

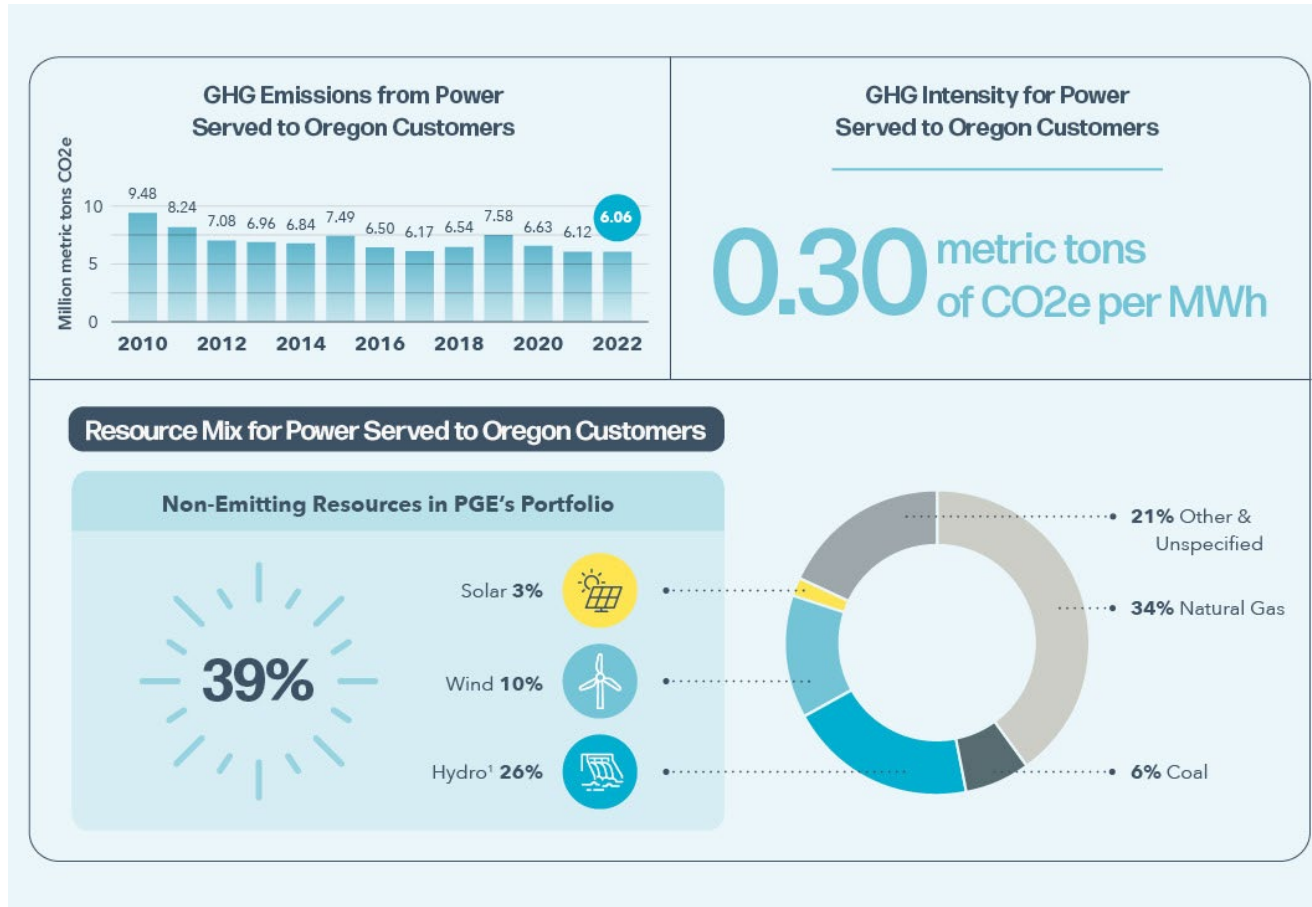
Portland General Electric: 2023 Clean Energy Plan and Integrated Resource Plan

May 2nd, 2023



2022 PGE Emissions & Targets

Emissions are already 25% below HB 2021 target baseline level*



Emissions targets & goals

HB 2021 Targets:

- 80% reduction below baseline for retail sales by 2030
- 90% reduction below baseline for retail sales by 2035
- 100% reduction below baseline for retail sales by 2040

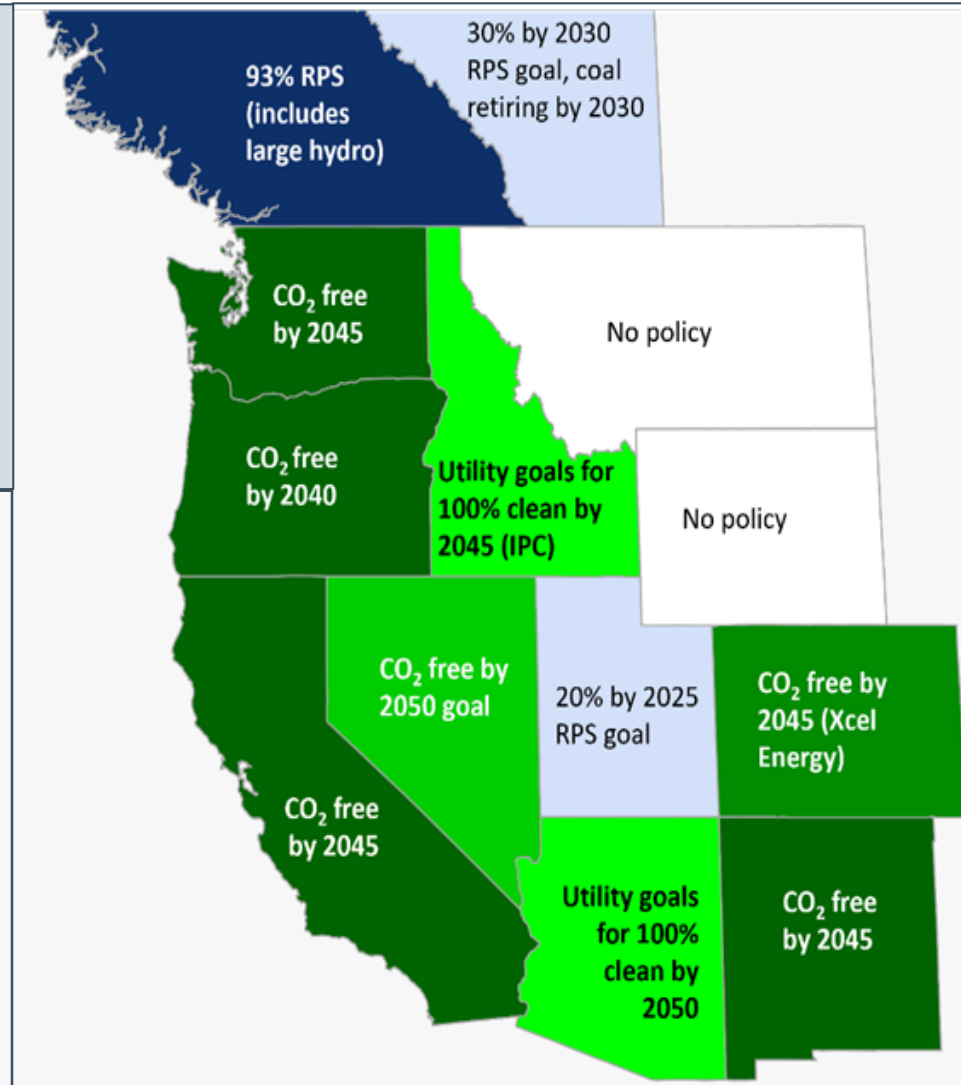
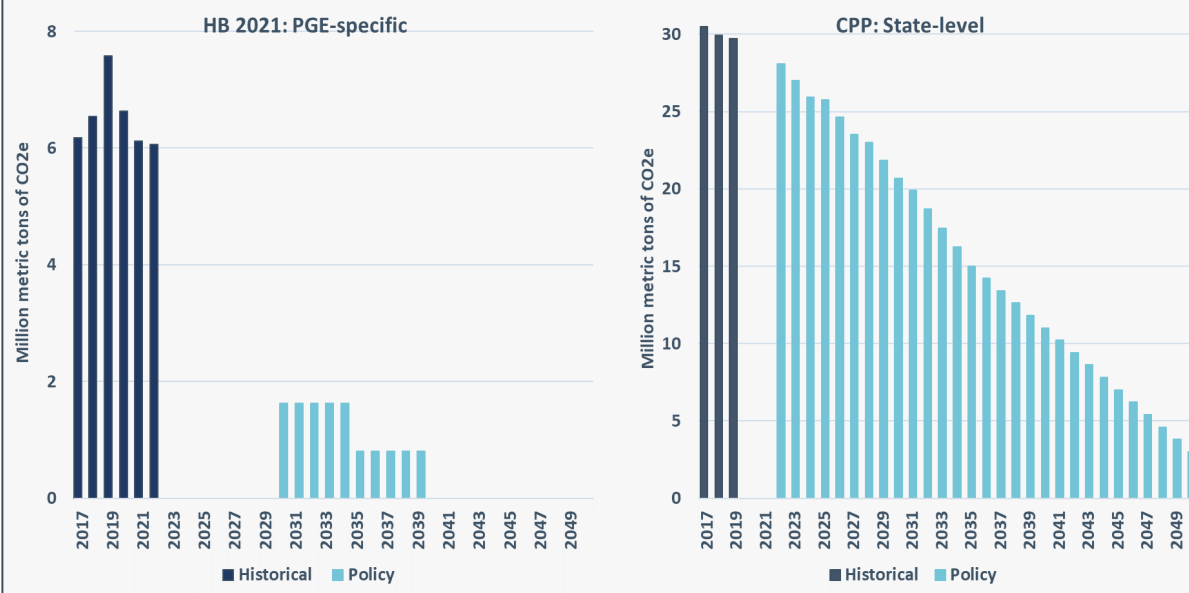
*Baseline = 8.1 MMTCO2e as established by ODEQ based on average of 2010-2012 PGE reported emissions. Based on energy served to retail customers within the State of Oregon, as required by Oregon Department of Environmental Quality (ODEQ). Some or all the renewable energy attributes associated with PGE's Basic Service Mix may be sold, claimed, or not acquired.
1. This includes power purchased from Bonneville Power Administration



Decarbonizing during highly dynamic period of change

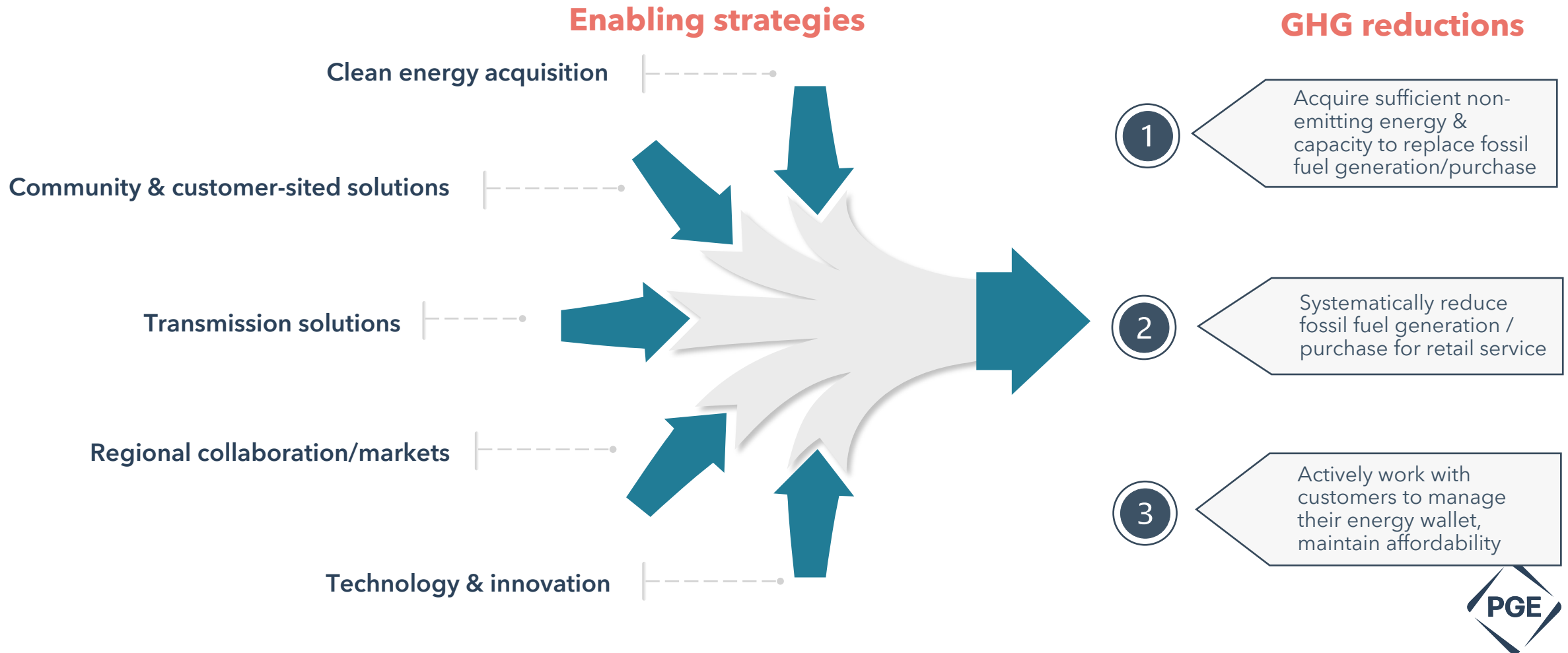
Federal, state, and regional decarbonization efforts pose significant challenges:

- Forecasting load
- Resource competition
- Supply chain and labor market dynamics
- Transmission constraints
- Resource adequacy
- Predicting rate of technology development and costs



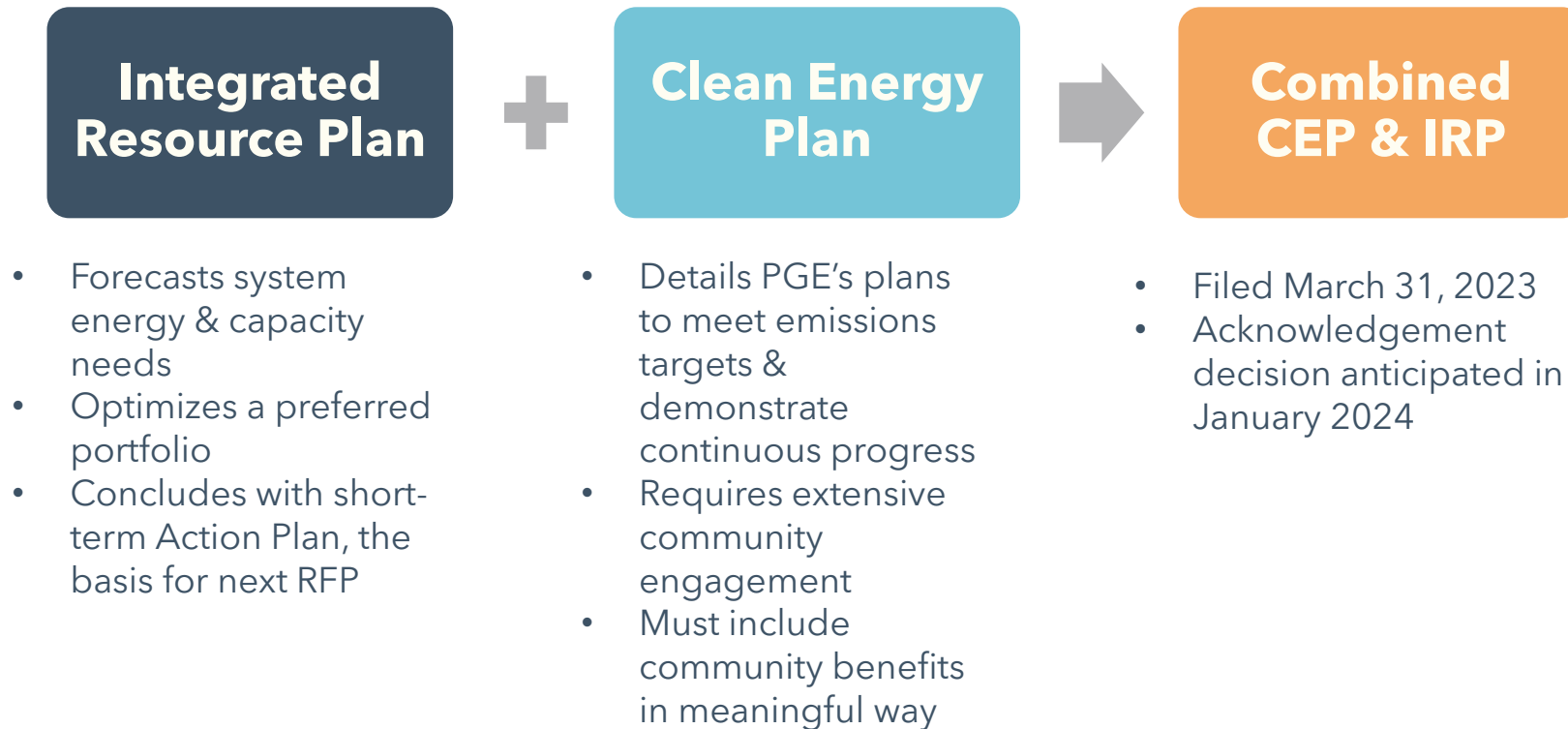
PGE's Path to 2030 Strategy

Our decarbonization strategy is multi-faceted to support reliable and affordable power



Clean Energy Plan & Integrated Resource Plan

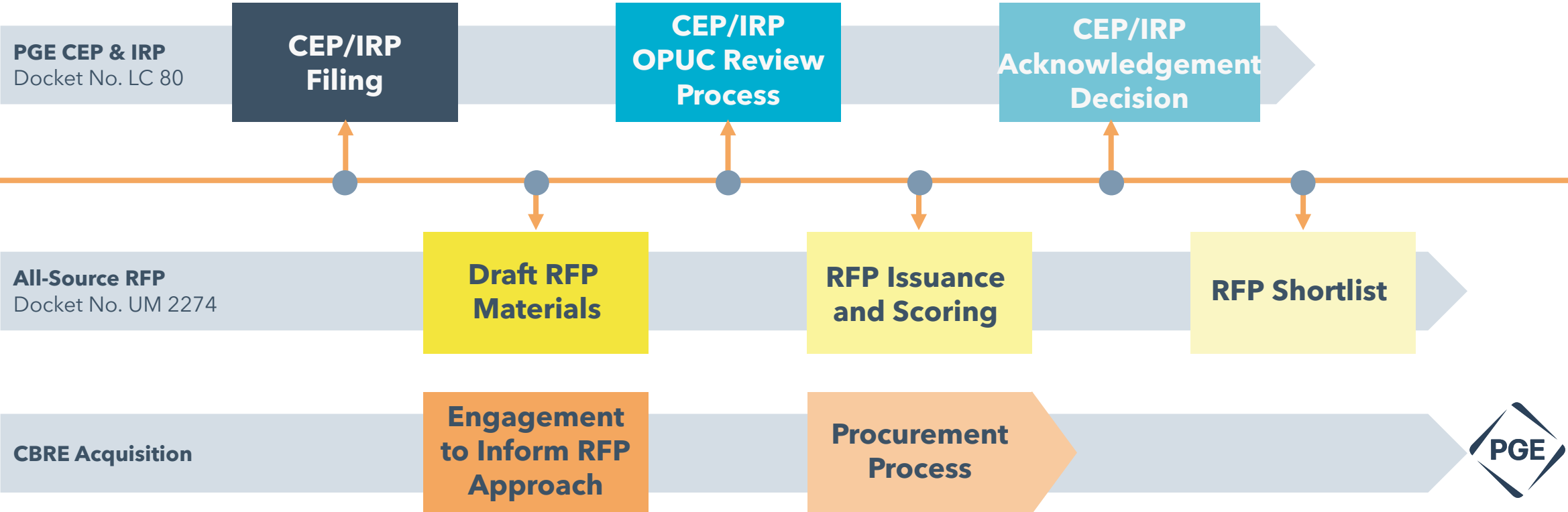
HB 2021 requires a clean energy plan (CEP) which builds off, expands on, and modifies the robust resource planning PGE is required to do for its integrated resource plan (IRP)



CEP/IRP Connection to RFP

PGE is taking steps to initiate resource procurement

- Streamlining the all-source RFP process to deliver on 2026 needs
- Coordination across planning, engagement and regulatory venues



Clean Energy Plan & Integrated Resource Plan

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



Clean Energy Plan and
Integrated Resource Plan
2023



Report structure

4 Studies

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

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

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

PGE Clean Energy & Integrated Resource Action Plan

The CEP/IRP Action Plan has five main components

- 1 Customer Actions
- 2 Community Based Renewable Energy Action
- 3 Energy Action
- 4 Capacity Action
- 5 Transmission Action



PGE Action Plan – Details

1. Customer actions

- Acquire all cost-effective energy efficiency (150 MWa cumulative 2024 - 2028)
- Incorporate customer demand response (211 MW summer & 158 MW winter by 2028)

2. Community-Based Renewable Energy (CBRE)

- CBREs are resources that are typically <20 MW that promote climate resilience, community benefits through a community benefits agreement or ownership
- Issue RFP for 66 MW of CBREs by 2026
- Conduct any additional RFPs necessary to achieve target of 155 MW by 2030
- Pursue federal/state incentives

3. Energy actions

- Conduct one or more RFPs for an additional 181 MWa (~520 MW nameplate) of non-emitting resources each year through 2028 (totaling 543 MWa)
- These resources are in addition to the ~1000 MW projected from the 2021 All-source RFP
- Additional renewables needed if energy efficiency, demand response don't materialize
- Successful acquisition of CBREs and/or the renewal of existing contracts can reduce energy need

4. Capacity actions

- Significant 2028 capacity need: 624 MW summer, 614 MW winter
- This need is estimated assuming the 400 MW of capacity resources acquired from the 2021 All-source RFP
- Will pursue staged approach: 1. acquire cost-competitive options in the bilateral market; 2. acquire CBREs, EE, and DR; 3. conduct one or more RFPs for remaining need
- Successful acquisition of CBREs and/or the renewal of existing contracts can reduce capacity need

5. Transmission

- Pursue options to alleviate congestion on the South of Alston (SoA) flowgate
- Explore options to upgrade the Bethel-Round Butte line (from 230 to 500 kV)



Key Takeaways

PGE is planning for a linear reduction in emissions associated with sales to Oregon retail customers from 2026-2030 and 2030-2040.

PGE forecasts a significant capacity need of 1136 MW in summer, 1004 MW in winter, and a significant energy need of 905 MWh (~2,500 MW nameplate) by 2030.

2030 emissions targets can be met by technologies and resources that are currently known and commercially available.

Pathways to 2040 will require further development of non-emitting resources to meet the region's energy and capacity needs.

PGE's natural gas plants will continue to play a role in helping meet our resource adequacy needs during the clean energy transition.



Key Takeaways

Achieving emissions targets reliably and affordably requires access to a wider geographic diversity of resources and the transmission solutions to access them.

Transmission constraints drive a greater role for customer-sited resources, including demand response, energy efficiency and community-based renewable energy.

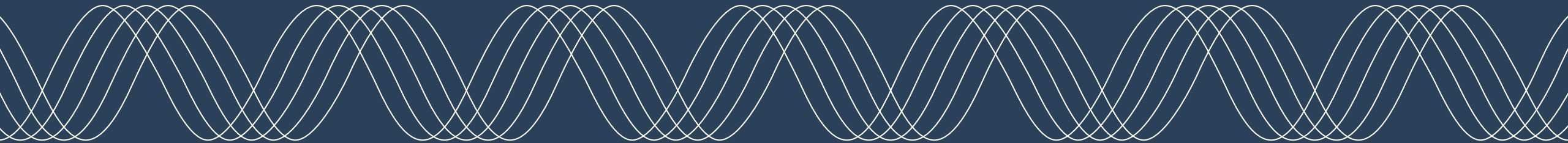
Regional markets and partnerships can increase reliability and lower costs for our customers.

Utilizing federal, state, and local funding opportunities to support decarbonization on our system will mitigate customer price pressure during the transition.

PGE's success will require continued collaboration with our customers, communities, and stakeholders and with a wide range of leaders at all levels of government.



CEP/IRP Deep Dive



2023 IRP Forecasts Significant Resource Need

2030 estimated capacity need: 1,136 MW in summer, 1,004 MW in winter

Energy need: 905 MWa by 2030, requiring ~2,500 MW of non-emitting energy resources, in addition to the 1,000 MW being pursued in 2021 RFP

Currently, PGE operates 3,300 MW of owned and contracted assets

By 2030, PGE may need to procure and integrate 3,000-4,000 MW of non-emitting resources & capacity to meet customers' energy demands & 2030 GHG emissions targets

Geographic & Resource Diversity Critical

A reliable grid must be resource adequate, with enough capacity and reserves to maintain balanced energy supply and demand to meet peak energy needs at any time and under all weather conditions.

As PGE looks to replace fossil fuel generation and purchases with renewables and storage, it will need geographic and resource diversity.

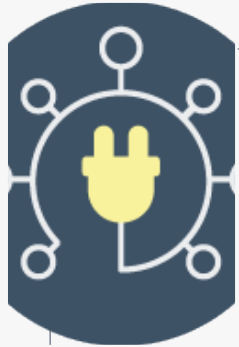
To inform the resource path to 2030 emissions targets, we examined the resource options that are currently known and at commercial scale in our region:



- **On-shore wind:** OR Gorge, SE Washington, Montana, Wyoming
- **Solar:** Central OR, OR Gorge, Willamette Valley, Desert SW
- **Battery Storage:** Lithium Ion, multiple durations
- **Hybrid:** Solar + Battery Storage
- **Pumped Storage Hydropower**
- **Distributed Energy Resources (DERs)**
- **Energy Efficiency (EE)**
- **CBRE** (community scale solar, solar + storage microgrids, in-conduit hydro)

As we look to the future and our target to reduce emissions by 100% by 2040, we are embracing innovation and preparing to adopt and scale cost-effective clean energy technologies to benefit customers. This will require infrastructure upgrades and new resources, storage and grid technologies to maintain resource adequacy and affordability for customers.

Empowering Customers & Communities



By 2030, PGE aspires to be able to meet as much as 25% of the energy needed on the hottest and coldest of days with power coming from customers and distributed energy resources.



Energy efficiency helps to reduce load, help customers save on bills.

- Cost-effective energy efficiency forecast to be 150 MWh through 2028
- Customer demand response: 211 MW summer and 158 MW winter by 2028



Community-Based Renewable Energy resources (CBREs), community-scale projects between ~1-20 MW that can integrate into the energy grid, are one of several alternatives for maintaining reliability and fostering resiliency in our communities.

- Target of 155 MW of CBRE acquisition by 2030

#1

For the 13th year¹,

PGE has held the U.S. Department of Energy's National Renewable Energy Laboratory's No. 1 ranking for the largest participation of business and residential renewable energy customers in a renewables program of any U.S. electric utility."

Building a Smarter Grid: Virtual Power Plant

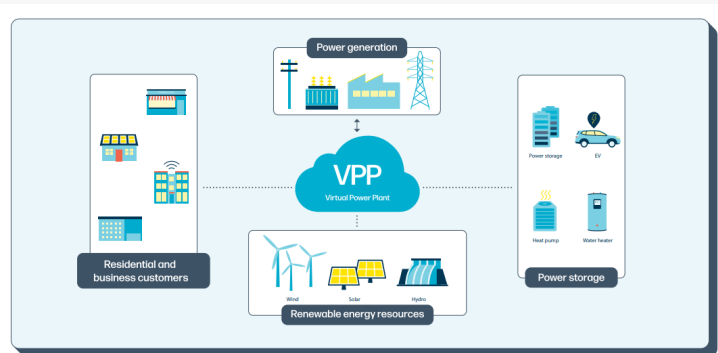
A reduced-emissions and reliable grid will require infrastructure upgrades and new resources, storage, and grid technologies to maintain affordability for customers.

Our Integrated Operations Center (IOC), which finished its first full year of operations in 2022, is fulfilling its role as the nerve center for an increasingly complex and intelligent energy network.

A VPP is effectively a power plant consisting distributed energy resources and flexible loads, orchestrated through a technology platform to provide grid and power operations services.

In 2022, we launched a new effort to expand our Virtual Power Plant capabilities to support our clean energy resource and capacity needs by leveraging our customers' participation in demand response, solar, battery storage, electric vehicles, and distributed energy generation programs.

We are actively planning for and investing in ways to equitably modernize our distribution system, while improving safety, reliability and reducing emissions. Building an equitable clean energy future will require intentional placement of resources like batteries, electric vehicle (EV) chargers and solar panels throughout Oregon communities.



Portfolio Analysis Tailored to Answer Key Questions

PGE explored 39 different resource portfolios to inform the creation of our Preferred Portfolio. Six key questions for developing a portfolio with a balanced path to achieve HB 2021 emissions targets:

At what pace should PGE reduce emissions?

Which resource actions maximize community benefits?

Will CBREs lower system costs?

Should PGE pursue energy efficiency and demand response beyond what is planned and estimated as cost-effective?

Is there sufficient transmission available to meet HB 2021 targets?

Do transmission expansion options allow PGE to meet system needs at the lowest cost?

Regional Solutions: Markets & Partnerships



By partnering with customers, communities and organizations across the West and beyond, PGE is enabling a flexible, resilient and integrated electric system – a smarter system. We are not just upgrading the grid; we are developing a clean energy ecosystem for the future.

To achieve GHG reduction targets, PGE will need access to a wider geographic area to source and site resources and a broader technological diversity of resources.

From participation in the expansion of regional markets to coordination on resource adequacy to transmission planning, PGE, like other utilities across the Western grid, is working across the energy system in the West to deliver better value and enhanced reliability as we and the region decarbonize.

Regional Solutions: Markets, Partnerships, Transmission

Transmission: As PGE's system evolves to meet decarbonization goals reliably, we will need to evolve our transmission portfolio to expand our reach throughout the West and strengthen our ability to serve locally.



The need for new on- and off-system transmission options is significant and will be required for PGE to achieve the HB 2021 targets reliably.

The reality of these transmission constraints makes additional customer-sited solutions like energy efficiency, demand response and CBREs more competitive in portfolio analysis.

PGE is working hard to increase transmission capacity throughout our service territory, including advancing over a dozen transmission projects with significant involvement of other jurisdictions.

PGE is also deploying technology such as remote sensors, dynamic line ratings, and the use of advanced conductor materials that help increase overall transmission capacity.

Working Toward an Equitable Clean Energy Future

PGE is committed to a future for Oregon in which all our customers & communities can thrive.



Climate change threatens the health and well-being of the communities we serve, and our most vulnerable communities, including Black, Indigenous and People of Color (BIPOC) and communities experiencing economic hardship, are often the most negatively impacted.



As the state's largest electricity provider, we have a unique responsibility to address the challenges of climate change head-on and lead the transition to cleaner, non-emitting sources of energy.



Integral to this work is our commitment to diversity, equity, and inclusion and to supporting everyone's opportunity to participate in and benefit from a clean and reliable energy future.

Federal Investments in a Clean Energy Future

With the passage of the Inflation Reduction Act and the Infrastructure Investment & Jobs Act, Congress delivered a comprehensive federal policy response to climate change and an investment package to support broad clean energy, climate, and infrastructure investments.



PGE is pursuing grant opportunities for infrastructure projects that can benefit our customers and lower customer rate impacts.



Currently, PGE is following the grant submission process for over \$500M of potential award, on just over \$900M of total project cost.

Questions?

