



100% Clean and renewable electricity: How far can we go?

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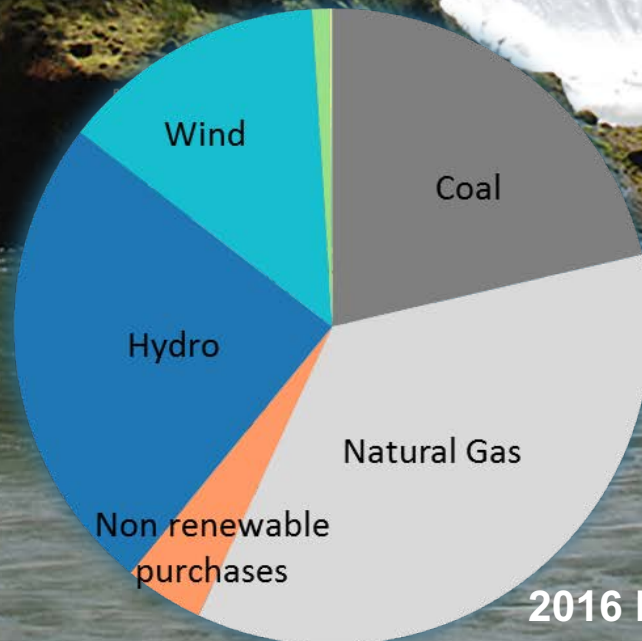
PGE at a Glance

- Investor-owned utility
 - 870,000 customers
 - 50% of Oregon's population
 - 75% of Oregon's commercial & industrial activity
 - 3,800 MW of generation
- Local business
 - Serves 52 cities, including Portland
 - 2,600 employees



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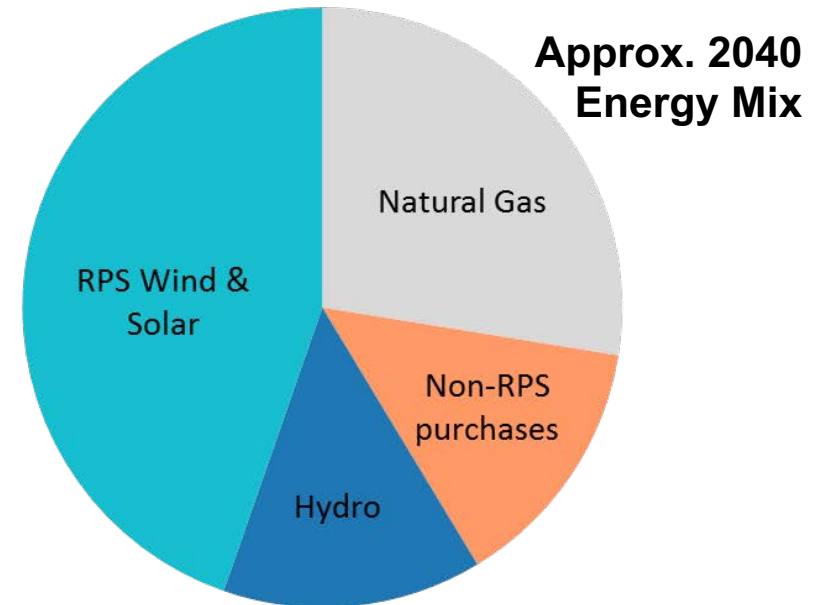
2016 Energy Mix



GHG & Renewable policy in Oregon

SB 1547 - Clean Electricity and Coal Transition Plan

- Increased Renewable Portfolio Standard (RPS), reaching 50% by 2040
- No coal by wires in portfolio by 2035



Oregon Global Warming Commission's GHG Goal:

75% below 1990 levels by 2050 (non-binding target)

City of Portland and Multnomah County 100% Clean and Renewable Goals

- 100% Clean and renewable electricity by 2035
- 100% Clean and renewable economy by 2050



PGE joined 1,200+ states, cities & businesses to affirm our commitment to act on climate change



PGE is committed to helping the city and county meet their long-term clean and renewable goals

State Policies and Local Initiatives

How can an electric utility support local initiatives within the context of state and federal regulation?

Opportunities

- Provide options for customers and communities ready to decarbonize faster than state policy targets
- Leverage an integrated grid to enable distributed resources

Challenges

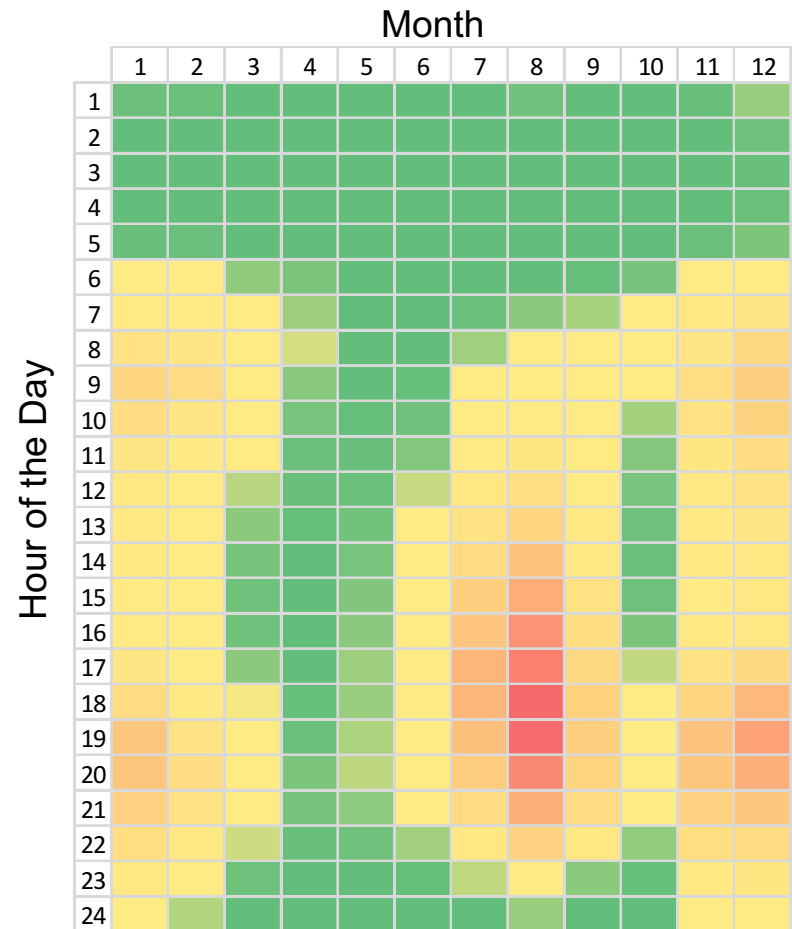
- Regulatory hurdles to green tariffs
- Protecting disadvantaged communities and vulnerable industries from costs of early adoption
- Maintaining reliability and appropriate attribution of associated costs

Reliability

Reliability and operability will remain core to electric utilities

- The electricity industry is learning more about how to plan for reliability under higher penetrations of renewables
 - Effective Load Carrying Capability (ELCC) methods will remain important
 - Nature of capacity needs will change as the electricity system evolves
- Challenges in understanding flexibility adequacy remain

PGE's seasonal and hourly reliability needs



Infrastructure Development

Massive investment in new resources will be needed

- Excluding reliability and flexibility resources, providing 100% clean and renewable energy in PGE's service area would require significant investment
- Approximately 20,000 GWh/yr of new renewables by 2050

	Installed Capacity (MW)	Upfront Capital (assuming 2025 COD)
Pacific Northwest Onshore Wind	~7,000	\$10 billion
Central Oregon Large-Scale Solar	~9,000	\$15 billion
Rooftop Solar	~15,000	\$30 billion

It's time to change the question

Rather than asking “how far can we go?” instead ask:

Researchers:

What technology challenges will need to be overcome to meet long term goals?

How can technology reduce costs of decarbonization?

Regulators and Utilities:

Given long term uncertainties, at what pace should we be investing in renewables?

How can customers be given more options without compromising reliable and affordable electricity for all?



Thank you!

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