Electric Draft Portfolio Results

2023 Electric Progress Report

December 12, 2022

PUGET SOUND ENERGY

Safety Moment

Winter Safe Driving Tips

- Check your tire tread depth and replace tires if necessary.
- Check your tire pressure. Pressure drops as the temps drop.
- Avoid using cruise control in wintry conditions.
- Increase following distance in low visibility or during rainy or snowy weather.
- Keep extra blankets, bottled water, and phone charger in your vehicle.

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Welcome to the Webinar!

If you **want to type a question regarding the presentation,** insert **"Slide X followed by your question"** in the chat box!

If you **have a technical issue or a general question**, please type it in the chat box.

Please **keep yourself on mute** unless you are speaking.

If you want to **ask a question verbally,** click the 'Reaction' button and click on the **'Raise Hand'** option and we will call on you.

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Facilitator Requests

- Engage constructively and courteously towards all participants.
- Respect the role of the facilitator to guide the group process.
- Take space and make space.
- Avoid use of acronyms and explain technical questions.

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Agenda

Time	Agenda Item	Presenter
9:00 a.m. – 9:10 a.m.	Introduction and agenda review	Sophie Glass, Triangle Associates
9:10 a.m. – 9:25 a.m.	Progress Report Process	Elizabeth Hossner, PSE
9:25 a.m. – 9:50 a.m.	Distributed Energy Resources	Heather Mulligan, PSE
9:50 a.m. – 10:50 a.m.	Resource Plan Modeling Results	Elizabeth Hossner, PSE
10:50 a.m. – 11:00 a.m.	Break	
11:00 a.m. – 11:55 a.m.	Candidate Portfolios Discussion	All
11:55 a.m. – 12:00 p.m.	Next Steps	Sophie Glass, Triangle Associates
12:00 p.m.	Adjourn	All

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Today's Speakers

Phillip Popoff

Director, Resource Planning Analytics, PSE

Elizabeth Hossner

Manager, Resource Planning and Analysis, PSE

Heather Mulligan

Manager, Customer Energy Renewable Programs, PSE

Sophie Glass

Facilitator, Triangle Associates

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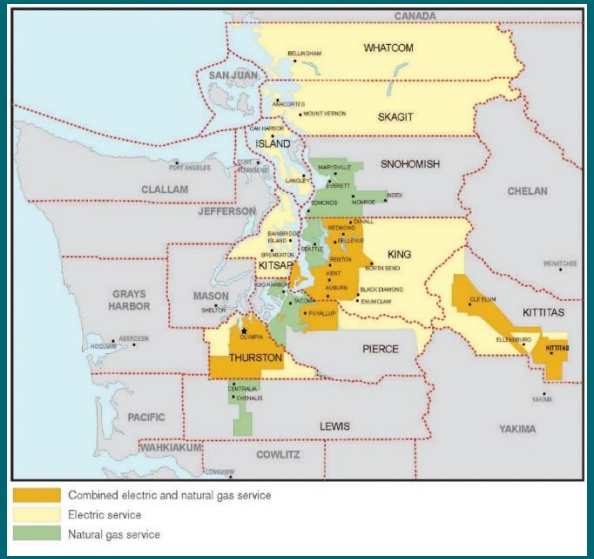
Electric Progress Report Process

2023 Electric Progress Report

December 12, 2022

PSE PUGET SOUND ENERGY

Puget Sound Energy



- Washington's largest and oldest utility, **serving 1.5 million customers** in 10 counties covering over 6,000 square miles
- Our **3,100+ employees** live and work in the communities we serve.
- We share our customers' **concern for the environment**, balanced with their expectations for uncompromised **reliability, affordability and safety**.
- **24 million MWh** annual sales
- **5,000 MW** winter peak

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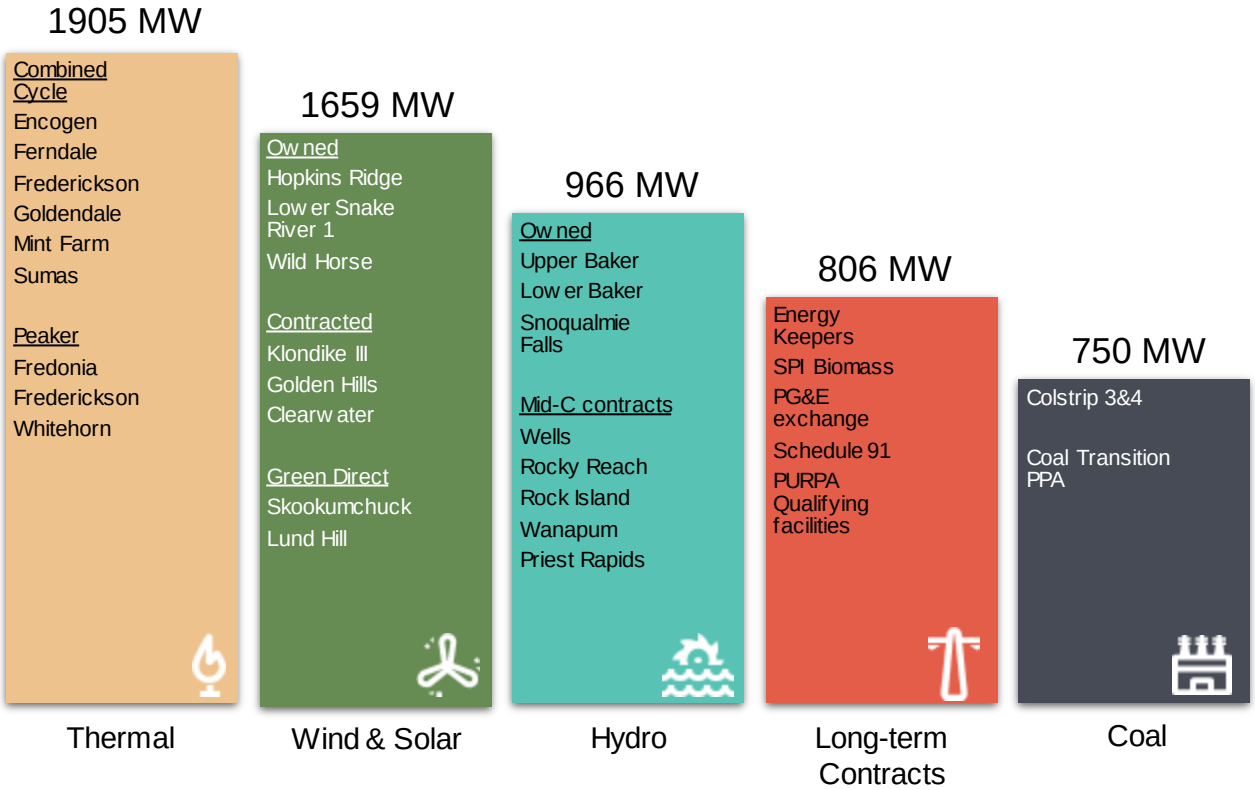
PSE's Current Nameplate Electric Generating Resources



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Resource Planning Foundations

- Continue to be a **clean energy leader**, in and beyond our region
- Meet our **CETA obligations**
  - 2025: Eliminate coal-fired resources
  - 2030: Greenhouse gas neutral
  - 2045: 100 percent of all retail sales of electricity supplied by renewable and non-emitting resources
  - Ensure **resource adequacy** while delivering a clean energy transition
- The future of power is a **diversified portfolio of non-emitting resources** providing energy security and reliability for all customers
- Ensure **equity for all customers** from the transition to clean energy
- Ensure **consistency with CEIP**

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How Public Participation Shaped our Work

- ✓ Reduce market reliance
- ✓ Incorporate climate change data and model winter and summer demand
- ✓ Consider range of resource alternatives and emerging technologies
- ✓ Model battery cycling at various frequencies, capacities, and types
- ✓ Model hybrid renewables and diverse energy storage resources
- ✓ Incorporate Inflation Reduction Act
- ✓ Embed equity

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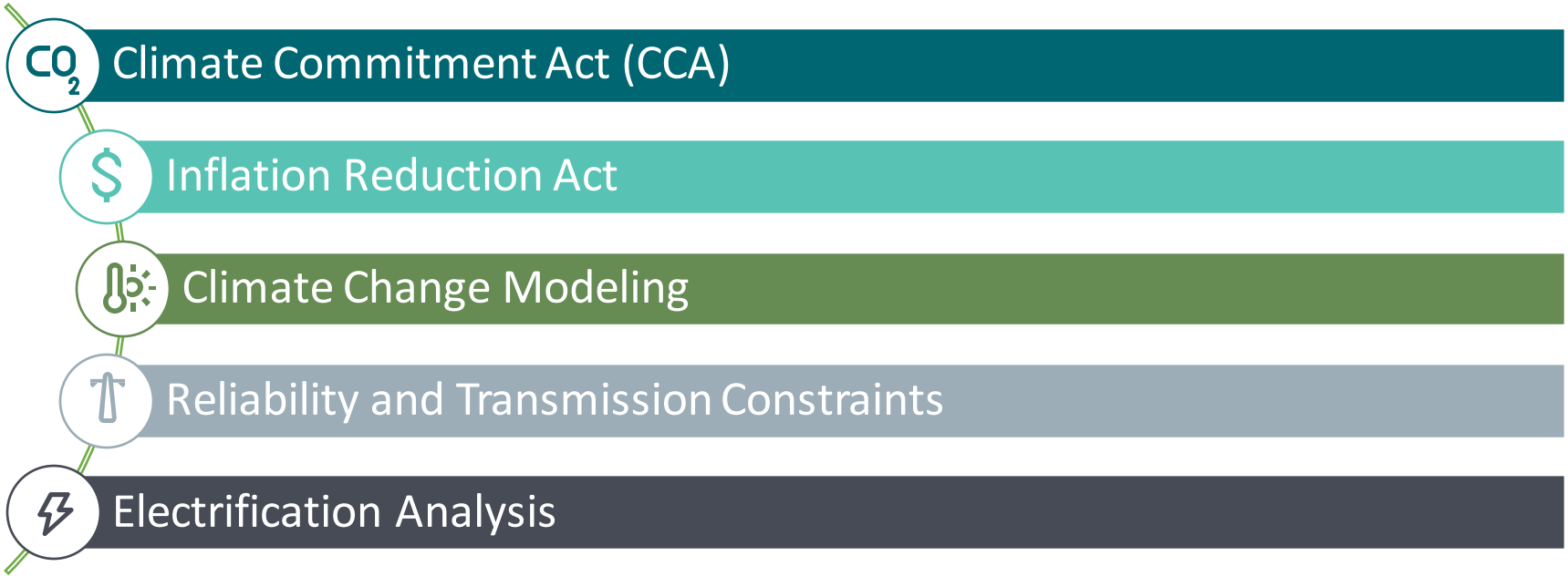
New Challenges and Opportunities



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Distributed Energy Resources

Clean Energy Products & Services in Operation Today

Heather Mulligan, Manager, Customer Energy Renewable Programs, PSE

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PSE Clean Energy Products and Services

PSE MATCH

GREEN POWER
- PNW REC purchases
- 62K residential, commercial, municipal customers

SOLAR CHOICE
- Solar RECs WA and ID
- 915K customers
- Residential, small commercial

CARBON BALANCE
- PNW third-party-verified carbon offsets
- 21K customers

PSE REPLACE

COMMUNITY SOLAR
- Expands access to new, 100% local solar
- 4 projects completed

RENEWABLE NATURAL GAS
- Replaces a portion of gas usage with local RNG supply
- ~5K customers

GREEN DIRECT
- Long-term partnership for dedicated resources
- 41 corporate/gov. customers

PSE GENERATE

NET METERING
- Up to 100 kW
- 15K+ customers; 130 MW
- All customer types

SMALL POWER PRODUCERS
- 100 kW – 5 MW
- Small renewable developers

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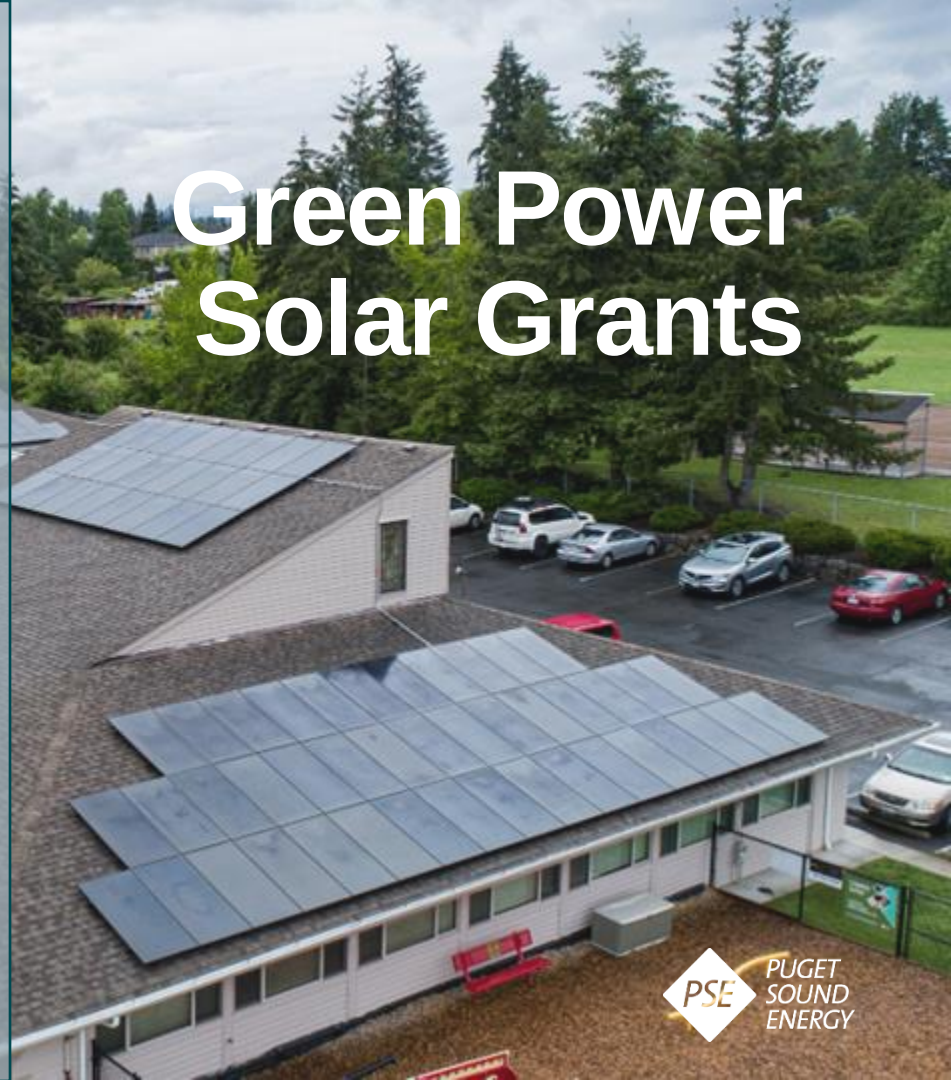
Green Power Solar Grants

- Awarded each year since 2016
- Opens each year in mid/late June through summer
- Non-profits and tribal entities that provide services to low-income or black, indigenous and people of color (BIPOC) communities
- $3.4M awarded over 5 years
- 48 projects funded, totaling 1.66 MW
- $750K available in 2023
- Funded by Green Power & Solar Choice programs and their participants



Green Direct

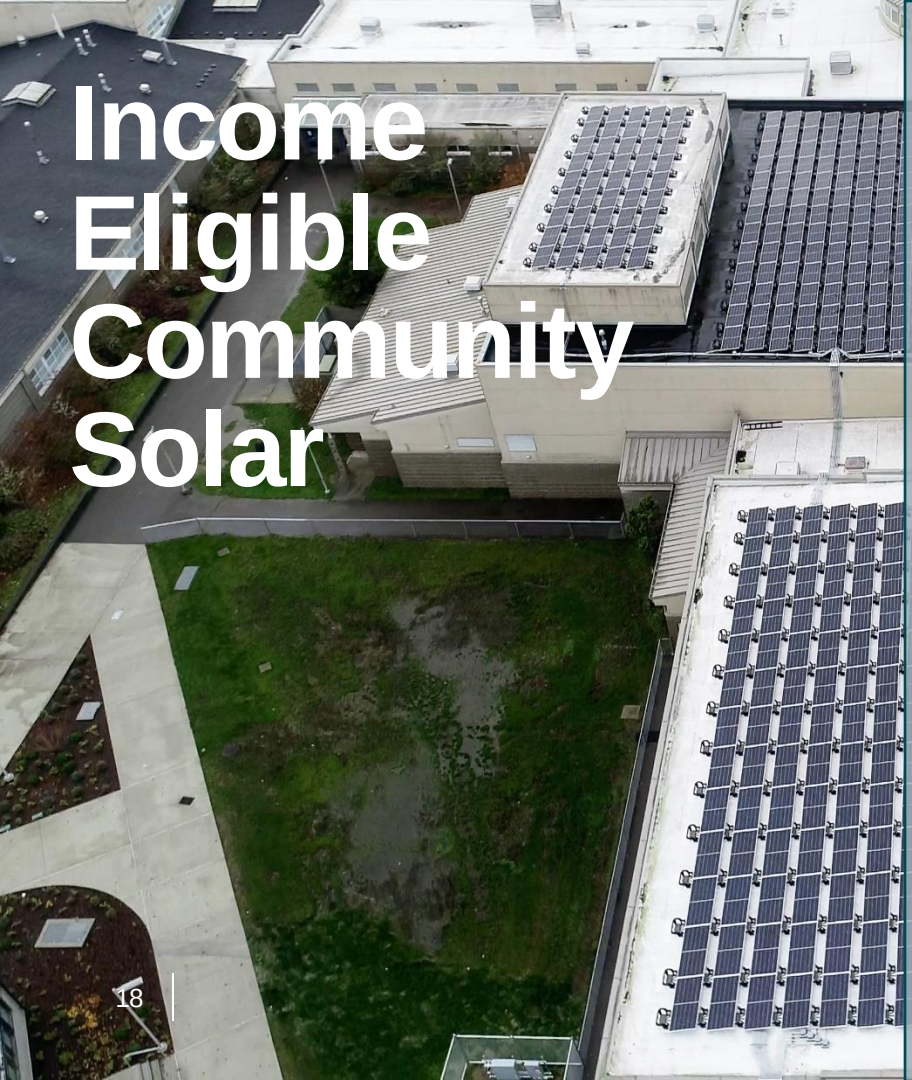
- Partnership with Corporate and Governmental customer to drive new renewable energy in Washington

- Skookumchuck Wind
- 137 MW's in Lewis County
  - Online in November 2020

- Lund Hill Solar
  - 150 MW in Klickitat County
  - Project completed this month

Community Solar

- Premium energy offering, residential focus
- Launched in Nov 2021
  - 3 sites in Western Washington – ~1 MW
  - 2 sites in Eastern Washington – 10 MW
  - More sites under development
- Western WA Solar installations **at the neighborhood level**
- Participants receive a credit based on actual generation
- Each share equals 1.46 kW



Income Eligible Community Solar

- $0 / per share cost
- Predictable monthly credit
- Annual true-up (always in customer favor)
- No contract
- No proof of income
- **20% of total program (20 MW) set aside**
- Annual re-affirm for eligibility

*Household average annual income level is at or below 200% of the Federal Poverty Level (FPL)

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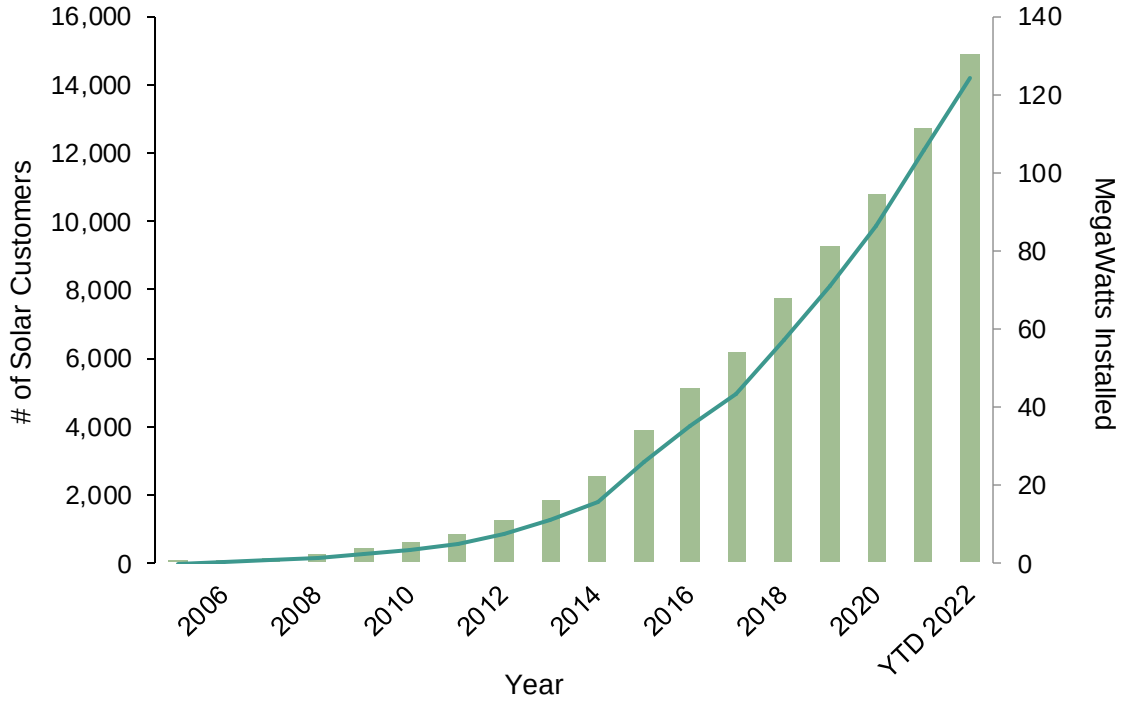
Customer Connected Solar

- Support for customers interconnecting solar at their home or business
- Customers with up to 100 kW can Net Meter – receive credit for energy put back on grid
- Customers generate their own renewable energy, lowering their electricity bills and reducing their carbon footprint.
- PSE offers information to help customers find qualified installers; and ensures safe interconnection to the grid.

Customer Connected Solar Growth



As of October 31st, over 15,500 customers have installed over 130 MW's of solar.

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What's Next: Distributed Solar & Storage RFP

- Projects between 200 kilowatts to 4.99 MWs, connected to PSE's Distribution System.
- Ground or rooftop mounted, including canopies and parking structures.
- Solar and Solar + Storage
- Bids must be submitted in Q1 2023
- Projects to be completed by the end of 2025
- Emphasis on projects that provide clean energy solutions to Highly Impacted Communities and Vulnerable Populations and their service providers

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Resource Plan Modeling Results

2023 Electric Progress Report

December 12, 2022

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Things to Keep in Mind

- In the following slides we will look at the least cost (reference) portfolio
- The reference portfolio is not the preferred portfolio
- Once we walk through the reference portfolio, we will discuss the sensitivities and some candidate portfolios
- We will then spend time getting your feedback on the candidate portfolios (during this meeting and in writing following the meeting)

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CETA Commitments

- PSE is the Pacific Northwest's largest utility producer of renewable energy
- PSE currently owns and contracts for over 10 million MWh of renewable energy annually.
- Meet Clean Energy Transformation Act standards
  - **2025:** Eliminate coal-fired resources from its allocation of electricity to Washington retail electric customers
  - **2030:** Greenhouse gas neutral
  - **2045:** 100 percent of all retail sales of electricity supplied by renewable and non-emitting resources
  - **Reliability:** maintain resource adequacy targets

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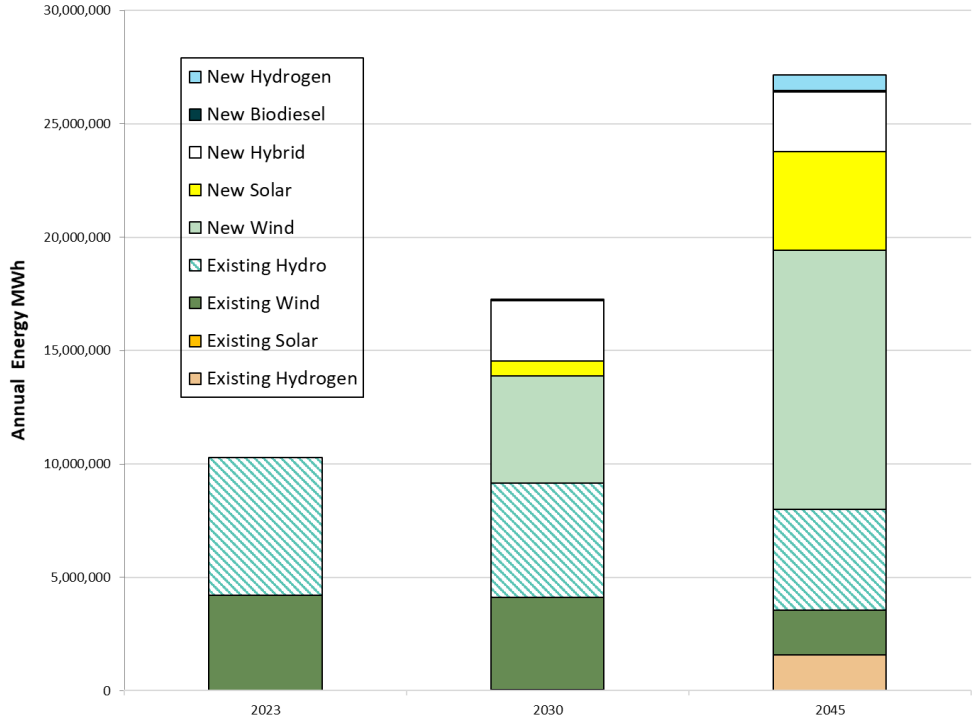
100 Percent Clean Energy by 2045: Least Cost (reference)

CETA Compliant Totals -

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



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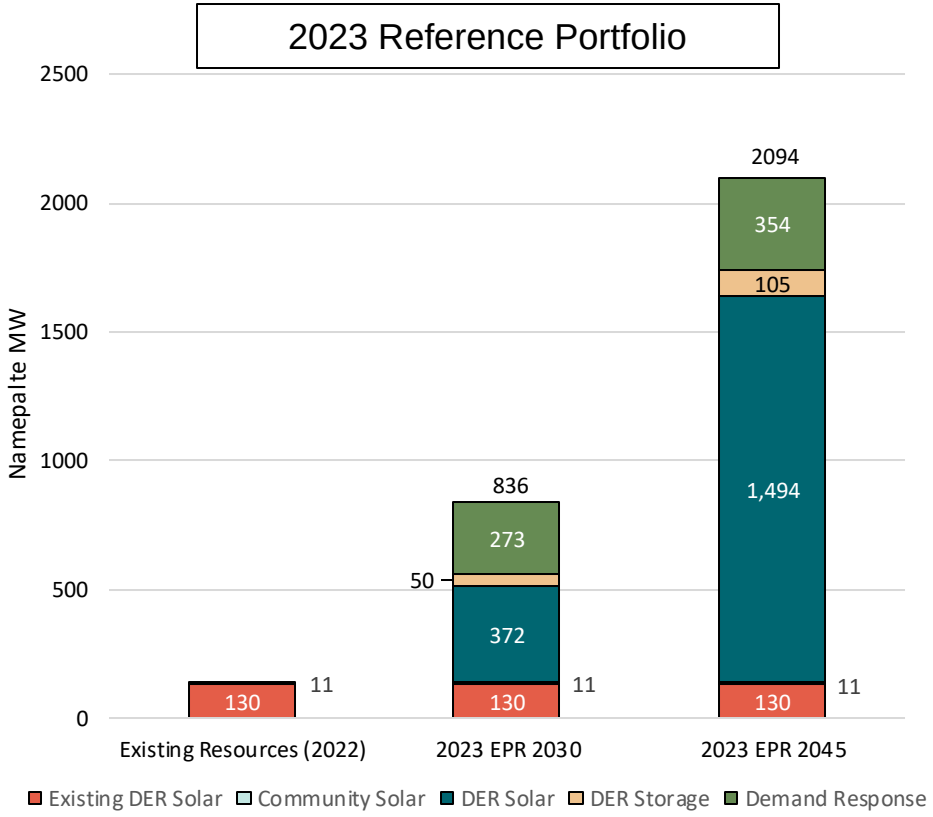
Meeting Future Growth

Significant increase in distributed energy resources by 2030:

- ✓ **Solar:** Over 300 MW of DER solar **added** by 2030 and growing to almost 1,500 MW by 2045
- ✓ **Demand Response:** Over 300 MW nameplate added by 2045
- ✓ **Battery Storage:** 50 MW added of DER storage by 2030 along with over 1,000 MW of large utility scale energy storage



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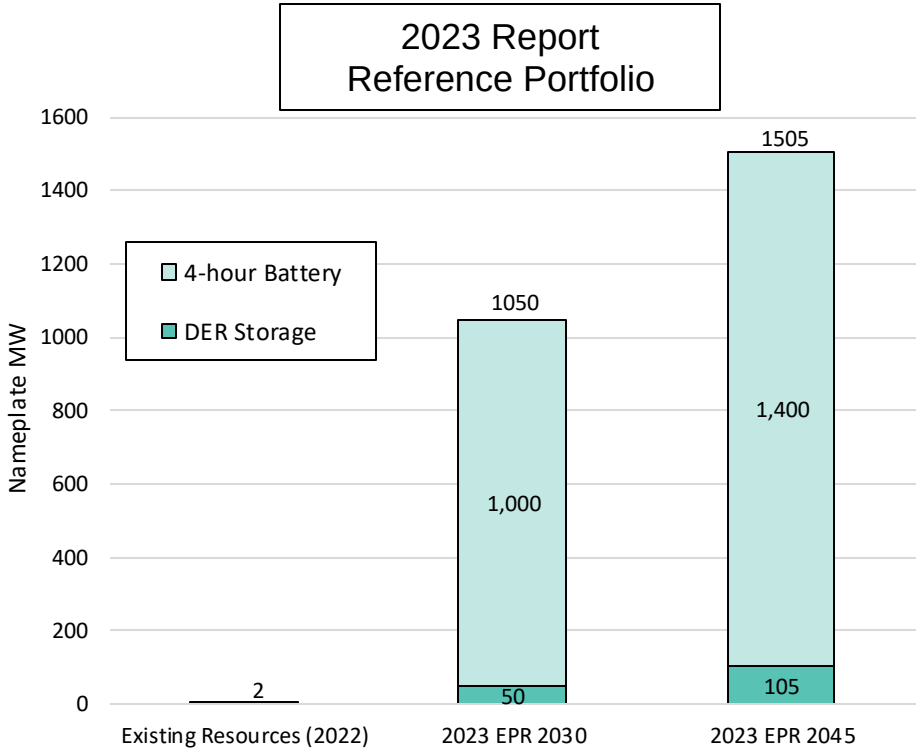
Energy Storage

Significant increase in energy storage resources:

- Over 1,000 MW increase by 2030
- Over 1,500 MW increase by 2045



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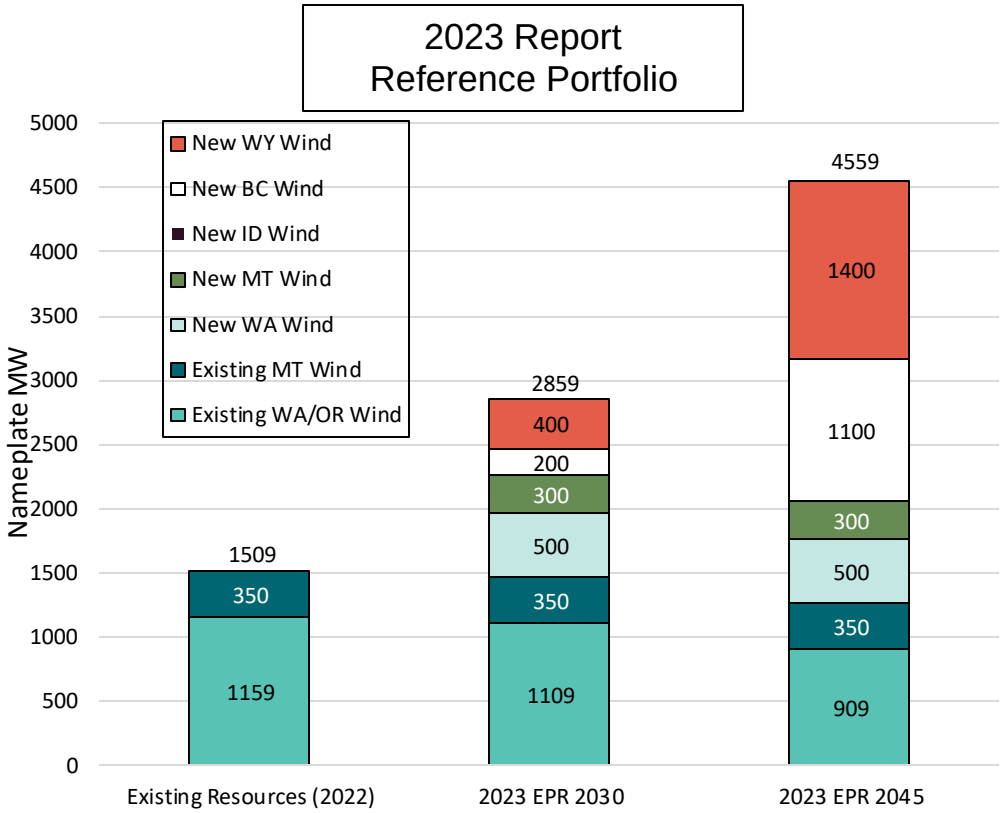
Wind Resources

Significant increase in energy storage resources:

- 1,400 MW additional by 2030
- 3,300 MW additional by 2045

Restricted transmission through 2030

Assume new transmission available after 2035



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Resource Adequacy

PSE analyzed both the winter and summer peak capacity needs.

Climate Change Data

- Slightly lowered the winter peak
- Increased the summer peak
- Still winter peaking through planning horizon

Electric Vehicle Forecast

- Increased peak demand from the EV forecast was larger than the decrease from the climate change data
- Overall increased demand

Market Reliance

- Availability of dispatchable generation resources are declining
- Market supply and demand fundamentals have tightened
- Market power prices and volatility are increasing
- Reliance on market as significant source of energy supply is risky

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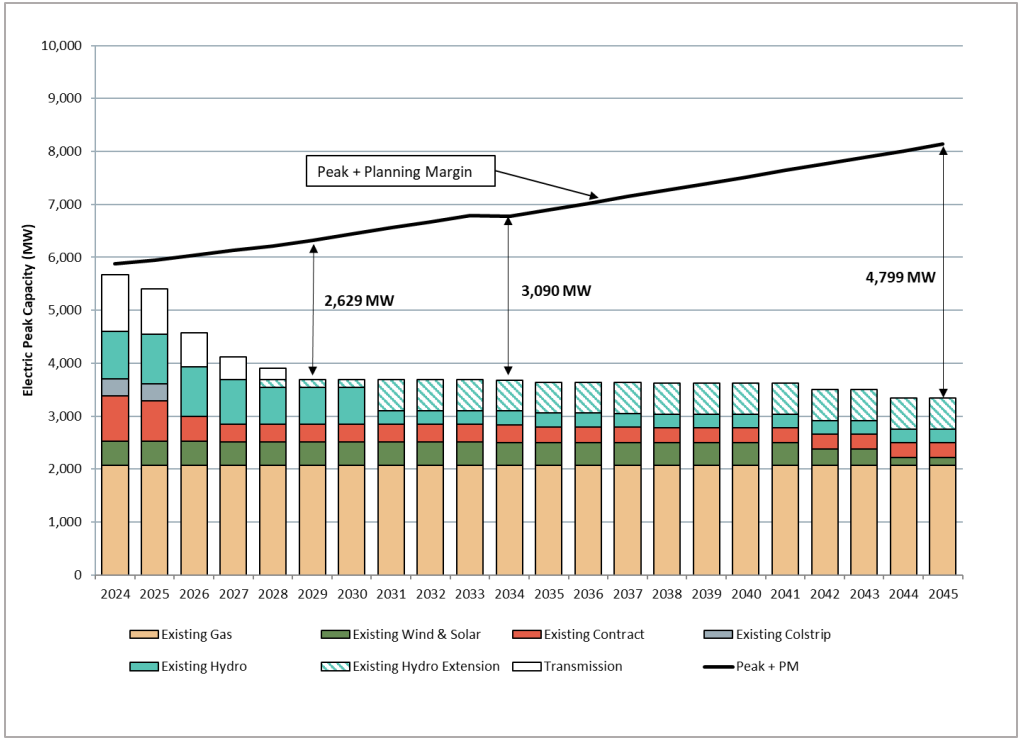
Winter Peak Driving Resource Capacity Additions

- Winter peak > summer peak through 2045
- Renewable and energy storage peak capacity contribution is larger in the summer
- New renewable and non-emitting resources will meet summer but not winter peaks
- New peaking capacity resources are needed



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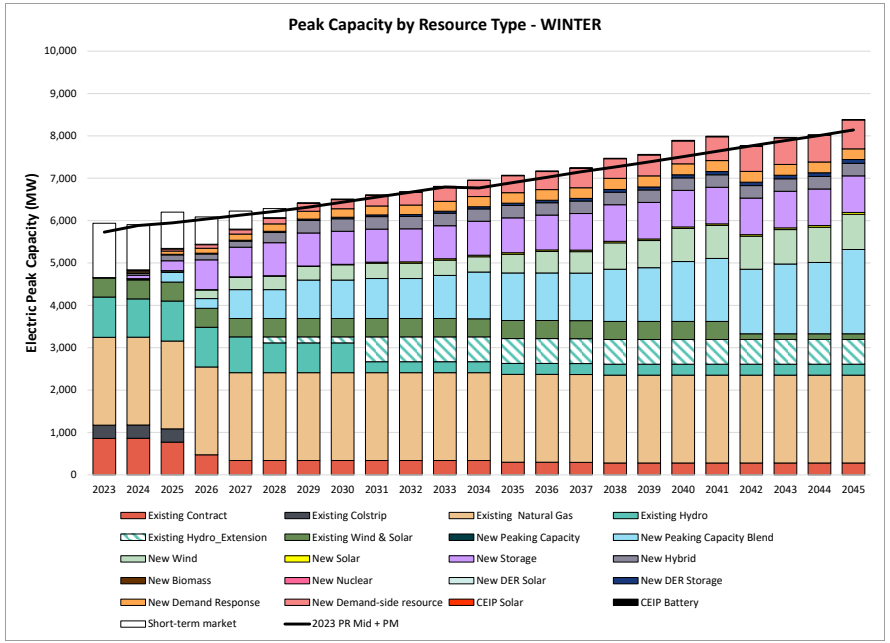
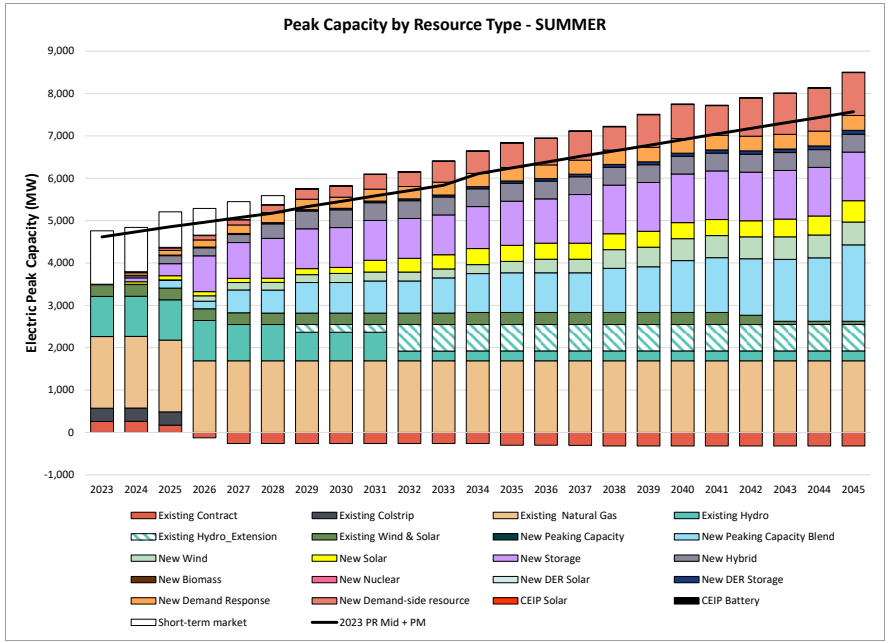
Meeting Winter and Summer Peak





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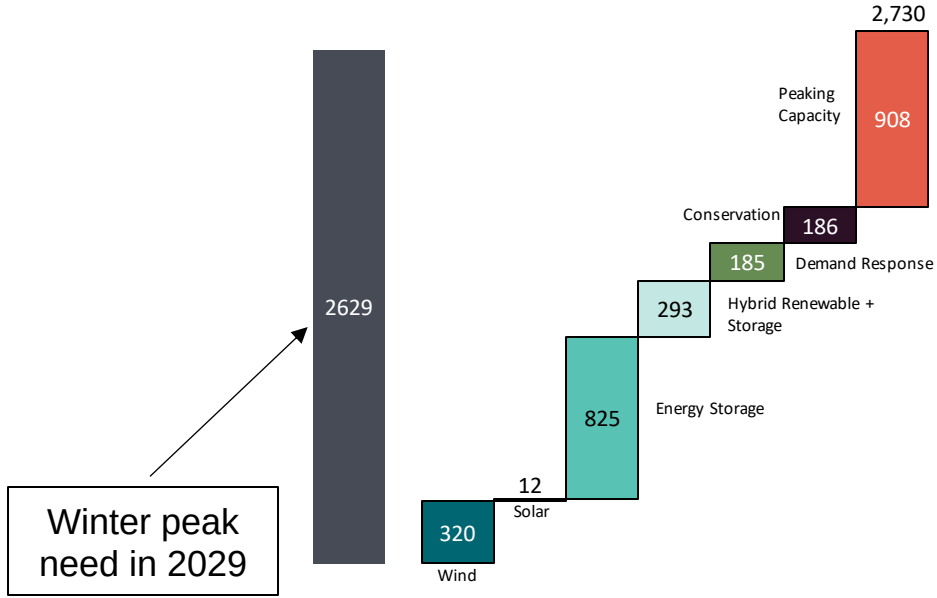
Meeting Winter Peak Need: 2029

The peak need is met using **new** capacity through a combination of:

- Conservation
- Demand response
- Clean energy resources
- Energy storage
- CETA compliant peaking capacity

Resources in peak capacity contribution (MW) using Reference Portfolio



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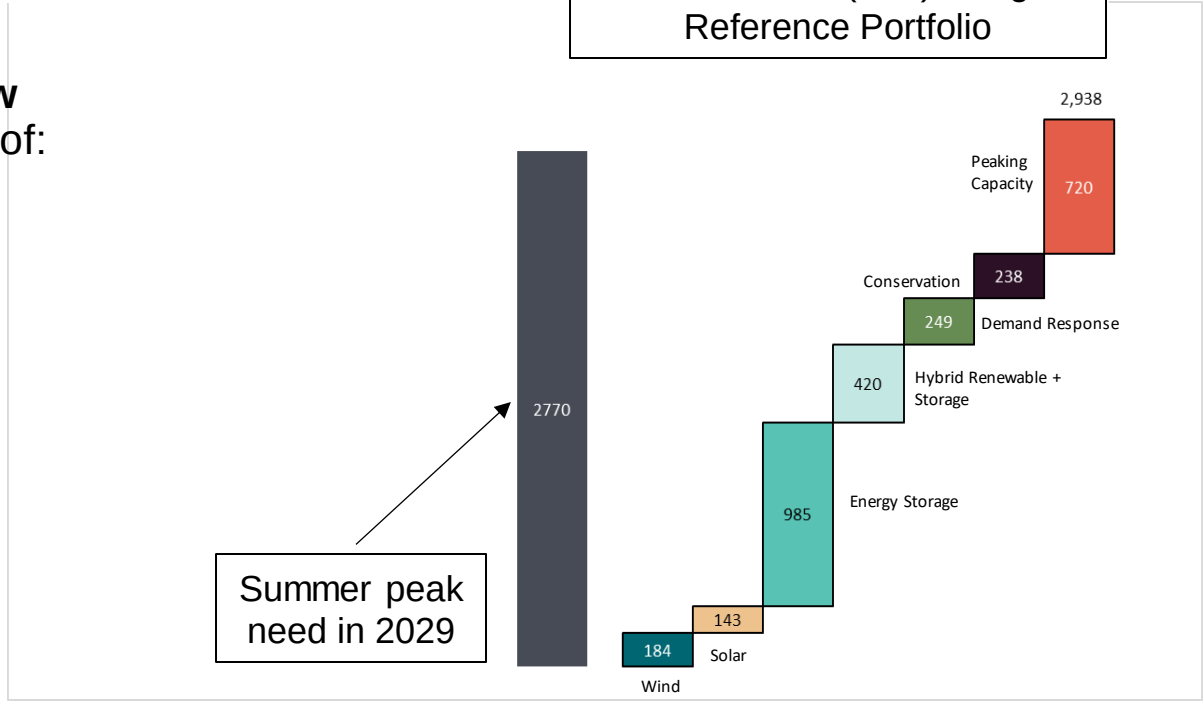
Meeting Sumer Peak Need: 2029

The peak need is met using **new** capacity through a combination of:

- Conservation
- Demand response
- Clean energy resources
- Energy storage
- CETA compliant peaking capacity

Resources in peak capacity contribution (MW) using Reference Portfolio



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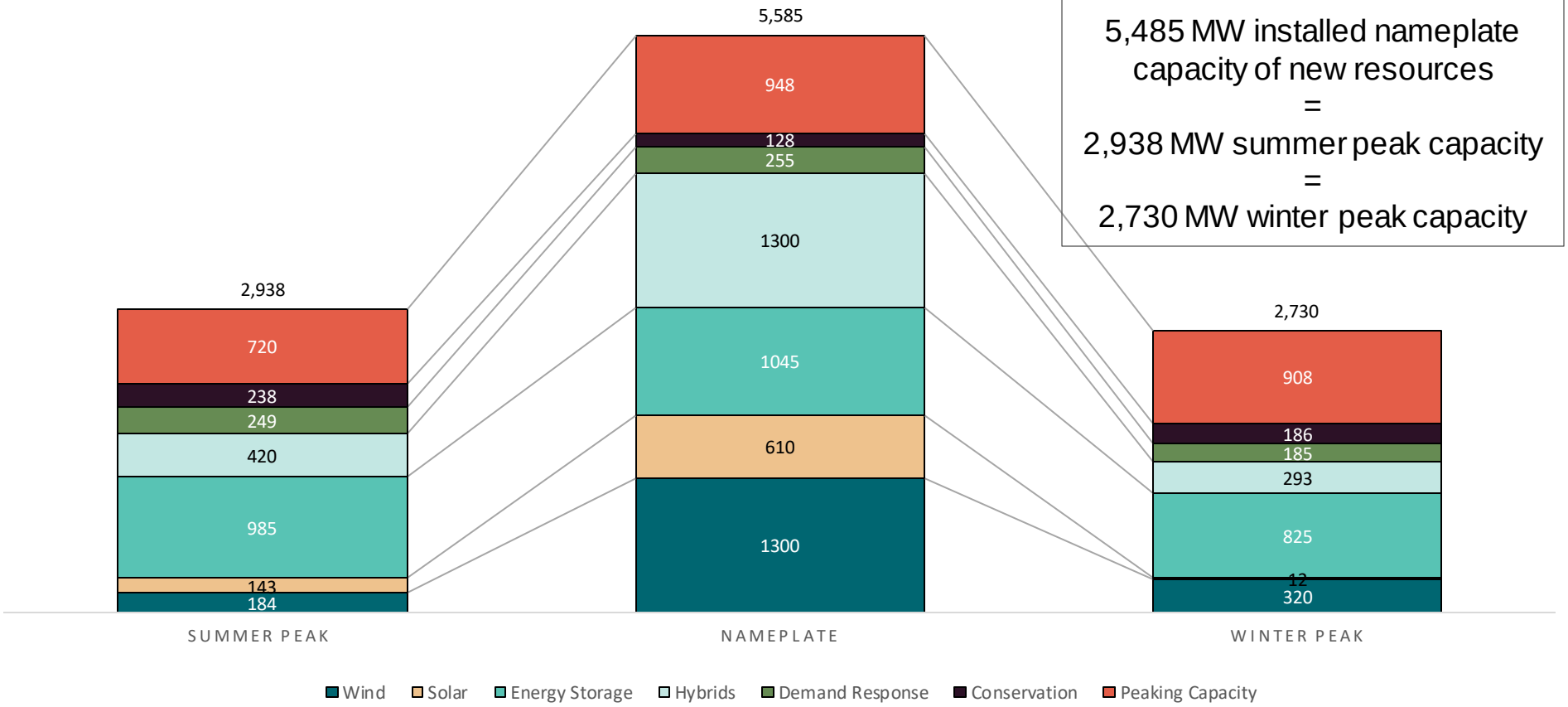
Nameplate Vs. Peak Capacity for 2029

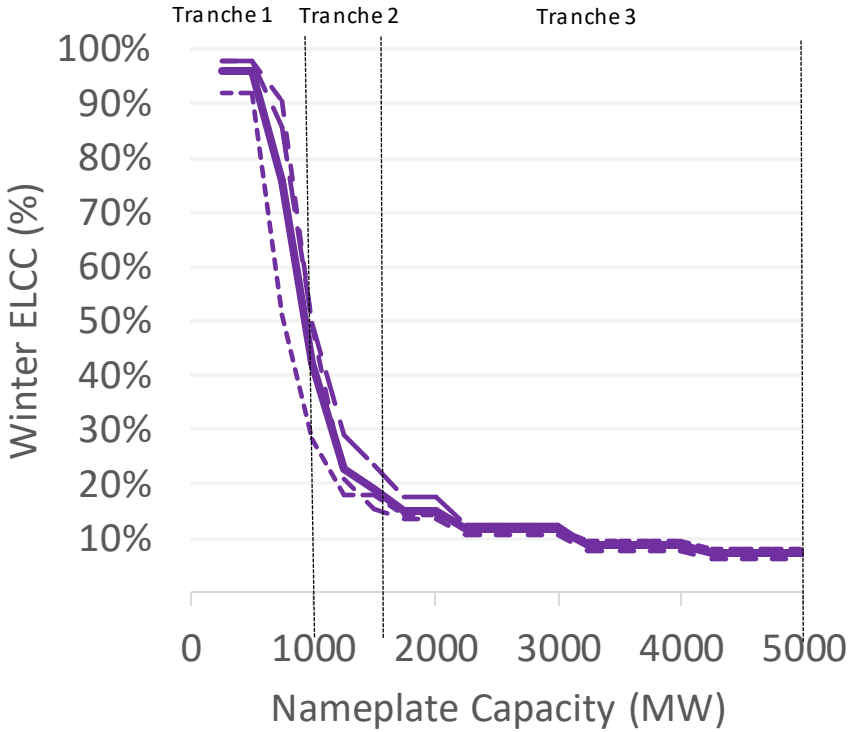
After adjusting for peak capacity contribution

5,485 MW installed nameplate capacity of new resources
=
2,938 MW summer peak capacity
=
2,730 MW winter peak capacity



Storage Peak Capacity Contribution

- Climate change data suggest shorter and less frequent winter events; more frequent summer events
- Increasing the ELCCs for shorter duration storage resources and solar
- Saturation effect can impact ELCCs significantly



Energy Storage Saturation ELCC (%)	Tranche 1 (0 -1,000 MW)	Tranche 2 (1,000 -1,500 MW)	Tranche 3 (1,500 -5,000 MW)
2-hour battery	61%	18%	3%
4-hour battery	78%	21%	10%
6-hour battery	86%	26%	11%
8-hour PHES	92%	33%	12%

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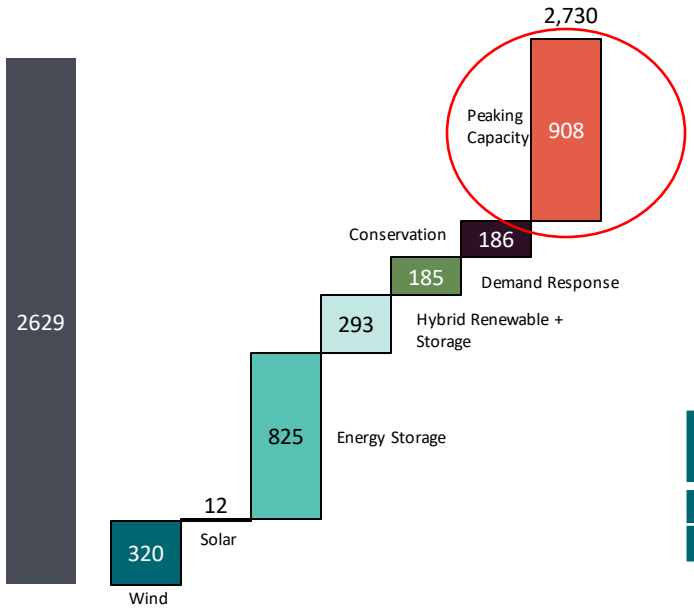
Alternatives for Achieving 900 MW Winter Peak Capacity



What other resources are available instead of the peaking capacity?

Note: Must account for peak capacity contribution and saturation curves

Energy Storage: In order to replace 908 MW of peak capacity, would need an additional 8,575 MW of installed nameplate energy storage.

Energy Storage Saturation ELCC	Balanced Portfolio	Tranche 2 @ 21%	Tranche 3 @ 10%	Additional
Nameplate	1,045 MW	455 MW	8,120 MW	8,575 MW
Peak Capacity	825 MW	96 MW	812 MW	908 MW

Note: calculation is intended to be illustrative and not result of the portfolio model

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Benefits of a Diverse Portfolio

- The future of electricity is a diversified portfolio of non-emitting resources
- A diverse energy mix is less dependent on a single source of fuel
- This will reduce risks due to market price and supply fluctuations
- Multiple, reliable generation sources allows a utility to provide power without disruption if one energy source fails, during extreme peak events, or during low hydro conditions
- A diverse energy portfolio reduces environmental impacts, improves reliability, and promotes innovation to meet needs to PSE's customers

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Creating a Diverse Portfolio

- Modeled alternative energy generation and storage solutions (must be commercially viable)
- Modeled multiple battery scenarios (cycling frequency, capacity, type)
- Modeled hybrid scenarios (wind, solar, storage)
- Studied range of storage alternatives (e.g., chemical, gravity, compressed and liquid air)
- Transmission capacity is primary factor limiting renewables integration

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Alternative Fuel Supply

Biodiesel

- Peaker and alternative fuel supply are commercially available
- Derived from waste cooking oil or dedicated crops
- Facilities in WA can manufacture over 100 million gal./year
- PSE has experience with diesel handling and protocol
- Modeling Assumptions:
  - 237 MW frame peaker would require 25,000 gallons/hour = 1.2 million gallons for 48-hour peak event
  - 7 days of fuel supply on site (approx. 2% capacity factor for year)
  - $15 million capital cost assumed for storage tank and infrastructure

US Department of Energy alternative Fuel Price Report, January 2022, https://afdc.energy.gov/files/u/publication/alternative_fuel_price_report_january_2022.pdf

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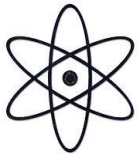
Emerging Technologies



Small Modular Nuclear

- Not available today
- Some data available through Energy Information Administration (EIA)
- Modules are similar in design to reactors used in submarines
- Additional research and development needed to scale up production.
- Modeling Assumptions:
  - 50 MW units for a total of 250 MW available starting in 2032

Hydrogen

- Not available today
- Technology exists to blend hydrogen with natural gas
- Large scale electrolyzers are an emerging technology
- Additional research and development needed to scale up production
- Will require large amount of low- or no-carbon electricity
- Modeling Assumptions:
  - Hydrogen is a fuel can that can be used in a combustion turbine or fuel cells
  - Fuel blending with NG starts at 30% in 2030 and grows to 100% by 2045

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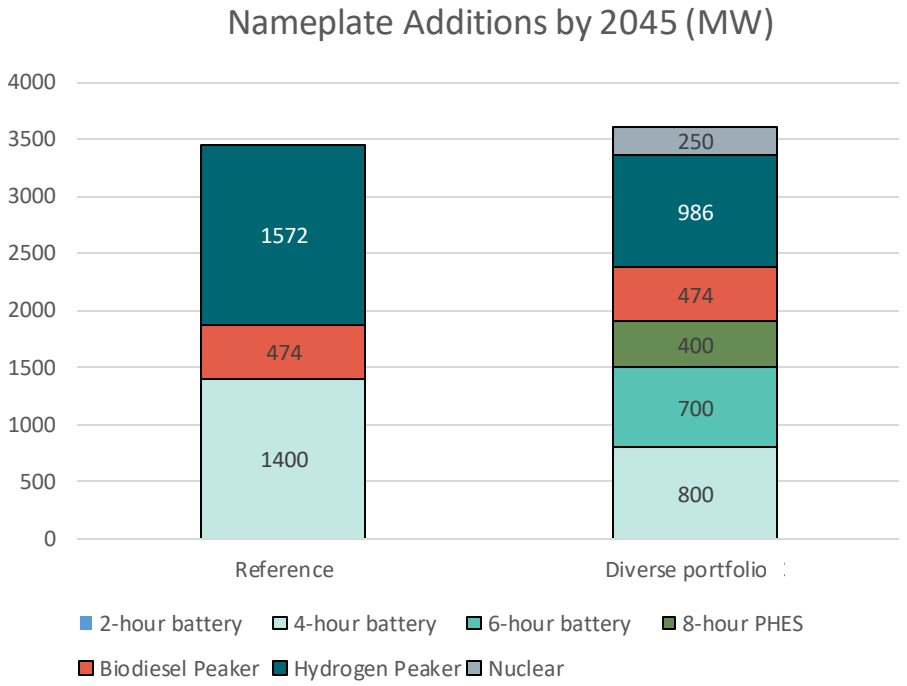
Diverse Energy Mix Example

- A diversified portfolio relies on multiple resources to meet demand
- A diversified portfolio has a combination of 4-hour, 6-hour and PHES technology
- A diversified portfolio has a mix of biodiesel and hydrogen peakers, and small modular nuclear to meet peak demand



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Integrating Equity

- Expanded upon 2021 IRP approach
- Evaluated traditional least cost portfolio against customer benefit indicators (CBIs) in the CEIP:
  - CBIs are equally weighted
  - Public provided great feedback on this methodology
- Refined portfolio with goal of maximizing benefits and reducing burdens to vulnerable populations and highly impacted communities
- Intend to improve methodology for the 2025 IRP and future CEIP cycles

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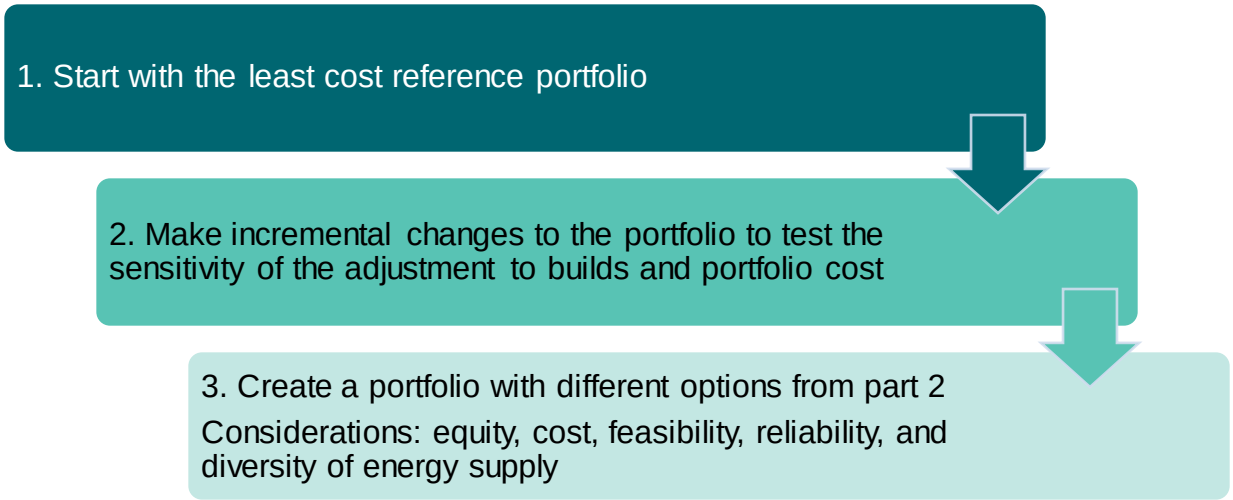
Diversified Portfolio

Goal: Identify a feasible portfolio of diverse resources that prioritizes equity and creates customer benefits while maintaining reliability and affordability.

To create the diversified portfolio:



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Considerations When Building a Diversified Portfolio

Near-term Additions

- Needs to be commercially available
- Limited transmission expansion
- Must meet resource adequacy and customer demand

Longer-term Additions

- More resource types available to explore emerging technologies
- Expanding transmission to more remote renewable resources

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Portfolios Evaluated

Portfolio ID	Portfolio Name	Description
1	Reference	Least-cost and CETA compliant
2	Conservation Bundle 10	Increase conservation to 358 aMW by 2045
3	Conservation Bundle 7	Increase conservation to 284 aMW by 2045
4	DER Solar	Added 30 MW per year of DER rooftop solar from 2026-2045
5	DER Batteries	Added 25 MW per year of DER batteries (3hr Li-ion) from 2026-2031
6	MT Wind PHES, All East Wind	Added 400 MW MT East Wind + 200 MW MT PHES in 2026
7	MT Wind PHES, Central & East Wind	Added 200 MW MT East Wind + 200 MW MT Central Wind + 200 MW MT PHES in 2026
8	PNW PHES	Added 200 MW of PNW PHES in 2026
9	Nuclear	Added 250 MW of nuclear in 2032
10	Restricted Thermal	Thermal builds were prohibited before 2030
11	Diversified Portfolio	Combinations of Portfolios 2-10, see later slides for details
12	100 Percent Non-Emitting by 2030	Existing thermal retired by 2030, no new thermal allowed
13	High Carbon Price	CCA ceiling price used for all carbon allowances

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Non-emitting Portfolios by 2030

Considered infeasible due to real-world limitations

Portfolio 10: Restricted thermal (no thermal builds before 2030)

- 4,700 MW Li-ion batteries added by 2030
- Additional 750 MW Li-ion batteries added from hybrid resources by 2030

Portfolio 12: 100% non-emitting by 2030:

- Model unable to solve without real-world constraints removed (i.e., build limits, transmission restrictions, adjusting nuclear availability to 2024)
- Portfolio costs $32 billion (60% cost increase from the Reference)
- Winter peak need met with nuclear builds starting in 2027 (technology not likely available)

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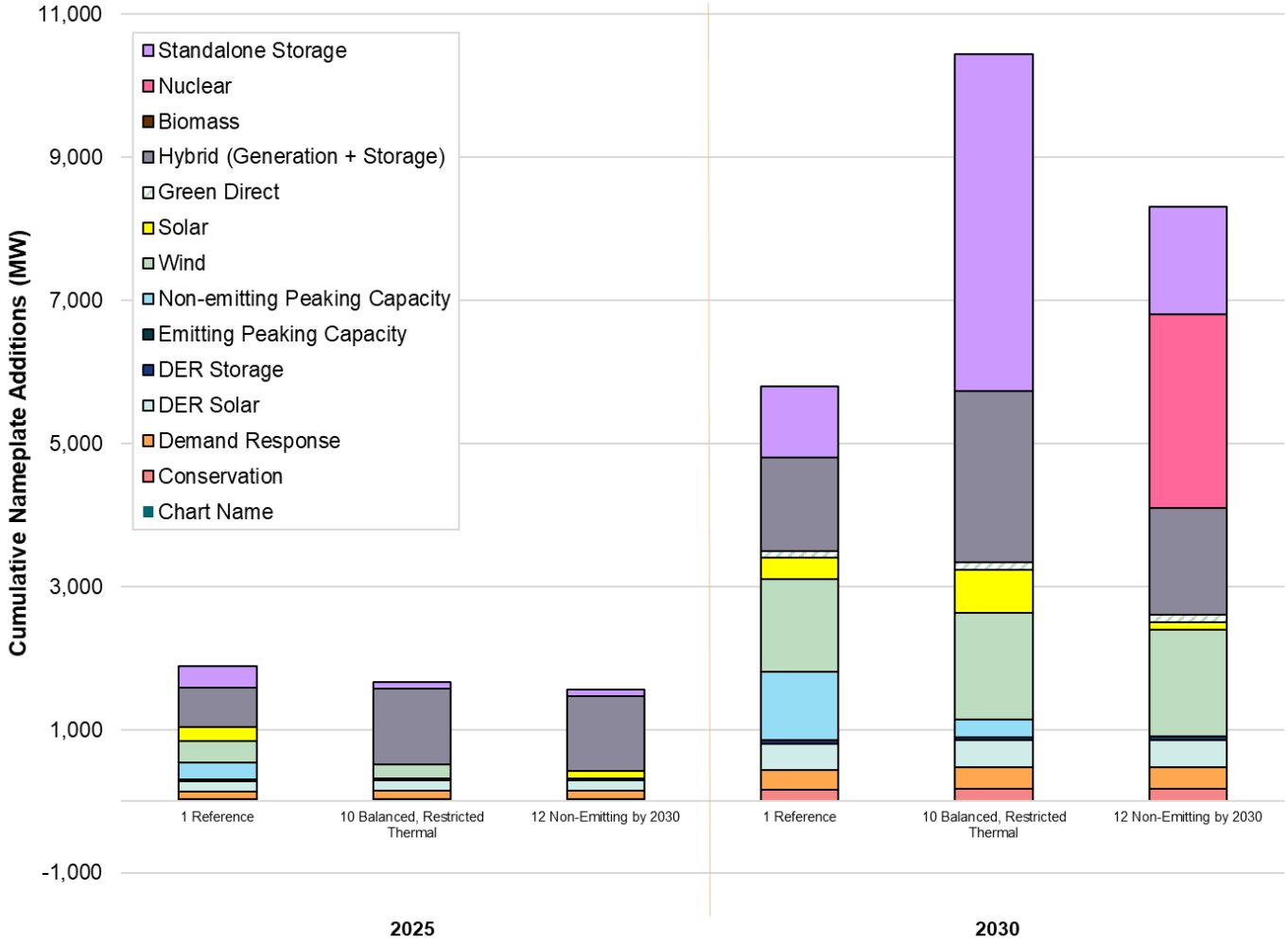
Restricted Thermal and Non-emitting by 2030 Portfolios



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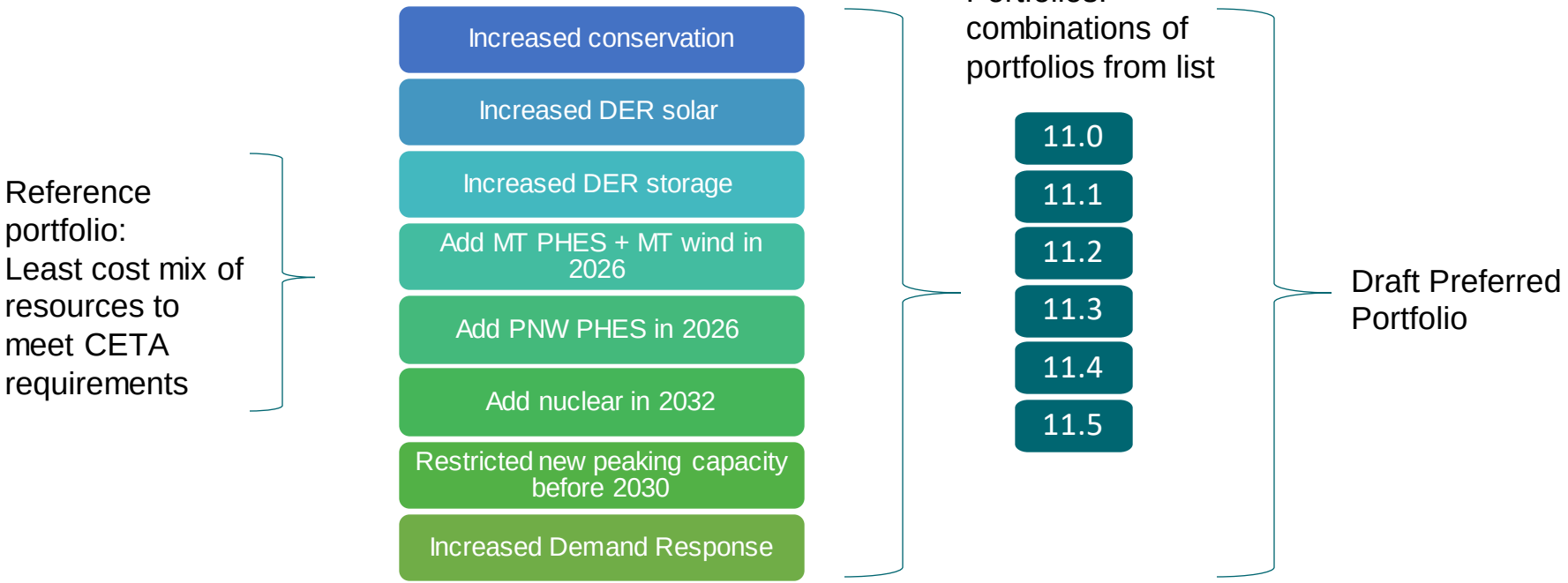
Additional Portfolios Evaluated



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Diversified Portfolios Iterations

Portfolio ID	Description
11.0	Combination of the following Portfolios: • **Portfolio 3**: Increase conservation by 284 aMW by 2045 • **Portfolio 4**: DER solar added - 30 MW/year from 2026-2045 • **Portfolio 5**: DER batteries added - 25 MW/year from 2026-2031 • **Portfolio 6**: Added 400 MW MT East Wind + 200 MW MT PHES in 2026 • **Portfolio 8**: Added 200 MW PNW PHES in 2026 • **Portfolio 9**: Nuclear added - 250 MW in 2032
11.1	Combination of the following: • **Portfolio 11.0** (above) • **Added all Demand Response programs**
11.2	Updated 11.1 with the following: • **Advanced battery builds**: 400 MW of 4hr Li-ion built in 2024/2025 instead of in 2025/2026 • **Delayed 1 biodiesel peaker** build from 2024 to 2026

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Diversified Portfolios Iterations

Portfolio ID	Description
11.3	Combination of the following Portfolios: • **Portfolio 3**: Increase conservation by 284 aMW by 2045 • **Portfolio 6**: Added 400 MW MT East Wind + 200 MW MT PHES in 2026 • **Portfolio 8**: Added 200 MW PNW PHES in 2026 • **Portfolio 9**: Nuclear added - 250 MW in 2032
11.4	Combination of the following: • **Portfolio 3**: Increase conservation by 284 aMW by 2045 • **Portfolio 4**: DER solar added - 30 MW/year from 2026-2045 • **Portfolio 6**: Added 400 MW MT East Wind + 200 MW MT PHES in 2026 • **Portfolio 8**: Added 200 MW PNW PHES in 2026 • **Portfolio 9**: Nuclear added - 250 MW in 2032
11.5	Combination of the following Portfolios: • **Portfolio 3**: Increase conservation by 284 aMW by 2045 • **Portfolio 6**: Added 400 MW MT East Wind + 200 MW MT PHES in 2026 • **Portfolio 9**: Nuclear added - 250 MW in 2032

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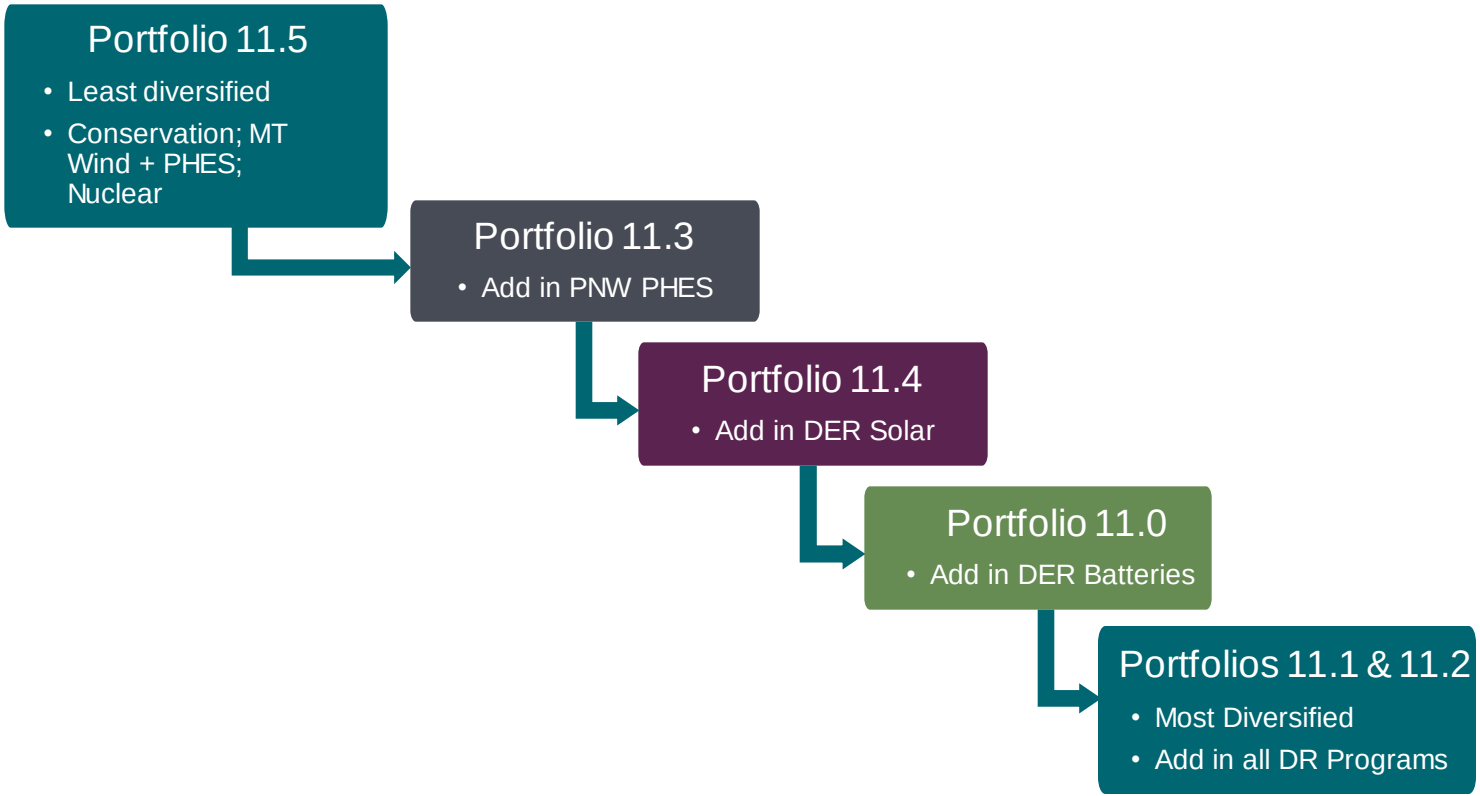
Diversified Portfolios Iterations



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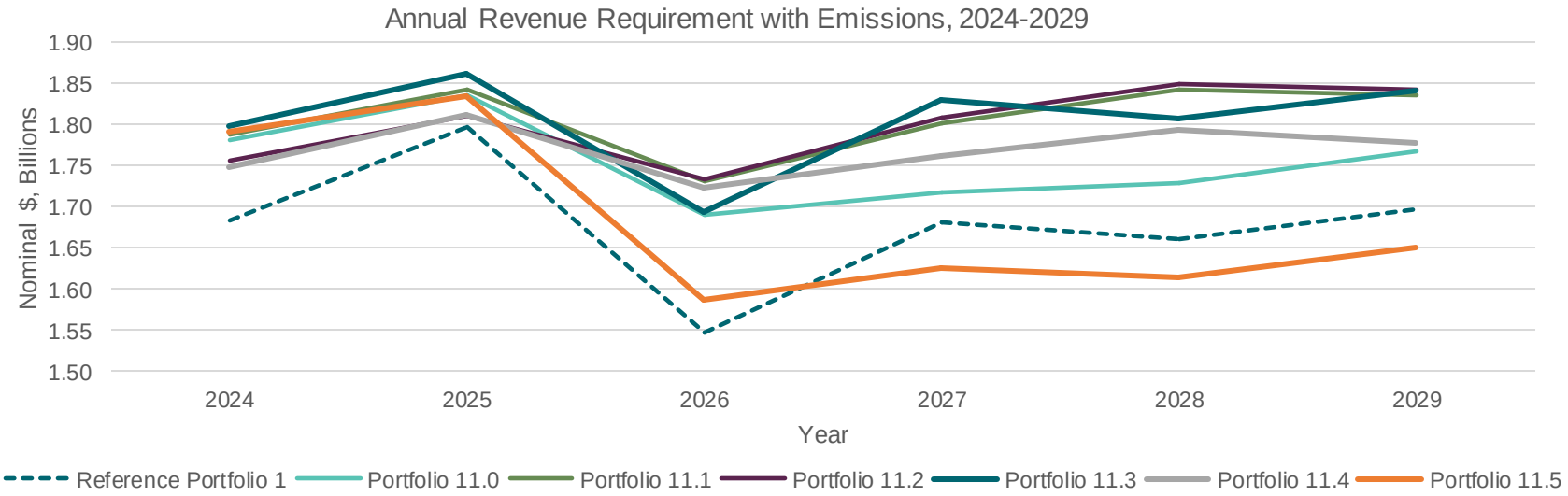
Diversified Portfolios: Near-term Costs



6 Year NPV (2024-2029) ($ Billions)	Reference Portfolio 1	Portfolio 11.0	Portfolio 11.1	Portfolio 11.2	Portfolio 11.3	Portfolio 11.4	Portfolio 11.5
Revenue Requirement with Emissions	8.06	8.42	8.66	8.62	8.66	8.48	8.11
Revenue Requirement without Emissions	6.14	6.78	6.90	6.86	6.89	6.77	6.53
Emissions Costs	1.92	1.64	1.76	1.76	1.76	1.72	1.58

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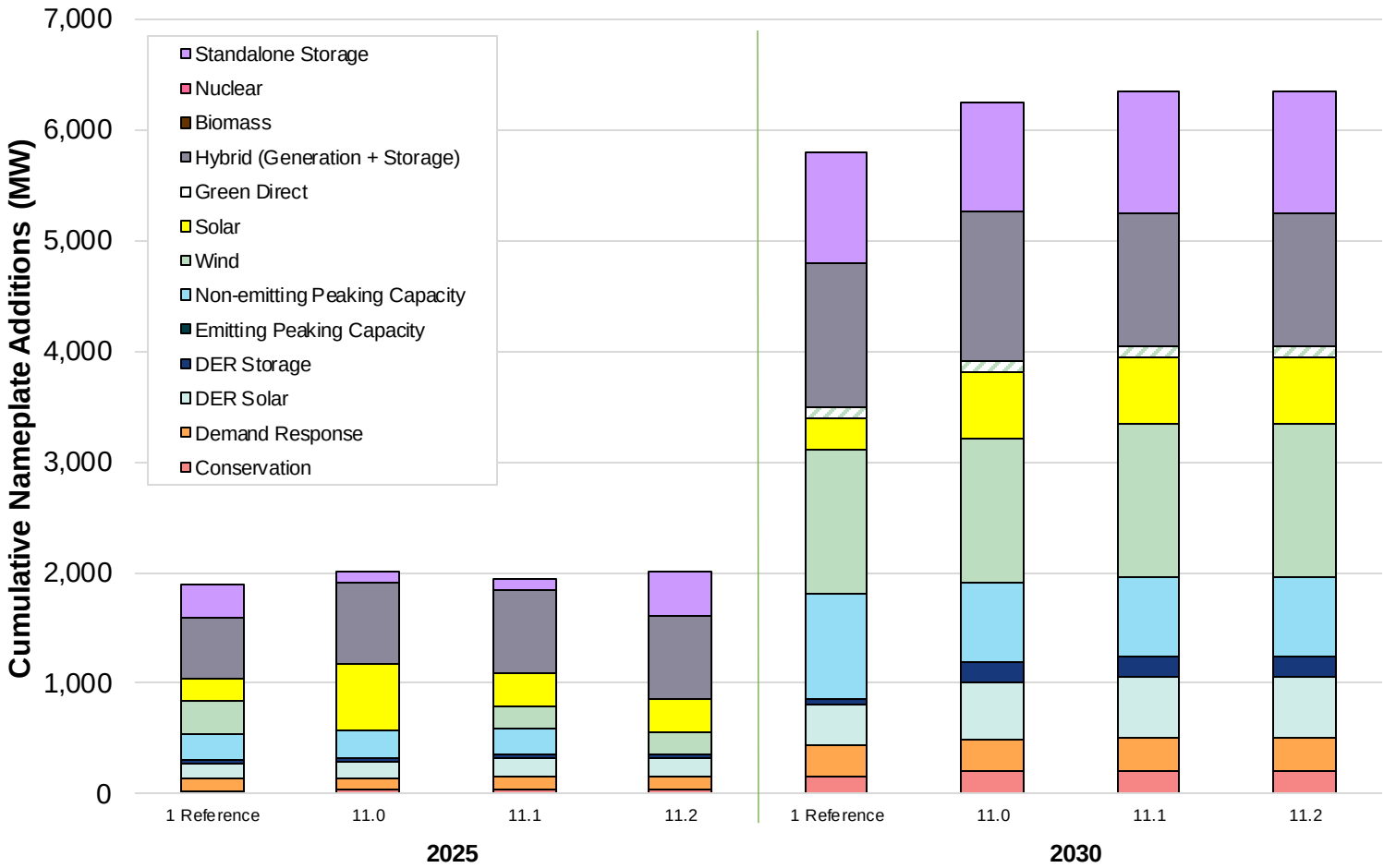
Diversified Portfolios: Near-term Resource Builds



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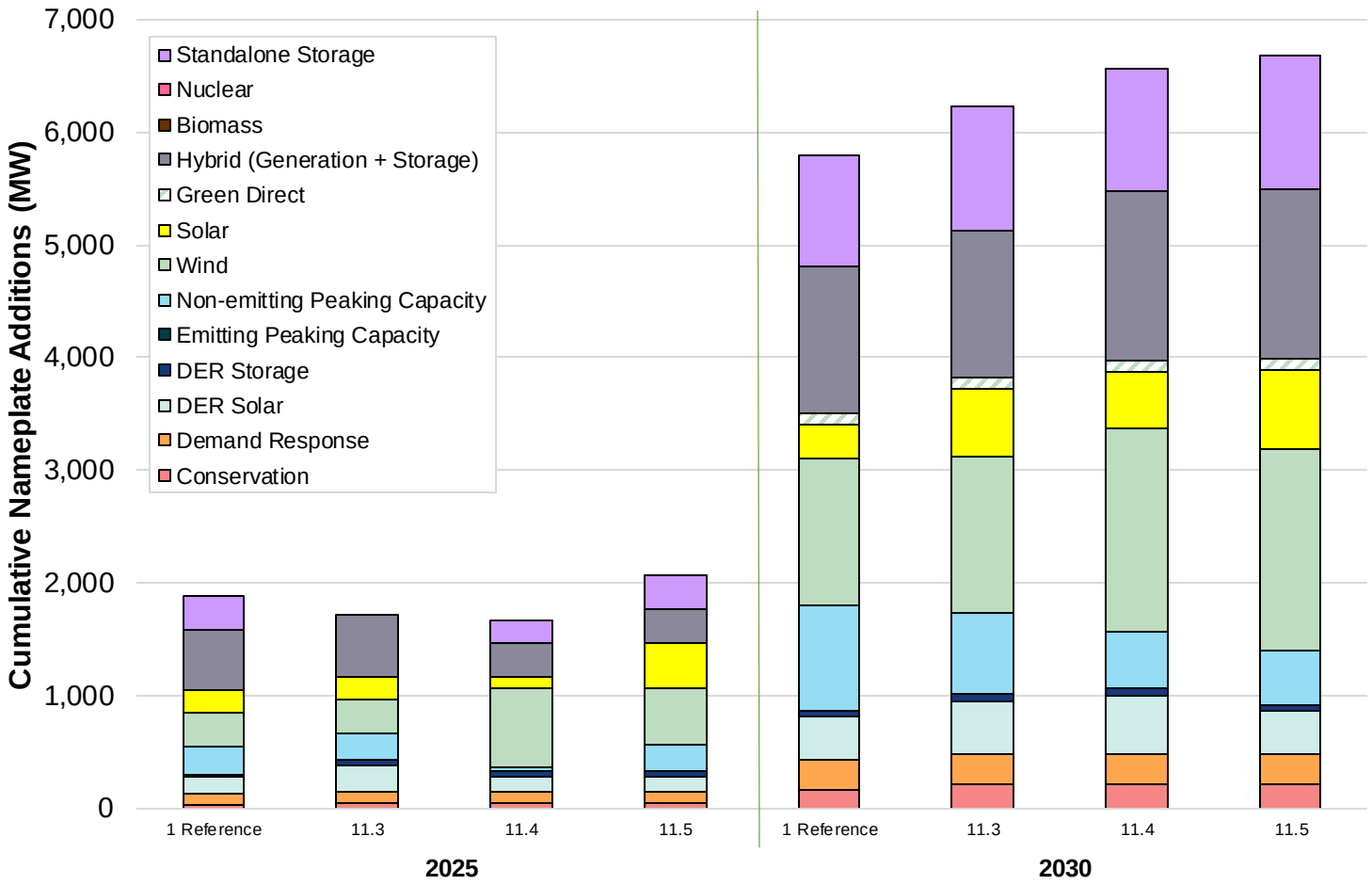
Diversified Portfolios: Near-term Resource Builds - Continued



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Key Differences

Changes from Reference:

<u>Portfolios 11 – 11.3</u> - have a combination of

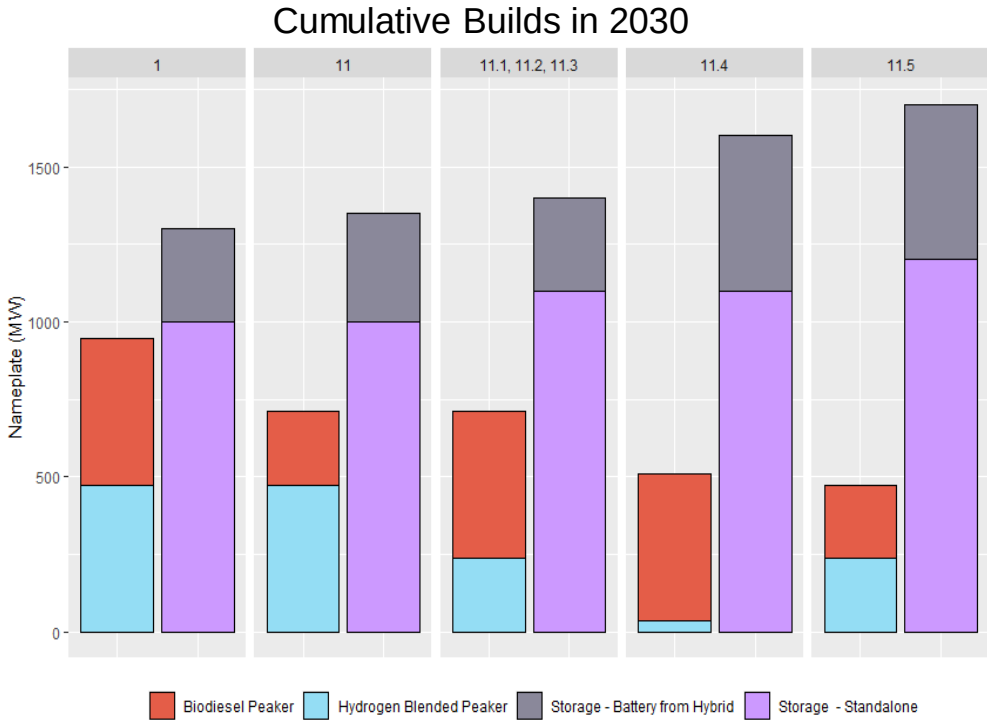
- increased distributed resources,
- increased conservation and
- increased Demand response

reduced the peaking capacity from 4 peakers to 3 by 2030 at a cost range of $640 - $760 Million over 6 years (NPV 2024 – 2029)

<u>Portfolios 11.4 and 11.5</u> – have a combination of

- increased utility scale energy storage
- increased conservation and
- Increased hybrid resources

Reduced peaking capacity from 4 peakers to 2 by 2030 at a cost range of $45 - 65 Million over 6 years (NPV 2024 – 2029)



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Customer Benefit Indicator (CBI) Tool

Goal: Illuminate customer benefits and burdens of each portfolio beyond cost and assist PSE in evaluating the types and amounts of resources needed to serve load.

CBI Metrics Evaluated:

- GHG Emissions
- SO_2, NO_x, PM
- Quantity of Jobs
- DR Peak Contribution
- DER Solar, DER Storage, & DR Participation
- EE Added

Note: some CBIs are not included in this tool due to lack of available data from LTCE modeling output.

- Consistent with approach presented in September / October 2022
- Uses modeling outputs to compare CBIs between portfolios
- Normalizes data: all portfolios are evaluated against the reference portfolio (portfolio 1)
- Each portfolio is assigned an overall index

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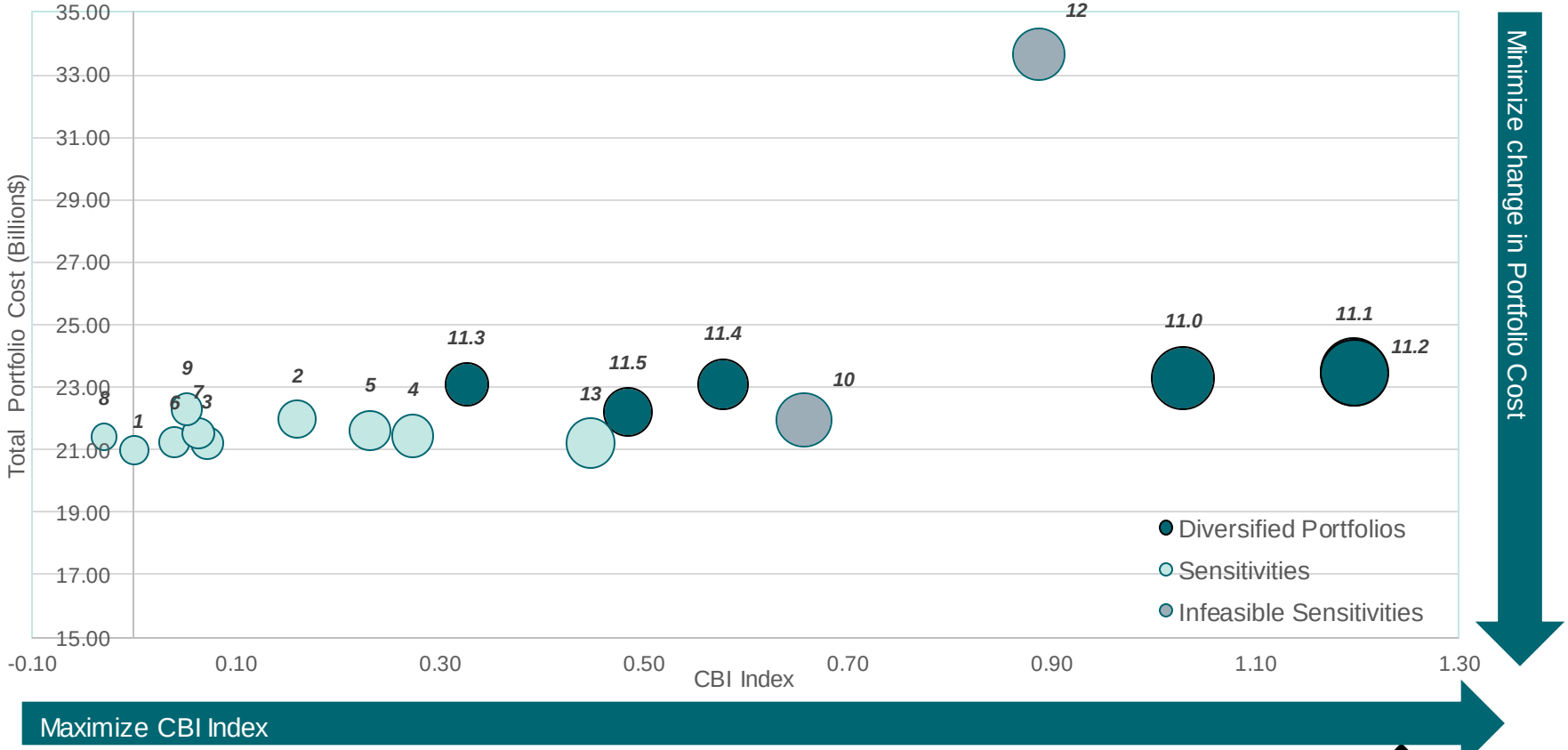
CBI Tool - Results

Portfolios	Descript	CBI Index	Portfolio Cost (2020 $, Billions)	% Change in Portfolio Cost from Reference	CBI Index per Dollar Spent
1	Reference	0.00	20.97	--	1.0
2	Conservation Bundle 10	0.16	21.97	4.8%	1.7
3	Conservation Bundle 7	0.07	21.20	1.1%	1.3
4	DER Solar	0.27	21.44	2.2%	2.3
5	DER Batteries	0.23	21.62	3.1%	2.1
6	MT Wind PHES, All East Wind	0.04	21.22	1.2%	1.2
7	MT Wind PHES, Central & East Wind	0.06	21.52	2.6%	1.3
8	PNW PHES	-0.03	21.41	2.1%	0.9
9	Nuclear	0.05	22.29	6.3%	1.2
10	Restricted Thermal	0.66	21.96	4.7%	4.0
11.0	Diversified Portfolio	1.03	23.29	11.1%	5.4
11.1	Diversified Portfolio	1.20	23.48	11.9%	6.1
11.2	Diversified Portfolio	1.20	23.47	11.9%	6.1
11.3	Diversified Portfolio	0.33	23.10	10.1%	2.4
11.4	Diversified Portfolio	0.58	23.10	10.1%	3.5
11.5	Diversified Portfolio	0.49	22.21	5.9%	3.2
12	100 Percent Non-Emitting by 2030	0.89	33.65	60.5%	3.6
13	High Carbon Price	0.45	21.21	1.1%	3.1

CBI Index and Total Portfolio Cost (with Emissions)



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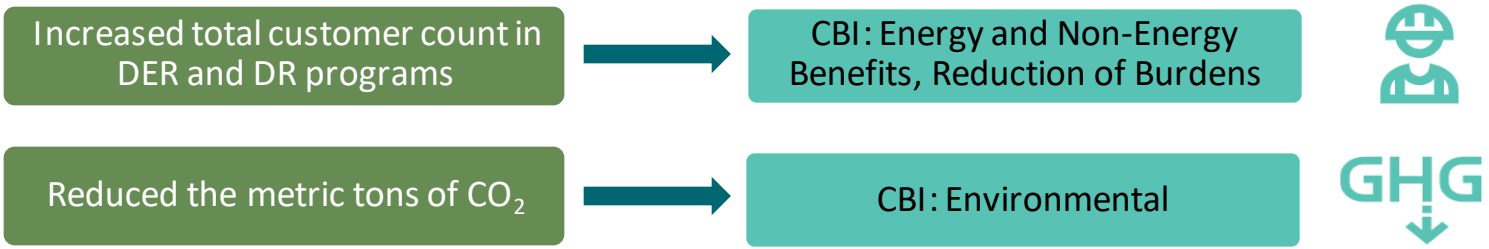
CBI Results - Diversified Portfolios

- Best overall CBI indices = 1.20 (Portfolios 11.1 & 11.2)
- Increased CBI indices driven by participation in:
  - DER solar
  - DER storage
  - DR programs
- GHG emissions reduced by ~11-15 million short tons
- About $2.8 billion more than Reference Portfolio (~12% cost increase)



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Diversified Portfolios

Meets Clean Energy Transformation Act (CETA) Standards

Cumulative Resource Additions by 2045 (MW)	1 Reference	11.0	11.1	11.2	11.3	11.4	11.5
Demand Side Resources	**880**	**1,022**	**1,064**	**1,064**	**989**	**978**	**1,019**
Conservation	526	624	624	624	635	624	624
Demand Response	354	399	440	440	354	354	395
Distributed Energy Resources	**1,599**	**2,367**	**2,407**	**2,407**	**1,712**	**2,212**	**1,612**
DER Solar	1,494	2,099	2,114	2,114	1,594	2,094	1,494
DER Storage	105	267	292	292	117	117	117
Supply Side Resources	**10,431**	**10,003**	**10,397**	**10,397**	**10,579**	**11,073**	**11,052**
Emitting Peaking Capacity	0	0	0	0	0	0	0
Non-emitting Peaking Capacity	2,046	1,515	1,460	1,460	1,442	1,333	1,515
Wind	3,200	2,800	2,800	2,800	3,000	3,100	3,500
Solar	2,389	1,592	1,891	1,891	1,892	1,895	2,490
Green Direct	100	100	100	100	100	100	100
Hybrid (Generation + Storage)	1,296	1,846	1,996	1,996	1,795	2,395	1,497
Biomass	0	0	0	0	0	0	0
Nuclear	0	250	250	250	250	250	250
Standalone Storage	1,400	1,900	1,900	1,900	2,100	2,000	1,700
Total	**12,910**	**13,392**	**13,867**	**13,867**	**13,280**	**14,263**	**13,683**

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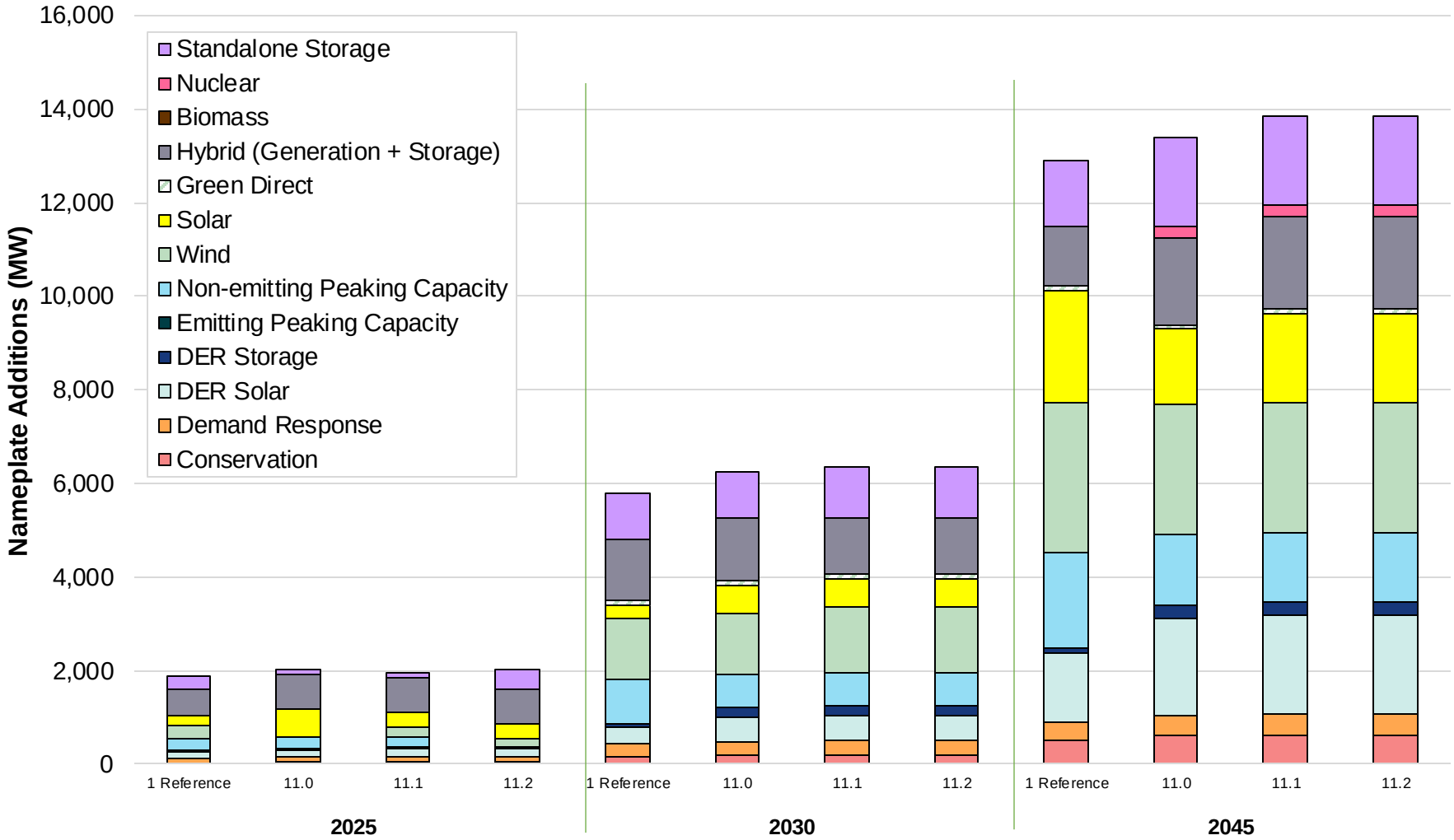
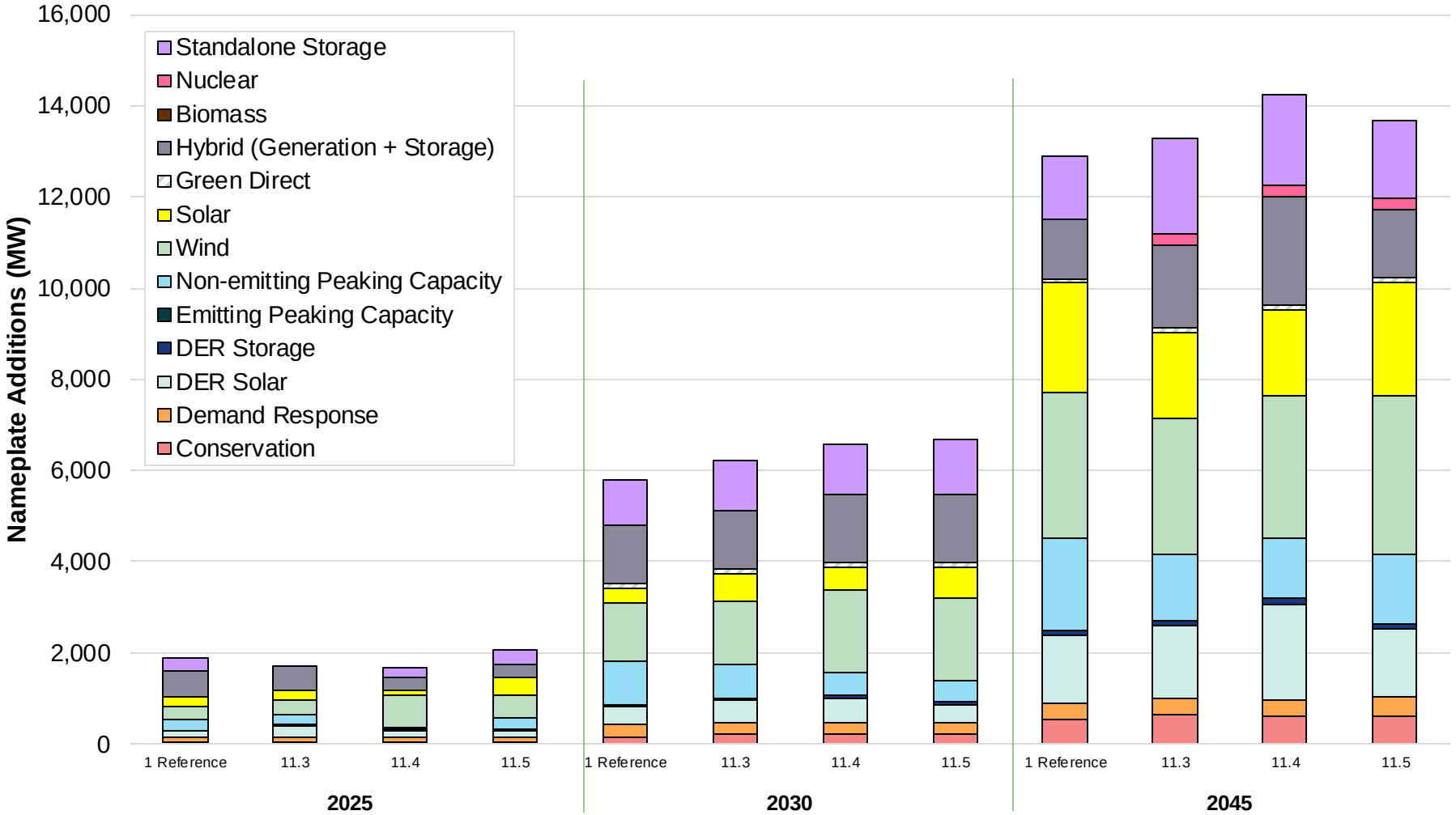

Nameplate Additions (MW)
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Standalone Storage
Nuclear
Biomass
Hybrid (Generation + Storage)
Green Direct
Solar
Wind
Non-emitting Peaking Capacity
Emitting Peaking Capacity
DER Storage
DER Solar
Demand Response
Conservation
1 Reference
11.0
11.1
11.2
2025
2030
2045


Nameplate Additions (MW)
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Standalone Storage
Nuclear
Biomass
Hybrid (Generation + Storage)
Green Direct
Solar
Wind
Non-emitting Peaking Capacity
Emitting Peaking Capacity
DER Storage
DER Solar
Demand Response
Conservation
1 Reference
11.3
11.4
11.5
2025
2030
2045

Diversified Portfolio CBI Index Comparison

CBI Metric	1 Reference Portfolio	11.0	11.1	11.2	11.3	11.4	11.5
Cost ($, billions) ↓	20.97	23.29	23.48	23.47	23.10	23.10	22.21
Average Index ↑	0	1.03	1.20	1.20	0.33	0.58	0.49
GHG Emissions ↑	0	1.13	0.83	0.83	0.89	1.13	1.14
SO_2, No_x, PM Emissions ↑	0	0.28	0.22	0.22	0.23	0.27	0.25
Jobs ↑	0	0.03	0.24	0.24	0.25	0.20	-0.04
DR Peak Capacity ↑	0	0.49	0.94	0.94	0.00	0.00	0.45
DER Solar Participation ↑	0	2.25	2.30	2.30	0.37	2.23	0.00
Energy Efficiency Added ↑	0	0.63	0.63	0.63	0.71	0.63	0.63
DR Participation ↑	0	1.29	1.96	1.96	0.00	0.00	1.28
DER Storage Participation ↑	0	2.14	2.47	2.47	0.17	0.17	0.17

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Considerations When Building a Diversified Portfolio

Near-term Additions

- Needs to be commercially available
- Limited transmission expansion
- Must meet resource adequacy and customer demand

Longer-term Additions

- More resource types available to explore emerging technologies
- Expanding transmission to more remote renewable resources

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Break

Please return in 10 minutes

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Candidate Portfolios Discussion

2023 Electric Progress Report

December 12, 2022

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Discussion Questions

1. The diversified portfolios were developed to reduce risks associated with over reliance on one or a few resources. Do you agree this type of resource diversification should be a priority?

The diversified portfolios require trade-offs:

- Utility scale resources are less expensive to diversify but result in lower CBI scores
- Localized resources (Distributed Energy Resources or DER) are more expensive but result in higher CBI scores

2. How would you prioritize these trade-offs between resource types, costs, and various CBI metrics?

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Next Steps

2023 Electric Progress Report

December 12, 2022

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Electric Progress Report Timeline

- **December 14, 2022** – Webinar recording and chat transcript posted
- **December 19, 2022** – Feedback form for Dec. 12 meeting closes
- **January 24, 2023** – Draft Chapter 3: Resource Plan Decisions of the 2023 Electric Progress Report posted; feedback form opens
- **February 7, 2023** – Deadline to submit feedback on draft 2023 Electric Progress Report
- **March 14, 2023** – Final results presentation
- **March 31, 2023** – Final 2023 Electric Progress Report Submitted


irp@pse.com


pse.com/irp

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Gas Integrated Resource Plan Timeline

- **January 10, 2023** – Feedback form opens
- **January 17, 2023** – Draft gas portfolio results meeting
- **January 24, 2023** – Draft Gas Utility IRP published
- **February 7, 2023** – Deadline to submit feedback on draft Gas Utility IRP
- **March 14, 2023** – Final gas portfolio results presentation
- **March 31, 2023** – Final 2023 Electric Progress Report Submitted


irp@pse.com


pse.com/irp

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