Oregon Energy Strategy

Draft Alternative Scenarios
Key Assumptions
Revised 10/2/24

NOTE: This draft was updated on October 2, 2024 to include clarifications to the assumptions for transit and school buses in the second scenario, "Lower Electrification of Transportation." However, no changes were made to the draft assumptions.

Introduction

This document provides the draft framing for the Alternative Scenarios of the Oregon Energy Strategy model.

The modeling phase of the Oregon Energy Strategy involves development of a Reference Scenario and several alternative scenarios. The modeled scenarios produce different pathways to meet Oregon's energy and climate objectives. They provide information on the effects of different energy choices and will serve as foundational information for policy discussions in Phase 2 of the Oregon Energy Strategy process. These discussions are where policy recommendations will be developed. The final Oregon Energy Strategy will be submitted to the Governor and Legislature by November 1, 2025.

The model must solve to meet Oregon's anchor climate and clean energy goals: Executive Order 20-04 (80 percent economy-wide reduction in greenhouse gas emissions by 2050); HB 2021 (100 percent clean electricity for the state's largest investor-owned electric utilities and Electricity Service Suppliers), and the Climate Protection Program (90 percent reduction in greenhouse gas emissions from fuels by 2050). This is a requirement of HB 3630, which directs ODOE to develop the energy strategy and identify pathways to achieving the state's energy policy objectives.

These goals are ambitious, and there are many uncertainties surrounding what combination of technologies and measures will allow Oregon to meet its clean energy and climate goals over time and out to 2050. What is relatively clear based on a range of studies ODOE has evaluated is that: (1) aggressive energy efficiency and electrification are key pillars of cost-effective decarbonization; (2) we have a suite of diverse technologies to choose from to decarbonize the electricity sector; and (3) clean fuels will play a key role.[i]

The modeling exercise requires well-informed, data-driven judgment calls on many of the assumptions relating to energy efficiency and electrification. This is because the transition to economy-wide decarbonization by mid-century requires a pace and scale that is much greater than past trends. And we are still working to understand the combination of consumer behaviors, market forces, and policy supports necessary to accomplish our goals.

In order to ensure the Reference Scenario and alternative scenarios are built on the best available data and assumptions, ODOE has collaborated with industry and community experts

[i] 2022 Biennial Energy Report. *Charting a Course for Oregon's Energy Future*.

to inform the modeling inputs and key questions that the alternative scenarios can help answer. Building on this input, ODOE has developed a list of alternative scenarios. These are presented in the table below.

How the Model Works

At the highest level, the model uses data on the existing state of energy production and consumption and combines this with forecasts on population growth, load growth, technology evolution, and weather patterns to assess future statewide energy demand. The model then determines the supply of energy resources across the entire energy sector to meet that future demand, considering reliability and cost.[ii]

For the Oregon Energy Strategy, the Reference Scenario is informed by Oregon's energy consumption across its state-wide economy (residential, commercial, industrial, agricultural, fuel, and transportation sectors). To determine energy demand, it looks at energy-consuming technologies across 80 different sub-sectors (space heating, cooking, cars and trucks, and many others), and makes assumptions about how these technologies change over time, including improvements in energy efficiency, when these technologies are expected to turn over, and what they will be replaced with when they reach the end of their useful life.

The Reference Scenario also considers factors like weather, population growth, and industrial load growth (including from industrial data centers and chip manufacturing) to account for how energy demand is changing over time. Through this process, the model comes up with a picture of Oregon's energy needs every 5 years, from now to 2050.

Once we have a picture of how much energy we will need over time, the model searches for the most affordable mix of resources to meet demand across all energy consuming sectors while meeting our key climate and energy goals and maintaining reliability.[iii] It draws on everything from utility-scale resources to smaller-scale and distributed energy resources to do this. The model also considers the availability of energy supply infrastructure (i.e., gas pipes and electricity wires) to deliver that energy to customers.

Interaction between the Reference Scenario and Alternative Scenarios

Model scenarios do not predict the future, rather they provide insights into pathways that meet our clean energy goals by considering differences in costs, energy efficiency, feasibility, and availability. The Reference Scenario will be compared against alternative scenarios that produce different energy pathways that are used to explore "What if?" questions. For example: What if transmission development is further delayed? What if we do not achieve as much electrification as in the Reference Scenario and instead rely more on clean fuels? What does this mean for overall system costs? What does it mean for the mix of resources we'd need to meet our clean

[ii] 294abc_c5f79e16ca7a470b8168e1bbe7d98c7f.pdf (evolved.energy)

[iii] The model can incorporate some non-energy constraints, such as land use protections. However, much of the analysis on non-energy costs and benefits will happen when we are evaluating the results of the modeling. ODOE will be working with our consultant to evaluate the effects of different scenarios on equity, environmental justice, air quality and public health, and employment.

energy goals? And most importantly: what do we learn from this exercise on the technologies and measures that are most likely to deliver a lowest-cost, highest-benefits energy transition for our state? The information we gather will provide a basis for analysis and discussion around what policies are needed to achieve our energy objectives while maintaining a resilient and affordable energy system — and create a more equitable energy future for Oregon.

The following are key data and assumptions for the Alternative Scenarios of the Oregon Energy Strategy. ODOE is accepting comments on these inputs until **5 p.m. on October 11, 2024.**

Draft Alternative Scenarios

Note that **green, bolded text** *is used to delineate changes made in the alternative scenario, as compared to the reference.*

1. Lower Energy Efficiency and Electrification

Key Assumptions

	Reference Scenario	Alternative Scenario
Residential Space Heating	Assume existing policies play out for all space heating technologies 65% heat pump sales by 2030; 90% by 2040	Assume existing policies play out for all space heating technologies **65% heat pump sales by 2040; 90% by 2050**

Commercial Space Heating	Weighted average of large and small commercial space heating loads, with the following framing:
	- Small commercial: follow residential
	- Large commercial:
	  ○ 2030: Electric heat pumps 15% of overall sales; other electric + electric hybrid systems (including hybrid heat pumps) 10% of overall sales
	  ○ 2045: Electric heat pumps 50% of overall sales; other electric + electric hybrid systems (including hybrid heat pumps) 40% of overall sales
		Weighted average of large and small commercial space heating loads, with the following framing:
		- Small commercial: follow residential
		- Large commercial:
		  ○ **2040: Electric heat pumps 15% of overall sales; other electric + electric hybrid systems (including hybrid heat pumps) 10% of overall sales**
		  ○ **2055: Electric heat pumps 50% of overall sales; other electric + electric hybrid systems (including hybrid heat pumps) 40% of overall sales**

Residential Water Heating	Incorporate Federal Energy Conservation Standards for Consumer Water Heaters (from May 6, 2029) Electric heat pump sales rising to 95% of overall sales by 2045	Incorporate Federal Energy Conservation Standards for Consumer Water Heaters (from May 6, 2029) **Electric heat pump sales rising to 95% of overall sales by 2055**

Commercial Water Heating	Weighted average of large and small commercial water heating loads, with the following framing:
	- Small commercial: follow residential
	- Large commercial:
	  ○ 2035: Electric heat pumps for water heaters 15% of overall sales, other electric technologies 10% of overall sales
	  ○ 2045: Electric heat pumps for water heaters 50% of overall sales, other electric technologies 40% of overall sales
		Weighted average of large and small commercial water heating loads, with the following framing:
		- Small commercial: follow residential
		- Large commercial:
		  ○ **2045: Electric heat pumps for water heaters 15% of overall sales, other electric technologies 10% of overall sales**
		  ○ **2055: Electric heat pumps for water heaters 50% of overall sales, other electric technologies 40% of overall sales**

Industrial Processes	1% process efficiency improvements per year in all sectors Fuel switching measures from fuels to electricity	**0.5% process efficiency improvements per year in all sectors** Fuel switching measures from fuels to electricity
Electrification	100% of machine drives by 2035 100% of heat by 2050, including in Oregon's largest industrials such as computer and electronics products 50% of integrated steam production, and 50% of integrated steam production in food manufacturing by 2045 100% of refrigeration by 2040 75% of industrial HVAC loads across industrial subsectors by 2050 80% of industrial vehicles including in agriculture by 2050	**50% of machine drives by 2035** **50% of heat by 2050, including in Oregon's largest industrials such as computer and electronics products** **25% of integrated steam production, and 25% of integrated steam production in food manufacturing by 2045** **50% of refrigeration by 2040** **37.5% of industrial HVAC loads across industrial subsectors by 2050** **40% of industrial vehicles including in agriculture by 2050**

Lower Electrification of Transportation

Key Assumptions

	Reference Scenario	Alternative Scenario
MDV and HDV sales shares – post 2035	Transit and School Buses: 100% zero emission vehicle (ZEV) sales by 2036 All other Class 2b-8 vehicles: 100% ZEV sales by 2040 Of the ZEVs: • For transit: 75% of ZEVs are assumed to be battery electric vehicles (BEVs), 25% are assumed to be hydrogen fuel cell electric vehicles (FCEVs) • For long haul: 65% of ZEVs are assumed to be BEVs, 35% are assumed to be hydrogen FCEVs • All other classes are assumed to be 100% BEVs	**For all Class 2b-8 vehicles, including buses: 100% zero emission vehicle (ZEV) sales by 2050** Of the ZEVs: • For transit: 75% of ZEVs are assumed to be battery electric vehicles (BEVs), 25% are assumed to be hydrogen fuel cell electric vehicles (FCEVs) • For long haul: 65% of ZEVs are assumed to be BEVs, 35% are assumed to be hydrogen FCEVs • All other classes are assumed to be 100% BEVs

2. Limited Demand Response

Key Assumptions

	Reference Scenario	Alternative Scenario
Demand Response – Households participation	50% of homes with demand response capability are participating in some form of firm demand response program by 2050 (linear growth from 2025) Residential EVs: Start at 0, ramp up to 2/3 of residential EVs participate in managed charging by 2030	**5% of homes with demand response capability are participating in some form of firm demand response program by 2050 (linear growth from 2025)** **Residential EVs: Start at 0, ramp up to 20% of residential EVs participate in managed charging by 2030**
Demand Response - Commercial	50% of commercial spaces with demand response capability are participating in some form of firm demand response program (linear growth from 2025) Commercial EVs: Start at 0, ramp up	**5% of commercial spaces with demand response capability are participating in some form of firm demand response program (linear growth from 2025)** **Commercial EVs: No commercial EV participation in managed charging**

	to 1/3 of commercial EVs participate in managed charging by 2030	
Vehicle-to-grid	26% V2G for residential EVs, assuming utilities can discharge battery down to 40% capacity (so use 60% of EV battery)	**No V2G for residential EVs**

3. Constrained Transmission

Key Assumptions

	Reference Scenario	Alternative Scenario
Timing of Electricity Transmission Development	No new transmission until 2035, except for certain priority transmission projects that are currently planned and/or under development: New Lines – PAC's Gateway South online by 2025; PAC's Gateway Central and Gateway West online by 2030; IPC's Boardman to Hemingway (B2H) project online in 2030; PAC's Gateway project online in 2035; Snow Goose to Longhorn (Boardman) online in 2035 Reconductoring/Rebuilding Existing Lines - BPA's Big Eddy to Chemawa project and PGE's Round Butte to Bethel project, both expanding East to West transfer capacity from 230 kV to 500 kV and both online in 2035	**No new transmission until 2045**, except for certain priority transmission projects that are currently planned and/or under development: New Lines – PAC's Gateway South online by 2025; PAC's Gateway Central and Gateway West online by 2030; IPC's Boardman to Hemingway (B2H) project online in 2030; PAC's Gateway project online in 2035; Snow Goose to Longhorn (Boardman) online in 2035 Reconductoring/Rebuilding Existing Lines - BPA's Big Eddy to Chemawa project and PGE's Round Butte to Bethel project, both expanding East to West transfer capacity from 230 kV to 500 kV and both online in 2035

Additional sensitivity: East/West constraint in (1) REFERENCE and (2) CONSTRAINED TRANSMISSION scenarios

Additional sensitivity: lower VMT reductions in (1) REFERENCE and (2) CONSTRAINED TRANSMISSION scenarios:

Reference Scenario	Sensitivity

VMT Assumption	20% reduction in VMT per capita by 2050	**No change in VMT per capita from today**

4. Constrained Utility-Scale Renewables

Includes constraints from "Constrained Transmission" scenario

Key Assumptions

The Reference Scenario will restrict the use of legally protected (Level 1) and administratively protected areas (Level 2) in Oregon for energy development using The Nature Conservancy's Power of Place West study as a framework to select land use screens.

This alternative scenario will restrict the use of legally protected areas (Level 1), administratively protected areas (Level 2), and high conservation value areas (Level 3) in Oregon for Energy development using The Nature Conservancy's Power of Place West study as a framework to select land use screens.

Categories of Exclusion	**Definition of Category**	**Examples**	**Biomass**
Level 1	Legally protected: Areas with existing legal restrictions	National Wildlife Refuges, National Parks, Marine Sanctuaries, Military Training Areas	All feedstocks included, exclude potential supply from conservation reserve program land
Level 2	Administratively protected: Level 1 + areas with existing administrative and legal designations where state or federal law requires consultation or review and lands owned by non-governmental organizations (NGOs) on which there are conservation restrictions.	Critical Habitat for Threatened or Endangered Species, Sage Grouse Priority Habitat Management Areas, vernal pools and wetlands, tribal lands	No net expansion of land for purpose-grown herbaceous biomass crops. Specifically, land available for herbaceous biomass crops (miscanthus and switchgrass) is limited to the share of land currently cultivated for corn that is eventually consumed as corn ethanol, which is phased out in all net zero scenarios by 2050.
Level 3	**High conservation value: Level 1 + Level 2 + areas with high conservation**	**Prime Farmland, Important Bird Areas, big game**	**Same as Level 2**

	value as determined through multi-state or ecoregional analysis (e.g., state, federal, academic, NGO) and lands with social, economic, or cultural value.	**priority habitat and corridors, TNC Ecologically Core Areas, "Resilient and Connected Network"**	

5. Higher Hydrogen Availability

Key Assumptions

	Reference Scenario	Alternative Scenario
Hydrogen Pipeline	Hydrogen pipelines operational in 2035	**Hydrogen pipelines operational in 2030**
Generation Options	Hydropower Solar (photovoltaic and thermal) Wind (onshore, offshore) Biomass (woody, manure, biogas) Biogas, hydrogen, renewable natural gas Geothermal Coal, gas, nuclear (siting restrictions – no new natural gas or nuclear sited in Oregon)	Hydropower Solar (photovoltaic and thermal) Wind (onshore, offshore) Biomass (woody, manure, biogas) Biogas, hydrogen, renewable natural gas Geothermal Coal, gas, nuclear (siting restrictions – no new natural gas or nuclear sited in Oregon)
Inflation Reduction Act Incentives	Supply-side incentives include for hydrogen production, renewable electricity generation, battery storage, carbon capture, clean fuels, out-of-state nuclear	Supply-side incentives include for hydrogen production, renewable electricity generation, battery storage, carbon capture, clean fuels, out-of-state nuclear
Hydrogen Supply Chain Infrastructure Buildout	CETI team is still developing the timeline for buildout.	CETI team is still developing the timeline for buildout, **but the alternative scenario will including faster buildout than the reference.**

6. More Aggressive Greenhouse Gas Emission Reductions

Key Assumptions

Reference Scenario	Alternative Scenario

Energy Policy Objectives	Executive Order 20-04 (80 percent economy-wide reduction in greenhouse gas emissions by 2050) HB 2021 (100 percent clean electricity for the state's largest investor-owned electric utilities and Electricity Service Suppliers) Climate Protection Program (90 percent reduction in greenhouse gas emissions from fuels by 2050).	**Oregon Climate Action Council recommendation of 95% greenhouse gas emission reductions by 2050**[iv] HB 2021 (100 percent clean electricity for the state's largest investor-owned electric utilities and Electricity Service Suppliers) Climate Protection Program (90 percent reduction in greenhouse gas emissions from fuels by 2050).

[iv] Recommendation 2B, Oregon Climate Action Roadmap to 2030, Commission Recommendations