



PGE

CEP Community Learning Lab # 7

March 16, 2023

Agenda

10:00 – 10:10 am: Welcome & Meeting Logistics

10:10 – 11:20 am: Walk through the CEP/IRP Report

- Structure of the document
- Chapter highlights

11:20 – 11:40 am: Preferred Portfolio

11:40 – 11:55 am: Yearly Price Impacts

11:55 am – 12:00 pm: Next Steps & Closing Remarks

Meeting Objectives

Share the work we have accomplished together

Express our gratitude to our community partners

Open the floor for questions

Share timelines & next steps

Meeting Logistics

- Audio
- Microphone
- Chat box
- Video
- Raise Hand
- Closed Caption

Operating Agreements

Establishing norms with our communities is foundational to building trust

To create a **safe space**, we established **common agreements** such as **respect, honoring diversity of thought** and **inclusivity**

Practice curiosity and **seek to understand different perspectives**

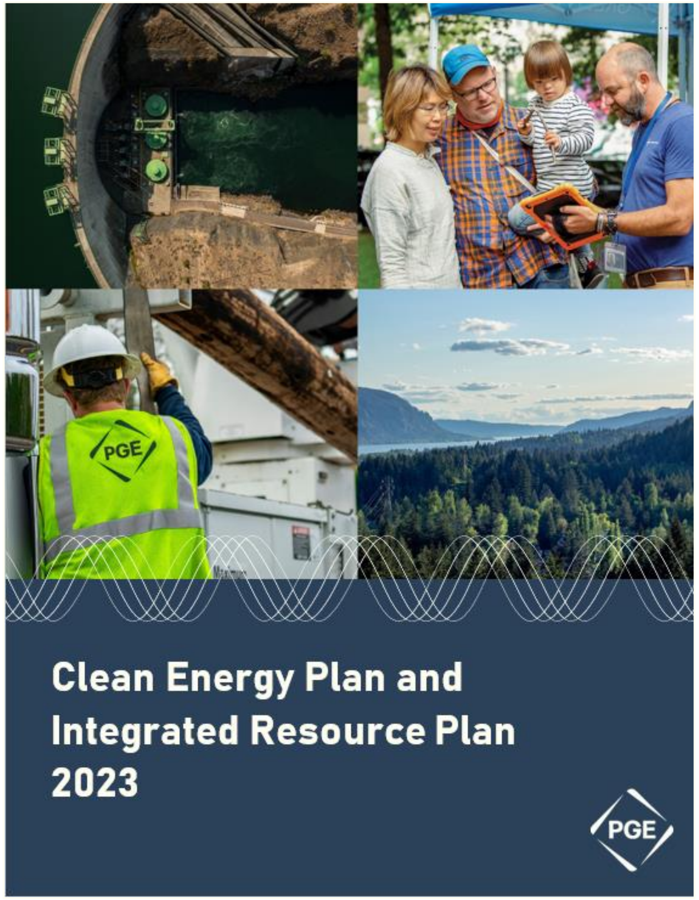
- **Stay Engaged**
- **Be Willing To Experience Discomfort**
- **Speak your Truth**
- **Expect and Accept Non-closure**
- **Share the Airtime**

The courageous conversations framework
By Glenn Singleton and Curtis Linton

Clean Energy Plan & Integrated Resource Plan Report

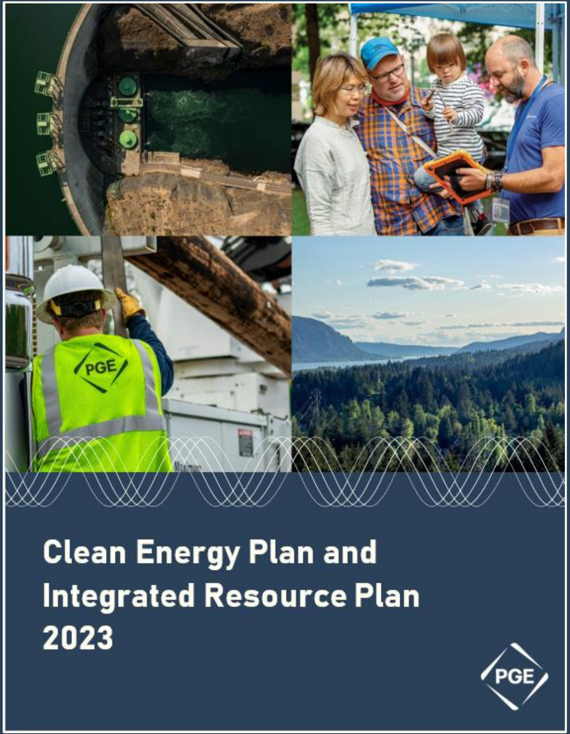
Seth Wiggins, Manager & Strategy, Integrated Resource Planning

Angela Long, Senior Manager & Strategy, Distributed Resource Planning



Clean Energy Plan & Integrated Resource Plan

Filing the Integrated Resource Plan and Clean Energy Plan jointly on March 31, 2023.



Report structure

14 Chapters

- Chapter 1. Clean energy plan
- Chapter 2. Accessing support for energy transition
- Chapter 3. Planning environment
- Chapter 4. Futures and uncertainties
- Chapter 5. GHG emissions forecasting
- Chapter 6. Resource needs
- Chapter 7. Community Benefits Indicators and Community-based Renewable Energy
- Chapter 8. Resource options
- Chapter 9. Transmission
- Chapter 10. Resource economics
- Chapter 11. Portfolio analysis
- Chapter 12. Action Plan
- Chapter 13. Resilience
- Chapter 14. Community equity lens

16 Appendices

- Appendix A. 2019 IRP action plan in review
- Appendix B. Compliance guidelines
- Appendix C. 2023 IRP public meeting agendas
- Appendix D. Load forecast methodology
- Appendix E. Existing and contracted resources
- Appendix F. Load resource balance
- Appendix G. Market capacity study
- Appendix H. 2023 IRP modeling details
- Appendix I. C-level analysis
- Appendix J. ELCC Sensitivities
- Appendix K. Tuned system ELCCs
- Appendix L. Clean Energy Plan: Learning Labs Community Feedback
- Appendix M. Supply-side options
- Appendix N. Renewable curtailment
- Appendix O. Thermal Operations/ Output
- Appendix P. Acronyms

4 Studies

- ES-I. Deep decarbonization
- ES-II. EE methodology
- ES-III. Climate adaptation
- ES-IV. Flexibility study

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Ch 1: Clean energy plan

Chapter highlights

- To meet our emissions reduction targets, we need to add non-emitting resources at an unprecedented pace and scale. For the foreseeable future, we will be in a near-continuous procurement cycle to replace GHG-emitting resources and keep pace with new customer demands.
- Achieving GHG reduction targets reliably and affordably requires gradually replacing fossil fuel generation and purchases with non-emitting energy and capacity resources.
- Transmission is a significant factor impacting the economics and timing of resource additions to meet HB 2021 targets reliably.
- Significant transmission constraints will drive a greater role for customer-sited resources such as demand response, energy efficiency, distributed solar/storage, and community-based renewable energy (CBRE) resources, highlighting the importance of PGE's efforts to improve our utilization of these resources through a virtual power plant (VPP).
- 2030 emissions reduction targets can be met by technologies and resources that are currently known and commercially available.
- Pathways to 2040 will require further technological advancement of non-emitting resources and transmission to meet the region's energy and capacity needs.

Ch 2: Accessing support for energy transition

Chapter highlights

- Federal and state policies are helping to drive rapid decarbonization in ways that impact PGE's resource planning.
- Federal legislation such as the IRA and IIJA that expanded and extended tax credits will facilitate PGE's acquisition of new resources and help manage customer rate impacts.
- We are partnering across the energy sector to stay abreast of rapid technological and market changes so that our customers benefit from the rapid change occurring across the energy ecosystem.

Ch 3: Planning environment

Chapter highlights

- Federal and state policy impacts the planning environment for PGE's Integrated Resource Plan (IRP) and Clean Energy Plan (CEP).
- Regulatory policy may need to adapt to changing dynamics created by state and regional decarbonization objectives.
- Thermal resource retirement in Oregon and the West creates challenges for resource adequacy as the region decarbonizes.
- Continued uncertainty related to labor markets, supply chains, and the macroeconomy presents challenges to decarbonization efforts.

Ch 4: Future & uncertainties

Chapter highlights

- Key drivers of uncertainty in this Integrated Resource Plan (IRP) include demand growth, economic trends and technological innovation, rate of electrification and customer adoption of new technologies, regional resource adequacy, and buildout of new non-GHG-emitting resources.
- PGE's portfolio analysis accounts for uncertainty in future resource needs, technology costs, wholesale energy markets, and hydro conditions.
- Portfolio analysis was conducted across 351 potential futures, defined by the range of resource needs, technology costs, and wholesale electricity market prices

Ch 5: GHG emissions forecasting

Chapter highlights

- House Bill 2021 sets 2030, 2035, and 2040 greenhouse gas (GHG) targets for energy used to serve PGE retail load of 1.62, 0.81, and zero million metric tons of GHG emissions, respectively.
- PGE reports its emissions to the ODEQ annually, and those reported emissions will be the basis for determining compliance with HB 2021.
- New for the 2023 IRP, PGE uses an intermediary GHG model to account for differences in regulation of GHG emissions associated with serving retail load and wholesale market sales.
- The IRP studies five different glidepaths for GHG reductions. Actual emissions will likely differ from those predicted here due to weather, resource procurement realities, and other factors.

Ch 6: Resource needs

Chapter highlights

- Load growth, expiring non-GHG emitting resource contracts, and decreasing retail sales from existing thermal resources drive the need for more non-GHG emitting resources through the planning horizon.
- The load forecast has increased since the 2019 Integrated Resource Plan (IRP) Update due primarily to higher industrial load growth projections. In addition, the persistent impacts of COVID-19 have increased residential usage.
- Distributed energy resources (DERs), including transportation and building electrification, are having a more significant impact on total PGE loads as compared to past IRPs.
- Capacity needs to step upwards in 2026 and grow through the planning horizon due to expiring contracts, exiting resources, and load growth. In the reference case, the 2026 capacity need is 506 MW in the summer and 430 MW in the winter.
- Flexibility needs in 2026 are estimated at 80 MW in the reference case, growing to 122 MW in 2030.
- Although capacity needs increase in both summer and winter throughout the planning horizon, climate change drives relatively more need in the summer and less need in the winter.

Ch 7: Community Benefits Indicators and Community-based Renewable Energy

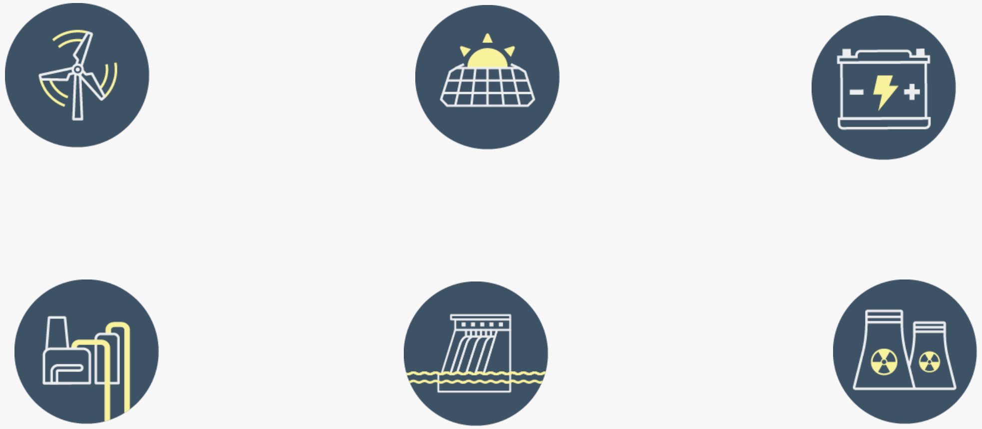
Chapter highlights

- PGE's Community Lens Potential study defines our approach to the community-based renewable energy (CBRE) forecast and identifies 155 MWs of CBRE potential by 2030.
- PGE's approach to community benefits indicators (CBI) within our Integrated Resource Plan (IRP) is to use a 10% adder for our Resource CBI pathway and a scoring methodology for our Portfolio CBI pathway.
- PGE is committed to evolving our approach to CBIs and CBREs through our Learning Labs as well as through working with our communities to identify future CBRE opportunities through our Community RFP and NWS.

Ch 8: Resource options

Chapter highlights

- PGE discusses utility-scale supply-side options available for meeting portfolio needs, including wind, solar photovoltaic, and energy storage resources, among others.
- The costs and MW potential of additional energy efficiency and demand response are included as resource options in this IRP.
- An analysis showing the adequacy challenges of a decarbonized system based on current resource options, followed by potential long-term resource options and strategies that can help address the challenges.
- A discussion of the benefits and risks of different resource ownership structures for customers is included.

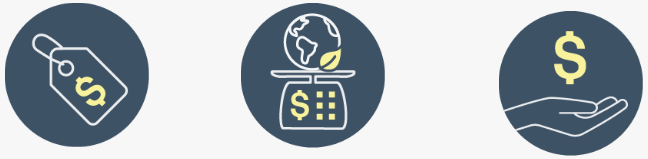


Ch 9: Transmission

Chapter highlights

- Portland General Electric's (PGE) unique footprint necessitates collaborative planning with Bonneville Power Administration (BPA) and regional peers to deliver resources to PGE's service area and to serve load within PGE's footprint. Transmission planning and development often takes longer than the Integrated Resource Plan (IRP) action window time horizon, necessitating early proactive efforts.
- As PGE plans to meet House Bill (HB) 2021's decarbonization targets, it is necessary to proactively mitigate transmission constraints to ensure reliable service of current and future load.
- Portfolio analysis in this IRP indicates additional transmission need on PGE's system, across BPA's system, and in additional climate zones.
- PGE proposes addressing transmission need through a combination of rights and/or projects to alleviate congestion across the South of Allston flowgate, expanding transmission to reach additional climate zones that provide resource diversity, and increasing PGE's ability to import electricity through the study of upgrading the Bethel to Round Butte line from 230 to 500 kV.

Ch 10: Resource economics



Chapter highlights

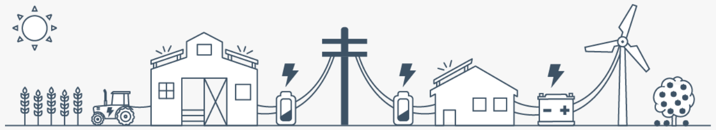
- Resource costs are primarily a function of fixed costs in the current planning environment
- With different resources providing disparate benefits, such as providing energy benefits and storage providing capacity benefits, resource competition is evolving within those two categories
- The inclusion of non-cost-effective Distributed Energy Resources (DER) provides insight into how their role can be further magnified in a decarbonized future
- The relative costs and benefits of different energy and capacity resources that will form the basis for resource selections in portfolio analysis are displayed

Ch 11: Portfolio analysis

Chapter highlights

- Portfolios are designed to meet emission reduction targets, adequacy needs, transmission, and procurement constraints and are solved across all 378 permutations of price futures, need futures, and technology cost futures
- Portfolio analysis provides insight on the need for transmission, the cost and risk implications of different greenhouse gas (GHG) glidepaths, community-based renewable energy resources (CBREs), and the role for additional DERs in a decarbonized future.
- The insights from these analyses form the basis of the creation of the Preferred Portfolio.
- The Preferred Portfolio represents the combination and timing of resources that best balance costs, risk, emission reductions, and community benefits for customers under the assumptions used in the IRP process.

Ch 12: Action Plan



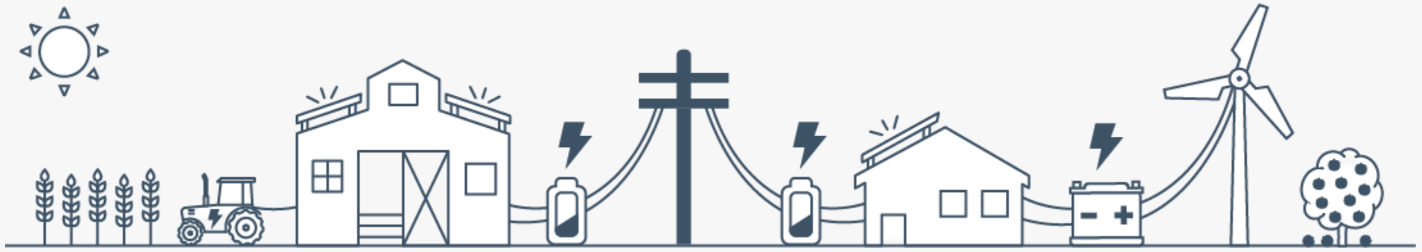
Chapter highlights

- PGE's Action Plan proposes a set of resource actions that we intend to take over the next four years.
- The Action Plan is built on the results of the five key components of the Preferred Portfolio that meet long-term system needs and decarbonization targets while minimizing cost and risk and maximizing community benefits.
- Customer resource actions include acquiring forecasted quantities of 'cost-effective' energy efficiency and demand response.
- The pursuit of Community-Based Renewable Energy (CBRE) resources is a cost-effective way to maximize community benefits.
- The energy action initiates a Request for Proposals (RFP) for non-GHG-emitting energy resources targeting one fifth of the remaining energy need after the addition of EE and CBRE resources.
- A capacity action targets the remaining resource adequacy needs in 2026 after contributions from CBRE and other energy resources as well as bilateral contracts.
- PGE will pursue all options to mitigate congestion on the South of Alston flowgate
- The Bethel-Round Butte transmission provides the best alleviation of near-term transmission constraints.

Ch 13: Resilience

Chapter highlights

- PGE used existing risk assessment analysis regarding system and customer resilience, including energy equity work conducted through PGE's Distribution System Plan (DSP).
- PGE's Annual Report provides historical reliability data and is the best place to add new reliability metrics required through the Clean Energy Plan (CEP).
- PGE identifies datasets and approaches to the zone of tolerance analysis.
- PGE's current and potential resilience programs and opportunities are needed to anticipate, adapt to, withstand, and quickly recover from disruptive events.

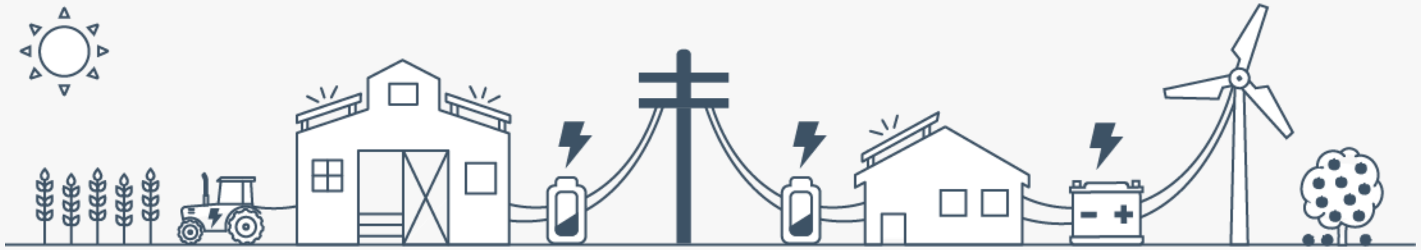


Ch 14: Community equity lens

Chapter highlights

- PGE's community engagement strategy and goals for PGE's long-term planning processes build on our experiences with the DSP.
- As part of our planning process, PGE sought input from non-traditional stakeholders, including individuals and organizations representing environmental justice communities. Our engagement strategy aligned multiple channels such as our Learning Labs, Roundtables, relationship building and surveys.
- PGE sought to deploy and iterate accessible opportunities to gather feedback, including Mural Boarding and surveys.
- We are tracking the input we received through Mural and using it to inform continuing planning and resource acquisition activities related to the CEP/IRP process.



Questions

Preferred Portfolio

Seth Wiggins, Manager & Strategy, Integrated Resource Planning

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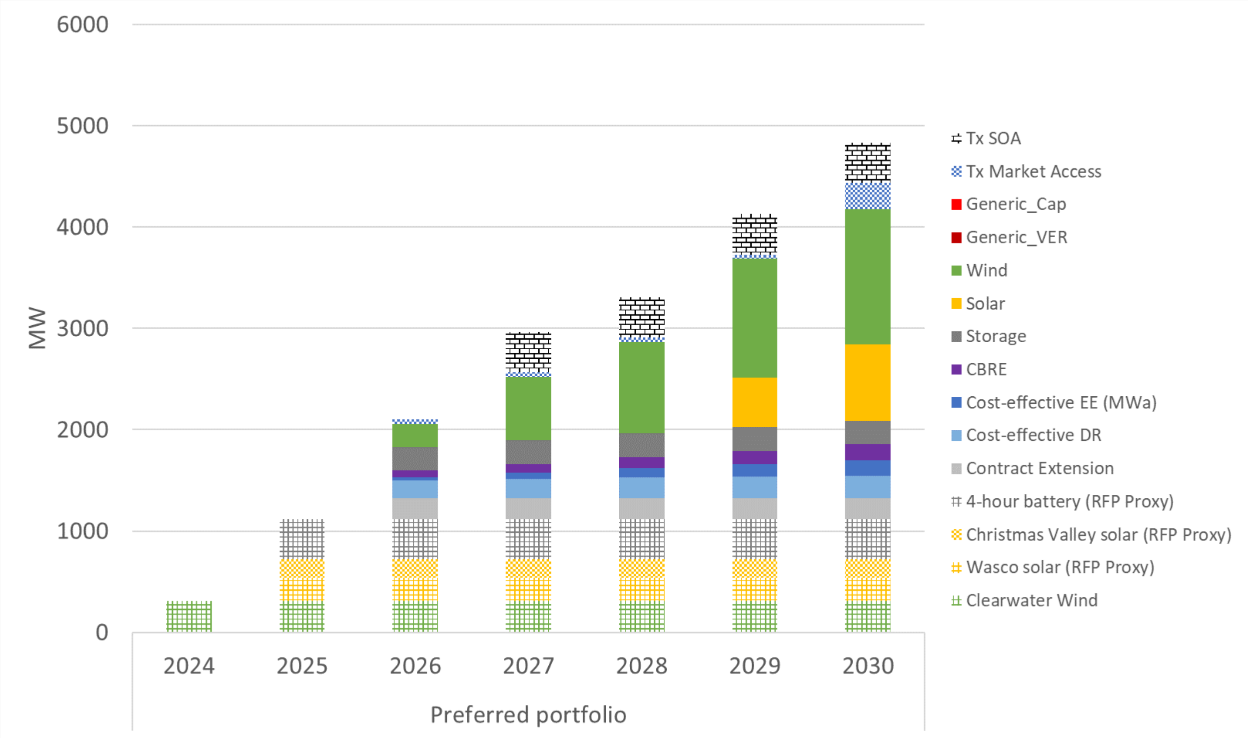
Preferred Portfolio

Created based on key insights gained through analysis of 39 portfolios:

Linear decarbonization glidepath from 2026-2030	Balances costs & risk & the rate of GHG reductions
Select 100% of CBREs available	Minimizes cost & maximizes community benefit
Incorporates 'cost-effective' quantities of EE & DR	Minimizes cost & risk
400 MW of South of Allston congestion relief in 2027	Minimizes cost & ensures reliability
Access to 400 MW each of NV and WY Tx starting in 2026	Minimizes cost & risk

Preferred Portfolio: Resource Build

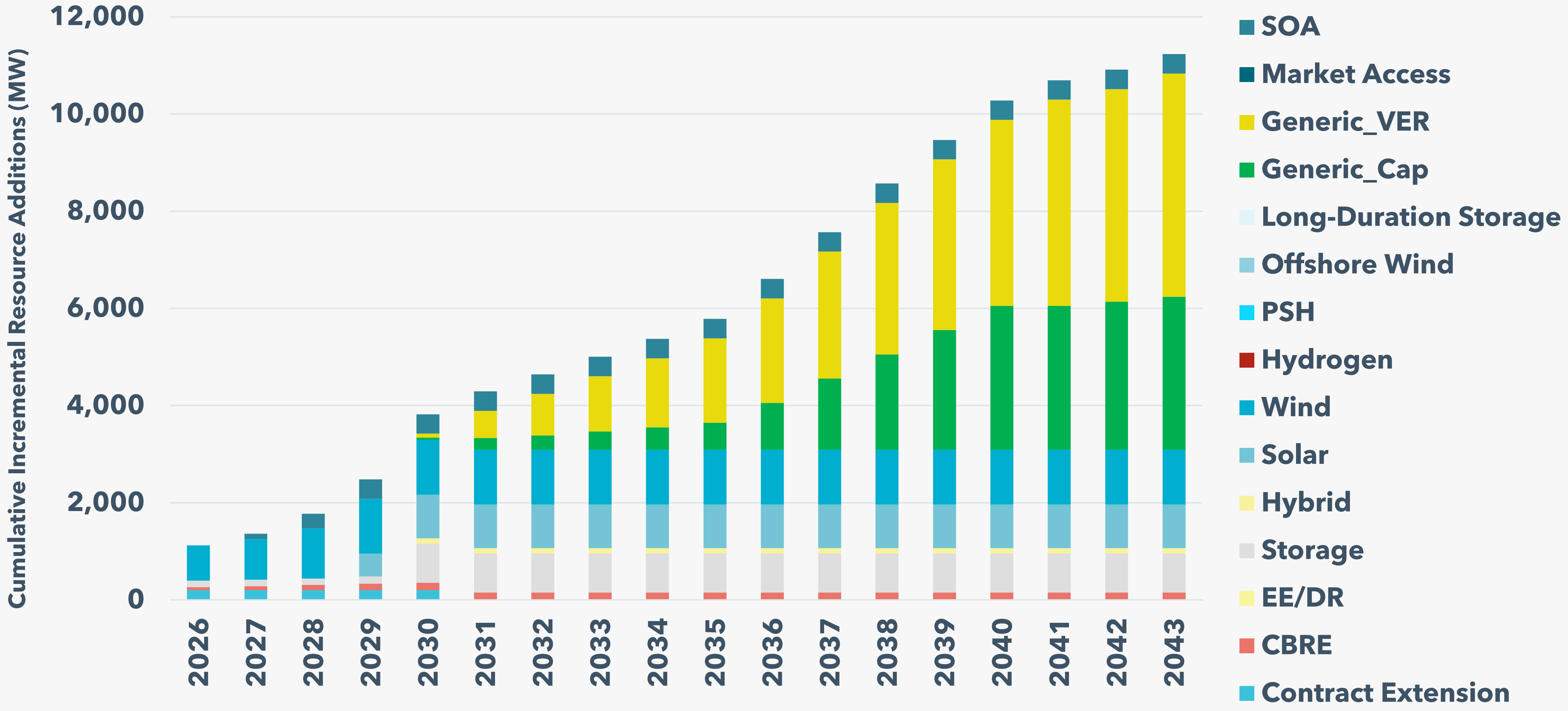
Cumulative Resource Additions (MW)	2024	2025	2026	2027	2028	2029	2030
Wind	0	0	227	627	901	1172	1334
Solar	0	0	0	0	0	490	756
Storage	0	0	232	232	232	232	232
CBRE	0	0	65	84	110	133	155
NV Tx	0	0	0	0	0	0	49
WY Tx	0	0	44	44	44	44	206
Tx SOA	0	0	0	400	400	400	400
Contract Extension	0	0	200	200	200	200	200
Clearwater Wind	311	311	311	311	311	311	311
Wasco solar (RFP Proxy)*	0	230	230	230	230	230	230
Christmas Valley solar (RFP Proxy)*	0	180	180	180	180	180	180
4-hour battery (RFP Proxy)*	0	400	400	400	400	400	400
Cost-effective EE (MWa)**	30	60	90	120	150	183	216
Cost-effective DR**	133	162	183	199	211	218	228



** RFP proxy resources represent expected additions acquired through the 2021 RFP*

*** Estimates of system need have already incorporated forecasts of cost-effective EE & DR – these are shown here for informational purposes*

Preferred Portfolio: Resource Build



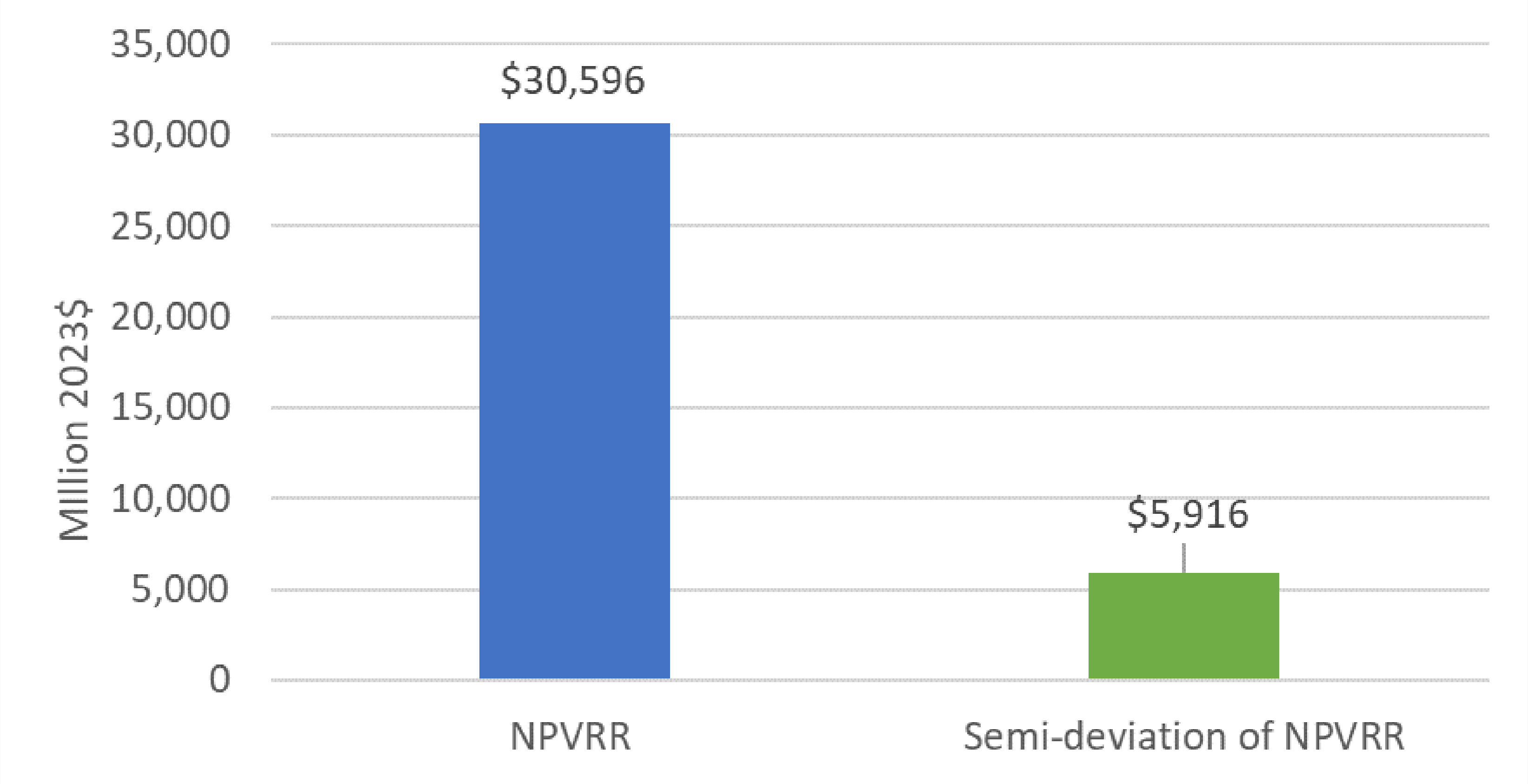
* *Estimates of system need have already incorporated forecasts of cost-effective EE & DR – these are shown here for informational purposes*

Preferred Portfolio: Resource Build

Resources	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Wind	0	0	227	627	901	1172	1334	1419	1528	1528	1528	1528	1528	1528	1528	1528	1528	1528	1528	1528
Solar	0	0	0	0	0	490	756	1267	1410	1410	1410	1410	1410	1410	1410	1410	1410	1410	1410	1410
Hybrid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Storage	0	0	232	232	232	232	232	232	232	232	232	332	400	500	600	700	800	800	800	800
EE/DR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CBRE	0	0	65	84	110	133	155	155	155	155	155	155	155	155	155	155	155	155	155	155
Market Access	0	0	44	44	44	44	255	548	800	800	800	800	800	800	800	800	800	800	800	800
SoA*	0	0	0	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
Contract Extension	0	0	200	200	200	200	200	0	0	0	0	0	0	0	0	0	0	0	0	0
Generic_Cap	0	0	0	0	0	0	0	0	0	0	0	13	321	821	1321	1821	2321	2321	2371	2470
Generic_VER	0	0	0	0	0	0	0	0	48	330	615	933	1353	1820	2320	2711	3031	3445	3577	3801
Cost-effective EE (MWa)**	30	60	90	120	150	183	216	251	285	317	348	377	404	429	452	471	487	503	514	523
Cost-effective DR**	133	162	183	199	211	218	228	242	252	261	270	272	287	296	303	310	306	314	330	336

** SoA represents transmission upgrades that allow access to additional resources, not a resource that provides energy or capacity directly.*
*** Estimates of system need have already incorporated forecasts of cost-effective EE & DR – these are shown here for informational purposes*

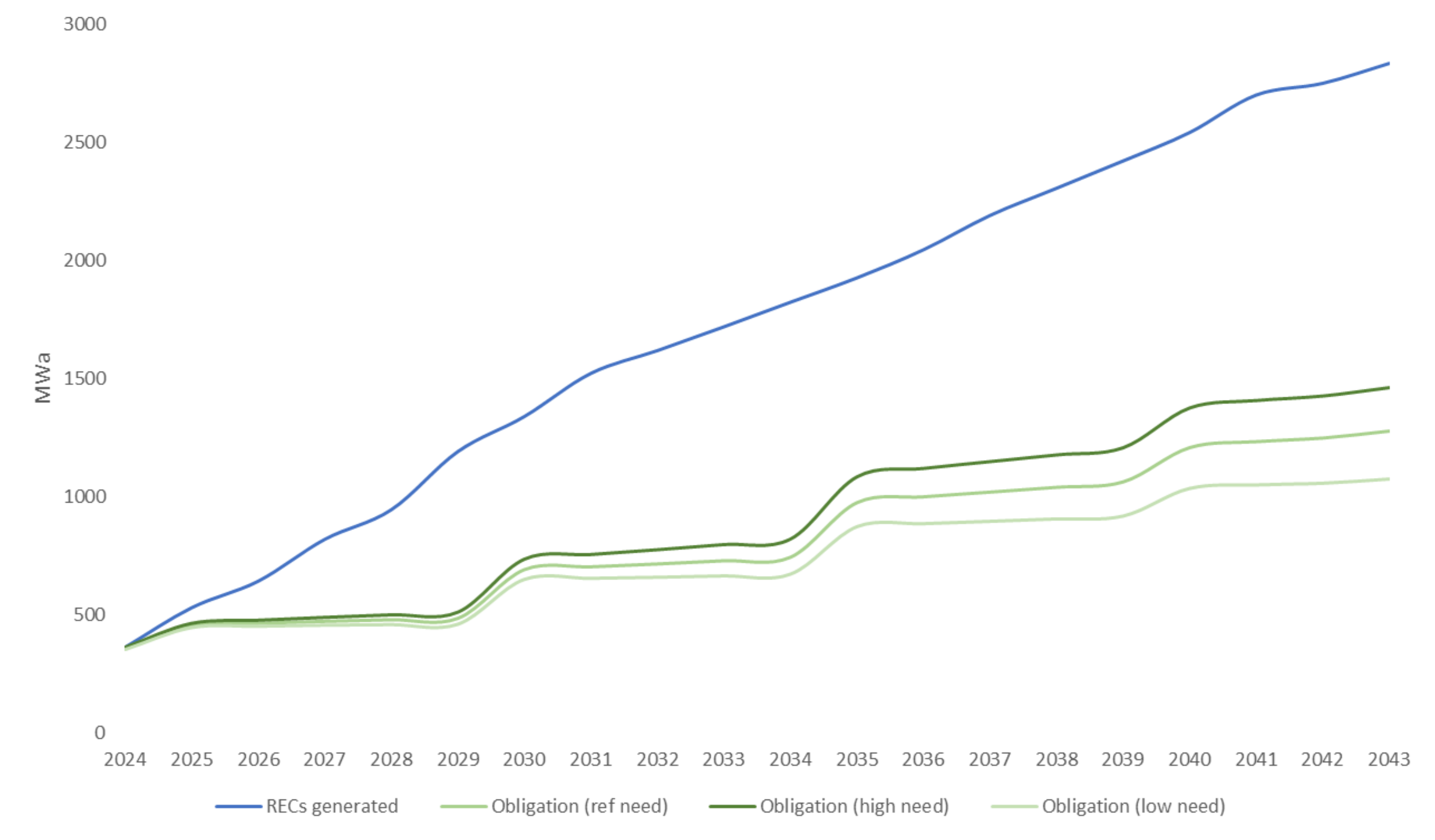
Preferred Portfolio: Cost and Risk Metrics



Preferred Portfolio: Resulting RPS Position

Generation of RECs from existing and incremental RPS resources in the Preferred portfolio is forecasted to enable PGE to be compliant with RPS requirements.

Because of the need to build new non-emitting resources to comply with HB 2021, the number of RECs forecast to be generated by PGE's portfolio will exceed RPS requirements.



Questions

Yearly Price Impacts

Seth Wiggins, Manager & Strategy Integrated Resource Planning

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Annual Rev. Req. Tool (ART)

ART enables the comparison of the yearly price impacts of different portfolios

Estimates include both PGE's existing portfolio and planned proxy new resource additions by portfolio

Limitations of ART and yearly price impact analyses within the IRP

- ART does not include costs from the rest of the company such as grid modernization, A&G, wildfire mitigation, or T&D costs
- Yearly price impacts do not reflect actual customer prices because they do include proxy resource generation costs and do not incorporate cost changes across PGE
- Applying percentages to these changes will not represent actual customer price changes because they do include proxy resource generation costs and do not incorporate cost changes across PGE
- Yearly prices are highly sensitive to assumptions of generic resources costs

Annual Rev. Req. Tool (ART)

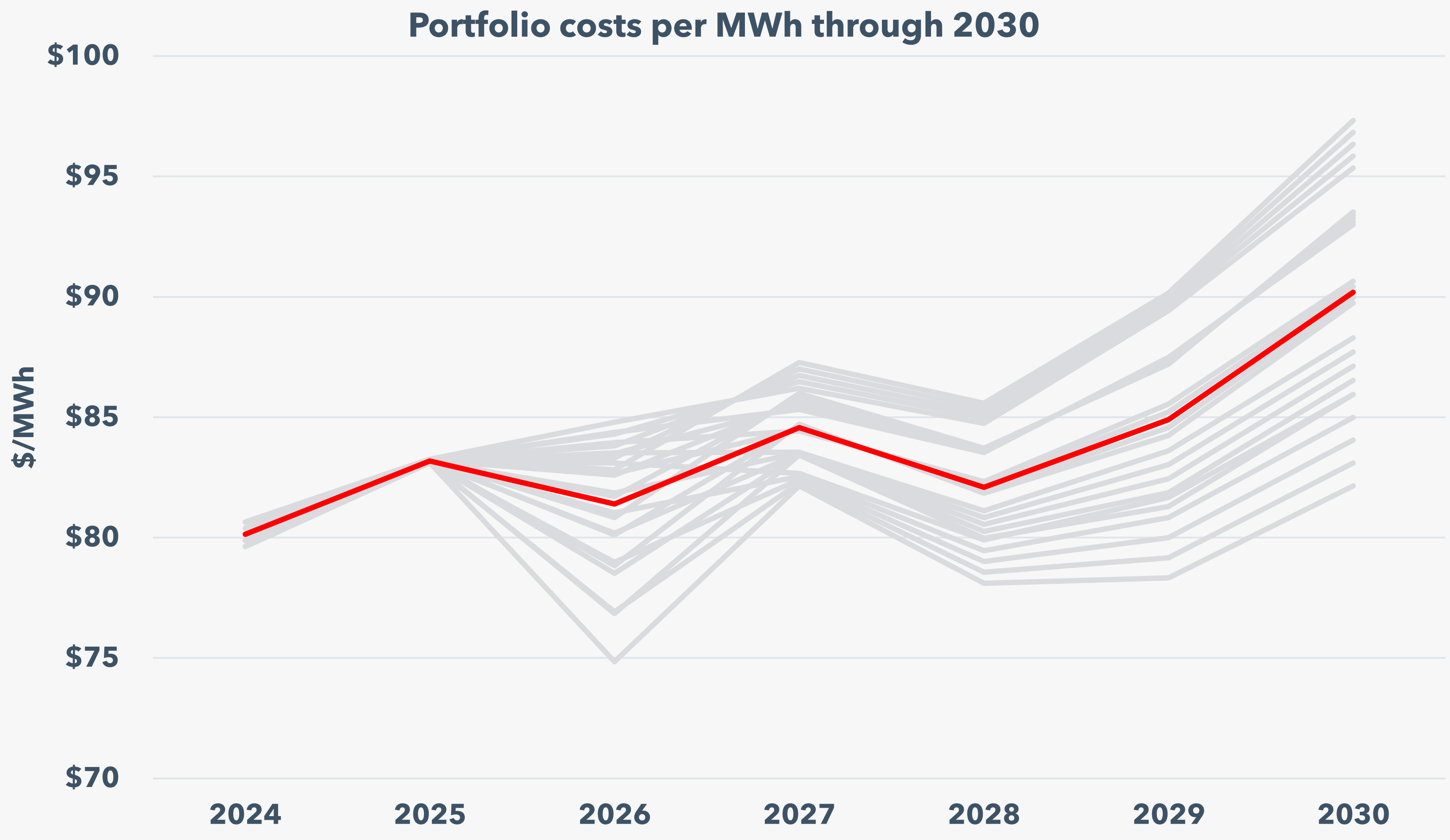
All costs are in nominal terms	The model uses proxy resource costs and associated operating characteristics	The model incorporates the impact of market sales and market purchases on an annual basis consistent with ROSE-E and the GHG model	Assumes 50% PPA and 50% PGE ownership of all new resources
Assumes 100% PPA for remaining 2021 RFP resources Clearwater wind project included from 2024	Assumes Colstrip exit in 2029	Assumes energy efficiency and demand response is not financed (consistent with current treatment)	Results are specific for the reference case scenario (reference need, reference prices, reference cost future)

Yearly Impact – Preferred Portfolio

Ownership structure and tax credits significantly impact annual price impact.

Tax credits assumed in ROSE-E and 50% PPA/50% PGE ownership assumption highlighted in **red**

Results are highly sensitive to assumptions about generic resource cost and buildout



Each line represents a unique combination of ownership structure and tax credits.
Ownership structures: 0%, 25%, 50%, 75%, and 100% PPA
Tax credit range: +/-25% and +/-50% of base tax credit

Questions

Next Steps & Closing Remarks

Next Learning Lab will be **Thursday, April 20 from 10:00am – 12:00pm focused on Transportation Electrification**

Please visit our CEP website at Clean Energy Planning (CEP) | Portland General Electric

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

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