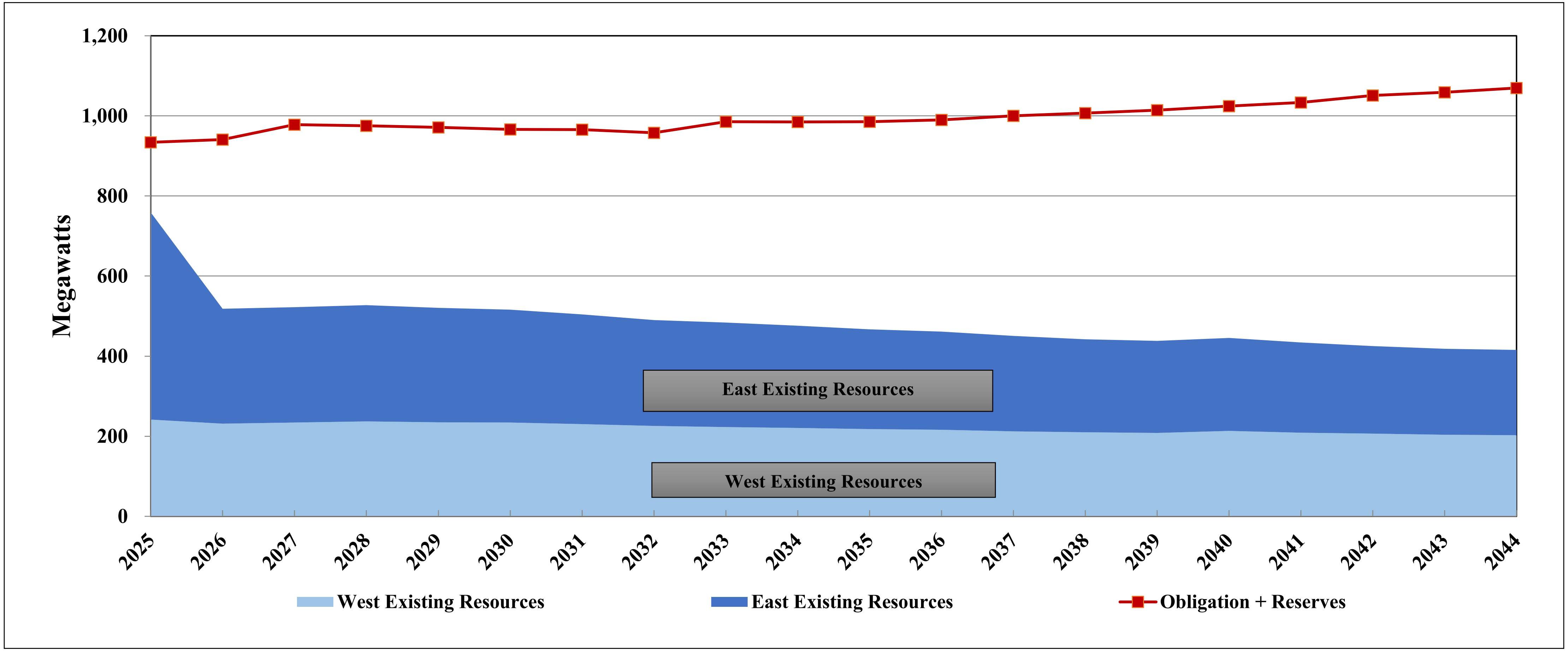
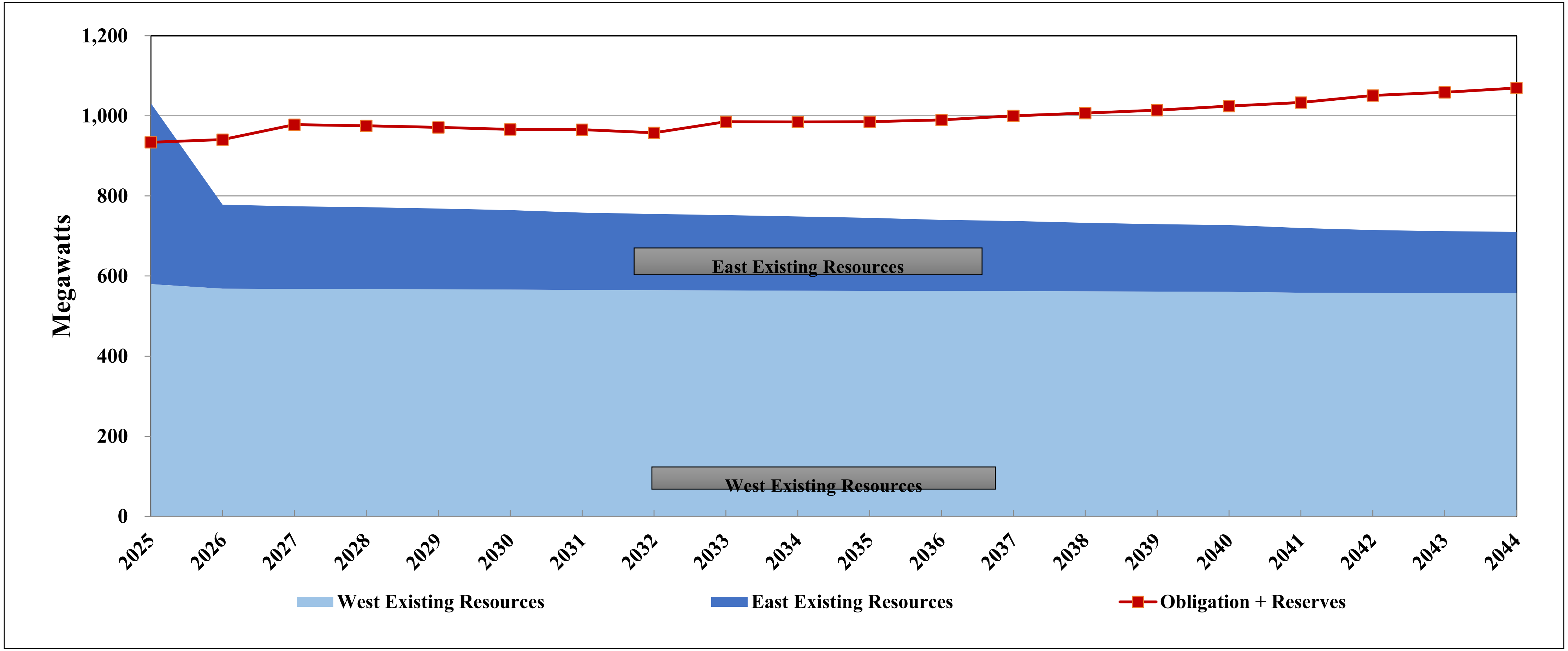
UIWC Summer L&R – Assumed Thermal Allocation



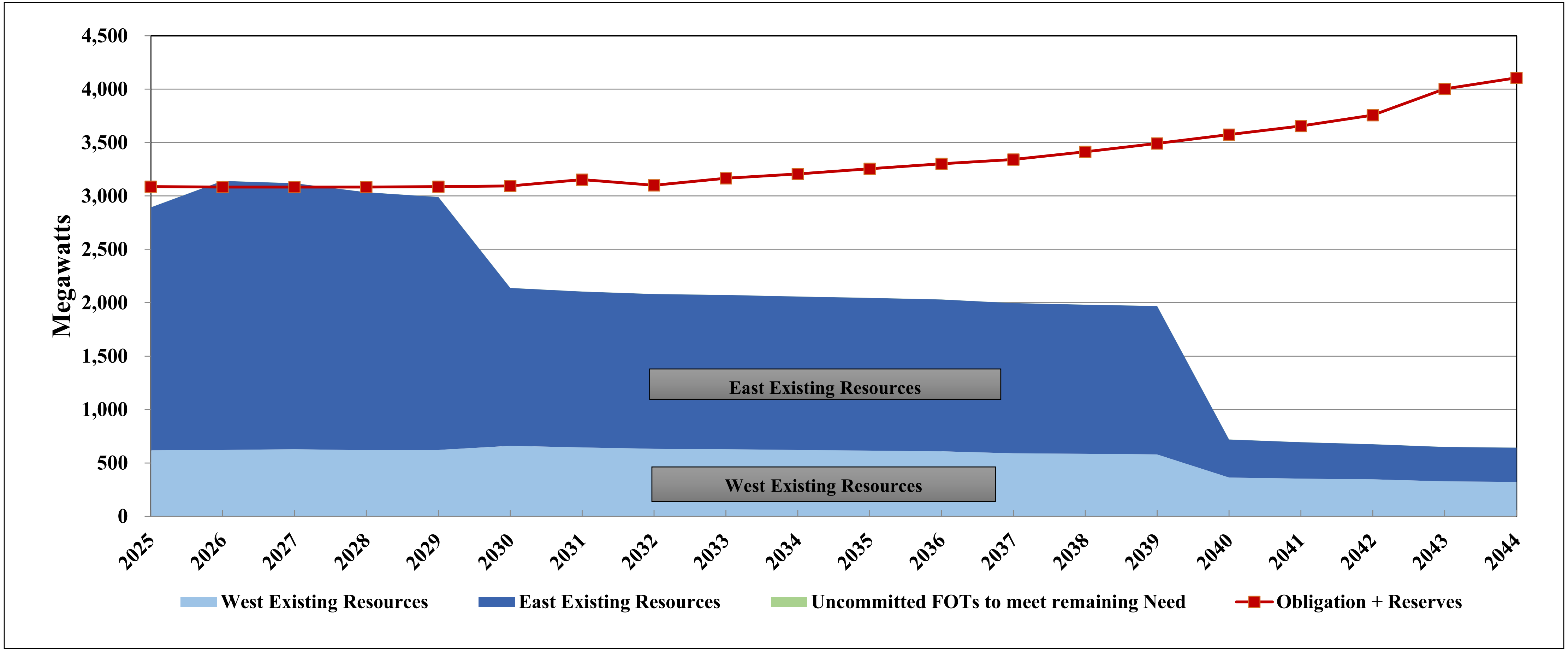
WA Summer L&R – Assumed Thermal Allocation



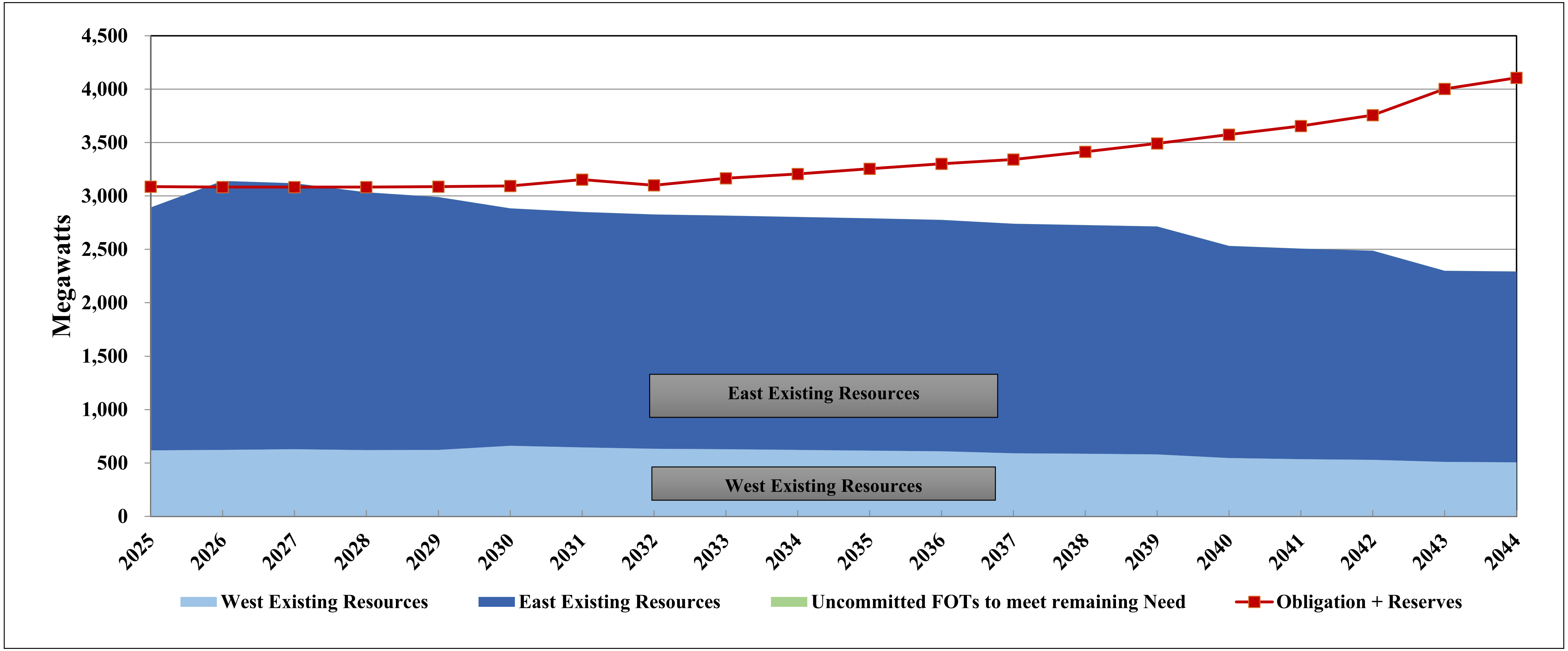
WA Summer L&R – 2026 Protocol



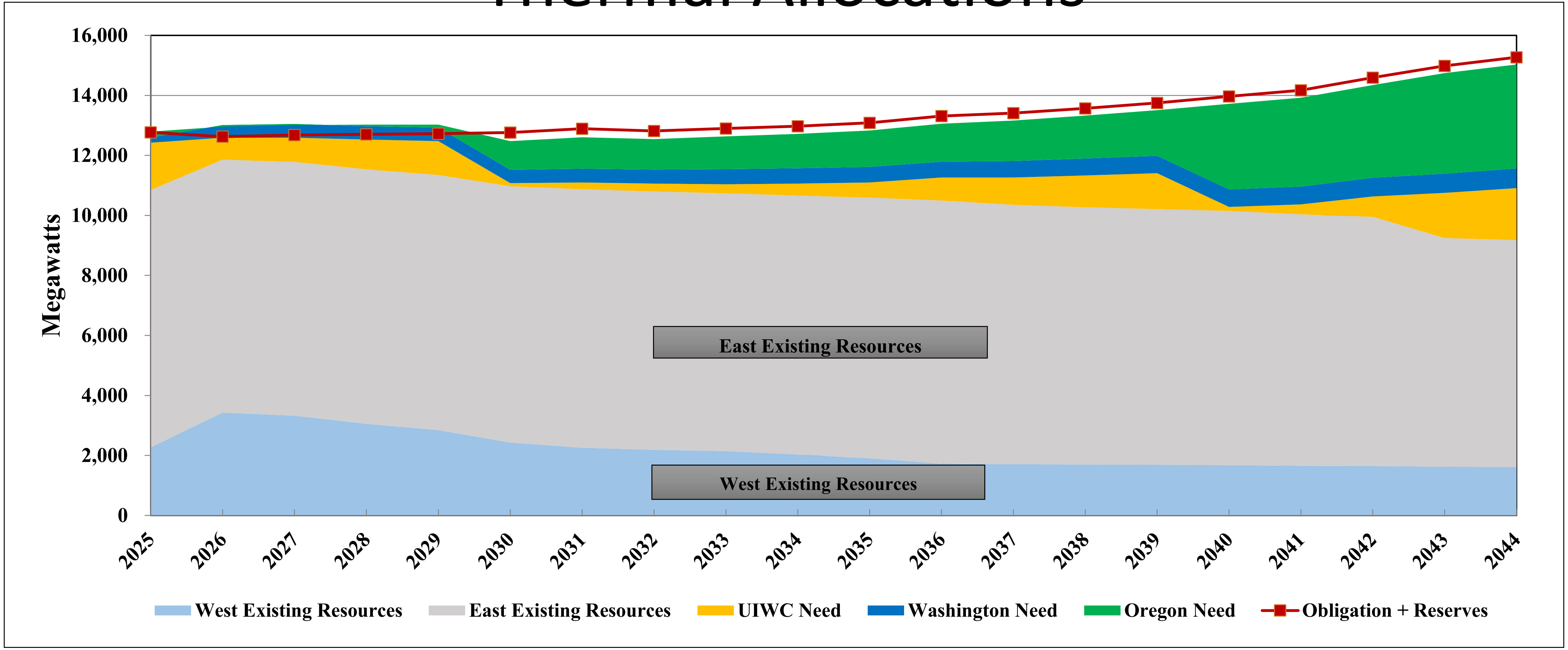
OR Summer L&R – Assumed Thermal Allocation



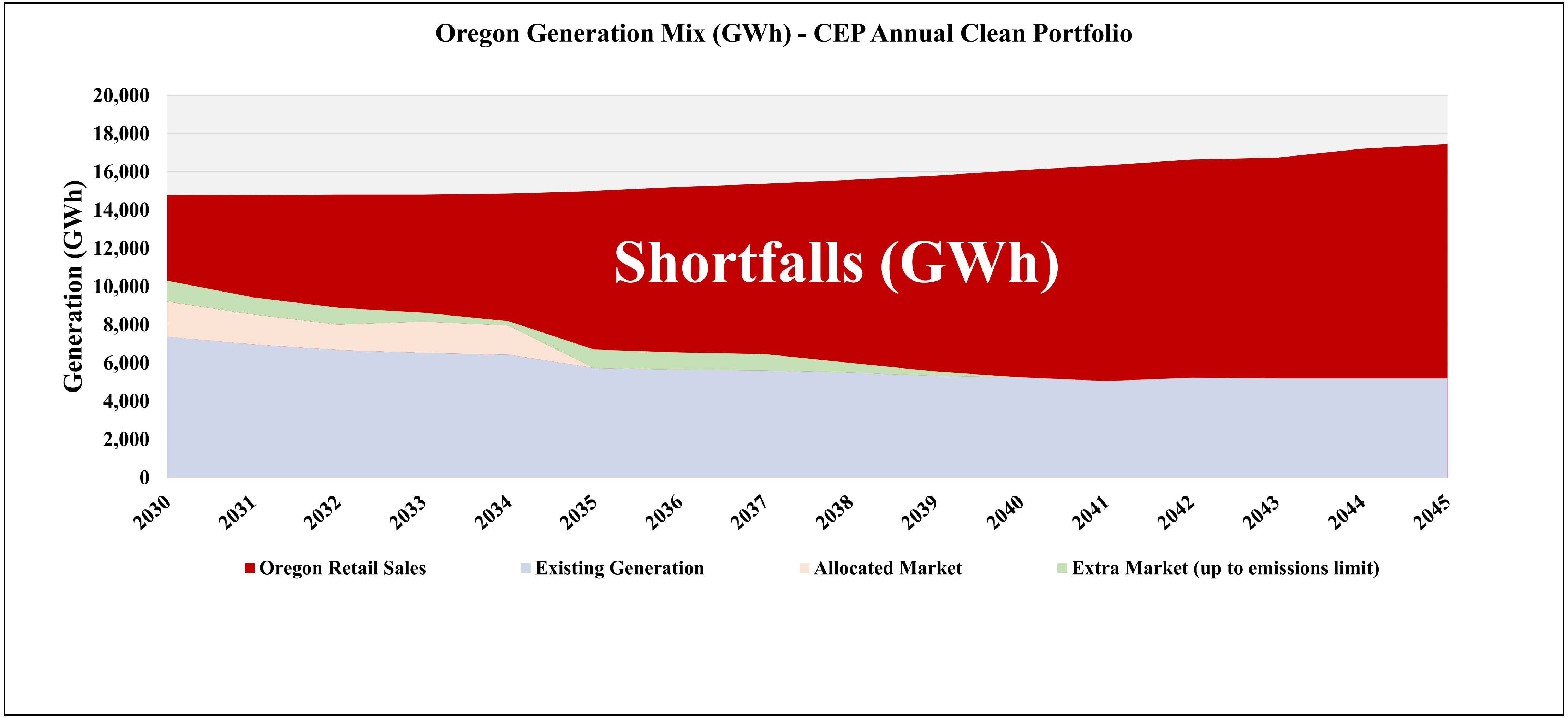
OR Summer L&R – Cont. Thermal Participation



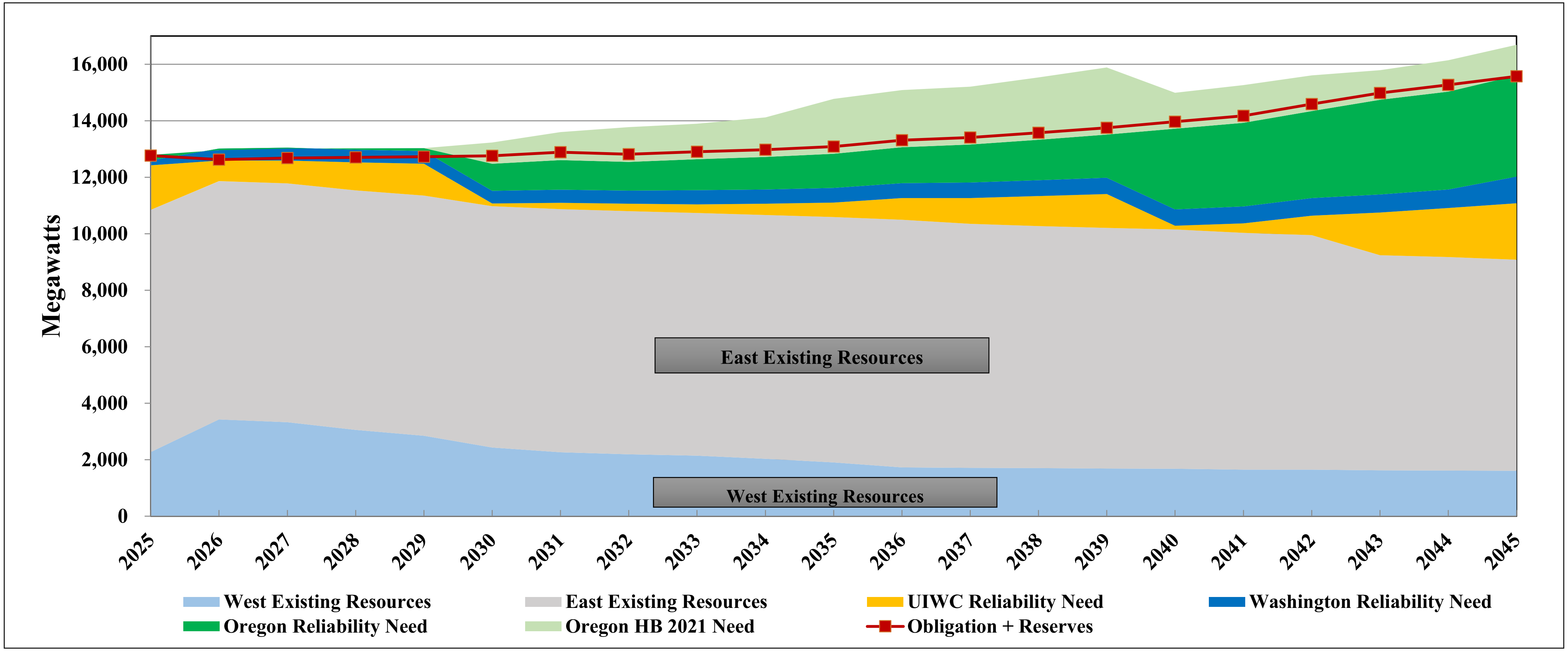
Summer L&R – Jurisdictional Needs Under Assumed Thermal Allocations



Oregon HB 2021 Energy Need



Summer L&R – Jurisdictional Needs Under Assumed Thermal Allocations & HB 2021



Portfolio Path Analysis

- Portfolios reporting divergent resource plans may still perform comparably over the course of the 20-year horizon.
- The most important time period in long-term modeling results is the near-term 2- to 4-year action plan window.
    - Near-term impacts can be evaluated by comparing the first years of candidate portfolios.
- Resource planning *beyond* the near-term window might require actions to be taken *in* the near-term, and this also requires due consideration.
- Flexibility in long-term planning has value.

Preferred Portfolio Market Signal

Resource	2025	2026	2027	2028	2029
Gas - CCCT	-	-	-	-	-
DSM - Energy Efficiency	92	89	209	220	239
DSM - Demand Response	18	2	-	63	21
Renewable - Wind	-	-	-	21	794
Renewable - Utility Solar	-	-	-	222	180
Renewable - Battery, < 8 hour	-	-	-	1,146	242
Renewable - Battery, 24+ hour	-	-	-	-	-
Coal Plant Retirements	-	-	-	(220)	-
Coal - Gas Conversions	-	357	-	-	205
Expire - Wind PPA	-	(64)	-	-	-
Expire - Solar PPA	-	-	-	(2)	-
Expire - QF	-	-	-	-	-

- The preferred portfolio signals significant resource needs in 2028 and 2029
- More than 1 GW of generation and storage each

Portfolio Path Analysis – Preferred Portfolio vs. Hunter

Resource	2025	2026	2027	2028	2029
Gas - CCCT	-	-	-	-	-
DSM - Energy Efficiency	-	-	10	12	3
DSM - Demand Response	-	-	-	-	(2)
Renewable - Wind	-	-	-	-	100
Renewable - Utility Solar	-	-	-	-	-
Renewable - Battery, < 8 hour	-	-	4	-	(27)
Renewable - Battery, 24+ hour	-	-	-	-	-
Coal Plant Retirements - Minority Owned	-	0	-	-	-
Coal Plant Retirements	-	-	-	-	-
Coal - Gas Conversions	-	(0)	-	-	-
Expire - Wind PPA	-	-	-	-	-
Expire - Solar PPA	-	-	-	-	-
Expire - QF	-	-	-	-	-

- Positive means Hunter has more
- No Transmission difference
- Minor differences through 2029

Portfolio Path Analysis – Preferred Portfolio vs. MR

Resource	2025	2026	2027	2028	2029
DSM - Energy Efficiency	-	-	-	1	(8)
DSM - Demand Response	-	-	-	-	(2)
Renewable - Wind	-	-	-	-	(100)
Renewable - Utility Solar	-	-	-	-	-
Renewable - Battery, < 8 hour	-	-	-	11	(27)
Renewable - Battery, 24+ hour	-	-	-	-	-
Coal Plant Retirements	-	-	-	-	-
Coal Plant Ceases as Coal	-	-	-	-	-
Coal - Gas Conversions	-	(0)	-	-	-
Expire - QF	-	-	-	-	-

- Positive means MR has more
- No Transmission difference
- Minor differences through 2029

Portfolio Path Analysis – Preferred Portfolio vs. HH

Resource	2025	2026	2027	2028	2029
DSM - Energy Efficiency	-	-	2	3	(3)
DSM - Demand Response	-	-	-	-	1
Renewable - Wind	-	-	-	-	-
Renewable - Utility Solar	-	-	-	-	1
Renewable - Battery, < 8 hour	-	-	2	-	60
Renewable - Battery, 8-23 hour	-	-	1	-	-
Renewable - Battery, 24+ hour	-	-	-	-	-
Coal Plant Retirements	-	-	-	-	-
Coal Plant Ceases as Coal	-	-	-	-	-
Coal - Gas Conversions	-	(0)	-	-	-
Expire - QF	-	-	-	-	-

- Positive means HH has more
- No Transmission difference
- Trivial differences through 2029

Optimization Modeling Overview

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Optimization Modeling

- Optimization modeling is a mathematical approach used to determine the optimal minimum or maximum of a complex equation.
- For PacifiCorp's system, we run models which seek the lowest present value revenue requirement (PVRR) of our multistate system, given all requirements and constraints.
    - Note that requirements and constraints reduce the optimality of outcomes.
- Optimization math obeys the constraints and meets the requirements it is given (e.g., reserves requirements, unit capabilities, transmission constraints, market prices, and other parameters and relationships).
- Optimization math avoids the need to examine every possible combination of options individually to determine the optimal solution.
- To understand how optimization models work, it is meaningful to compare it to the alternative of "stepwise" problem solving.

Stepwise Approach

- Solves a problem by executing a series of intuitive steps.
- Example: If you know that you must hold reserves on your energy system, some of your steps might be:
  - Rank your generators by reserve carrying cost, low to high.
  - Hold reserves on each unit, in order, until reserve requirements are met.
  - Determine how much generating capacity is left after reserves.
  - Rank order your units by energy production cost, low to high.
  - Generate from each unit, in order, until all loads are met.
  - Calculate remaining generating capacity that could produce “excess energy”.
  - Sell excess energy at market:
    - … when economic; compare production cost to market prices.
    - … when deliverable; keep a running total of transmission usage and market depth.
- Repeat your steps for every hour (or other period) of every year, accounting for what you did in each prior hour (e.g., unit commitment or fuel use).

Optimization Modeling Approach

Optimization modeling mathematically determines the “best” (optimal) solution

- By eliminating solutions that cannot meet requirements or obey constraints (infeasible).
- By eliminating feasible solutions that cannot be the optimal solution.
- By assessing linear relationships to get as close to the theoretically optimal solution (“relaxed solution”) as possible and;
- Provides available output about the best solution. Possible output includes:
  - Discrete decisions (e.g., add capacity at a particular site, acquire a particular DSM bundle).
  - Energy production of modeled resources, usage of transmission, purchases of from markets.

Not all information is needed to provide a solution

- No need for a reserve stack.
- No need to assign reserves to specific units.

Simple Optimization Example: Thermal Generation

Problem

- How much gas energy and how much coal energy should we generate?

Objective

- Minimize system costs assuming two generating units (one gas, one coal), one transmission line, and one load area, operating for a period of one hour.

Relationships

- A transmission line conveys energy to the load area.

Parameters and Constraints (in a single hour)

- Generate up to 120 MW from our gas unit.
- Generate up to 150 MW from our coal unit.
- Transmission capacity and load requirement are both 200 MW.

Run Cost

- 1 MWh of gas-power costs $2 to generate.
- 1 MWh of coal-power costs $3 to generate.
- Failure to meet load costs $100/MW.

Simple Optimization Example, Continued

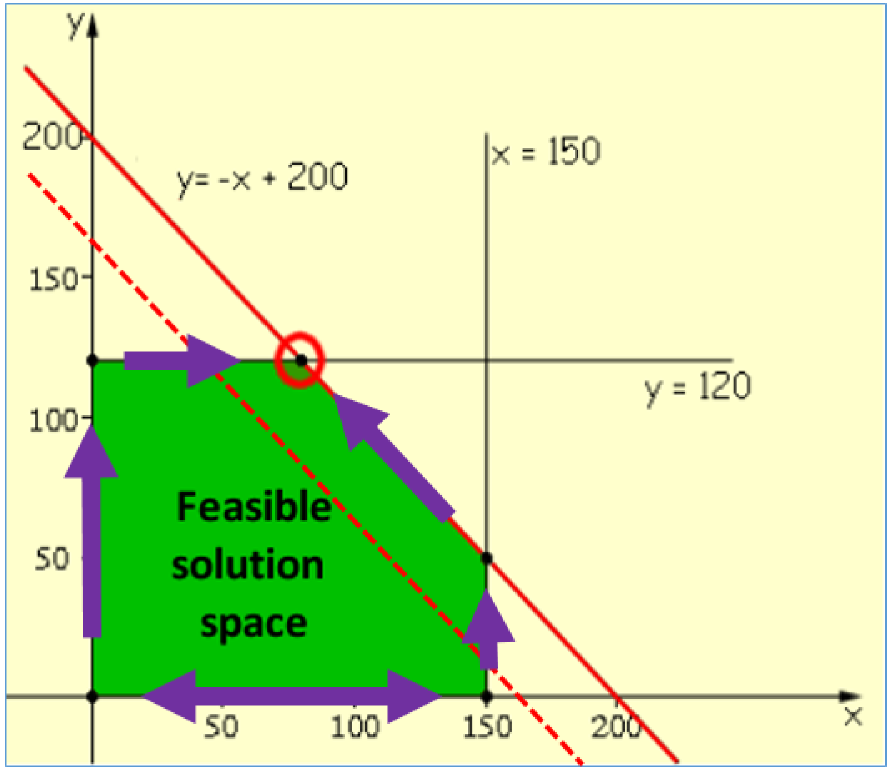
- When the model runs, modeled constraints and objectives become mathematical constraints and objectives in a complex formula, expressed as inequalities:

Linear Inequalities	Purpose
$x \leq 150$	Coal can generate up to 150 MW
$y \leq 120$	Gas can generate up to 120 MW
$x + y \leq 200$	Total generation cannot exceed transmission
$x \geq 0$	Coal generation cannot be negative
$y \geq 0$	Gas generation cannot be negative

- The model uses these inequalities to explore a “feasible solution space” – a range of possible solutions that *might* be the right answer.
- In our example, we’re going to assume a $100/MW penalty for not meeting system load.

Simple Optimization Example, Continued

- The graph at right illustrates how the math defines the “feasible solution space”.
- The load requirement dictates that only solutions along the red line could be the best answer. (At each point on the red line, the generation total is 200 MW, avoiding the $100/MW penalty for not meeting load).
- The model “searches” for the edge of the feasible solution space, then examines other solutions along that edge to see if moving in one direction or another improves the solution (by lowering PVRR).
- The model quickly arrives at the optimal solution, found at one end (vertex) of the 200 MW load requirement.
- This vertex meets all requirements and constraints and produces the lowest PVRR. No other solution does this.



- The dotted red line would apply to a scenario where the two generators could not supply the 200 MW needed for load. The model would find an optimal solution in the same manner, minimizing the amount of penalty it must pay. If the requirement to meet load was absolute, the solution would be infeasible.

Optimization Modeling Advantages & Complexities

You quickly approach the best (i.e., optimal) answer.

- Complexity: The best answer may not be immediately intuitive.
- If the result isn't intuitive, it is usually an indication of a problem that must be investigated.

Multi-dimensional problem solving; detailed precision and accuracy that non-optimization approaches cannot match.

- Complexity: Determining an acceptable amount of complexity.
- Complexity: Tremendous amounts of data are required.
- Complexity: Time required to produce and analyze results.
- Complexity: Highly technical software, equipment.
- Complexity: 1-2 year training ramp-up, starting with a skilled analyst.

Avoids Stepwise Bias.

- Complexity: Co-optimizing divergent requirements and constraints cannot always be done in a reasonable amount of time, such as modeling two price environments simultaneously.
- As a result, in the 2023 IRP Update and the 2025 IRP we implemented jurisdictional integration to capture divergent requirements. (See earlier slide regarding State Policy Divergence")

Optimization modeling is incredibly fast for what it does; has the effect of examining every modeled possibility.

- Complexity: All desired outputs may not be readily available.

PLEXOS Advantages

Since adopting PLEXOS, we have been able to:

- Model endogenous transmission.
  - No complex topology additions or analytics, just math constraints.
  - No need to create a faux topology or multiple copies of every resource (as in the 2019 IRP).
  - Combined or dependent transmission options can be considered *in whole and in part* at the same time.
- Introduce endogenous thermal planning optimization.
  - 2019 IRP: 78 individual retirement portfolios.
  - 2021 IRP: > 260,000 retirement combinations considered in every model run.
  - 2023 IRP: > 5,000,000,000,000 (5 trillion) combinations considered in every model run.
  - 2025 IRP: ?
  - In addition, each model run considers gas unit retirements and alternate configurations such as carbon capture and gas conversions.
- Implement multi-faceted reliability.
  - Operating reserves and resource availability *supplement* the planning reserve margin as a central driver for capacity expansion.
  - The short-term dispatch model identifies all hours with unserved energy. These hourly shortfalls are added to the load forecast used in the next phase of the long-term capacity expansion model.
  - The short-term dispatch model also identifies the value (i.e., net revenue) produced by each resource. The difference between the net revenue in the short-term and long-term models is added to the next phase of the long-term model. This process allows the granularity provided by the short-term model to inform capacity expansion.

2025 IRP Update Assumptions

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2025 IRP Update Planned Assumptions Overview

- A draft of the 2025 IRP Update will be filed on January 30, 2026.
- No modeling inputs and methodological assumptions will be finalized before the data lockdown date of November 30, 2025.
- The default modeling approach for the 2025 IRP Update is the 2025 IRP modeling approach, informed by subsequent changes made for Oregon's Clean Energy Plan (filed June 30) and Washington's Clean Energy Implementation Plan (filed October 1st).
- The following slides focus on a few topics of interest and show the assumptions that we would make *if we had to start final modeling for the 2025 IRP Update tomorrow.* They are subject to change as we continue to implement new inputs and assumptions in PLEXOS and work through problems.
- Additional changes may be implemented subject to stakeholder feedback received in the next 2 weeks, model performance, and other discovered challenges.
- As part of the 2027 IRP process, we will re-evaluate all modeling assumptions

Planned Assumptions Resource Adequacy

- We will continue to use planning reserve margin (PRM) and effective load carrying capability (ELCC) values provided by the Western Resource Adequacy Program as a representation of resource adequacy.
- In the 2025 IRP, consistent with WRAP, we did not allow front office transactions (FOTs) to contribute towards resource adequacy. In the 2025 IRP Update, we will allow up to 1,000 MW of FOTs to be selected by the model for resource adequacy. This is responsive to comments from stakeholders asking the IRP to evaluate the tradeoffs between firm market purchases and resource procurement.

Planned Jurisdictional Models

- *System resource adequacy run that selects the portfolio of resources necessary for system RA compliance, regardless of state policies**
- System resource adequacy run inclusive of Oregon SB 1547
  - Oregon SB 1547 increases Oregon's reliability need, changing the portfolio of resources that is optimal for system resource adequacy.
- Oregon jurisdictional model that includes HB 2021 and small-scale compliance
  - All proxy generating resources, regardless of location, are eligible to contribute towards HB 2021 compliance.
- Washington jurisdictional model that includes CETA compliance and social cost of greenhouse gases (SCGHG).
  - All proxy generating resources, regardless of location, are eligible to contribute towards CETA compliance.
- UIWC shares are selected in the second system resource adequacy run.

*Baseline

Planned Treatment of Large Loads/B2H

- We will include committed loads in the 2025 IRP Update load forecast. Committed large loads that are covered by Oregon’s House Bill 3546 (POWER act) or Utah’s Senate Bill 132 will be included and have designated proxy resources that enable them.
    - Proxy resources added for committed large loads will be reported separately
- The treatment of non-committed large loads will be consistent with the 2025 IRP. We believe that this approach protects retail customers from the costs of large loads.
- B2H will be eligible for selection in the Update preferred portfolio. A “B2H with redirects” sensitivity will be included. This sensitivity is responsive to stakeholder feedback.

Planned Treatment of Tax Credits

- In the 2025 IRP, we assumed that the expanded federal tax credits established by the Inflation Reduction Act and Infrastructure Investment and Jobs Act would continue through the end of the horizon.
- We are revising our modeling of federal tax credits to be consistent with recent federal legislation (HR 1) and executive orders.
- In the 2025 IRP Update:
  - Proxy wind and solar resources will not be eligible for tax credits
  - Proxy geothermal, hydro pumped storage, and nuclear is eligible for tax credits if built no later than 1/1/2037.
  - Proxy batteries are eligible for the investment tax credit if built no later than 1/1/2037.

Stakeholder Feedback

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Stakeholder Feedback Form Update

Status

- Two feedback forms submitted to date.
- Feedback forms can be located at: [IRP Stakeholder Feedback (pacificpower.net)]
- Depending on the type and complexity of the feedback, responses may be provided in a variety of ways including, but not limited to, a written response, a follow-up conversation, or incorporation into subsequent public-input meeting material
- Generally, written responses are provided with the feedback form and posted online at the link above
- ***Considering the 2025 IRP Update data lockdown date of November 30th, we encourage feedback related to the 2025 IRP Update to be submitted as soon as possible.***

Next Steps

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Upcoming Public Input Meetings

Tentative Agendas

December 17, 2025

- Conservation Potential Update
- Distributed Generation Study Overview
- Transmission Modeling Strategy
- Price Curve Update
- Load Forecast Status
- Qualifying Facility Renewals

January 28-29, 2026

- Draft 2025 IRP Update
- Federal Policy Updates
- Hydro Forecast Update
- Distributed Generation Update
- Reliability and Resource Adequacy
- Supply Side Resources Update
- Transmission Interconnection Options

March 11-12, 2026

- 2025 IRP Update Status
- Distributed System Planning Update
- Renewable Portfolio Standards
- Price-Policy Scenarios
- Market Reliance
- Volatility and Stochastics
- 2027 IRP Initial Studies List
- Emissions Modeling
- DSM Bundling Portfolio Methodology

2025 IRP Update / 2027 IRP Schedule

2027 IRP Public Input Meeting (PIM) Schedule		
	Event	Date
2025	Meeting #1	October 1, 2025
	Meeting #2	November 12, 2025
	Lockdown for 2025 IRP Update	November 30, 2025
	Meeting #3	December 17, 2025
2026	Meeting #4	January 28-29, 2026
	Publish Draft 2025 IRP Update	January 30, 2026
	Meeting #5	March 11-12, 2026
	Distribute 2025 IRP Update	March 31, 2025
	Meeting #6	April 22-23, 2026
	Meeting #7	June 3-4, 2026
	Meeting #8	July 15-16, 2026
	Input Review	**July 15, 2026**
	Meeting #9	August 26-27, 2026
	Meeting #10	October 14-15, 2026
	Indicative Portfolios[UT 3.3, 3.4]	**October 14, 2026**
	Meeting #11	November 18-19, 2026
	Draft 2027 IRP[WA (3)]	**November 30, 2026**
2027	Meeting #12	January 28-29, 2027
	Present final evaluations[UT 3.5]	**January 28, 2027**
	Meeting #13	February 25-26, 2027
	File 2027 IRP	**March 31, 2027**

Utah DOCKET NO. 23-035-10 September 24, 2024 Order

UT 3.3 For Future IRP cycles, PacifiCorp shall, prior to ranking resource portfolios, present indicative resource portfolios to stakeholders at a PIM at least five months before the planned filing date of PacifiCorp's (final) IRP.

UT 3.4 For Future IRP cycles, the deadline established, in the third ordering paragraph above (3.3), for presenting indicative resource portfolios shall also function as the Data Lockdown Date; PacifiCorp shall not further alter modeling inputs after presenting indicative resource portfolios as the third ordering paragraph above requires and must wait to incorporate any late-breaking data until, at least, the subsequent IRP Update filing.

UT 3.5 For Future IRP cycles, PacifiCorp shall present updated modeling results, including final evaluations and preferred portfolio selections, to stakeholders at a PIM meeting to be held at least two months before the planned filing date of PacifiCorp's (final) IRP.

Washington WAC 480-100-625

WA(3) Draft IRP. No later than four months prior to the due date of the final IRP, the utility must file its draft IRP with the commission. At minimum, the draft IRP must include the preferred portfolio, CEAP, and supporting analysis, and to the extent practicable all scenarios, sensitivities, appendices, and attachments.

(a) The commission will hear public comment on the draft IRP at an open meeting scheduled after the utility files its draft IRP. The commission will accept public comments electronically and in any other available formats, as outlined in the commission's notice for the open public meeting and opportunity to comment.
(b) The utility must file with the commission completed presentation materials concerning the draft IRP at least five business days prior to the open meeting.

Additional Information

Public Input Meeting and Workshop Presentation and Materials

- pacificorp.com/energy/integrated-resource-plan/public-input-process

2027 IRP Stakeholder Feedback Forms and Responses

- pacificorp.com/energy/integrated-resource-plan/comments

IRP Email / Distribution List Contact Information

- IRP@PacifiCorp.com

IRP Support and Studies

- pacificorp.com/energy/integrated-resource-plan/support