Toward Net Zero Emissions from Oregon Buildings – Emissions and Cost Analysis of Efficient Electrification

LBNL Webinar - End-Use Load Profiles for the U.S. Building Stock: Data Access and Use Cases

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- Founded in 1996 by CEO Bruce Biewald
- Leader for public interest and government clients in providing rigorous analysis of the electric power, natural gas, and transportation sectors
- Staff of 40+ includes experts in energy, economic, and environmental topics

Scope of the study

- **Background:** Oregon Governor's Executive Order No. 20-04 (EO 20-40) on GHG emissions reduction mandates:
  - At least 45 percent below 1990 emissions levels by 2035
  - At least 80 percent below 1990 emissions levels by 2050
- **Overview**: On behalf of Sierra Club, Synapse assessed the potential impact of two future scenarios in which Oregon meets its 2035 and 2050 goals by incorporating aggressive efficient building electrification initiatives
- **Reference**: Takahashi et al. 2022. *Toward Net Zero Emissions from Oregon Buildings - Emissions and Cost Analysis of Efficient Electrification Scenarios*. Synapse Energy Economics, Inc. for Sierra Club. Available at: https://www.synapse-energy.com/net-zero-emissions-oregon-buildings.

Scope of the study (cont')

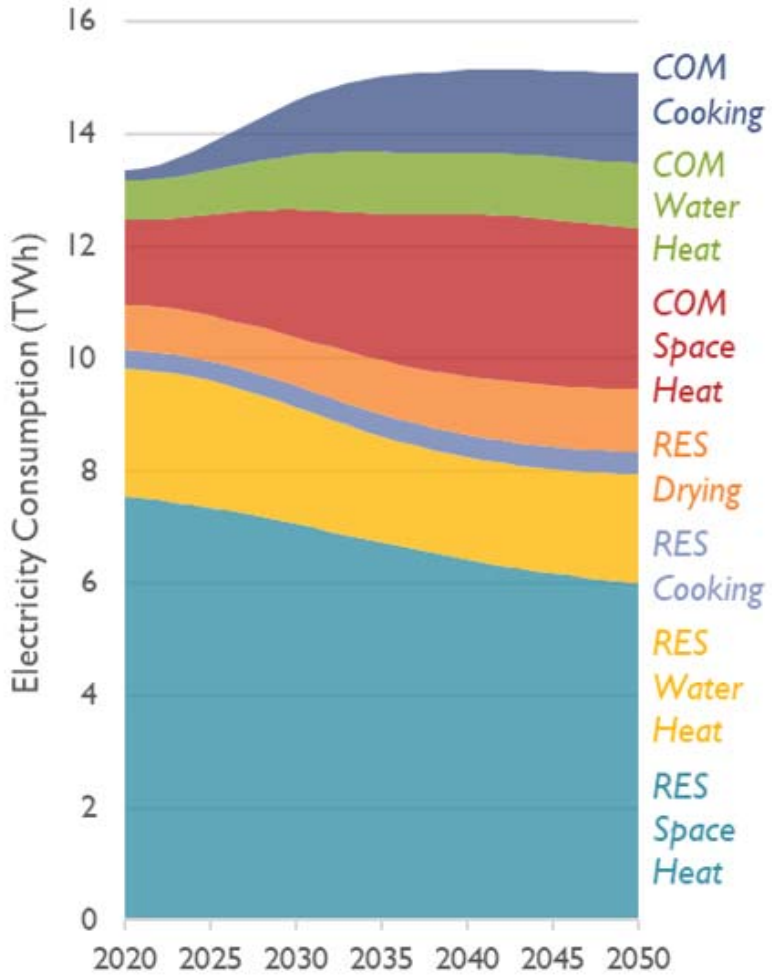
- **Scenarios**:
  - Scenario 1: No fossil fuel equipment sales post 2030: accelerates adoption of electrification measures towards 100-percent market share by 2030
  - Scenario 2: No fossil fuel equipment sales post 2025: accelerates adoption of electrification measures towards 100-percent market share by 2025
- **End-uses**:
  - Space heating, water heating, cooking, and clothes drying

Scope of the study (cont')

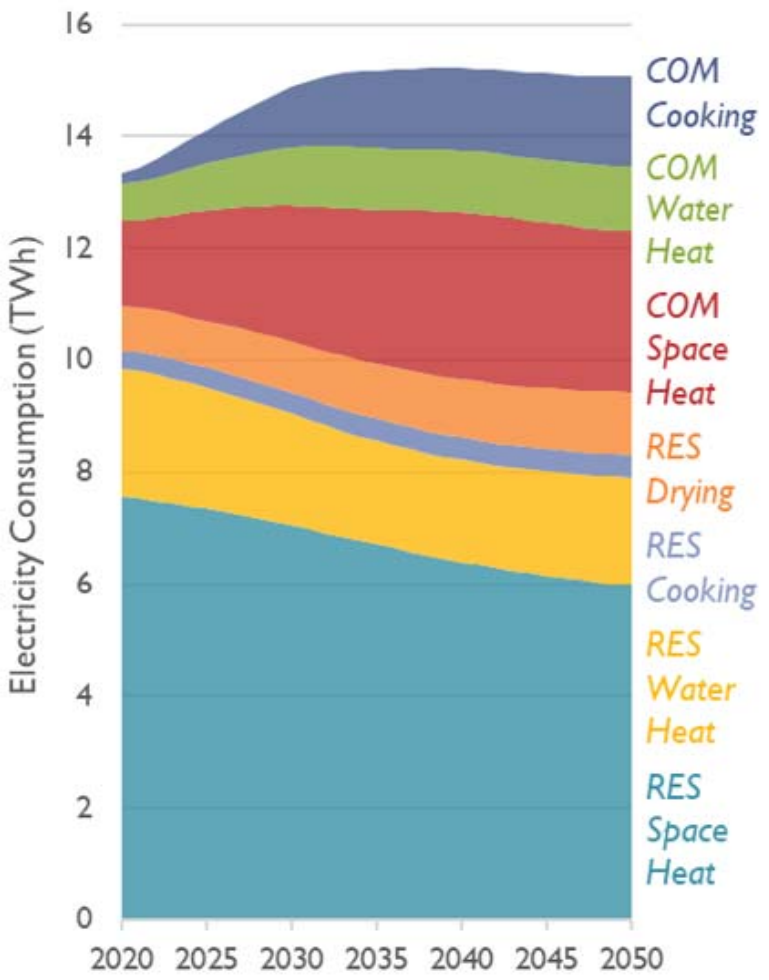
- **Analysis**:
  - Incorporated technology switching from inefficient electric resistance space and water heating systems to efficient electric heat pumps to reduce winter electric peak demand
  - Projected energy and emissions impacts of electrification measure adoption using Synapse' Building Decarbonization Calculator (BDC)
  - Estimated electric peak load impacts using NREL's EULP data and the associated economic impacts on electric and gas system operations and investments
  - Estimated bill impacts and customer payback of residential electrification in two cities in Oregon

Statewide electricity consumption by end-use and scenario

Scenario 1: No fossil fuel equipment sales post 2030



Scenario 2: No fossil fuel equipment sales post 2025



Source: Takahashi et al. 2022. Figure 16.

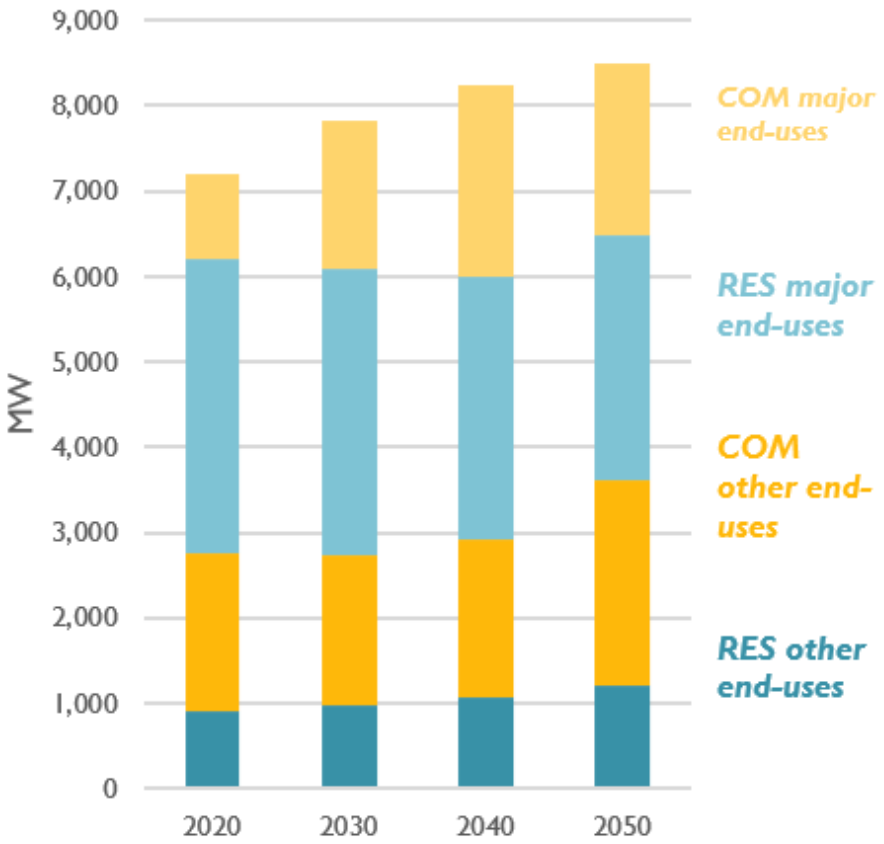
High level summary of two building electrification scenarios

	2030 Sales Target Scenario	2025 Sales Target Scenario
Executive Order 20-40	2035: 45 percent 2050: 80 percent	
CO_2e emissions reductions relative to 1990	2035: 3.3 million metric tons (47%) 2050: 6.8 million metric tons (97%)	2035: 3.9 million metric tons (56%) 2050: 6.9 million metric tons (98%)
2050 energy consumption reductions relative to 2019	57.8. Tbtu (61%)	58.5 Tbtu (61%)
Electricity consumption increase relative to 2019	2030: 1,340 GWh (10%) 2050: 1,720 GWh (13%)	2030: 1,580 GWh (12%) 2050: 1,700 GWh (13%)

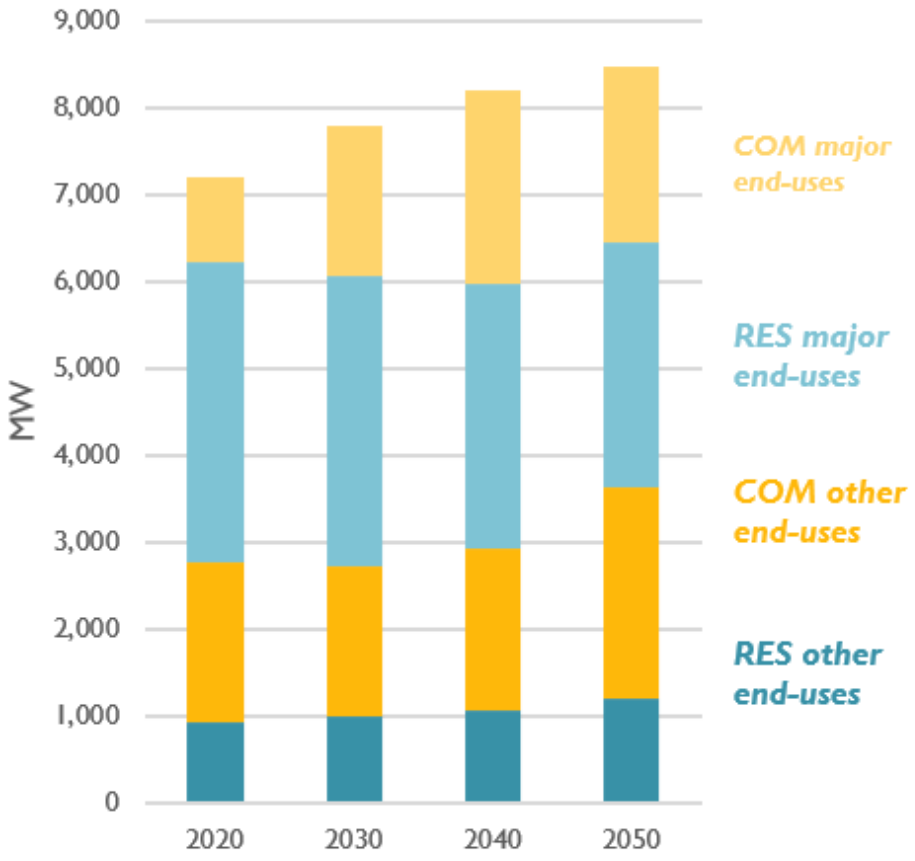
Source: Takahashi et al. 2022. Table ES-1.

Projections of winter peak loads by end-use category

Scenario 1: No fossil fuel equipment sales post 2030



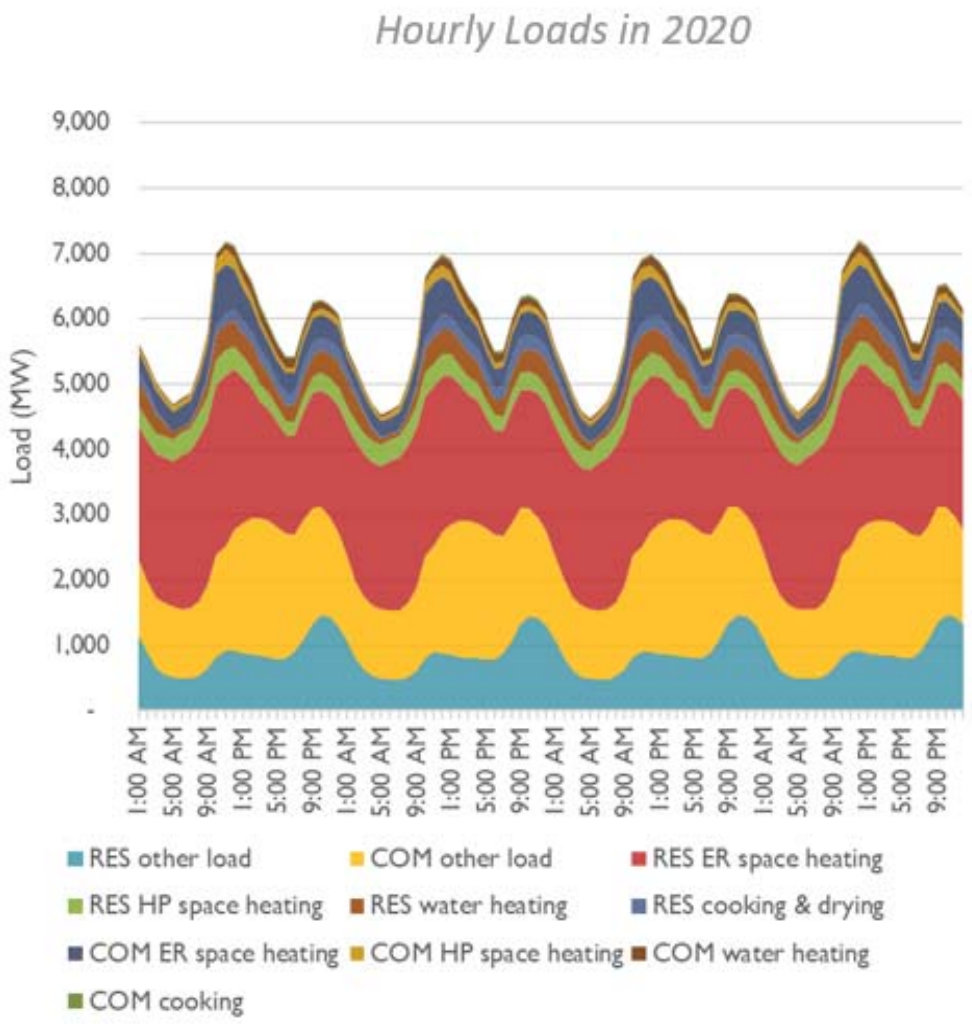
Scenario 2: No fossil fuel equipment sales post 2025



Note: COM stands for commercial, and RES stands for residential.

Source: Takahashi et al. 2022. Figure 29.

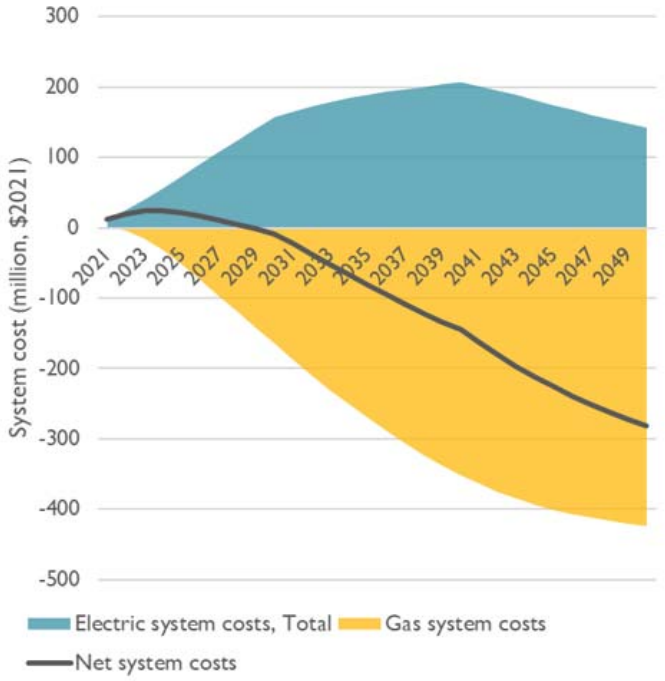
Projected changes in hourly loads by end use – Scenario 1



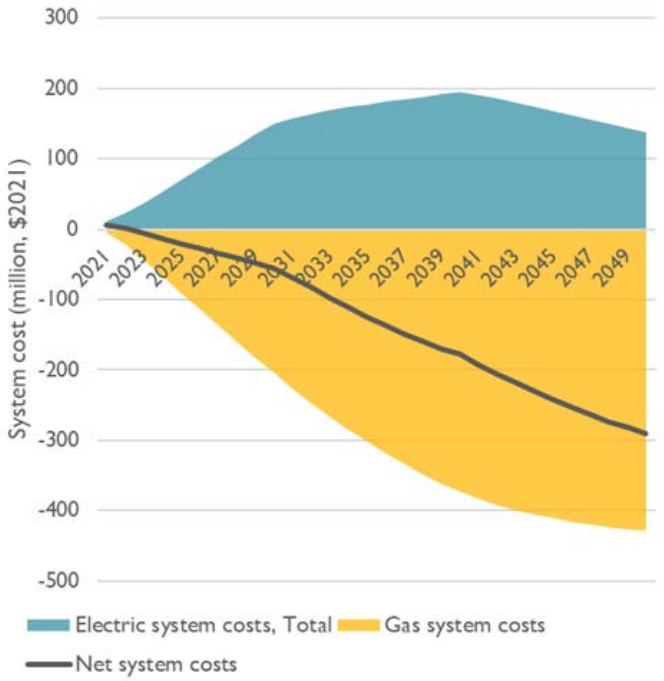
Source: Takahashi et al. 2022. Figure 30.

Projections of electricity and gas system cost impacts

Scenario 1: No fossil fuel equipment sales post 2030



Scenario 2: No fossil fuel equipment sales post 2025



Source: Takahashi et al. 2022. Figure 33.

	2030	2040	2050	Total (net present value)
Scenario 1	-8	-145	-282	-1,088
Scenario 2	-55	-177	-290	-1,661

Source: Takahashi et al. 2022. Table 9.

Summary

1. Under Scenarios 1 and 2, Oregon's building sector can reduce significant GHG emissions by 47-56% by 2035 and 97-98% by 2050—well beyond the state's GHG reduction targets for 2050.
2. Building electrification will increase electric loads, but the expected growth rate is similar to the historical levels (0.5-0.6% per year).
   - Switching from electric resistance heating to heat pumps can play a critical role in keeping load growths down and reducing electrical system investments in Oregon.
3. The building electrification scenarios can save $1 to $1.6 billion of energy system investments in Oregon by avoiding a substantial amount of gas system operating costs and fuel costs.
4. NREL's end-use load profile (EULP) database was critical for estimating peak load impacts from building electrification in our study.

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