# Transportation Electrification Policy Working Group

The Transportation Electrification Policy Working Group is one of five Policy Working Groups formed to reflect on the results of the Oregon Energy Strategy technical modeling and help identify policy gaps and opportunities. This group will focus on topics related to light-, medium-, heavy-duty and other zero emission vehicles (battery and hydrogen fuel cell), charging and fueling infrastructure, the grid impacts of electrification, and vehicle miles traveled (VMT).

Model results provide valuable information on the tradeoffs of different energy choices. This document provides a summary of the modeling results relevant to this working group. It is meant to assist members in processing the results so they can more effectively engage in policy discussions.

## Background: The Oregon Energy Strategy Energy Pathways Modeling

Using input from Tribes, the Energy Strategy's Advisory and Working Groups, staff-to-staff conversations with state agencies and the Inter-Agency Steering Group, and comments from the public, ODOE and its consultants developed scenarios that represent different energy pathways the state could take to achieve its energy policy goals by 2050. The model uses a two-step process:

1) It develops a bottom-up demand model to establish baseline and future energy demand in Oregon's economy from now to 2050.
2) It determines the energy supply needed to meet that demand reliably and at least cost.

The model compares energy pathways from a Reference Scenario to six Alternative Scenarios. The Reference Scenario includes "aggressive but achievable" adoption of demand-side technologies and actions, including energy efficiency and electrification. Assumptions were informed by multiple studies that assessed technologies and strategies to decarbonize the energy sector.[i] The model then selects the least cost portfolio of supply-side solutions to meet this demand over time. Each alternative scenario changes a critical assumption from the Reference Scenario and seeks a least-cost pathway across available resources given the new constraint.

For more information about how the model works and the key assumptions used for the reference and alternative scenarios, see: Energy Strategy Modeling Assumptions and Sources. It is recommended that members of the Transportation Electrification Policy Working Group review the Reference Scenario assumptions around transportation as well as the key assumptions for the No Change in VMT sensitivity, the No ACT sensitivity, and the Delayed TE scenario.

High-level key takeaways relevant for all policy working groups include:

- Oregon has multiple pathways it can take to achieve its clean energy objectives.
- Our existing policies get us far.
- More action is needed than current policies will deliver.

[i] ODOE references some studies in the 2022 Biennial Energy Report: *Charting a Course for Oregon's Energy Future*.

As you review the findings below, consider: what policies does the State of Oregon need to maintain or adopt, and what topics does it need to better understand to enable a cost-effective pace and scale of transportation electrification and VMT reduction?

## Key Finding 1: Transportation electrification reduces system-wide energy demand and costs, and the pace matters.

Model results suggest that rapid adoption of electric vehicles (EVs) will lower economy-wide energy demand and the overall cost of meeting Oregon's clean energy goals.

The modeling indicates that system-wide energy demand decreases by 2050 across all scenarios due to efficiency gains. Most of these efficiency gains come from electrifying vehicles, as electric motors are far more efficient than internal combustion engines.

As shown in Figure 1, energy demand decreases by approximately 22 percent in the Reference Scenario. In the Delayed Transportation Electrification (TE) and No Advanced Clean Trucks (ACT) scenarios, this decrease is still substantial but reduced slightly to roughly 21 percent and 20 percent respectively due to a greater number of conventional vehicles still on the road in 2050.

Energy demand increases even more in interim years, peaking in 2045 at about 1 percent and 2.5 percent more than the Reference for Delayed TE and No ACT respectively, before catching up slightly by 2050 when electric vehicles make up a larger percentage of the fleet (Figure 2). A slower pace of transportation electrification means there are more conventional vehicles in the fleet in any given year, and therefore more energy required for fueling.

Costs increase – sometimes significantly – as the pace of transportation electrification slows. In the Delayed TE scenario, when medium- and heavy-duty (MHD) vehicles reach 100 percent zero emission vehicle sales in 2050 instead of 2040, costs are $14 billion higher than the Reference Scenario over 25 years (Figure 3).

**Figure 1: Energy Demand by Fuel in the Reference Scenario**

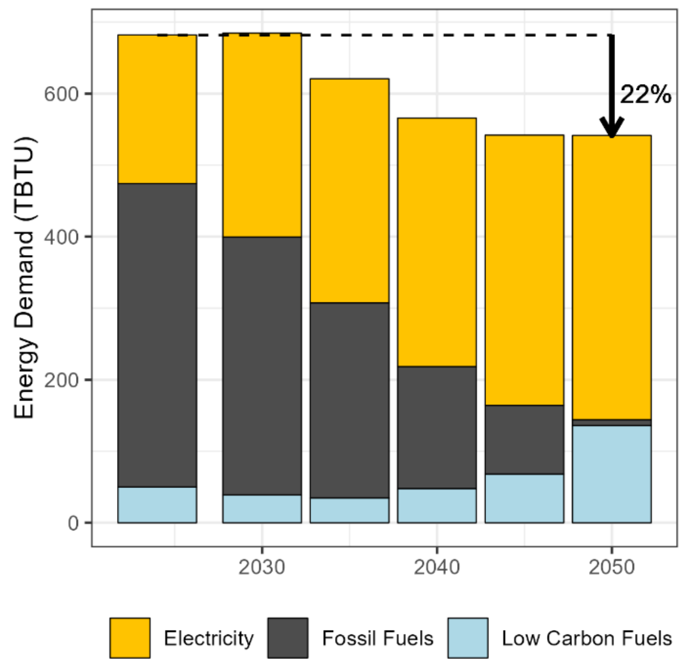



**Figure 2: Percent Difference in Energy Demand in Delayed TE and No ACT versus the Reference Scenario**

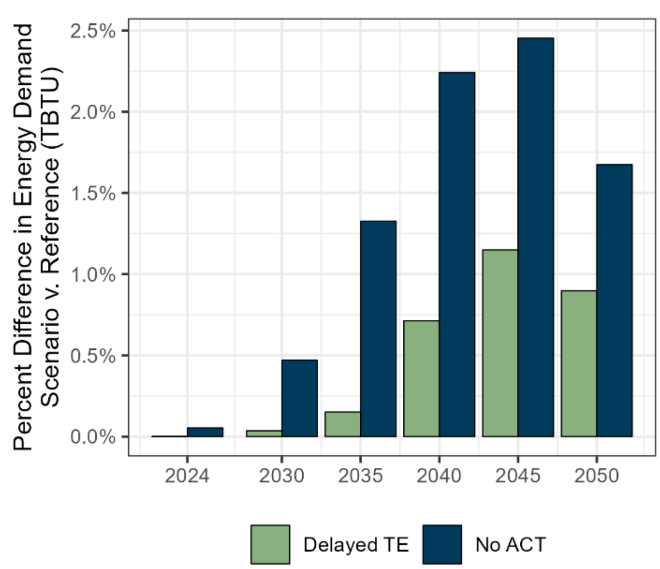
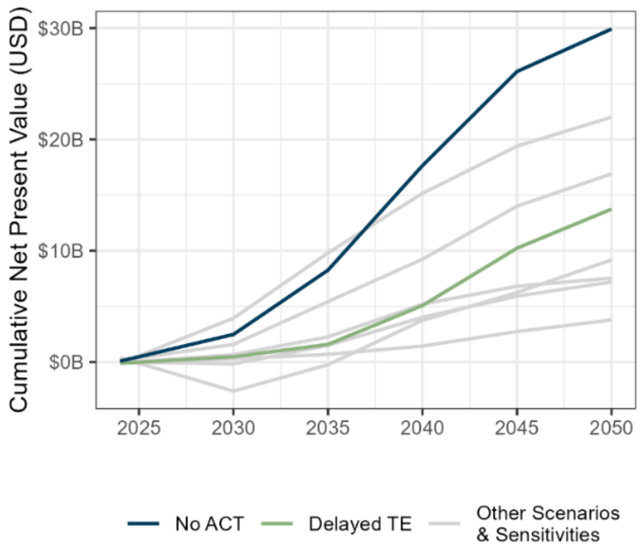


**Figure 3: Difference in System-wide Costs in All Scenarios Compared to the Reference**




*Note: Net present value costs calculated with a 3% societal discount rate.*

Further slowing vehicle electrification by eliminating near-term sales targets for medium- and heavy-duty zero emission vehicles, as in the No ACT sensitivity, is even more costly and results in an additional $30 billion over 25 years compared to the Reference Scenario — more than double the additional cost of the Delayed TE scenario. The costs associated with vehicle electrification, including increased near-term investment in vehicles, charging and fueling infrastructure, and distribution system upgrades, are significantly offset by costs associated with building out a clean fuels market and the additional generation and transmission needed to meet larger energy demand. Because the lifetime of MHD vehicles can be 15 to 20 years, delaying the purchase of zero emission vehicles (ZEVs) results in a vehicle fleet in 2050 that is more reliant on fuels, which must be decarbonized to meet economy-wide GHG emissions reduction targets at a higher cost than electrification.

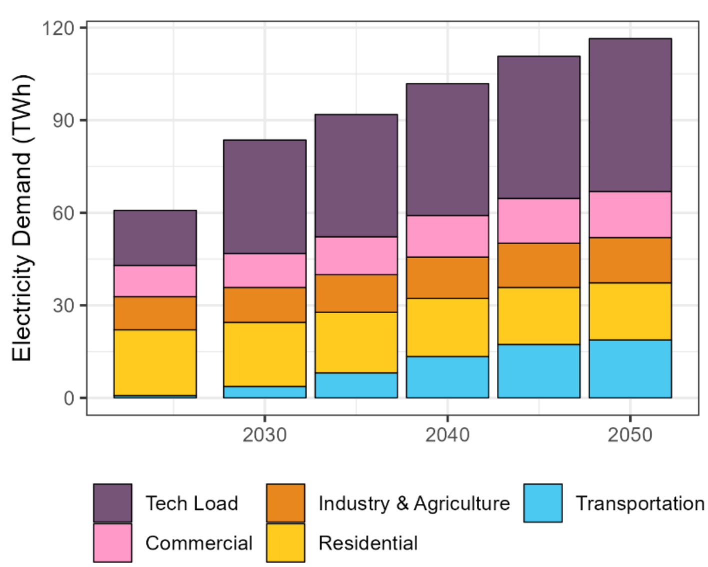
Early adoption of electric vehicles, including MHD vehicles, is a critical cost-containment strategy for decarbonization.

## Key Finding 2: Transportation electrification will significantly increase electricity demand, but EVs can provide a net benefit to the grid if flexibly managed.

Electrification of vehicles contributes to the need for more electricity generation, but electric vehicles have the potential to be flexible resources for managing demand.

The modeling indicates that electricity load increases significantly from today across all scenarios, even as total energy demand decreases. In the Reference Scenario, electricity demand nearly doubles by 2050, from roughly 60 TWh in 2024 to just under 120 TWh in 2050 (Figure 4). While most of this increase results from tech load growth, transportation load increases from less than 1 TWh in 2024 to almost 19 TWh in 2050, contributing to 31 percent of the overall load growth. In the Delayed TE and No ACT scenarios, transportation is responsible for approximately 30 percent and 28 percent of electricity load

**Figure 4: Reference Scenario Electricity Demand by Sector**

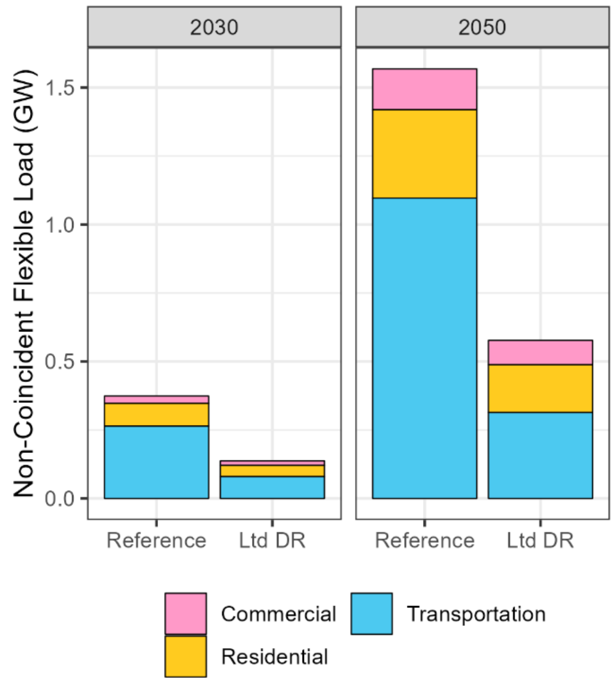



*Note: Tech load includes data center and chip fabrication facilities.*

growth respectively, illustrating that even scenarios with a slower rate of EV adoption require a considerable expansion of the electricity grid. A primary reason for this is the fact that light-duty vehicles are electrifying at the same pace across all scenarios, reaching 100 percent ZEV sales in 2035, and thus contribute significantly to this load growth.

While expanding the grid to meet this anticipated load growth will be costly and complex, electric vehicles can provide benefits beyond energy efficiency gains and reduced tailpipe emissions. When adopted in large quantities, they can serve as a significant source of flexible load for the electric grid. Electric vehicles are considered flexible loads because drivers or utilities can manage when and where they are charged. They can be charged during off-peak times when demand is low and, in the future, are expected to be able to supply electricity back to the grid when demand is high (referred to as vehicle-to-grid). In the Reference Scenario, the modeling indicates that transportation can provide more than 1 gigawatt of flexible load to the grid by 2050 (Figure 5).

**Figure 5: Non-Coincident Flexible Load for the Reference and Limited Demand Response Scenarios**




Flexible loads can result in systemwide savings because they result in reduced peak demand, which avoids investment in the most expensive future energy resources that would otherwise have to be built to meet that peak. In the scenario with limited demand response (Ltd DR), which assumes a reduced number of EV drivers participate in managed charging and vehicle-to-grid opportunities, the amount of flexible load provided by transportation is reduced to about 0.3 GW (Figure 5) and costs increase by approximately $4 billion over 25 years. Higher peak demand results in a larger energy system, including increased battery storage to help manage peaks and balance the grid, and therefore increased costs.

Operating electric vehicles as flexible loads can help manage the costs and complexity of a growing electricity grid.

## Key Finding 3: Reducing light-duty vehicle miles traveled (VMT) reduces system-wide energy demand and costs for maintaining and upgrading the electric grid.

Reducing light-duty VMT is another option for reducing overall energy demand and lowering costs.  The modeling indicates that removing the assumed reductions in light-duty VMT per capita by 2050 included in the Reference Scenario drives up costs by approximately $22 billion over 25 years, a result of increasing the overall energy demand in the economy. The differential in energy demand from the Reference Scenario peaks at more than 3 percent by 2050 in the No Change in VMT sensitivity, significantly higher than both the Delayed TE and No ACT scenarios, as illustrated by Figure 6. The more vehicles — whether internal combustion engines or EVs — are driven, the more energy is required to power those vehicles, and the more investments are needed for energy production and distribution infrastructure. The No Change in VMT sensitivity is the second most expensive scenario modeled, behind only the No ACT sensitivity (Figure 7).

**Figure 6: Percent Difference in Energy Demand in Transportation Scenarios versus the Reference Scenario**

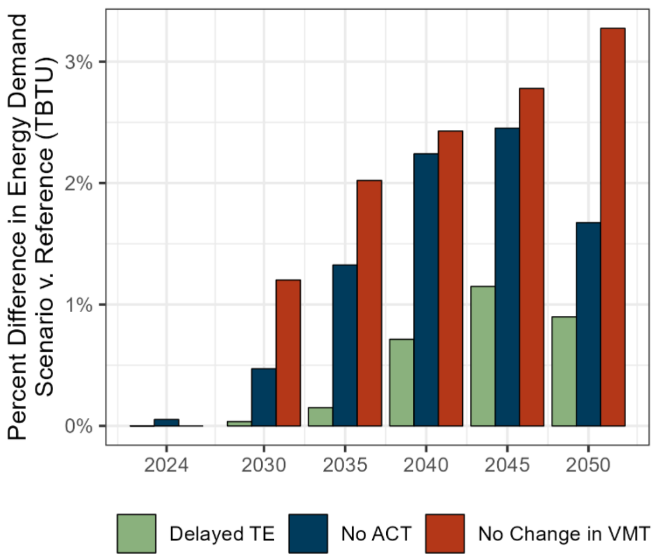
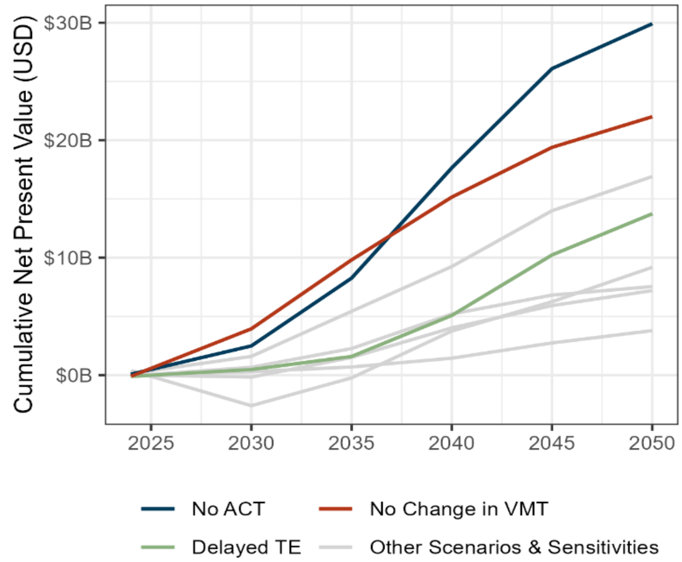



**Figure 7: Difference in System-wide Costs in All Scenarios versus the Reference Scenario**




*Note: Net present value costs calculated with a 3% societal discount rate.*

An important caveat is that the model does not account for any investment that may be required to achieve the level of VMT reduction that is assumed in the Reference Scenario (20 percent per capita by 2050). Some level of investment will be necessary, including for infrastructure that makes alternative modes of transportation more convenient and desirable, such as accessible and affordable transit or safe and connected bike or walking paths. Therefore, these results are best interpreted as providing an investment value for VMT reduction measures, rather than cost savings resulting from them.

Investments in light-duty VMT reduction strategies provide value over time through reduced system-wide energy demand and costs.

## Key Finding 4: Low-carbon fuels play a role in decarbonizing transportation across all scenarios, and that role increases as the pace of transportation electrification slows.

If transportation electrification cannot be achieved at the pace needed, Oregon will have to invest in more low-carbon fuels to meet clean energy goals. The modeling indicates that fuels remain in the transportation sector across all scenarios, but they are required in greater quantities when the pace of transportation electrification slows, as demonstrated by Figures 8 and 9 below.

Delaying the electrification of MHD vehicles, as in the Delayed TE and No ACT scenarios, results in increased reliance on both fossil and low-carbon fuels. The modeling indicates that while fossil fuels can be used in greater quantities in earlier years, nearly all transportation end uses will be met with electricity or decarbonized fuels by 2050 to meet economy-wide emissions targets (Figure 9).

**Figure 8: Low-Carbon Fuels in Transportation Sector, 2024 & 2050 Reference & Transportation Scenarios**

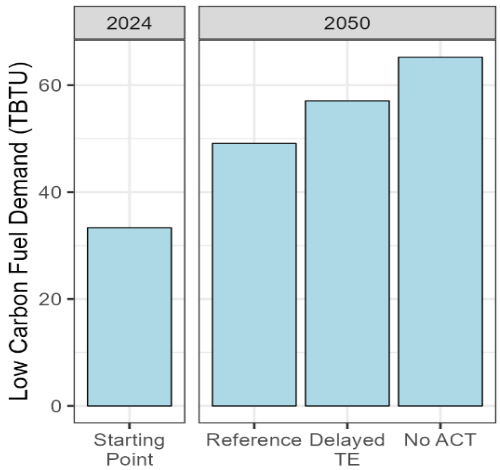
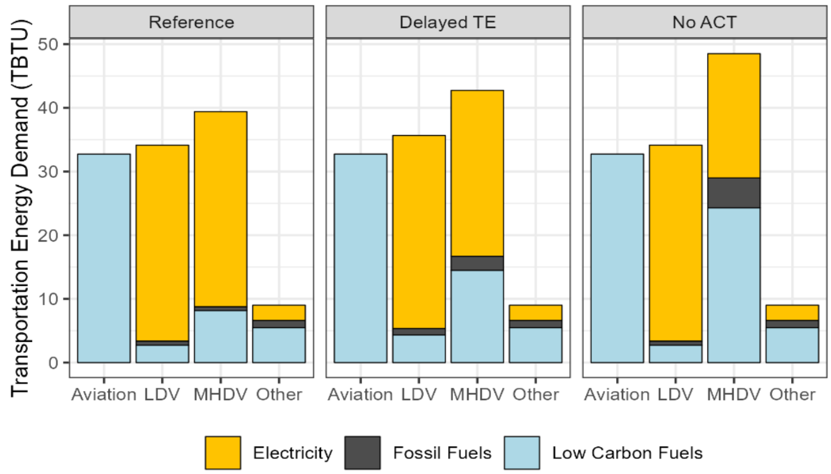



**Figure 9: Fuel Use in Transp. by Type & End Use, 2050 Reference & Transportation Scenarios**




Low-carbon fuels are currently expensive to produce and are predicted to continue to be significantly more expensive than fossil fuels. They are also more expensive than electrification, as demonstrated by the significant cost increases resulting from scenarios with a slower pace of electrification, such as the Delayed TE and No ACT scenarios (Figure 3). Electrifying most light-, medium- and heavy-duty vehicles and reserving the use of low-carbon fuels for transportation sectors that are hardest to electrify, such as off-road vehicles, rail, maritime, and aviation, is an important strategy for containing decarbonization costs.

Electrification is a cost-effective strategy for decarbonizing transportation. Where electrification is more difficult, low-carbon fuels will be required.