Northwest **Power** and **Conservation** Council

April 2, 2019

MEMORANDUM

TO: **Council Members**

FROM: **John Ollis, Power System Analyst**

SUBJECT: **Briefing on PGE Decarbonization Study**

BACKGROUND:

Presenter: Elysia Treanor, Environmental Policy Manager at Portland General Electric

Summary: In 2018, Portland General Electric (PGE) worked with Evolved Energy Research to study pathways for deep decarbonization in its service territory to inform its next IRP process and the carbon policy discussion in Oregon.

Relevance: As the Council develops its 2021 Power Plan, staff will be monitoring the regional discussion about the implications of deep decarbonization strategies.

More Info: Decarbonization Study
https://www.portlandgeneral.com/our-company/energy-strategy/resource-planning/integrated-resource-planning

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Decarbonization in PGE's Service Area

August 2018

Elysia Treanor
Government Affairs and Environmental Policy

Elaine Hart
Integrated Resource Planning

What is deep decarbonization?

DEEP DECARBONIZATION

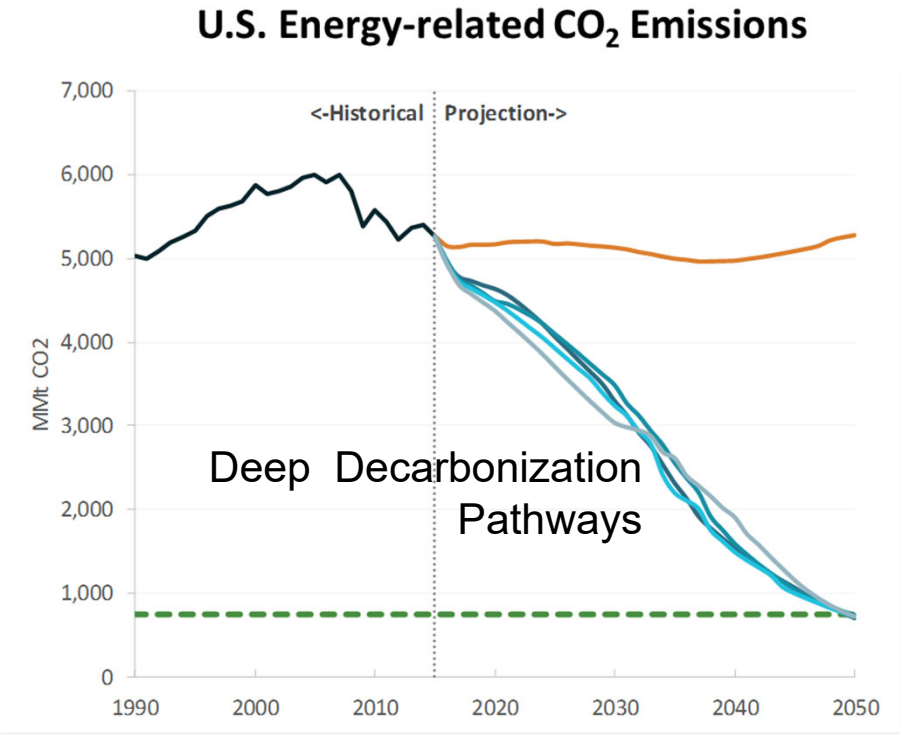
Transformation of the energy economy consistent with keeping global warming less than 2°C

ENERGY SYSTEM

The network of all energy producing, converting, delivering, or consuming infrastructure

PATHWAY

Plan or blueprint to achieve deep decarbonization of the energy system



Source: Evolved Energy Research

PGE commissioned a Decarbonization Study to inform the next IRP and to help inform carbon policy conversations in Oregon

Why decarbonization?

- The City of Portland and Multnomah County signed resolutions for deep reductions in GHG emissions
  - 100% clean & renewable electricity by 2035
  - 100% economy-wide clean & renewable energy by 2050
- **#WeAreStillIn** pledge
  - PGE joined 2,500+ businesses and local governments in pledging to do our share to meet obligations in the Paris Climate Agreement
- In the 2016 IRP, stakeholders expressed interest in seeing portfolios that meet GHG reduction targets
  - Current goal: 75% below 1990 levels by 2050
- Understanding deeply decarbonized scenarios will contribute to prudent long term planning in the IRP

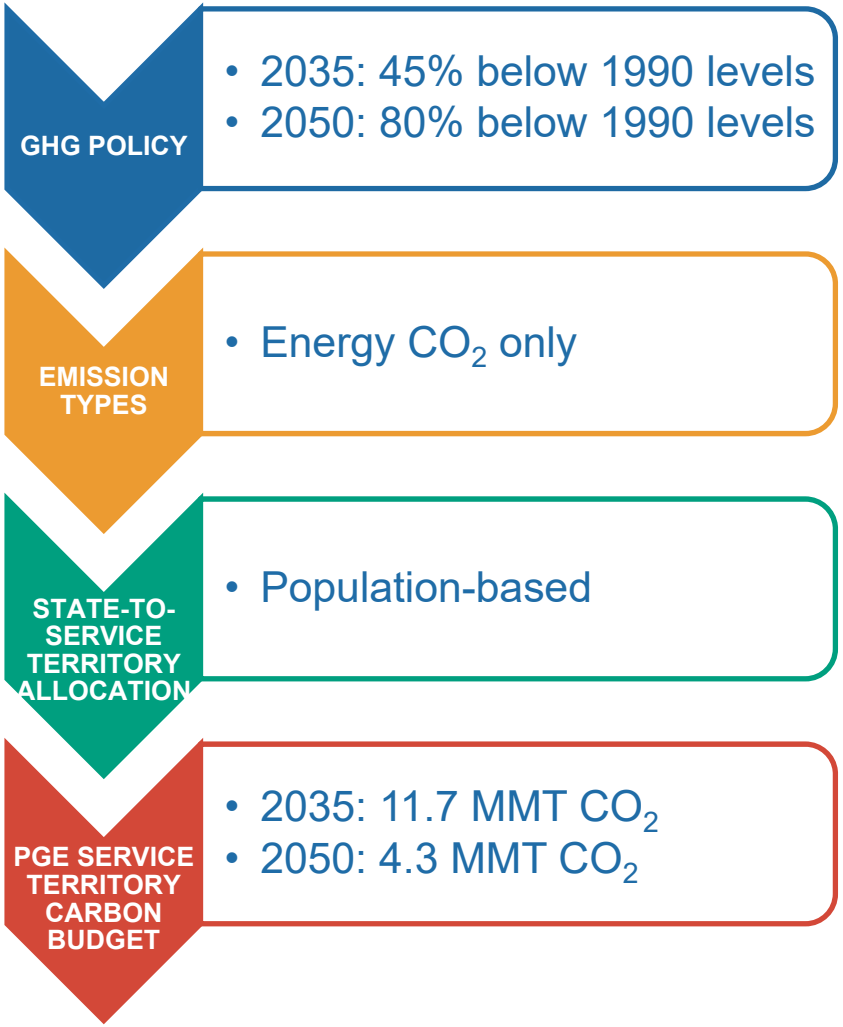
PGE's decarbonization study

PGE commissioned a Decarbonization Study to inform the next IRP and to help inform carbon policy conversations in Oregon

- Study developed economy-wide decarbonization pathways across PGE's service area (including transportation and non-electric end uses)
- Emissions target: **80% reduction by 2050**, consistent with guidance from the scientific community for limiting global temperature rise to 2°C
- PGE commissioned the study to address key questions:
  - How might energy services be met in PGE's service area in a decarbonized future?
  - What are the implications for PGE's electricity demand – both magnitude and shape?
  - How much renewable infrastructure will be needed to support economy-wide decarbonization?
  - What might energy (not just electricity) costs look like for our customers?

Scope of decarbonization study

- PGE service territory only
  - Three energy scenarios (pathways) that transition to a low-carbon future
- All energy types
  - Gasoline, hydrogen, etc.
- Energy-related CO2 only
  - Does not include industrial process emissions, landfills, agricultural CO2 emissions or non CO2 GHGs
- Allocated state-wide budget to PGE service territory using its share of state's population (45-47% of total)
  - By 2050, per capita energy CO2 emissions decrease from 16.0 tCO2 to 1.6 tCO2/person



Study principles

Natural stock rollover

- No early replacement - vehicles and appliances replaced upon failure
  - This creates inertia in the energy system, limits the rate of emissions reductions

Technology cost and performance

- No technological breakthroughs – study uses only commercial or near-commercial technologies and today's forecasts for gradual technology improvement
  - More rapid technological improvement would reduce costs

Conservation and behavior change

- Study assumes no structural change to the energy services demanded by our customers
  - Additional conservation, behavioral change, smart city planning, etc. make it easier to meet the reduction goals

Deep decarbonization pathways investigated

High Electrification

Fossil fuel consumption is reduced by electrifying end-uses to the extent possible and increasing renewable electricity generation

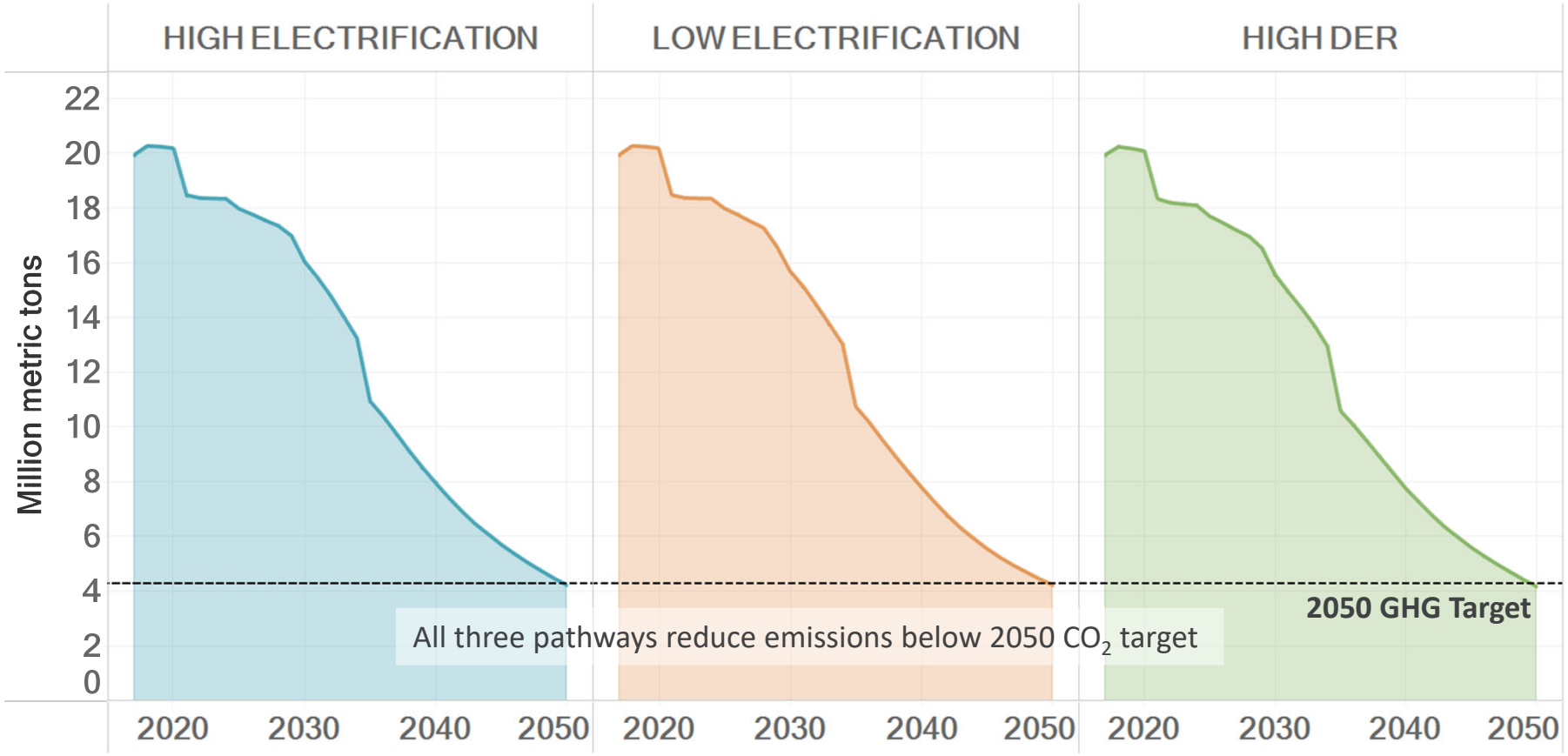
Low Electrification

Greater use of renewable fuels, notably biofuels and synthetic electric fuels, to satisfy energy demand and reduce emissions

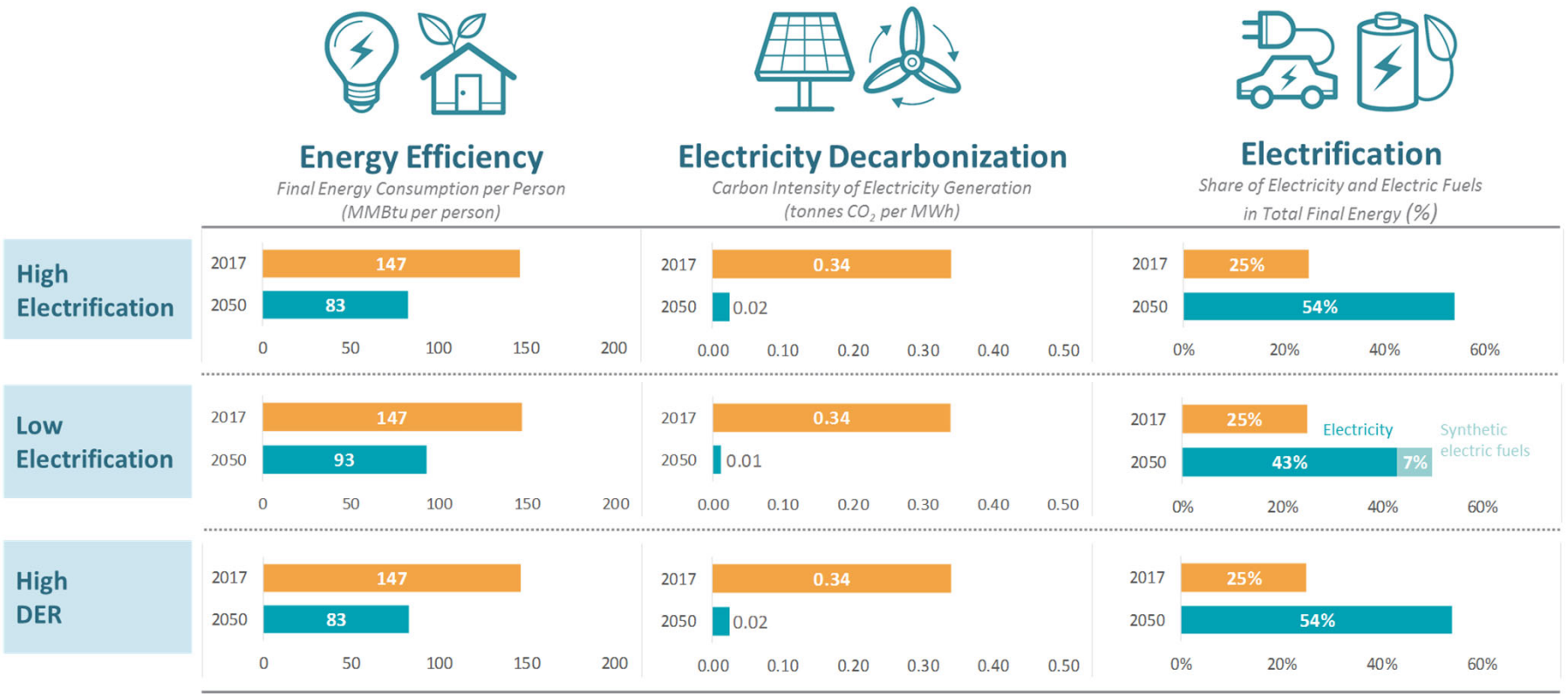
High DER

Distributed energy resources proliferate in homes and businesses, which also realize higher levels of electrification

Multiple pathways achieve 2050 reduction targets

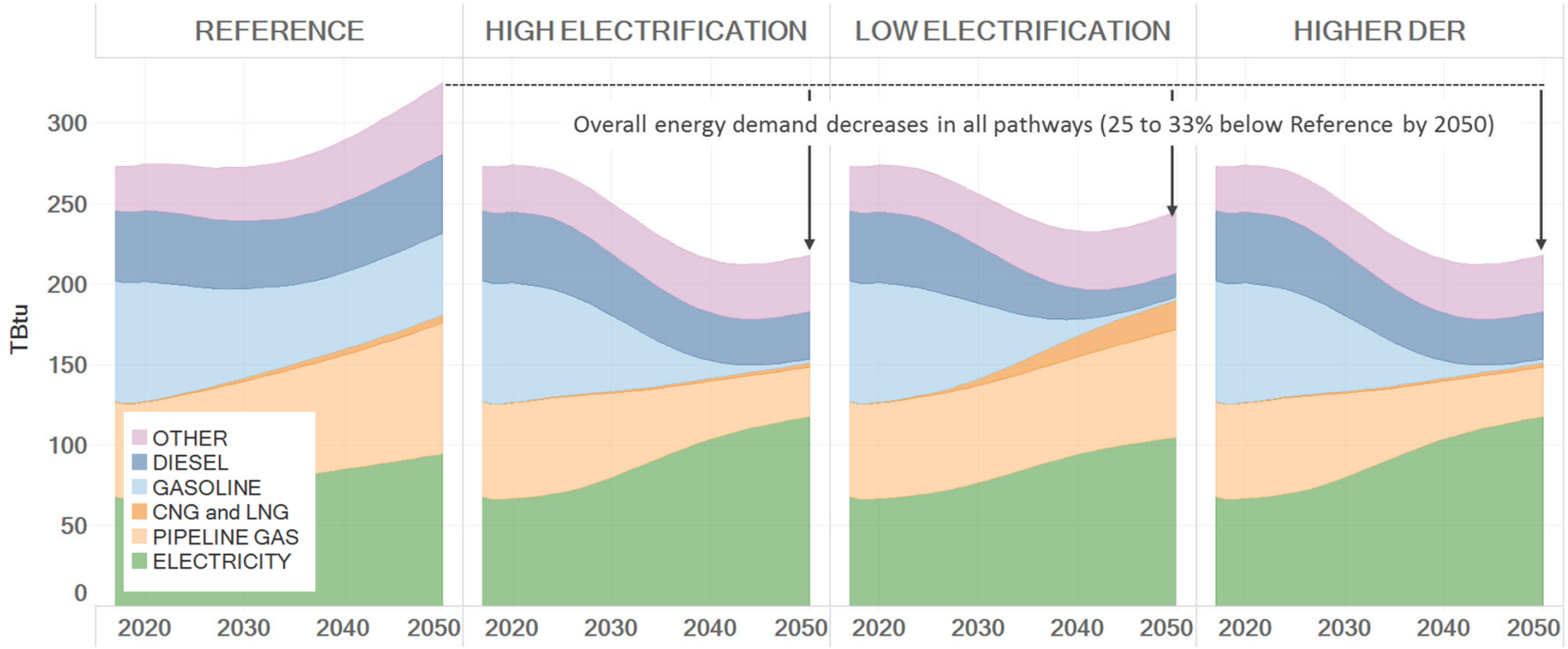


All pathways require success across all three pillars



Impacts to energy demand

In deep decarbonization pathways, total energy consumption drops 25% to 33% relative to the Reference Case by 2050, but reliance on electricity increases



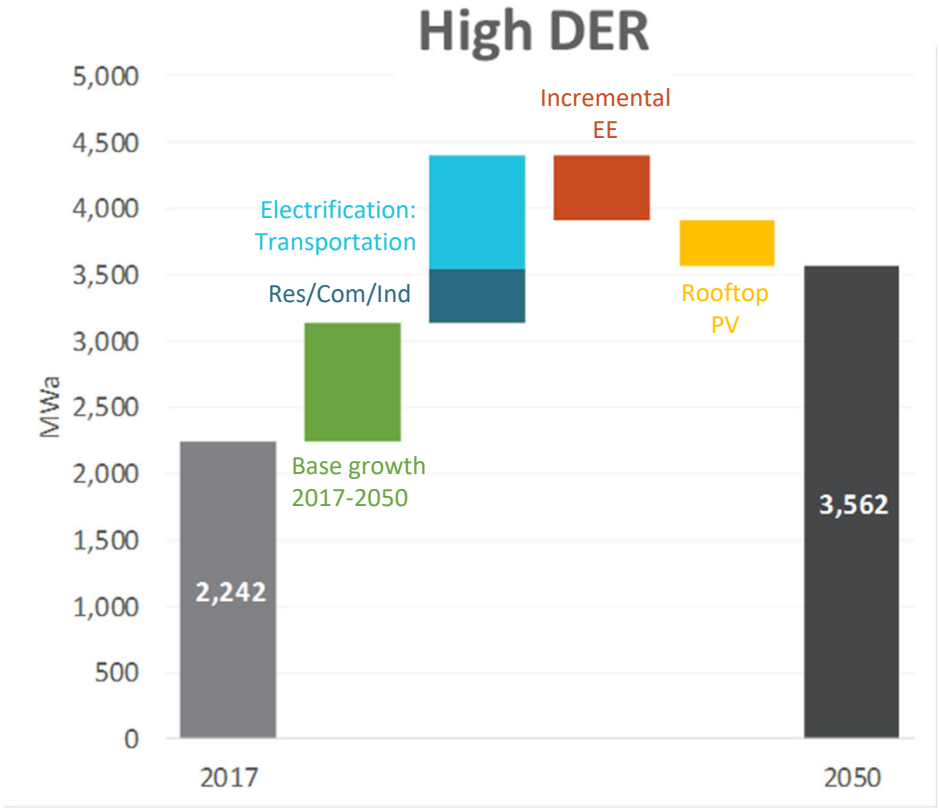
Key energy efficiency technologies

Reduced energy demand is associated with adoption of LEDs, electric vehicles, and heat pumps (or high efficiency gas appliances)

		High Electrification and High DER	Low Electrification
Energy Supply	**Pipeline Gas**	No change	Decarbonized with renewable natural gas (RNG), hydrogen (H2) and synthetic natural gas (SNG)
	Liquid Transportation Fuels	Renewable diesel and jet fuel	Renewable diesel and jet fuel
Buildings	**Space Conditioning**	Air source heat pump	High efficiency gas furnace High efficiency air conditioner
	Water Heating	Heat pump water heater	High efficiency gas water heater
	Lighting	LED	LED
	Other Appliances (clothes washer, refrigerator, etc.)	Best available technology	Best available technology
Industry	**Process Heat**	Partial electrification	No change
Transportation	**Passenger Vehicles**	90% battery electric vehicle (BEV); 10% plug-in hybrid electric vehicle (PHEV)	90% battery electric vehicle (BEV); 10% hydrogen fuel cell vehicle (HFCV)
	Freight Trucks	50% electric 50% hybrid diesel truck	50% electric 50% liquefied & compressed gas (LNG/CNG)

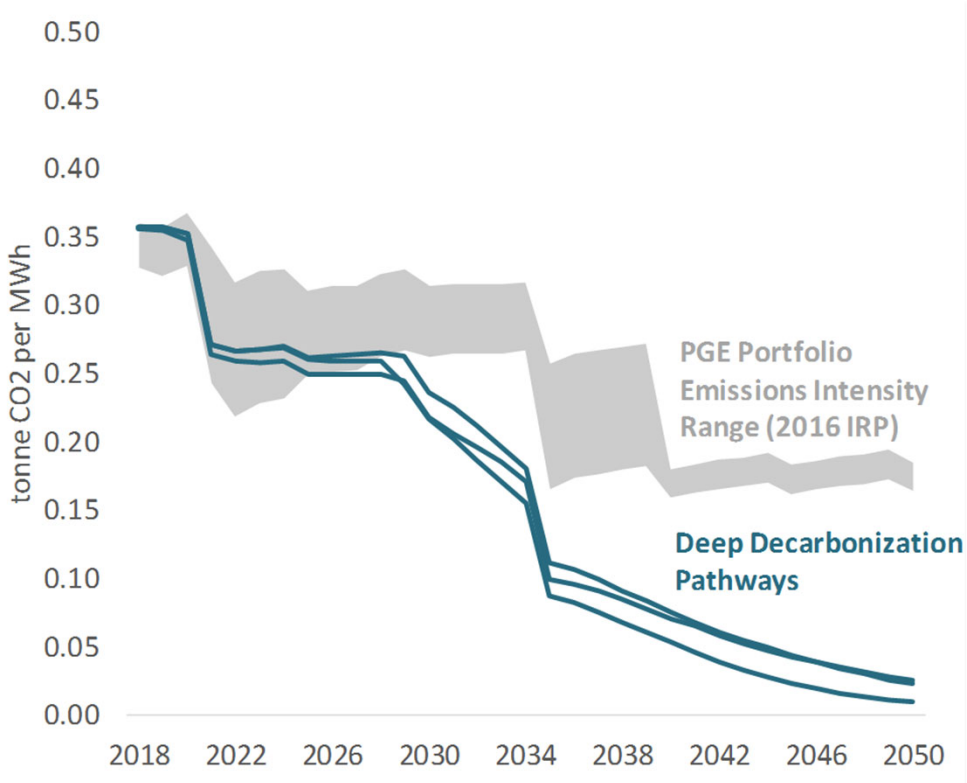
Load impacts of electrification

Electricity use grows to fuel new clean end uses, like electric vehicles, heat pumps, and/or synthetic fuel production



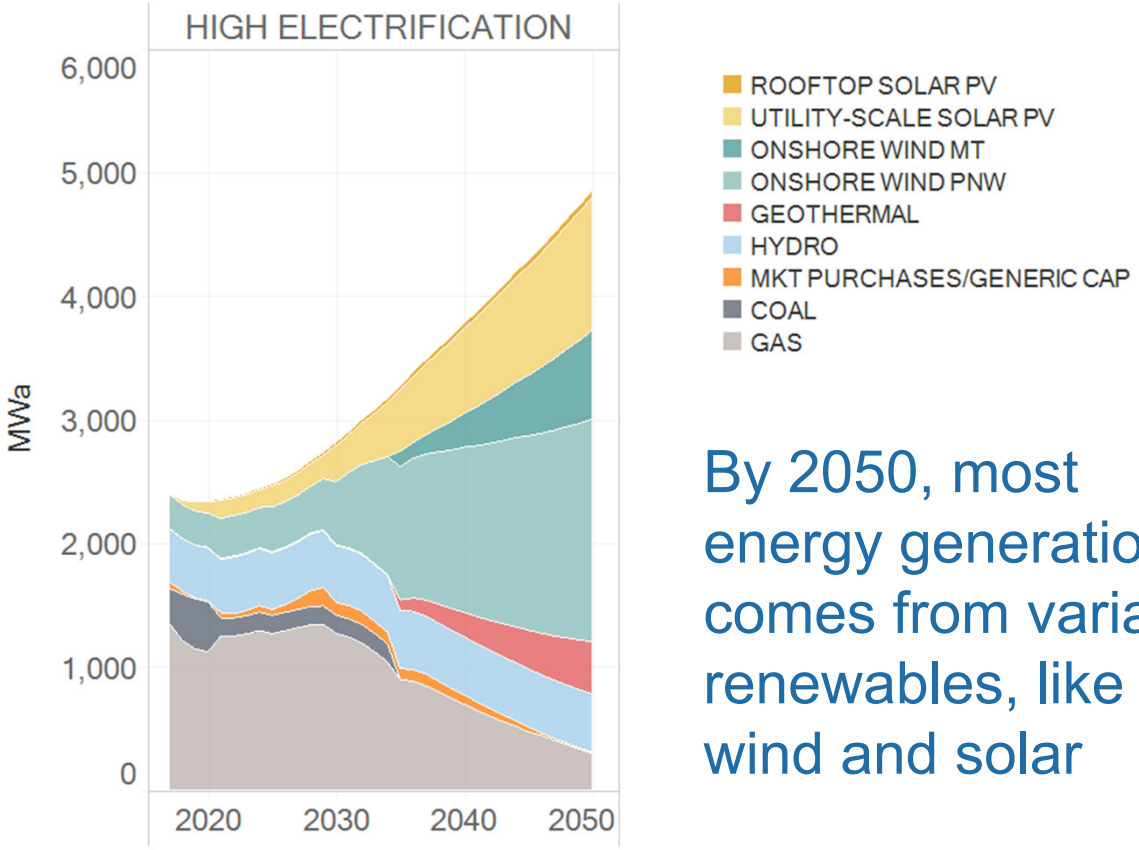
Electricity decarbonization

As electricity use grows, electric generation must be increasingly carbon-free



Implications for the electricity system

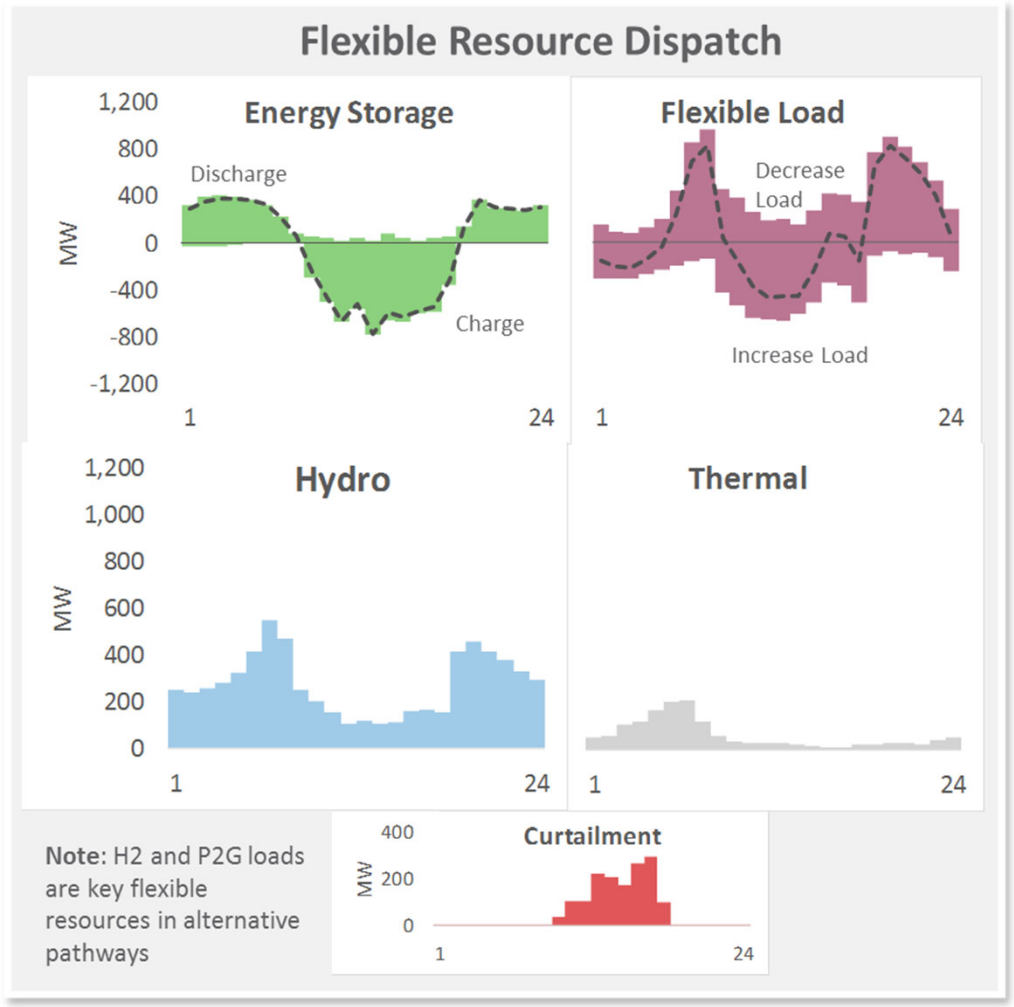
Electricity systems in a deeply decarbonized future will need new capabilities to efficiently integrate variable renewable resources



By 2050, most energy generation comes from variable renewables, like wind and solar

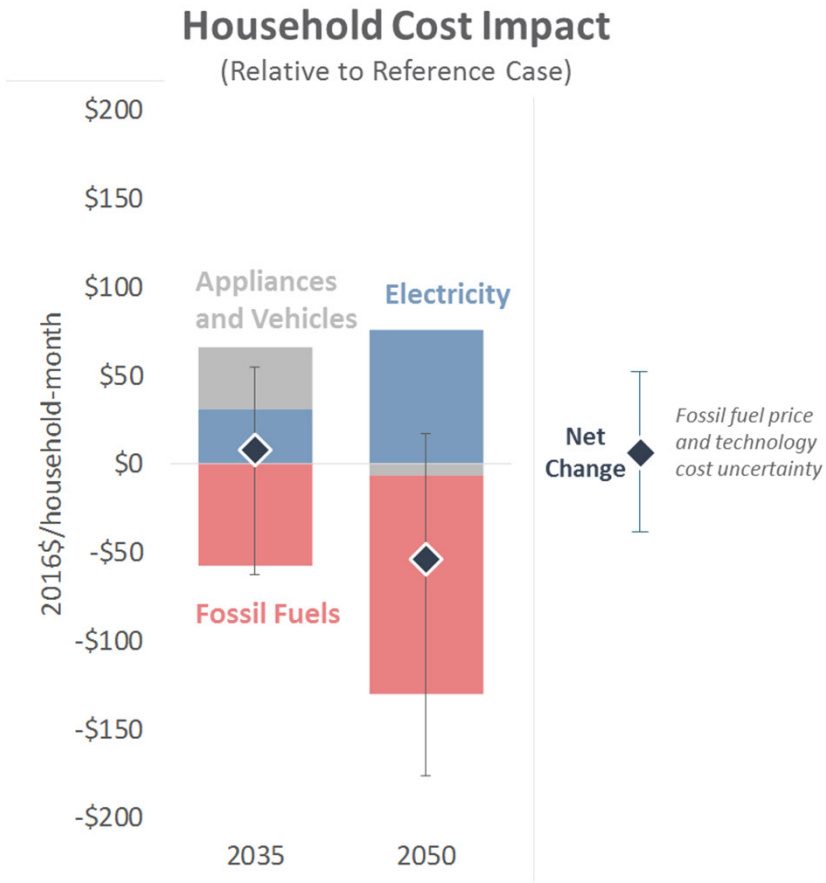
Balancing solutions

In a deeply decarbonized future, flexibility in the electricity system is provided by generators, loads, and storage



How might we pay for our energy services in this future?

- We will be spending more on clean and efficient technology (appliances and vehicles) and electricity (largely renewables)
- These additional costs will be offset by reduced fossil fuel expenditures (e.g., savings at the pump)
- Technology cost reductions over time reduce long-term cost impacts



Decarbonization takeaways

- Meeting 2050 GHG goal across the economy in PGE's service area is possible, but will require transformative changes in how we use, produce, and deliver energy
- Transformation of the energy economy will rely on:
  - Both consumer and producer participation
  - Timely planning and coordination to reduce barriers to implementation
- New sources of flexibility (e.g., energy storage and flexible loads) can complement traditional sources of flexibility (hydro and thermal) to ensure renewables are efficiently integrated
  - Flexible EV charging and flexible water heaters show particular promise under the electrification pathways
- Electrification of the transportation sector plays a critical role in achieving GHG reduction targets

To learn more about our Decarbonization Study:
https://www.portlandgeneral.com/our-company/energy-strategy/resource-planning/integrated-resource-planning