[bw] RESEARCH PARTNERSHIP

Oregon Energy Strategy

Jobs Analysis Overview

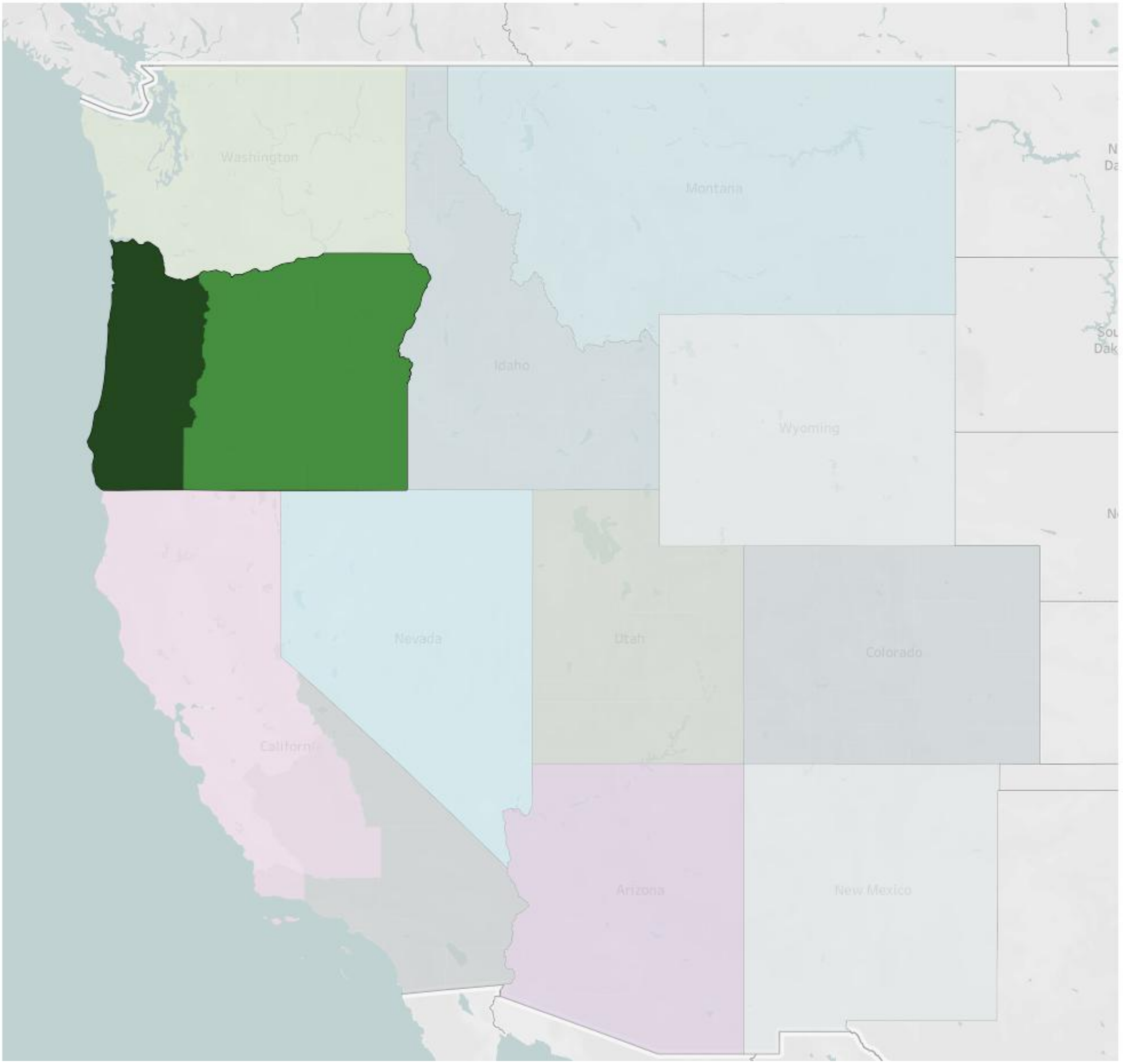
August 14, 2025

Introduction: Reminder of Energy Modeling Key Takeaways

- Modeling results confirm that Oregon’s existing policies are important to meet the state’s clean energy goals
- Electrification and energy efficiency are key to reducing the size of the overall energy “pie” and to economy-wide cost containment
- Fuels play a strategic role in the transition, with a shift toward clean fuel alternatives toward 2050
- All scenarios indicate a need to build infrastructure in Oregon
- Tech loads are the biggest driver of near-term electricity demand growth but are also uncertain in when and where they could emerge

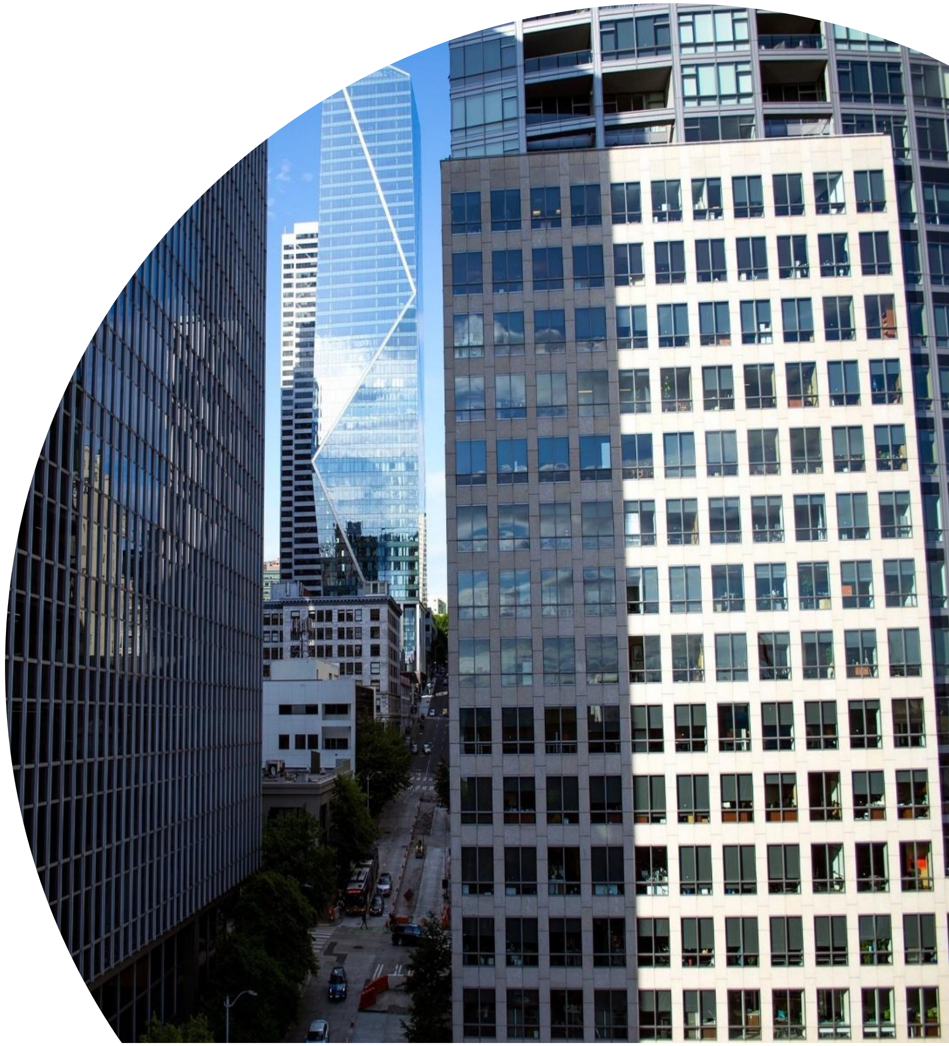
Model Geography: East and West Oregon

- Oregon modeled as part of larger energy system
- All states in the West modeled with their specific energy policies
- Oregon modeled as two zones: East and West of the Cascades
  - Some jobs results also presented for these two zones to highlight regional differences



Key Findings by Sector: Buildings

- Building electrification, energy efficiency, and demand response are significant drivers of economy-wide cost savings for Oregon's future energy system
- Building electrification results in system-wide reductions in energy demand
- Delaying energy efficiency and building electrification leads to increased economy-wide costs



Key Findings by Sector: Transportation

- Transportation electrification reduces system-wide energy demand and costs, and the pace matters
- Rapid adoption of electric vehicles (EVs) will lower economy-wide energy demand and the overall cost of meeting Oregon's clean energy goals
- Economy-wide costs increase – sometimes significantly – in scenarios with a slower pace of transportation electrification

Key Findings by Sector: Fuels

- Fuel demand declines but fuel remains a significant component of Oregon's energy system across all scenarios
  - Electrification is more cost effective than adopting low-carbon fuels in many applications
  - As more end uses electrify, overall energy demand and fuel demand decrease
- Low-carbon fuels are an increasing proportion of Oregon's energy supply across all scenarios
- Low-carbon fuel gas plants can provide capacity and support the growing electricity grid

Key Findings by Sector: Electricity

- The demand on Oregon's electricity system increases across all modeled scenarios
  - The biggest near-term driver of new demand is new tech loads, including data centers, though this load growth is uncertain
- Across all scenarios, the modeled least-cost supply portfolio includes a substantial increase in installed generating capacity in Oregon in every five-year increment
  - Both in-state and out-of-state resources contribute to a least-cost supply portfolio
- There is a need for additional transmission to meet state energy goals

Alternative Scenarios

- In addition to the Reference Scenario, the jobs study modeled six (highlighted below) of the ten alternative scenarios and *sensitivities*, selected based on which ones were likely to provide the greatest learnings about jobs implications:
  - *0a. No Change in VMT (No VMT)*
  - *0b. 50% Lower Tech Load Growth (50% Tech Load)*
  - *0c. No Advanced Clean Trucks Regulation (No ACT)*
  - 1. Delayed Energy Efficiency and Building Electrification (Delayed BE & EE)
  - 2. Delayed Transportation Electrification (Delayed TE)
  - 3. Limited Demand Response (Ltd DR)
  - 4. Limited Utility-Scale Electricity Generation in Oregon (Ltd Gen)
  - 5. High Distributed Energy Resources + Limited Transmission (High DER + Ltd Tx)
  - *5a. No Change in VMT with High Distributed Energy Resources + Limited Transmission*
  - 6. Alternative Flexible Resources (Alt Flex Res)
- For the sake of clarity, both scenarios and sensitivities will be referred to as "scenarios" in the jobs analysis

Alternative Scenarios Key Findings (1)

- **50% Tech Load**
  - Assumes half of Reference Scenario electricity demand from tech loads (data centers and chip fabrication), based on forecast from NW Power and Conservation Council
  - Even with only half of the modeled tech load electricity demand, Oregon's electricity demand could still increase by over 25% by 2030 and 35% by 2035
- **No ACT**
  - Assumes no interim electrification targets for medium- and heavy-duty vehicles through 2035, whereas ACT targets are assumed through 2035 in Reference Scenario and Delayed TE scenario
  - Still reaches 100% zero emission vehicle sales by 2050
  - Slower pace of transportation electrification leads to increased economy-wide costs
- **Delayed EE & BE**
  - Electrification sales shares for space and water heating in buildings delayed 10 years from Reference Scenario
  - Industrial process efficiency assumptions and fuel switching assumptions halved
  - Delaying energy efficiency and building electrification increases economy-wide costs

Alternative Scenarios Key Findings (2)

- **Ltd Gen**
  - Limits grid-scale wind, solar, and geothermal generation in Oregon to half of Reference Scenario
  - Leads to increased economy-wide costs and increased imported generation relative to Reference Scenario
- **High DER & Ltd Tx**
  - Higher levels of rooftop solar, demand response (vehicle-to-grid), and behind-the-meter storage; transmission limited to reconductoring
  - Rooftop solar can displace the need for some grid-scale energy
- **Alt Flex Res**
  - Does not allow construction of any new gas or biogas electricity generators (Reference Scenario allows 100% hydrogen- or new biogas-supplied electricity plants under 25 MW)
  - Leads to significantly more renewable build-out (mostly solar and geothermal), largely to create clean hydrogen from electrolysis, which can serve a flexibility role on the system

Oregon Energy Strategy

Agenda

I. Introduction to BW Research

II. Overview of modeling methodology and framework

III. Reference scenario key findings for Oregon, East Oregon, and West Oregon

IV. Alternative scenario key findings for Oregon

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BW Research Background

I. DOE's United States Energy and Employment Report (USEER)

II. Employment Modeling

1. CETI's Net-Zero Northwest

2. NYSERDA's Just Transition Working Group Jobs Study

Jobs Analysis

Evolved Energy Research (EER) modeled scenario energy and investment data through 2050

→

BW Research (BWR) employment modeling – applying job multipliers on EER data

→

Report jobs by industry group, detailed occupation, and region (Oregon, East Oregon, or West Oregon).

Jobs reported for 2024, 2030, 2035, 2040, 2045, and 2050

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Model Framework

1. Determine unit inputs
From EER data – e.g., device stocks and sales, MW electric capacity, fuel demand, etc.

↓

2. Determine unit and total costs
From EER data where provided, additional costs may be assumed from secondary sources.

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3. Split costs into industry category by technical costs data
Segment overall costs from EER into industries and based on activity using secondary data sources – e.g., installation of efficiency measures, manufacturing of EV batteries, etc.

↓

4. Apply multipliers
Input 5-year-increment costs into IMPLAN/JEDI industry multipliers based on the above cost allocation

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5. Report
Jobs created by industry group, detailed occupation, and region (per 5-year increments)

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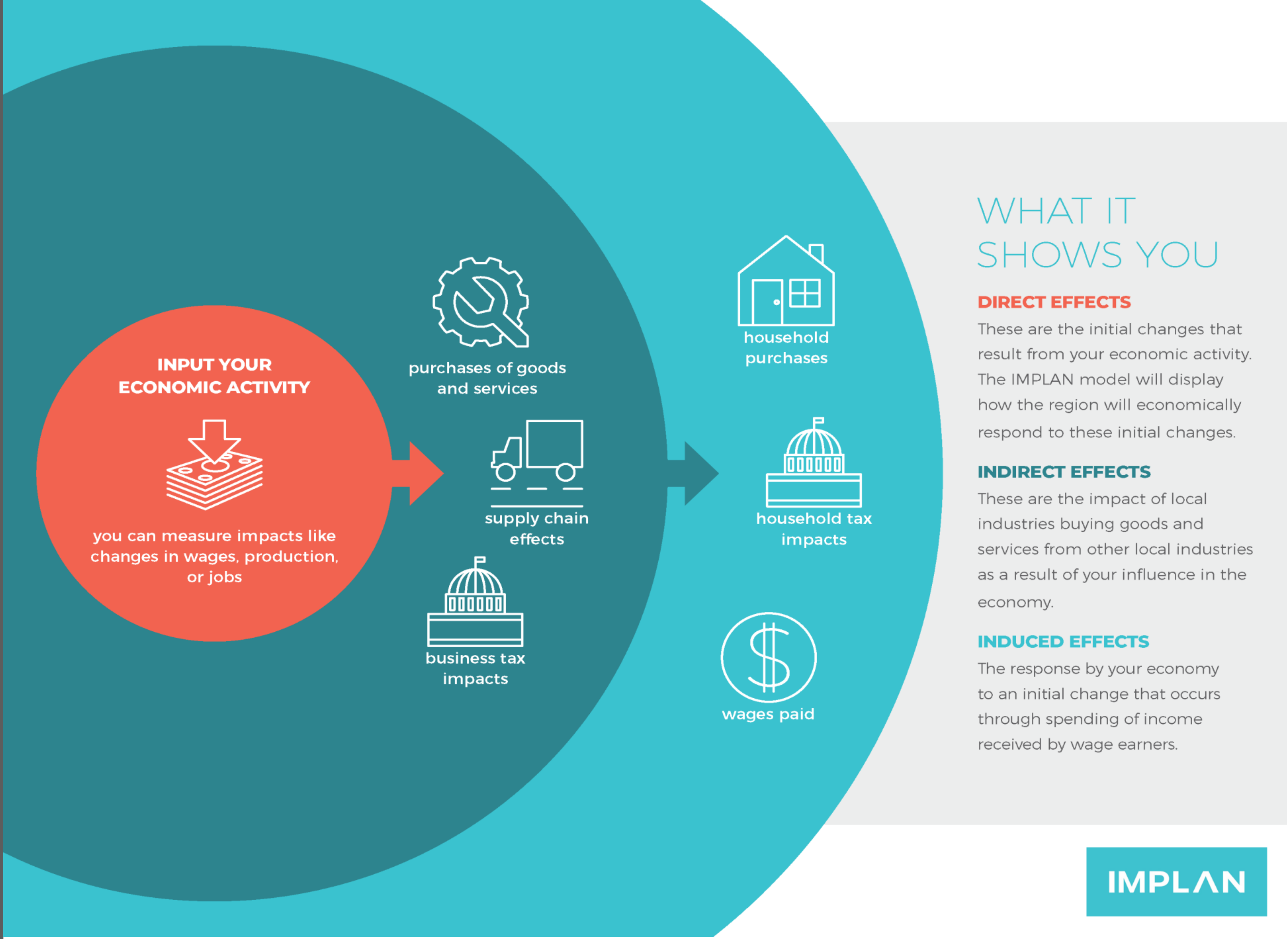
Summary of Input Output Models, IMPLAN & JEDI



All graphs in this presentation include induced effects unless otherwise noted.

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Model Framework

Job Numbers Include & Do Not Include

Include	Do Not Include
Direct, Indirect, and Induced employment changes from the four primary sectors (Electricity, Fuels, Buildings & Transportation)*	The entire economy; this is not a general equilibrium macroeconomic model that measures all the potential changes in the economy
For example:	
Construction jobs to build new power plants to meet increased electricity demand from data centers	Construction jobs to build the data center facilities
Electricians needed to install solar projects or new transmission and distribution power lines	Electricians needed to respond to more frequent extreme weather events impacting transmission lines
Manufacturing jobs assembling components of a home heating appliance, motor vehicle, or piece of fuel processing equipment	Jobs gained or lost at a manufacturing facility due to cost changes in process inputs, including energy, steel, etc.
*These four sectors represent approximately +80% of all GHG emissions	

Model Framework

- The job metrics presented here are point-in-time estimates, or jobs held within each of the benchmark years. They are not FTEs or job-years and are not cumulative changes over intervening years.
- Job figures reflect the ebb and flow of investments and activities over time.
- Job figures can inform workforce development strategies by identifying required educational programs, trainings, or certifications to support growing sectors.
- While the jobs forecasts are directional and give a sense of scale of future employment demand in Oregon, uncertainty exists in any model.

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Model Framework

Sector Framework

I. **Energy Supply**

1. **Electricity** – Distributed Solar, Utility Solar, Land-based Wind, Hydropower, Gas Generation, Nuclear, Other Fossil Generation, Geothermal, Biomass, Transmission, Distribution, and Storage – Batteries

2. **Fuels** – Hydrogen, Biofuels, Natural Gas, Natural Gas Distribution, Other Fossil Fuels

II. **Energy Demand**

1. **Buildings** – Residential and Commercial HVAC, Shell, Other

2. **Transportation** – Vehicle Maintenance, Vehicle Manufacturing, Wholesale Trade, Fueling Stations, Charging Stations

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Introduction

- The jobs modeling results give us information to consider the broader effects of different choices and priorities for Oregon's energy system
- The employment modeling finds that Oregon stands to gain jobs under all modeled scenarios
  - In 2035: Between 9,200 – 16,500 additional jobs over 2024 employment (7-12% increase from 2024)
  - In 2050: Between 15,400 – 26,200 additional jobs over 2024 employment (11-19% increase from 2024)
- The jobs modeling shows us the future of demand for employment spurred by investments in Oregon's energy economy but does not address any current workforce limitations
  - Magnitude of new employment demand shown in these outputs illustrates the need for workforce planning to avoid labor shortages and bottlenecks in achieving the expansion of new electric generating potential and efficiency and electrification upgrades

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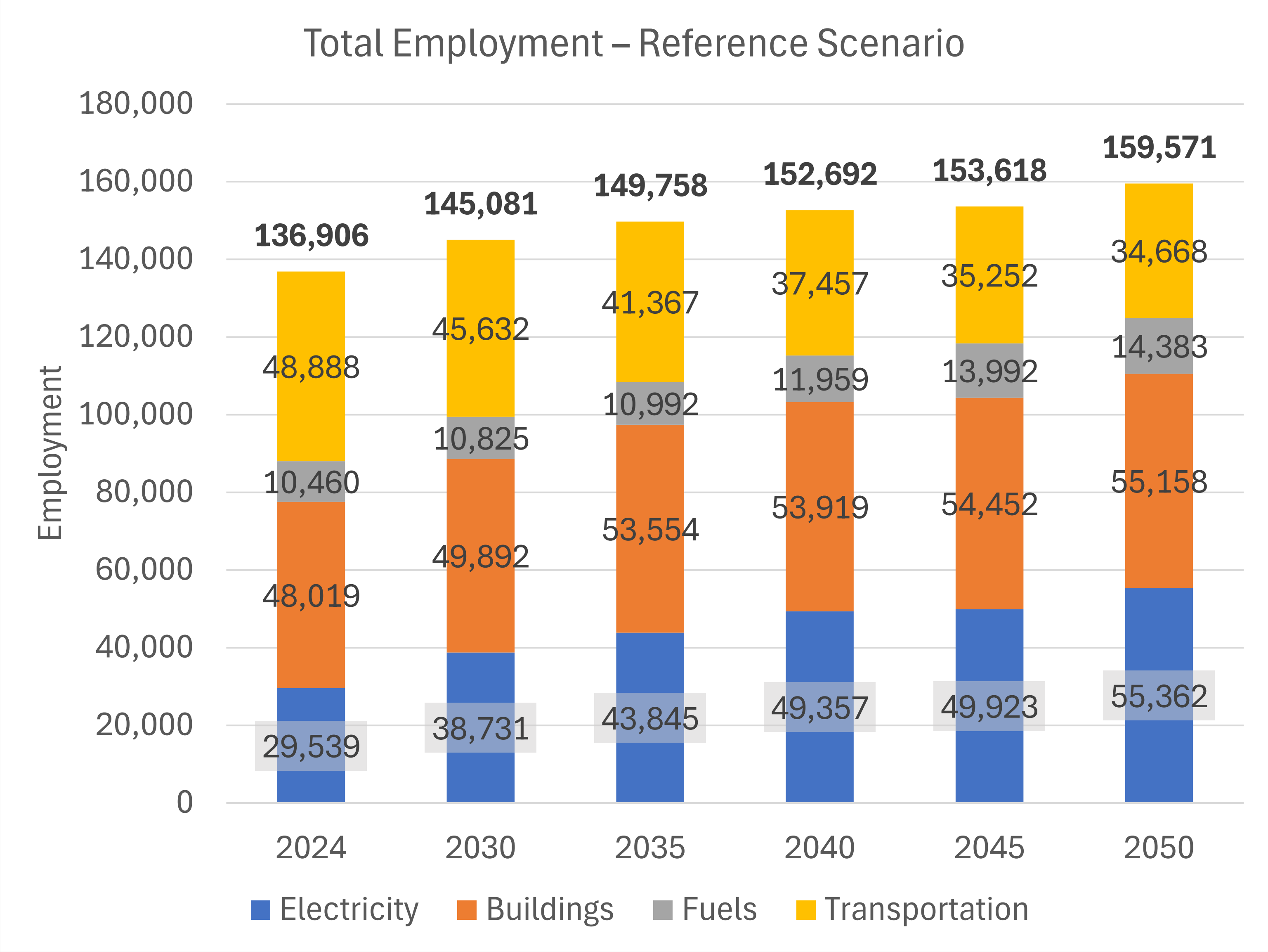
Key Findings

Reference Scenario

All Oregon

- Total employment under the Reference Scenario grows 9% by 2035 and 17% by 2050



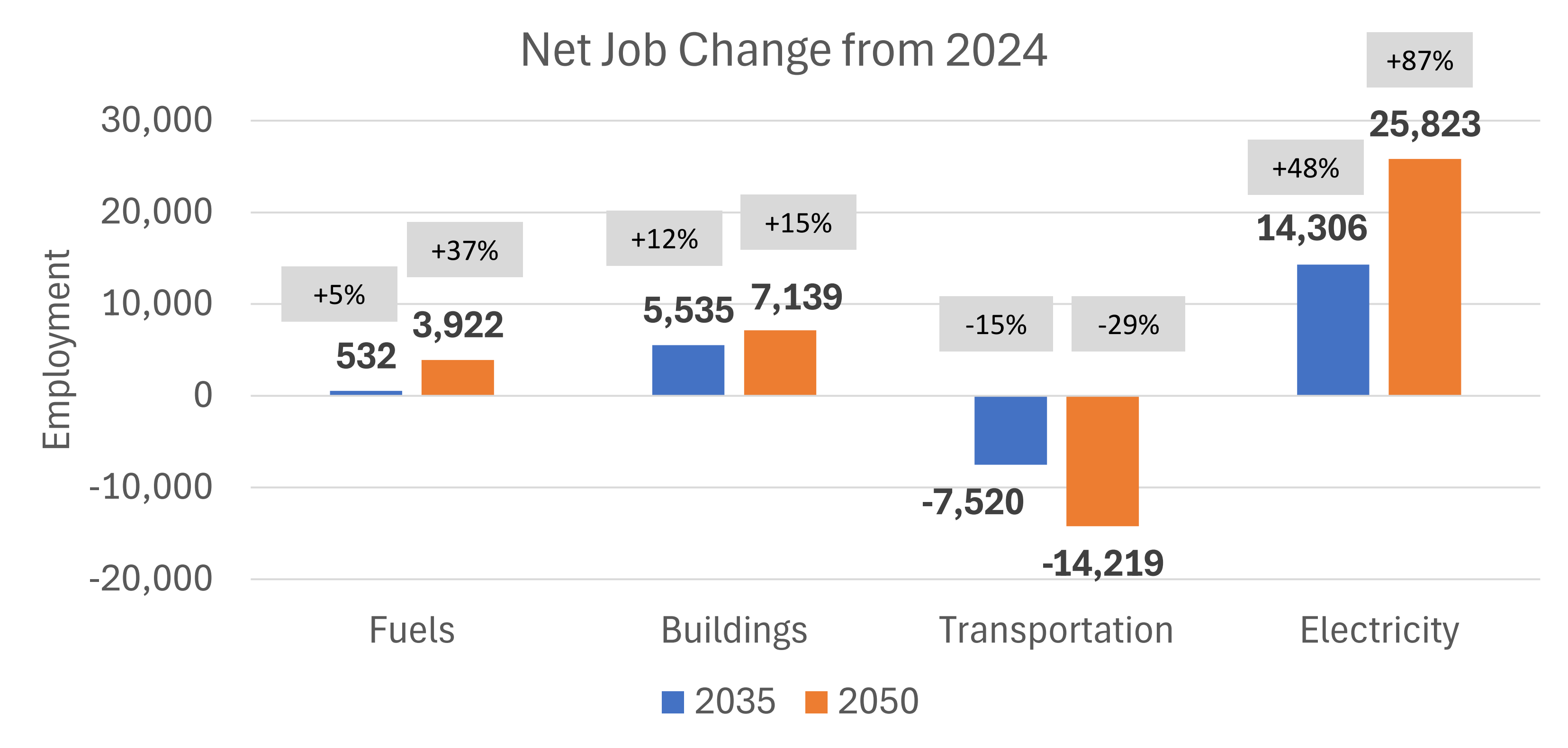
Oregon Energy Strategy

Key Findings

Reference Scenario

All Oregon

- The Electricity sector experiences the largest increase in jobs in 2035 and 2050, while Transportation experiences the largest job displacement
- These net job changes (job gains minus jobs displaced) are driven by
  - **Electricity:** Increases in Transmission and Distribution employment as grid investments increase to accommodate growing loads and increased renewable energy production
  - **Transportation:** Decreases in Fueling Stations and Vehicle Maintenance as the composition of vehicles in the state transitions from internal combustion engine vehicles to alternative vehicles, which require less maintenance



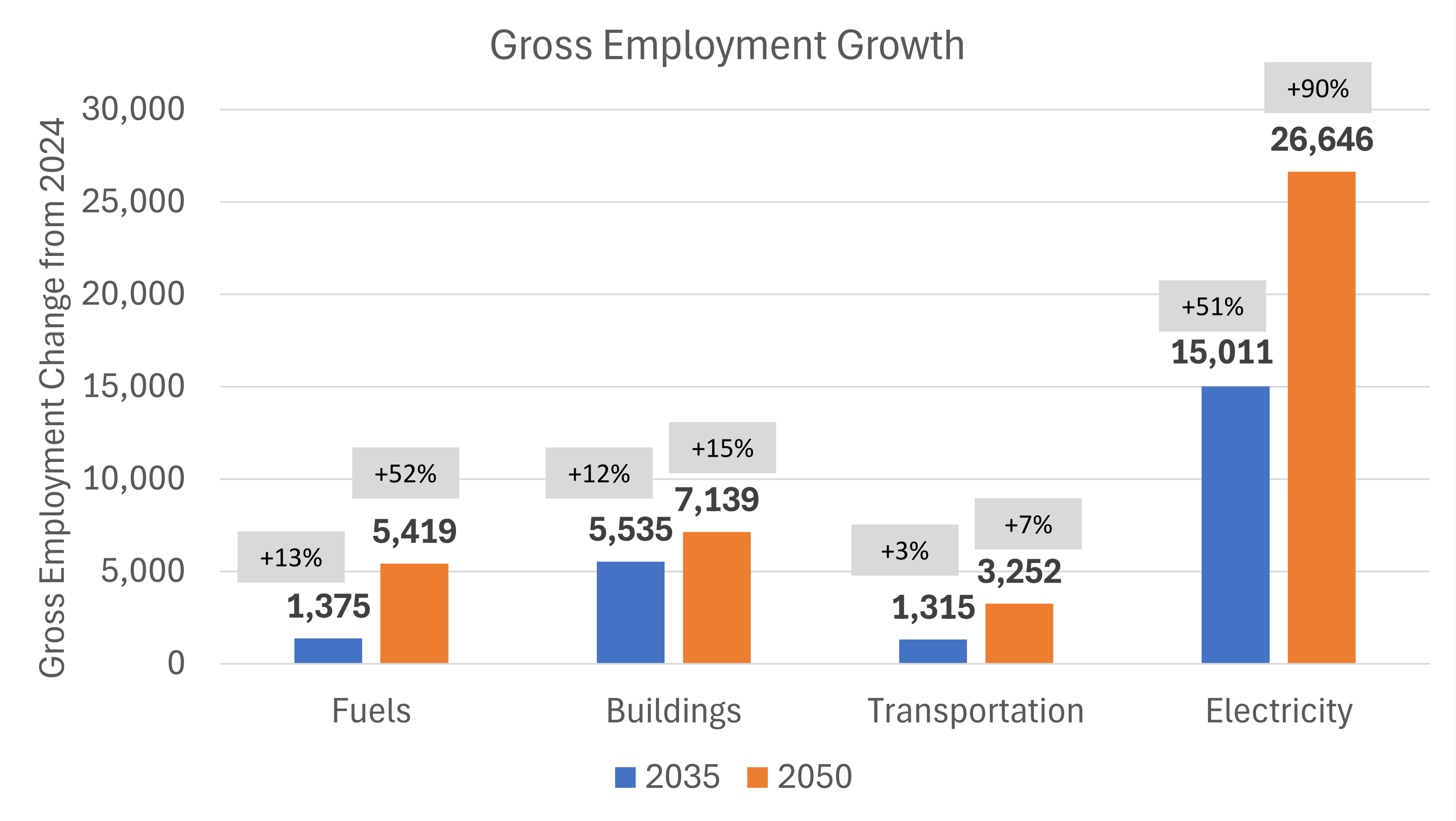
Oregon Energy Strategy

Key Findings

Reference Scenario

All Oregon

- Gross employment growth is highest within the Electricity sector in 20235 and 2050, both driven by the Distribution and Transmission sub-sectors
- In both 2035 and 2050, gross employment growth in the other three sub-sectors is driven by:
  - **Buildings:** Commercial HVAC, Residential Other, and Commercial Other sub-sectors
  - **Fuels:** Hydrogen Fuels sub-sector
  - **Transportation:** Charging Stations and Wholesale Trade Parts sub-sectors



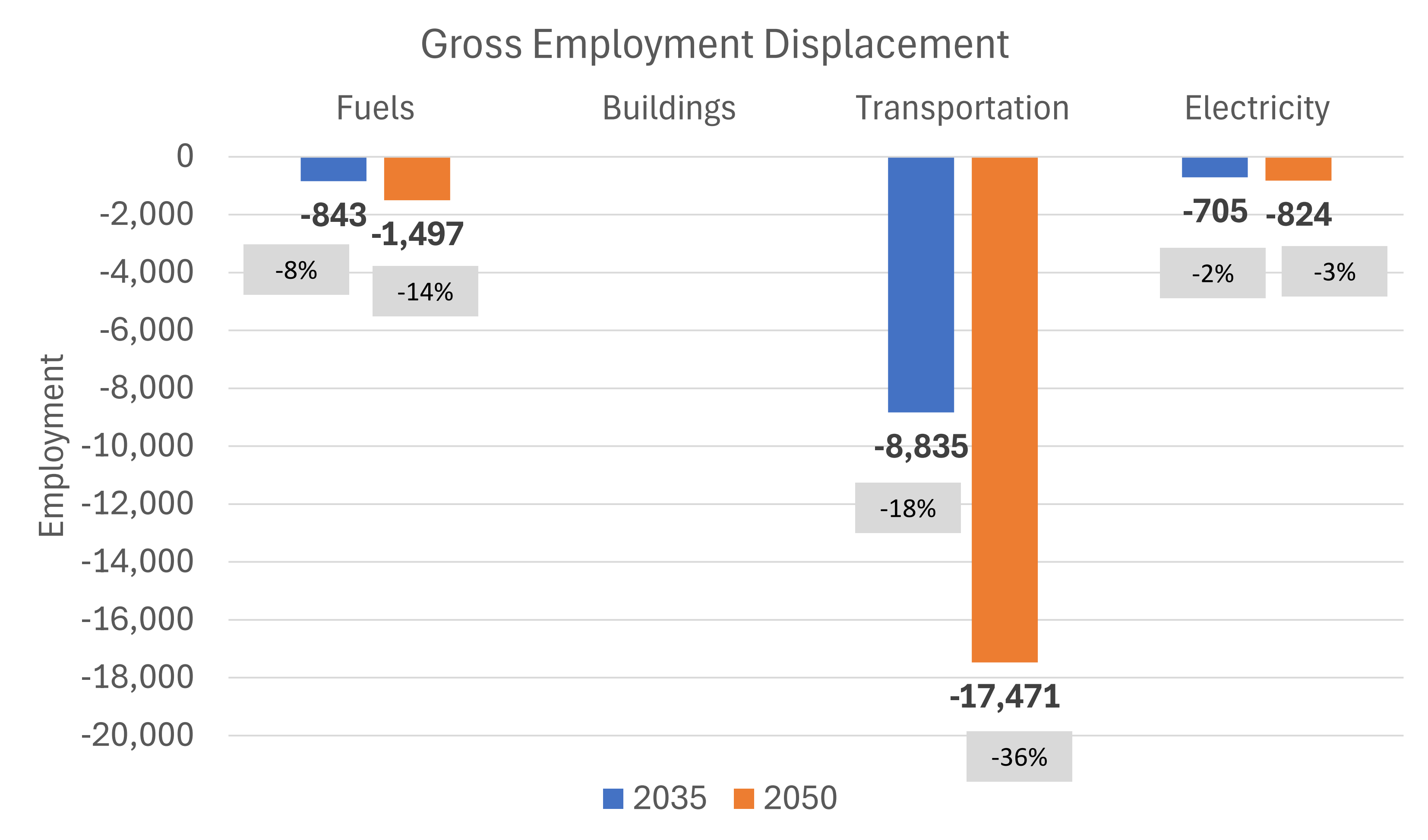
Oregon Energy Strategy

Key Findings

Reference Scenario

All Oregon

- Gross displacement is largest in the Transportation Sector, driven by declines in the Fueling Stations and Vehicle Maintenance sub-sectors
- In both 2035 and 2050, gross displacement in the other two sub-sectors is driven by:
  - **Fuels:** Natural Gas Distribution and Other Fossil Fuels sub-sectors
  - **Electricity:** Biomass and Other Fossil Generation sub-sectors



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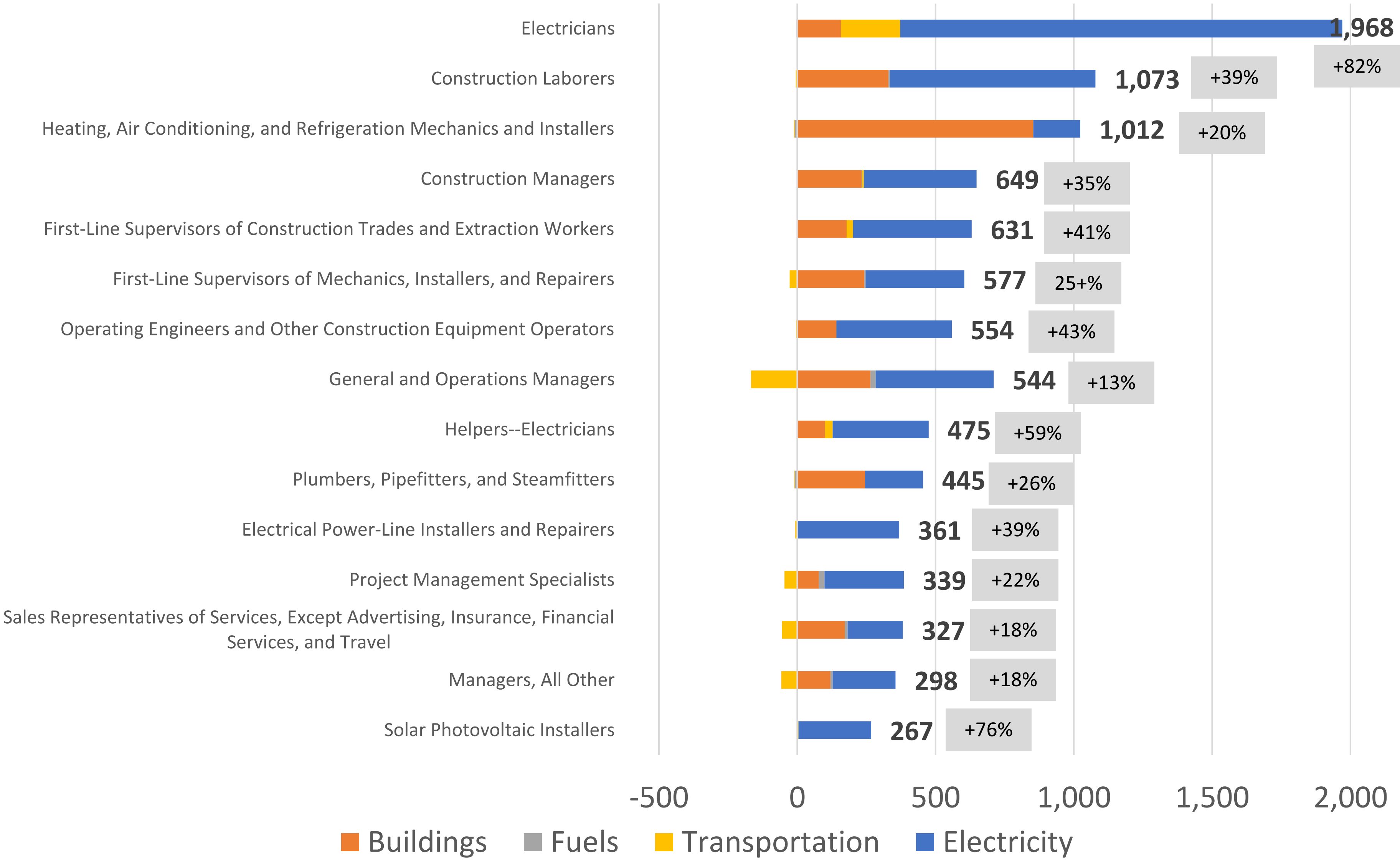
Key Findings

Reference Scenario

All Oregon

Occupations with Highest Demand in 2035

- Electricians see the largest occupational demand in 2035 with nearly 2,000 net new jobs, representing an 82% growth over current energy sector electrician employment
- *Note: Occupational analysis only includes direct and indirect jobs, not induced*



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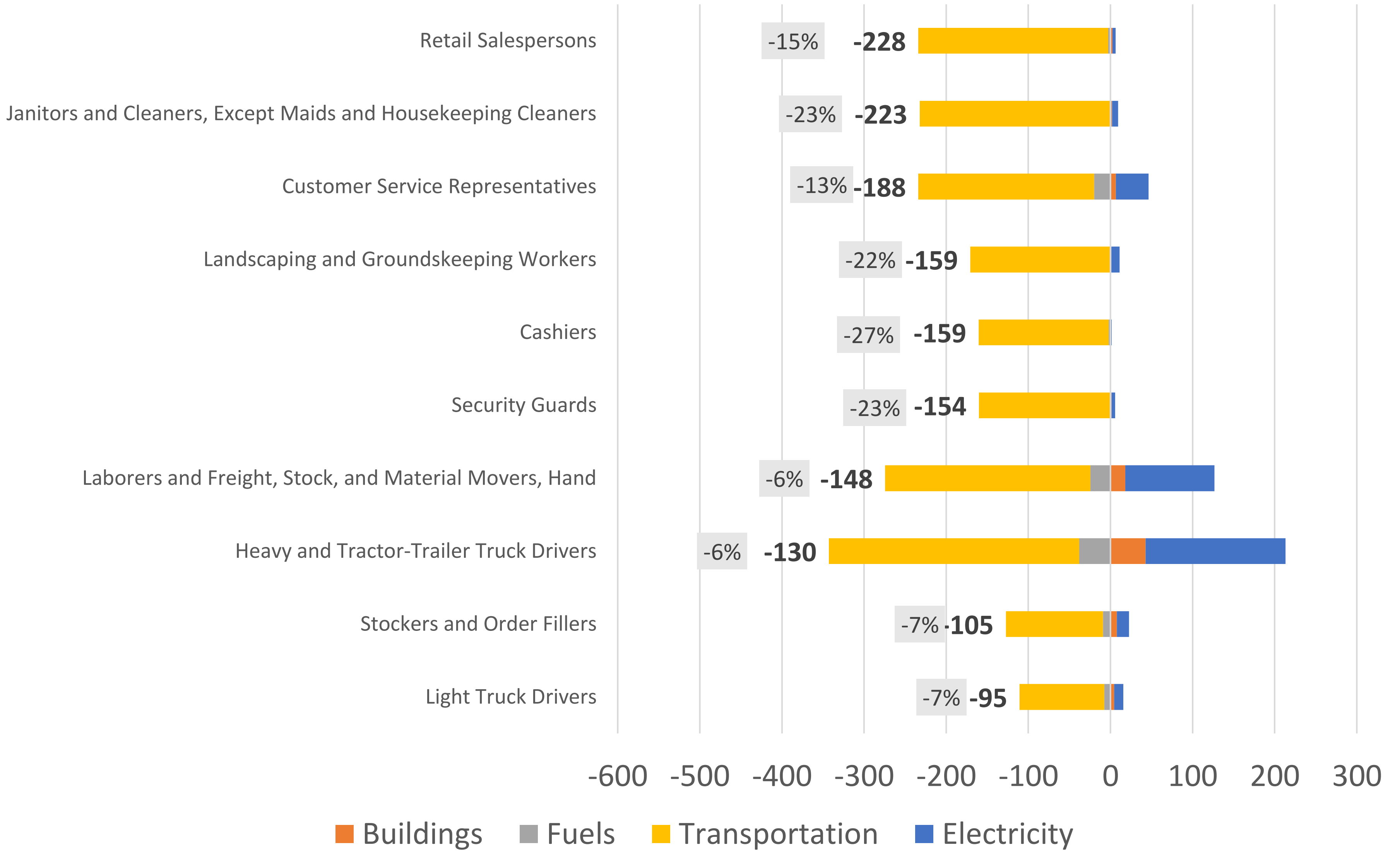
Key Findings

Reference Scenario

All Oregon

Occupations with Greatest Displacement in 2035

- Retail workers like retail salespersons, customer service reps, janitors, and cashiers see the greatest job displacement in 2035, driven by the Transportation sector
- *Note: Occupational analysis only includes direct and indirect jobs, not induced*



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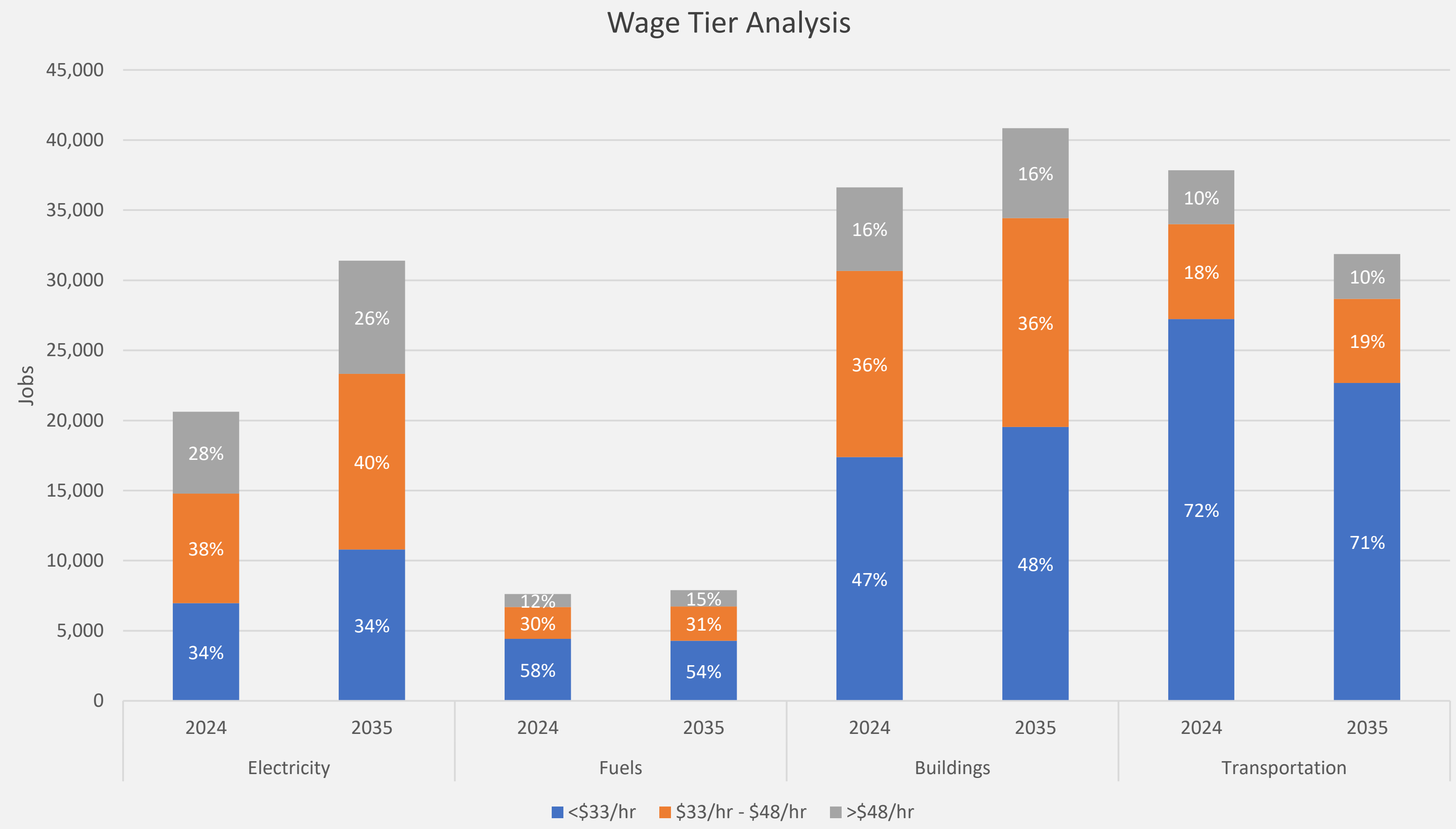
Wage Tier Analysis

All Oregon

- Transportation has largest share of jobs in the lowest wage tier, followed by Fuels
- In all sectors, wage tier distribution does not change substantially between 2024 and 2035, indicating the importance of intentional planning for job quality
  - Underscores need for early planning and investment to ensure quality, family-sustaining jobs
  - Consider various strategies, including labor union pathways, prevailing wage requirements, registered apprenticeships, project labor agreements, etc.
- *Note: Wage tier analysis is conducted only on direct and indirect jobs, not induced*



Note: Wage tiers derived from MIT Living Wage Calculator based on living circumstances in Oregon

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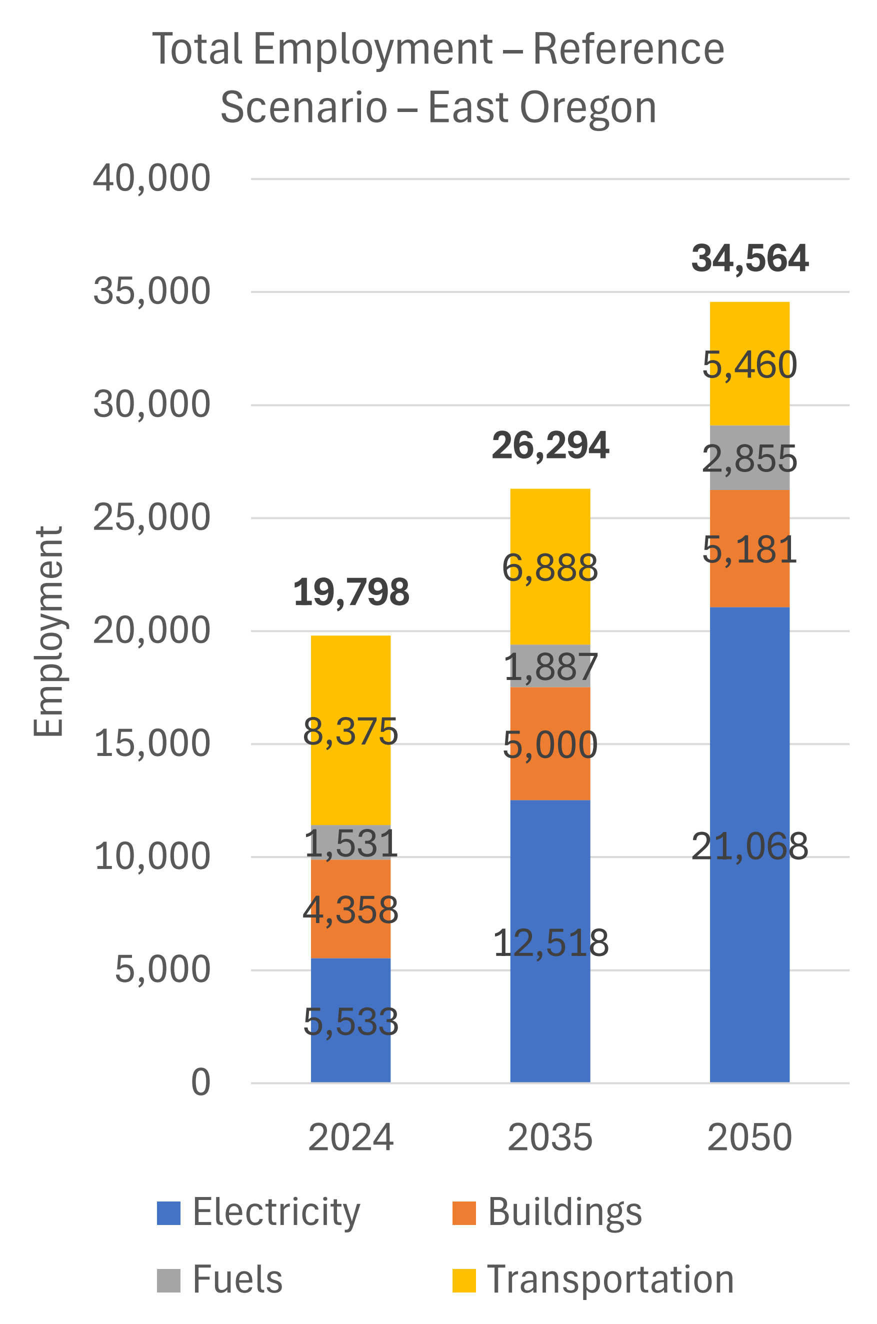
Key Findings

Total Employment

Reference Scenario

East Oregon



- Total employment in East Oregon under the Reference Scenario grows 33% by 2035 and 75% by 2050
- Developments in renewable electric generation and transmission are responsible for most of the employment growth in East Oregon
- This expansion highlights the need for location-based workforce development strategies in order for rural communities to take full advantage of these employment opportunities

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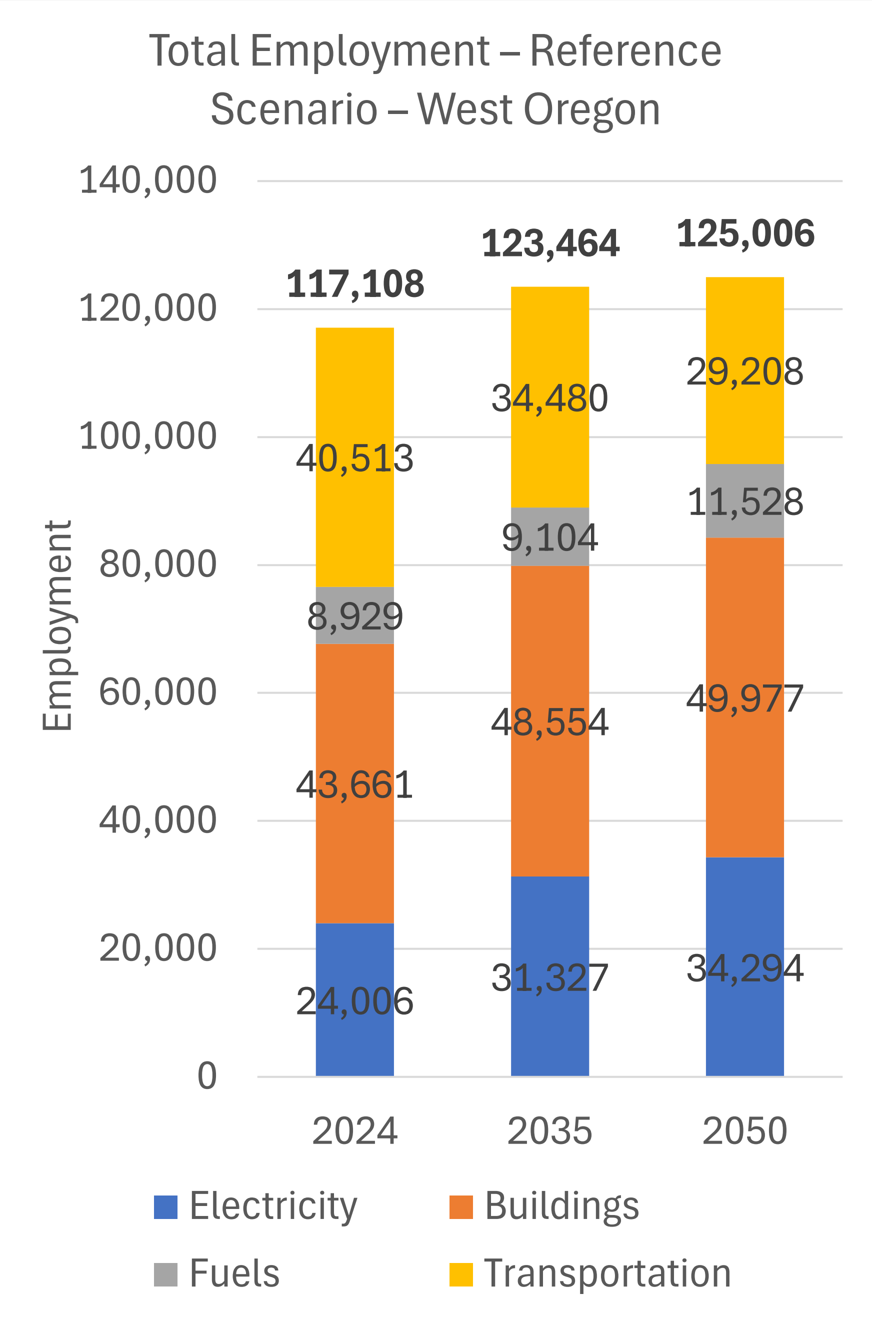
Key Findings

Total Employment

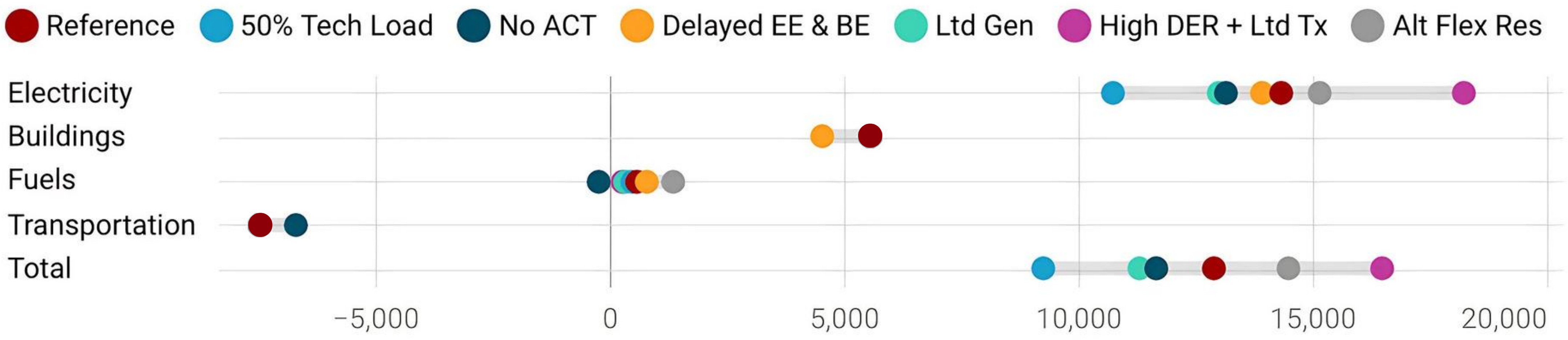
Reference Scenario

West Oregon



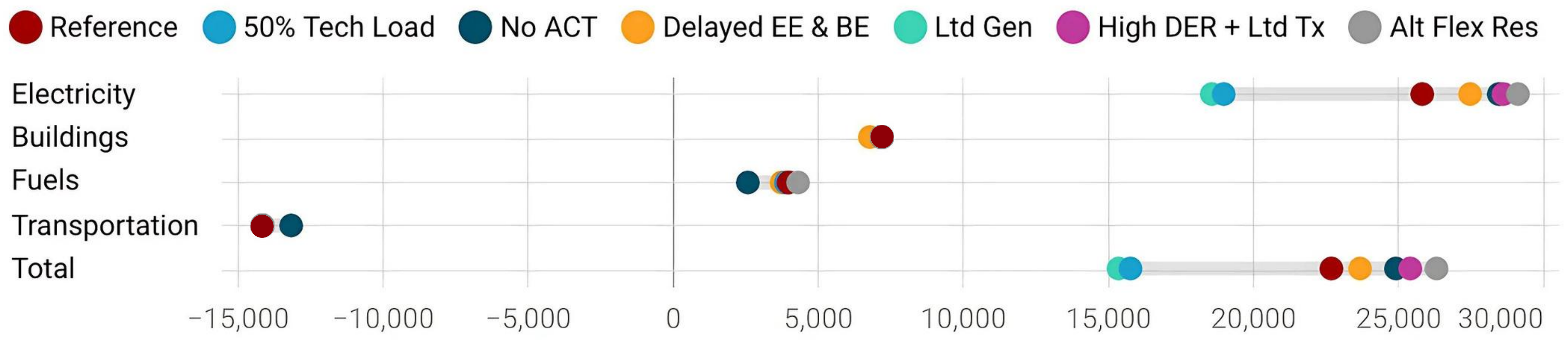
- Total employment in West Oregon under the Reference Scenario grows 5% by 2035 and 7% by 2050
- The Electric and Buildings sectors contribute most to this growth, with new electric generating capacity, transmission, distribution, and building electrification and efficiency measures
- The Transportation sector experiences job displacement at conventional fueling stations and vehicle maintenance firms, highlighting the need for potential transition opportunities for workers in those fields

Net Employment Change by Sector, 2035



The Electricity and Buildings sectors are the **largest contributors to employment growth** by 2035 across scenarios.

Net Employment Change by Sector, 2050



The Electricity and Buildings sectors are the **largest contributors to employment growth** by 2050 across scenarios.

Comparisons to Reference Scenario, 2035

- Employment across sectors and scenarios falls closely around the Reference Scenario
- The Electricity sector sees the largest variation in employment across scenarios, but these differences are still fairly small relative to total employment

Employment Difference from Reference Scenario, 2035

	Electricity	Buildings	Fuels	Transportation	Total
50% Tech Load	-3,573	0	-59	0	-3,632
No ACT	-1,175	0	-810	789	-1,195
Delayed EE & BE	-435	-1,016	235	0	-1,220
Ltd Gen	-1,339	0	-244	0	-1,584
High DER + Ltd Tx	3,890	0	-267	0	3,623
Alt Flex Res	837	0	783	0	1,620

Key Takeaways

- Oregon gains jobs under all modeled scenarios, but **employment impacts are not equally distributed**
  - Increasing renewable electric generating capacity in the East will require high levels of construction and development employment through 2050
  - Some sectors, such as fossil fuels and conventional fueling stations, will see employment displacement
- **Workforce planning is needed**:
  - To avoid labor shortages and bottlenecks in high-demand sectors
  - To create transition opportunities for displaced workers

9,200 – 16,500

jobs added by 2035

(7-12% increase from 2024)

15,400 – 26,200

jobs added by 2050

(11-19% increase from 2024)

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Next Steps I

- Recommend additional research beyond the total jobs numbers estimated in this report
  - To inform a full understanding of workforce needs
  - To carefully consider how to best ensure a well-trained workforce is established and available at the scales necessary to support Oregon's clean energy transition
  - To consider how to promote a just transition by ensuring access to workforce training and jobs to environmental justice communities

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Next Steps II

- Next steps for ODOE could include a comprehensive workforce analysis to assess the workforce implications of meeting Oregon's future energy needs, with the goal of identifying gaps in current and estimated occupation-level employment and informing strategies to support and expand workforce development efforts to promote a just transition:

    - Massachusetts Clean Energy Workforce Needs Assessment – Analyzed the state's clean energy workforce by industry, technology, and occupation to assess workforce gaps and transition opportunities; and identified potential partner organizations to support transition strategies.

    - Washington State Residential Energy Workforce Gap Analysis – Conducted a comprehensive workforce assessment of the state's energy efficiency workforce, analyzed IRA climate policy impacts, and built a statewide energy efficiency training inventory.