APPENDIX J

2023 Regional Transportation Plan

Climate Smart Strategy implementation and monitoring

November 30, 2023

oregonmetro.gov/rtp

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Metro is the federally mandated metropolitan planning organization designated by the governor to develop an overall transportation plan and to allocate federal funds for the region.

The Joint Policy Advisory Committee on Transportation (JPACT) is a 17-member committee that provides a forum for elected officials and representatives of agencies involved in transportation to evaluate transportation needs in the region and to make recommendations to the Metro Council. The established decision-making process assures a well-balanced regional transportation system and involves local elected officials directly in decisions that help the Metro Council develop regional transportation policies, including allocating transportation funds.

Regional Transportation Plan website: **oregonmetro.gov/rtp**

The preparation of this strategy was financed in part by the U.S. Department of Transportation, Federal Highway Administration and Federal Transit Administration. The opinions, findings and conclusions expressed in this strategy are not necessarily those of the U.S. Department of Transportation, Federal Highway Administration and Federal Transit Administration.

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PURPOSE

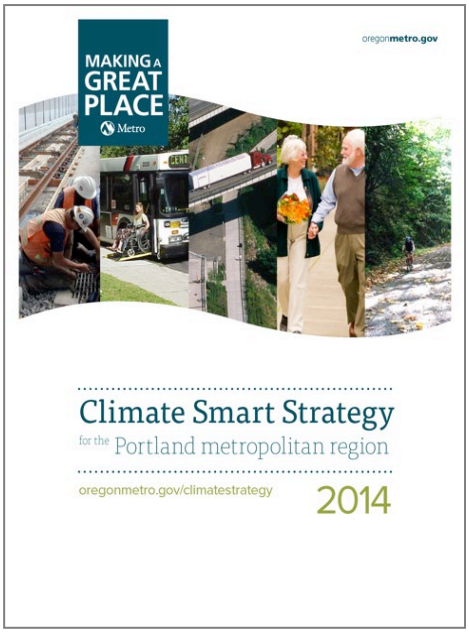
Climate change is the defining challenge of this century. Global climate change poses a growing threat to our communities, our environment and our economy, creating uncertainties for the agricultural, forestry and fishing industries as well as winter recreation. Documented effects include warmer temperatures and rising sea levels, shrinking glaciers, shifting rainfall patterns and changes to growing seasons and the distribution of plants and animals. Warmer temperatures will affect the service life of transportation infrastructure, and the more severe storms that are predicted will increase the frequency of landslides and flooding. Consequent damage to roads and rail infrastructure will compromise system safety, disrupt mobility and hurt the region's economic competitiveness and quality of life.

Recognizing the significant impact the transportation sector has on overall greenhouse gas emissions, there are a number of actions that can be pursued to lessen the carbon footprint of transportation. This appendix summarizes the key mitigation approaches adopted in the region's Climate Smart Strategy as well as implementation activities since 2014 and monitoring and analysis conducted through the 2023 Regional Transportation Plan update.

Climate Smart Strategy (2014)

As directed by the Oregon Legislature in 2009, the Metro Council and the Joint Policy Advisory Committee on Transportation (JPACT) developed and adopted a regional strategy to reduce per capita greenhouse gas emissions from cars and small trucks (light-duty vehicles) by 2035 to meet state-mandated targets. Adopted by the Metro Council and JPACT in December 2014 with broad support from community, business and elected leaders, the Climate Smart Strategy relies on policies and investments that have already been identified as local priorities in communities across the greater Portland region.

Adoption of the strategy affirmed the region's shared commitment to provide more transportation choices, keep our air clean, build healthy and equitable communities, and grow our economy—all while reducing greenhouse gas emissions.



The 2023 Regional Transportation Plan is a key tool for the greater Portland region to implement the adopted Climate Smart Strategy.

As part of the process, Metro, in partnership with the Oregon Department of Transportation (ODOT), conducted a detailed modeling analysis of various greenhouse gas scenarios and identified the types of transportation-related mitigation strategies that would have the greatest potential for reducing greenhouse gas emissions in the long term. This informed the final strategy.

The analysis of the adopted strategy demonstrated that with an increase in transportation funding for all modes, particularly transit operations, the region can provide more safe and reliable transportation choices, keep our air clean, build healthy and equitable communities and grow our economy while reducing greenhouse gas emissions from light-duty vehicles as directed by the Oregon Legislature. It also showed that a lack of investment in needed transportation infrastructure will result in falling short of our greenhouse gas emissions reduction goal and other desired outcomes. The Land Conservation and Development Commission approved the region's strategy in May 2015.

Figure 1: Climate Smart Strategies by level of impact

Climate Smart Strategy | Largest potential carbon reduction impact	
	**Vehicles and Fuels (Investment)** • Newer, more fuel efficient vehicles • Low- and zero-emission vehicles • Reduced carbon intensity of fuels
	**Pricing (Policy)** • Carbon pricing • Gas taxes • Per-mile road usage charges (e.g., OReGO) • Parking management and pricing • Pay-as-you-drive private vehicle insurance
	**Community Design (Policy with Investment)** • Walkable communities and job centers facilitated by compact land use in combination with walking, biking and transit connections
	**Transit (Investment)** • Expanded transit coverage • Expanded frequency of service • Improvements in right-of-way to increase speed and reliability of buses and MAX

Climate Smart Strategy | Moderate potential carbon reduction impact

Active Transportation (Investment)

- New biking and walking connections to schools, jobs, downtowns and other community places

Travel Information and Incentives (Investment)

- Commuter travel options programs
- Household individualized marketing programs
- Car-sharing and eco-driving techniques

System Management and Operations (Investment)

- Variable message signs and speed limits
- Signal timing and ramp metering
- Transit signal priority, bus-only lanes, bus pull-outs
- Incident response detection and clearance

Climate Smart Strategy | Low potential carbon reduction impact

Street and Highway Capacity (Investment)

- New lane miles (e.g., general purpose lanes, auxiliary lanes)

Source: *Understanding Our Land Use and Transportation Choices Phase 1 Findings* (January 2012), Metro.

CLIMATE SMART STRATEGY IMPLEMENTATION

Strategy implementation Since 2015

Responsibility for implementation of the Climate Smart Strategy does not rest solely with Metro. Continued partnerships, collaboration and increased funding from all levels of government will be essential. To that end, the Climate Smart Strategy also identified actions that can be taken by the state, Metro, cities, counties and others to enable the region to monitor performance and report on progress in implementation. Since adoption in 2014, Metro has continued to work with partners to implement the Climate Smart Strategy as follows.

2022-2023 implementation (Metro actions)

- **Updated the Regional Transportation Plan** (2021-2023), including:
    - Adopted an updated High Capacity Transit (HCT) Strategy and HCT investment priorities.
    - Updated the RTP climate goal, objectives, policies and investment priorities.
    - Piloted a project-level assessment of the RTP project list with respect to RTP goal areas—safety, climate, equity, mobility and economy—to inform investment priorities.
    - Updated the regional mobility policy in partnership with ODOT. The new policy replaces the "volume to capacity" vehicle throughput-focused approach to identifying transportation needs and prioritizing projects. Developed collaboratively by Metro, ODOT and regional partners, the new approach focuses on safety, mobility and access using three measures to identify needs and priorities: household-based vehicle miles traveled per capita, system completion of all modes (including TSMO and TDM) and throughway reliability. The policy addresses OAR 660-012-0160 and OAR 660-012-0215.
    - Improved climate modeling tools and methods to align with state Target Rule evaluation methods OAR 660-044) and planning requirements (OAR 660-012).
    - Convened a Climate and Transportation Expert Panel with JPACT and the Metro Council to learn about national best practices and tools for climate analysis, build a shared understanding of state requirements and set the foundation for regional collaboration to reduce climate pollution through the RTP (June 2022).
- **Convened an internal Metro Climate Justice Task Force** to create a framework to envision, develop, implement and coordinate regional climate justice and resilience

strategies across Metro departments that will serve as a foundation for better coordinating and advancing climate action across Metro departments and position the agency to serve as a regional leader in developing a coordinated, regional climate justice and resilience strategy (Fall 2022 – July 2023)

- **Initiated update to the Urban Growth Report.** Metro began working with state and local partners to develop the 2024 Urban Growth Report for adoption by Dec. 31, 2024. This This work will include preparing amendments to Title 6 of the Urban Growth Management Functional Plan (UGMFP) as directed OAR 660-012-0012(4)(d). This report will be the basis for the population and employment forecast for the 7-county metropolitan statistical area (MSA) that will be used for the 2028 RTP update.
- **Led an EPA Climate Pollution Reduction regional planning grant for the Portland-Vancouver metropolitan statistical area** that will lead to development of a Priority Climate Action Plan (by March 2024) and will create a Comprehensive Climate Action Plan (by July 2025) for the region. Completion of the PCAP will establish eligibility of Metro and agency partners for federal Climate Pollution Reduction implementation grants offered by EPA. The transportation element of the CCAP will advance implementation of the Climate Smart Strategy. (Fall 2023 – ongoing)
- **Conducted an expedited allocation of nearly $19 million of federal Carbon Reduction Program (CRP) funds to these Climate Smart Strategy priorities**:
    - Project development to advance bus rapid transit in the Tualatin Valley Highway and 82nd Avenue corridors.
    - Transit signal priority in the McLoughlin Boulevard corridor.
    - Transportation system management and operations (TSMO) investments in priority TSMO corridors throughout the region.

  The allocation of the CRP funds was directed by policies from the RTP, Climate Smart Strategy, the draft Oregon Carbon Reduction Strategy, and federal eligibility rules. A second allocation is planned in 2025. Metro also coordinated with ODOT on development of the Oregon Carbon Reduction Strategy. (Spring/Winter 2023)
- **Adopted an updated Regional Transportation System Management and Operations (TSMO) Strategy** that further advances Climate Smart Strategy investments and related activities, including traffic signal timing, coordinated traffic incident response and traveler information and increased coordination of transportation operators and transportation assets to effectively and efficiently manage the region's multimodal transportation networks, optimize operations for reliability and help people connect to more transportation options that are equitable, safe, reliable and climate-friendly (Jan. 2022)

- **Initiated an update to the Urban Growth Report.** Metro began working with state and local agency partners to develop the 2024 Urban Growth Report for consideration by the Metro Council by Dec. 31, 2024.

2023 implementation (Local actions)

Local communities and transit agencies in the Portland region have also demonstrated leadership in developing localized strategies and policies to reduce greenhouse gas emissions and mitigate the impacts of climate change in support of the Climate Smart Strategy.

- **Development of climate action plans.** At least a third of the region's cities and counties and TriMet have adopted local climate action plans including:
    - City of Milwaukie's Community Climate Action Plan
    - TriMet's Climate Action Plan and Non-Diesel Bus Plan
    - City of Portland's Climate Emergency Workplan and Pathways to Net-Zero Carbon by 2050
    - City of Beaverton's Climate Action Plan
    - City of Lake Oswego's Sustainability and Climate Action Plan
    - Clackamas County's Climate Action Plan
    - City of Tigard's Climate Action Report
    - Multnomah County's Climate Action Plan, 2020 Progress Report, and Climate Justice Plan
    - City of Gresham's Climate Action Strategies
    - City of Hillsboro's 2035 Community Plan (includes an extensive set of climate-related Energy and Mobility Actions)
- **Updates to local parking codes.** The cities of Portland, Beaverton and Tigard repealed all parking mandates in 2023. Clackamas and Washington counties and several cities anticipate adopting state-required parking reforms in 2024, including Cornelius, Fairview, Forest Grove, Gladstone, Gresham, Happy Valley, Hillsboro, Lake Oswego, Milwaukie, Oregon City, Sherwood, Tualatin and West Linn. (2023)
- **Updates to transportation system plans.** The cities of King City, Tualatin, Milwaukie and Beaverton initiated updates to their TSPs in 2023 that will continue in 2024.

2015-2021 Implementation (Metro actions)

- **Adopted 2018 Regional Transportation Plan and supporting Regional Transit Strategy, Regional Transportation Safety Strategy, Regional Freight Strategy and Emerging Technology Strategy** that further advance Climate Smart Strategy investments and related policies and actions to reduce greenhouse gas emissions from all vehicles (Dec. 2018)
- **Initiated activities to support regional efforts to secure needed funding** to build planned transportation investments needed to serve our growing and changing region (2018 – ongoing)
- **Adopted new Regional Travel Options Strategy** that further advances Climate Smart Strategy investments and related activities, including trip reduction services for commuters, vanpools and carpools, Safe Routes to Schools and tools to connect people to demand-responsive transit options (May 2018)
- **Prioritized funds allocated through the Regional Flexible Funds Allocation Process** toward more effective Climate Smart investments, including making the most of existing roads and transit, bike and pedestrian safety retrofits and complete street designs, and expanding high capacity transit and enhanced transit service through subsequent regional flexible fund allocation processes (2017 – ongoing)
- **Expanded Regional Travel Options Grant Program** criteria and emphasis on funding climate smart investments and actions; the grant program implements the RTP, Climate Smart Strategy and the Regional Travel Options Strategy (2015 – ongoing)
- **Advocated for increased funding** for transit operations, transportation investment, transition to cleaner, low-carbon fuels and more fuel-efficient vehicles, state-level carbon pollution reduction programs and other Climate Smart Strategy actions in state and federal legislative agendas (2015 – ongoing)
- **Expanded 2040 Planning and Development Grant program** to include funding local efforts aimed at development of Climate Smart policies and actions in local plans (2015 – ongoing)
- **Used the Transit Oriented Development Program** to provide funding to stimulate private construction of multi-unit and multi-family housing, affordable housing and mixed-use projects near transit to help implement the 2040 Growth Concept and Climate Smart Strategy (2015 – ongoing)

The Climate Smart Strategy and subsequent updates to the RTP in 2018 and 2023 presented opportunities for the region to work together to demonstrate leadership on reducing greenhouse gas emissions while addressing the need to identify funding to

implement adopted local and regional plans. The Climate Smart Strategy adopted by JPACT and the Metro Council in 2014 included a set of performance measures and performance monitoring targets for tracking implementation and progress. The purpose of the performance measures and targets is to monitor and assess whether key elements or actions that make up the strategy are being implemented, and whether the strategy is achieving expected outcomes. The Climate Smart Strategy highlighted the need for a diverse set of policies and investments to achieve the GHG emission target. The performance measures give Metro and its partners the ability to get a sense of progress toward the goals in a quick and comprehensive way. It also provides insight into what may be lagging in terms of responses to achieving the GHG target and where further action may be needed. See Table 4 for a full list of performance measures and monitoring targets.

Target rule updates

The Oregon GHG target rules require that Metro (as a federally designated metropolitan planning organization) must assess its GHG target, which is a reduction in per capita GHG emissions from light-duty vehicles within the Portland metropolitan area by 20 percent from 2005 levels by 2035, 30 percent by 2045 and 35 percent by 2050.[1] The Climate Smart Strategy was designed to achieve the 2035 target reduction.

The most recent updates to the state GHG target rules in OAR 660-044 and the Climate-Friendly and Equitable Communities (CFEC) land use and transportation planning rules that support implementation of OAR 660-044 and the Climate Smart Strategy were adopted by LCDC in July 2022.

The state, recognizing the role that RTPs play in influencing transportation policies, projects, and outcomes, has relied on RTPs to help reduce transportation emissions. The state is responsible for allocating state and federal funds to reduce GHG emissions by making vehicles and fuels cleaner; it assigns regions targets that are designed to make up the gap between those State-led reductions and State goals.

The 2023 RTP includes actions and strategies consistent with the Climate Smart Strategy to achieve the 2045 GHG target. The targets pertaining to the Portland metropolitan region are:

- A 20 percent reduction in per capita greenhouse gas emissions by the year 2035 (the original Climate Smart Strategy and planning horizon for the 2014 RTP)

[1] OAR Section 660-044-0020 specifically identifies the targets for the Portland Metro Area. 660-044-0000 & 660-044-0005. https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=3093

- A 25 percent reduction by 2040, the planning horizon for the 2018 RTP.
- A 30 percent reduction by 2045, the planning horizon for the 2023 RTP.
- A 35 percent reduction by 2050, the planning horizon for the 2028 RTP.
- Targets for the years 2041-2049 steadily increase from 26 to 34 percent in order to maintain progress toward the 2050 target.[2]

These targets are relative to a 2005 base year. They are based on per capita emissions in order to control for population growth and focus on the impact of transportation policies, programs, and plans on GHG emissions. Regional targets only apply to certain types of emissions and reduction strategies:

- **Targets apply to household travel**, including light duty passenger vehicles (cars, pickup trucks and SUVs) and commercial trucks with a vehicle weight rating of 10,000 pounds or less. Light-duty household travel captures average daily travel and transportation needs, whether physically traveled by the members of the household or deliveries and miscellaneous commercial travel to their home.[3]
- **Regional targets are focused on reducing vehicle miles traveled.** The state has the primary responsibility for regulating vehicles and fuels sold in Oregon and allocates almost all state and federal funding for clean vehicles and fuels spent in Oregon. As discussed above, the state estimates the impact of state-level vehicle- and fuel-based GHG reduction strategies and then sets regional greenhouse gas targets to fill the remaining gap needed to meet Oregon's emissions goals. The state requires regional GHG analyses to be consistent with the vehicle and fuel assumptions used by the state in order to avoid double-counting of the resulting GHG reductions, which would lead agencies to overestimate progress toward Oregon's climate goals. Because of this, the state has clarified that the updated targets shown above are equivalent to VMT reduction targets, and now allows regions to demonstrate that they are meeting the targets based on forecasted VMT rather than requiring a full GHG analysis. The RTP's progress toward climate goals, and local/regional agencies are only able to count vehicle electrification strategies and other clean vehicle/fuel strategies toward meeting regional targets if those strategies are funded and implemented locally (i.e., above and beyond what is done at the state level).

[2] Oregon Administrative Rule 660-044-0020, https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=3093; https://www.oregon.gov/lcd/LAR/Documents/2022-01_Div44.pdf

[3] ODOT Scenario Planning Technical Guidelines

2023 Regional Transportation Plan

The 2023 RTP includes key investments and policy recommendations that continue to implement the Climate Smart Strategy policies and actions adopted in 2014. Progress toward these actions is measured by the performance measures identified in the Climate Smart Strategy and included in the RTP and Regional Framework Plan.

The performance monitoring targets are not policy targets, but instead reflect a combination of the planning assumptions used to evaluate the adopted Climate Smart Strategy and outputs from the evaluation to monitor and assess whether key elements or actions that make up the strategy are being implemented. The measures and performance monitoring targets are shown in Table 4 of this appendix.

Table 4 documents progress implementing the strategy since 2014, using observed data sources to the extent possible for the 2020 Base Year, and expected progress that would be achieved if planned projects included in the 2023 RTP financially constrained list are fully implemented by 2045. The Climate Smart Strategy targets were established for the year 2035 and are not directly comparable to the 2045 values that represent full implementation of the 2023 RTP. Nonetheless, comparing these two sets of values can still provide a sense of where the region is on track to achieve the targets established through the Climate Smart Strategy, and where more work is needed to meet these targets.

Specifically, OAR 660-012-0160 in the transportation planning rule was updated to direct the GHG emissions reduction targets in OAR 660-044-0020 to be monitored and reported as a VMT per capita measure. This is the goal that is supported by actions measured in Table 4.

Key findings include:

1. **The 2023 RTP makes satisfactory progress towards implementing the Climate Smart Strategy**. If fully funded and implemented, the 2023 RTP can reasonably be expected to meet the state-mandated targets for reducing per capita greenhouse gas emissions from cars and small trucks (light-duty vehicles) for 2045**.**
2. **By 2045, the 2023 RTP meets or surpasses many of the Climate Smart Strategy performance monitoring targets shown in Table 4**.
    - The RTP **meets or surpasses all targets related to implementing local and regional land use plans**, which is critical to creating walkable, transit-supportive communities where people can choose to drive less.
    - The RTP **surpasses most targets to make transit more convenient, affordable, and accessible** by expanding transit coverage and frequency and by locating more jobs and homes near transit.

- The RTP **meets or surpasses all targets related to managed parking** by expanding the use of managed and priced parking in the region.
- The clean vehicle- and fuel-related assumptions provided by the state suggest that **the region will surpass targets for the share of passenger cars and light trucks that are electric or plug-in hybrid electric vehicles**.

3. **The 2023 RTP does not meet most Climate Smart Strategy targets to make walking and biking safe and convenient or to expand the use of travel options.**
   - Under the 2023 RTP, **the total number of transit service revenue hours in 2045 falls short of Climate Smart Strategy targets**. Oregon House Bill 2017 significantly increased funding for transit to allow for the region to increase service to the levels envisioned in the Climate Smart Strategy. However, the impact of the COVID-19 pandemic, ongoing challenges hiring drivers, and inflationary project costs have prevented these resources from achieving the envisioned levels of transit service and ridership.
   - The number of trips and miles traveled by bicyclists and pedestrians increases, but **except in the case of pedestrian trips the RTP falls short of the targets established in the Climate Smart Strategy**.
   - The total length of the bicycle and pedestrian networks increases, but except for the trail network the **RTP does not appear on track to meet Climate Smart Strategy targets to add to these networks—nor does it meet policy targets to complete the active transportation network**, as discussed in Chapter 7 of the plan.
   - **The plan falls short of targets to reduce fatal and severe crashes across all modes**, and pedestrian crashes have increased over the past decade, as discussed in more detail in Chapter 7. However, fatal and severe crashes involving bicyclists have been declining and do appear to be on track to meet targets.
   - **The plan falls significantly short of targets to reach households and employees with travel options programs**. Metro changed its approach to measuring progress toward these targets during the 2023 RTP update, and now uses historical data on engagement in travel options programs to estimate both base year and 2045 results. This data shows that under projected funding levels agency partners in the region will only be able to reach 0.5% of households and 5% of employees; well short of the targets established in Climate Smart (45% and 30%, respectively).
   - In part due to the issues noted above, **the RTP is not expected to achieve policy targets to triple biking, walking and transit mode share region-**

wide. However, use of these modes grows considerably under the 2023 RTP; collectively the share of travelers using these three modes grows from 15 percent in the base year to 17 percent in 2045.

4. **The RTP is expected to meet state-mandated targets for reducing per capita household-based vehicle miles traveled and corresponding per capita greenhouse gas emissions from household light-duty vehicles by 2045**.
    - Under the RTP, **per capita vehicle miles traveled falls to 10.7 miles per day**, **a 35% reduction below 2005 levels, surpassing the target to reduce GHG emissions to 30%** below 2005 levels by 2045.
    - By 2045, the plan, together with advancements in fleet and technology, is expected to **reduce per capita annual greenhouse gas emissions from household light-duty vehicles by 89 percent** below 2005 levels.
5. **Metro remains unable to report on several of the original Climate Smart Strategy monitoring targets**, including those related to travel time and reliability, and managing the region's transportation system, typically because the data needed to forecast future performance for these measures as identified in the Climate Smart Strategy is not yet available. These measures will be revisited as part of a future update to the Climate Smart Strategy.
6. **Table 4 includes new reporting measures related to lane miles of road construction and teleworking**, which provide important context for interpreting the VMT and GHG results of the analysis, but which do not have corresponding targets established in the Climate Smart Strategy. **This finding, along with the finding above, indicates a need to update these measures and targets to align with available data that best captures the RTP's progress in reducing GHG emissions.**

FUTURE ACTIONS AND RECOMMENDATIONS MOVING FORWARD

The findings in the previous section demonstrate the RTP surpasses the state mandated VMT reduction targets if fully implemented along with state-led pricing actions adopted in the Statewide Transportation Strategy and assumed in the region's targets. However, the findings also show mixed progress on implementation of several key elements of the region's adopted Climate Smart Strategy. As a result, and as required by OAR 660-012-0900(7)(D), Metro staff identified the following future actions and recommendations that will be addressed prior to the next update to the RTP (due by November 30, 2028).

1. **Metro will begin monitoring and reporting current state and regional trends in transportation-related GHG emissions in coordination with ODOT.** This information will be communicated to JPACT and the Metro Council and as part of the annual minor reports Metro must submit to DLCD on behalf of the region to report on implementation of the region's Climate Smart Strategy. The first minor report will be due in 2025. Current state monitoring efforts are now published online at: https://www.oregontransportationemissions.com.
2. **Metro will continue to improve its climate analysis tools, assessment methods and capabilities in advance of the 2028 RTP update to better estimate GHG emissions impacts of RTP projects and to better inform regional policy and investment decisions that impact climate.** Projects occurring in 2024-25, such as development of a Comprehensive Climate Action Plan through the EPA Climate Pollution Reduction Grant program, allocation of federal Carbon Reduction Program (CRP) grant funding, the Regional Flexible Funds Allocation process, and next Metropolitan Transportation Improvement Program (MTIP) update provide opportunities to test and develop new approaches to estimating GHG impacts of different project types over the next several years.
3. **Metro recommends state agencies conduct a detailed, comprehensive review of the STS assumptions used to set regional greenhouse gas emissions reduction targets as described in OAR 660-044-0035 (Division 44 - Metropolitan Greenhouse Gas Reduction Targets Rules) and to update the STS and GHG target rules as needed.** The goals of this review should include:
    - ensuring that state-provided assumptions reflect current trends,
    - clarifying how state-led pricing assumptions used in setting regional greenhouse gas emissions targets should be accounted for in future regional climate analyses, and

- ensuring that the assumed implementation and GHG impact of state-led policies and assumptions are documented in a manner consistent with how regions are required to document their RTP climate analyses.

This will help improve the analysis in next RTP update and provide clarity on what different state-led pricing actions are assumed in the state targets in OAR 660-044-0020 and how those pricing actions should be accounted for in future analyses.

Metro included assumptions about state-led STS actions (including state-led pricing programs) in the RTP climate analysis because these actions were assumed by the state when it set GHG reduction targets for the region. Metro recommends that the pricing assumptions be reviewed and updated by the state to best reflect how pricing will be implemented. Other assumptions include ambitious state-led pricing programs such as pay-as you-drive insurance, mileage-based road user fees to replace the gas tax (e.g. VMT fees), a carbon tax, and congestion pricing in the Portland area. While the state does have authority to implement these actions, limited progress has been made to date. The state-adopted climate targets were set at a level that assumed that some combination of these forms of pricing would be implemented in Oregon by 2050. These assumptions should be reviewed and updated as necessary. This information will also help the region identify pathways to meet its targets while accounting for uncertainty in state-led pricing actions.

The most recent STS Monitoring Report, completed in 2023,[4] reports back on general progress on categories of actions like improving passenger vehicle technology – it does not quantitatively examine whether specific individual assumptions used in the STS are consistent with current trends and policy changes.

This level of detail will improve the transparency and accuracy of the assumptions and targets used in the RTP climate analysis. Metro encourages the State agencies to make this a transparent process and to collect robust public and policymaker feedback on underlying assumptions so that it does not fall to Metro and other partners to communicate the State's assumptions as part their climate analysis and monitoring. The State Agencies' review should also identify corrective actions needed to achieve STS assumptions that are not on track.

4. **Metro recommends ODOT update the Statewide Transportation Strategy, as needed, if the review described above reveals that assumptions are significantly off-track, and subsequently update Division 44 using the updated STS assumptions.** This process would need to be completed by 2026 to inform the climate analysis that will be conducted as part of the next RTP update (due in 2028).

[4] https://www.oregontransportationemissions.com/

5. **Metro will work with state and local partners to conduct a comprehensive review and update to the Climate Smart Strategy to inform the next RTP update.** This work will reflect new information about the potential to implement different GHG reduction measures (e.g., the changing transportation funding landscape and evolving State plans to implement congestion pricing) and new data and tools that will improve methods for estimating the GHG reduction potential from different policies and actions. Metro will also incorporate any required updates emerging from the review of STS assumptions described above. If the State does not address the issues identified about the STS vehicle/fuel and pricing assumptions identified elsewhere in this appendix, Metro may also explore more realistic assumptions and GHG reduction scenarios representing these assumptions for comparative purposes to inform regional policymaker discussions.
    - This will result in more clarity and an updated Climate Smart Strategy that can guide how the region can best reduce GHG emissions and meet climate targets that are predicated on both the State and region doing their part to reduce GHG emissions.
    - This may include in-depth planning to address some of the areas where the region is falling short on climate implementation (e.g., TDM funding) as well as new GHG reduction strategies identified by agency partners (e.g., promoting electric bikes and scooters and exploring other potential actions to advance transportation electrification that complement federal and state policies and programs).
    - This work will also include a review and recommendations for updates to the adopted Climate Smart Strategy performance monitoring measures and targets, as appropriate.
6. **Metro will update its Climate Smart Strategy implementation monitoring and reporting to reflect the updated strategy and any changes recommended to the Climate Smart Strategy performance monitoring measures and targets.** The next RTP update is due by November 30, 2028. The next major report to DLCD is due the following year, in 2029.
7. **Metro will update the Regional Travel Options (RTO) Strategic Plan and develop a Regional Transportation Demand Management (TDM) strategy**. A goal of this work is to provide clearer direction regarding the role of transportation demand management in helping implement the Climate Smart Strategy – an area in which the region is falling short based on the implementation monitoring results shown in Table 4. As called for in Chapter 8 of the RTP, the new strategy will provide implementation guidance to state agencies, transit providers, local agency and non-profit partners that

administer TDM programs, as well as direction on how the Metro RTO program can support these efforts and implementation through transportation system plans.

8. **Metro will work with regional partners to identify actions to advance transportation electrification in the greater Portland region that complement existing federal and state policies and programs.**

9. **Metro will work with cities, counties, community-based organizations and transportation agencies to improve the process of developing and evaluating the project list in advance of the next RTP update.** Called for in Chapter 8 of the RTP, this work will include:

    - Convening a group or multiple groups to review Metro's existing metrics and tools for evaluating the impacts of transportation decisions on the region's safety, climate, equity, mobility and economy to ensure metrics and tools reflect community and regional priorities.
    - Conducting a review of processes and best practices used by four to five peer MPOs to identify needs and evaluate and prioritize investments.
    - Working with cities, counties and transportation agencies to share best practices and information on conducting inclusive, equitable engagement and applying safety, climate and equity data and metrics to identify investment priorities in advance of the 2028 RTP call for projects.
    - Developing strategies to improve coordination on submitting projects on state highways and facilities that cross multiple jurisdictional boundaries.
    - Reviewing lessons learned during past RTP project-level evaluations, including those conducted during the 2018 and 2023 RTP updates. The 2018 RTP tested a rigorous qualitative, self-scoring approach to comparing selected RTP projects across ten factors, and Metro encountered several technical challenges in producing consistent information for projects of varying types and sizes. The 2023 RTP tested a qualitative, GIS-based approach that provided consistent information across all projects for each RTP goal area, but did not provide information in enough detail for decision-makers to distinguish between the potential greenhouse gas emissions and VMT impacts of both larger-scale projects and smaller-scale projects. This suggests that a hybrid approach that involves a qualitative evaluation of most RTP projects and a more detailed quantitative evaluation of larger-scale projects could better meet the region's needs.

10. Working in coordination with state and local partner agencies, **Metro will increase efforts to prioritize and secure funding for transit service, bicycle and pedestrian infrastructure, and other regional greenhouse gas reduction**

strategies identified in the updated Climate Smart Strategy. Over the past several RTP cycles Metro and its local agency partners have shifted funding from projects that support driving to bicycle, pedestrian and transit projects, and the state has increased funding for transit projects in the region. However, this increase in funding has not kept up with inflation, and is not adequate either to address recent challenges to transit nor to make transit and active transportation as ubiquitous and convenient as driving is throughout the region.

Metro will work with local, regional and state partners to implement these actions and recommendations and submit annual progress reports to DLCD as required by OAR 660-012-0900(3).

GREENHOUSE GAS EMISSION ANALYSIS IN THE RTP

Overview

The 2023 Regional Transportation Plan update includes a review of key Climate Smart Strategy actions, updating climate analysis tools and responding to the latest state requirements in OAR Division 12 and OAR Division 44. The new state requirements in Division 12 shifted the emphasis to analyzing per capita VMT reduction as a proxy for measuring progress toward state GHG reduction targets defined in Division 44. The RTP also summarizes progress toward meeting these goals with the monitoring report on the actions identified in the Climate Smart Strategy.

History

The greenhouse gas emissions targets were first set for the Portland metropolitan region in 2012 using ODOT's GreenSTEP software tool. The Climate Smart Strategy performance measures and targets provided the preliminary set of actions and set a pathway toward achieving the GHG reduction target for the region. The Climate Smart Strategy guides policies and actions that are included in the Regional Transportation Plan and the Urban Growth Report that, together, track existing land use and transportation policies and expected outcomes. The Climate Smart Strategy performance monitoring targets are not policy targets, but instead reflect a combination of the planning assumptions used to develop and evaluate the Climate Smart Strategy and outputs from the evaluation of the adopted strategy using a metropolitan version of ODOT's GreenSTEP software package. The Climate Smart Strategy performance measures and monitoring targets were adopted in 2014 with an acknowledgement that they will be reviewed during subsequent RTP updates to account for new information, such as federal transportation performance-based planning rulemaking and changes to the applicable state rules.

GreenSTEP has since been replaced with a more robust analysis tool that is called VisionEval Regional Strategic Planning Model (VE-RSPM). The 2023 RTP updates the analysis by using VE-RSPM to calculate the VMT and GHG reductions for the various RTP investment scenarios.

MOVES emission modeling will continue to provide a direct emissions output from the network-based travel demand model accounting for greenhouse gas emissions, criterion pollutants and other air toxins. Metro has an agreement with the Oregon Department of Environmental Quality to report on air toxin emissions for the regional transportation plan scenarios as part of RTP updates.

These MOVES-based estimates are going to produce results that are not directly comparable to the greenhouse gas emissions forecasts from VE-RSPM. MOVES is based on

outputs from Metro's network-based travel model that describe number of trips by each mode that occur on each link in the network during different periods of the day (as well as the speed distribution and estimated fleet composition for motor vehicles on each link of the network, which are important inputs in estimating pollution and air toxin levels). VE-RSPM is not a network-based model; it estimates travel demand and fuel consumption based on inputs such as the aggregate cost of travel by mode, total length of facilities by mode, and the overall composition of the passenger vehicle fleet. The network-based approach is more nuanced. For example, when forecasting how future investments in infrastructure and transit service will change people's mode choices and VMT, VE-RSPM compares the average cost and travel time to drive versus using other modes *across all trips in the region*, whereas Metro's network-based model compares the cost and travel time of driving versus other modes *for specific times and routes within the region* and then aggregates those results, which better captures how local conditions shape people's travel choices. In addition to these differences, each tool has a different vehicle choice model, uses a different geographic configuration, and may have other variability in the fuels and energy consumption modeled for the vehicles on the network.

Modeling tools

VisionEval is a transportation planning and policy analysis tool developed by ODOT in partnership with the Federal Highway Administration (FHWA) for evaluating the transportation related impacts of land use, transportation, and policy decisions. It is an integrated model that simulates the interactions between land use, transportation, and the environment. VisionEval is designed to help transportation planners and policy makers understand the potential impacts of different transportation and land use scenarios on factors such as travel behavior, vehicle emissions, air quality, and energy consumption. It can be used to evaluate the potential impacts of a wide range of policy and investment decisions, such as the construction of new highways, the expansion of public transportation, or the implementation of land use regulations. It allows for the implementation of different policy scenarios and can be used to evaluate the potential impact of these scenarios on transportation performance, energy consumption, and emissions.

Metro primarily uses VisionEval to assess its regional GHG target in accordance with the state target rule guidance. Previously, the extent of GHG reduction and changes in per capita household VMT in the STS were evaluated using the statewide model GreenSTEP, an earlier form of VisionEval that has evolved into the state-level model in the VisionEval platform (VE State). A separate regional version of VisionEval, the Regional Strategic Planning Model (VE-RSPM), is also available.

The VisionEval suite of tools account for average daily travel at the household level across a specific geographic region and apply a detailed accounting of the vehicles, fuels, and miles traveled to estimate the GHGs produced in the model region. Metro's Climate Smart Strategy, adopted in 2014, used GreenSTEP to analyze and define the suite of state and regional policies to achieve the GHG reduction targets. DLCD has clarified that VE-RSPM is the preferred tool for evaluating progress toward meeting the DLCD Target Rule GHG reductions. Given the differences between MOVES- and VisionEval-based GHG estimates discussed above, Metro cannot use MOVES in its GHG analysis. The ideal approach would be to use a tool that is consistent with both the VisionEval model that the state used to set targets and with the network-based model that is used to assess all other aspects of the RTP's performance, but no such tool is currently available. Metro therefore used VE-RSPM in the 2023 RTP climate analysis in order to ensure that results are comparable to targets.

MODELING THE TARGET RULE

Overview

The latest Oregon Administrative Rule regarding the GHG emission reduction targets was adopted by LCDC as part of the Climate-Friendly Equitable Communities (CFEC) rulemaking in July 2022. Those rules describe the extent of the reduction targets and the types of emissions covered by the rules. The new state targets were set at a specific point in time under an agreed set of policy and investment assumptions. Assessing Metro's progress and plan for achieving the GHG targets during each RTP update requires using a consistent approach. That approach includes a consistent definition of the geographic area included and who is counted in the per capita values versus who is excluded from that analysis. The approach also applies the state-led GHG reduction actions that were assumed in original target rule and included in the Oregon Statewide Transportation Strategy (STS).

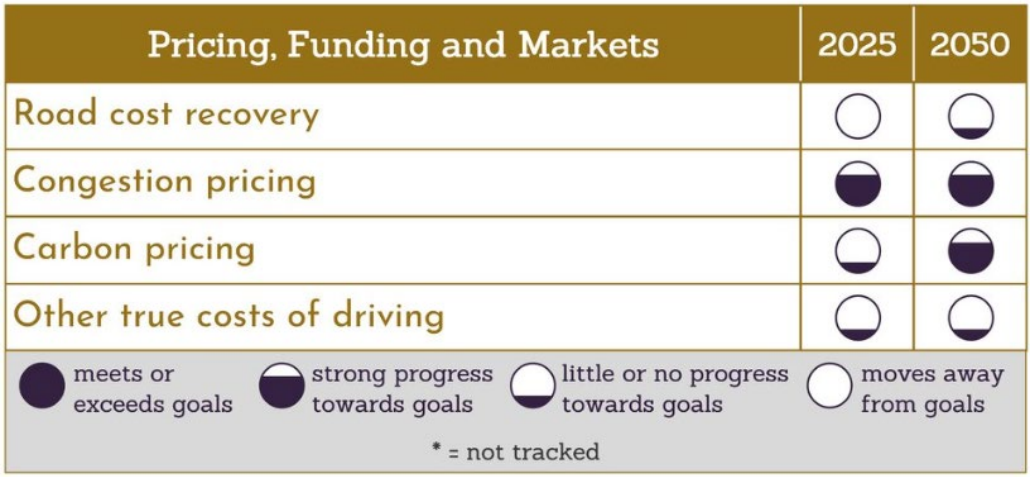
The STS includes state-led pricing actions and captures implementation of clean vehicle and fuel programs and regulations at the state and federal levels. The fleet and technology actions cover variables such as the share of zero-emission vehicles, the carbon intensity of fuels, the balance of cars and trucks in the passenger fleet, and vehicle turnover. The state-led pricing-actions in the STS assume that the state will implement extensive changes to how transportation revenues are collected in Oregon—both to replace the gas tax, which is not producing enough revenue to meet Oregon's transportation needs, and to reduce GHG emissions by managing demand for driving and encouraging the use of cleaner modes and vehicles. The STS includes policies such as pay-as-you-drive insurance. This isn't so much a new form of pricing, but it converts a fixed cost to a marginal cost in a way that benefits people who drive less.

New revenue mechanisms in the STS include a road user charge that levies carbon taxes, per-mile fees on drivers, and other additional road pricing beyond what is currently included in the 2023 RTP. These changes are not reflected in the RTP because they are not yet adopted in state policies or regulations, but the climate analysis for the RTP is allowed to include them because these state-led pricing actions are adopted in STS and because the state agencies assumed significant implementation of new pricing when setting the region's climate targets in 2017.[5] The State of Oregon has put together a website, https://www.oregontransportationemissions.com/pricing, to introduce the pricing

[5] OAR 660-044-0030(4)(a): https://secure.sos.state.or.us/oard/viewSingleRule.action;JSESSIONID_OARD=Pk5WeLsr40n1ZMdFGJr943D9KeHyA7LSgdLuG_bsnXZJvNrXnI8x!-286176765?ruleVrsnRsn=293065

concepts that are included in the STS. Exhibit B contains a memo prepared by ODOT that describes these concepts with a recommendation for Metro to include them in the 2023 RTP climate analysis.

Figure 2: State of Oregon progress toward implementing state-led pricing (ODOT, DEQ, ODOE, and DLCD)



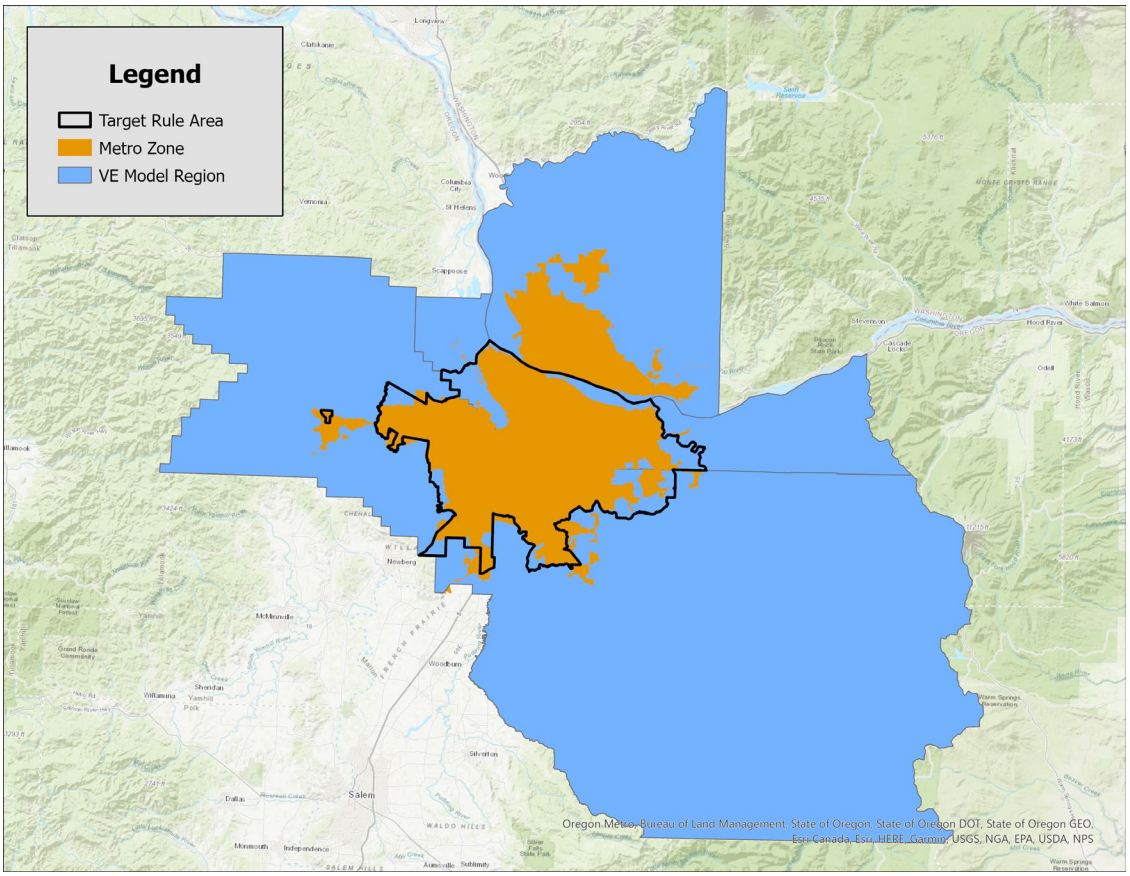
Geography

The VisionEval model, like the regional travel demand model, covers a wider region to account for regional interactions but the reporting is done only for the households within the reporting boundary shown in Figure 3. Note that the target rule area is intended to include the urban growth boundary (UGB) within Metro's metropolitan planning area boundary by excluding the area in Washington state.

The VisionEval model accounts for the daily travel for a household, regardless of where on the network their actual travel took place. The miles per vehicle are aggregated at the household level for all households within the reporting area—which means that the miles traveled outside of the region still count toward the total travel reported by VisionEval. However, the GHG emissions and VMT for any household that is located within the VisionEval modeling region but outside of the UGB (e.g., a household located in Vancouver, WA) is excluded from the Target Rule analysis. This approach in VisionEval differs from the travel behavior accounted for in the Metro's travel demand model, which uses on-road link by link aggregation of trips to account for the total GHG produced on all links in the regional travel network that are within Metro's planning boundary. There is no aggregation to households or to other land uses associated with those trips.

The target rule analysis is centered on the behaviors of households within the Target Rule Area shown in Figure 3.

Figure 3: Model boundaries used within the VisionEval model



While the light-duty vehicle emissions captured by state-mandated targets include local service and delivery vehicles, this type of vehicle activity is produced within VisionEval at the regional scale and is not currently accounted for in Metro's VisionEval target rule analysis. Capturing these vehicles using the VisionEval model would require a consistent and valid way to prorate the regional scale of some results (i.e., commercial vehicles and transit vehicles) results down to the specific target rule area of analysis in Figure 3. Given that this limitation exists in both the base and future conditions, the current approach implicitly assumes that delivery trips grow in proportion with household vehicle trips.

VisionEval model

The VisionEval platform supports several model versions, consisting of different sets of inputs and structures. The development of a VisionEval model suitable for the target rule analysis for the 2023 RTP included:

- Updating a core module to improve the consideration of built-form factors including those produced by the national Smart Location Database (SLD) and would be more sensitive to changes in transit service. This update also included estimating the

module using 2017 National Household Travel survey data rather than 2009 data. The current SLD inputs were translated for use within the Metro models.

- Introducing a teleworking module to account for future changes in teleworking, or working from home, in their daily travel. A review and analysis of the travel behaviors resulting from differing teleworking rates led to the final recommendation to assume a future rate of teleworking in the year 2045 similar to that of teleworking rates observed during the fall of 2022—roughly 45 percent of workers commute full-time, roughly 15 percent telework full time, and the remaining 40 percent do a hybrid of the two.
- Updating the inputs to reflect existing and planned future conditions in the Metro region. This included core input files such as roadway capacity and lane miles, transit revenue miles and transit service frequency, expected density and the share of households in mixed use areas, fuel taxes, travel demand management programs and participation rates, safety data and crash rates, and ITS and operations programs.
- The 2020 base year was modeled using the updated Metro inputs along with the current adopted state-led vehicles and fuel inputs. This model was compared to available empirical data produced by the Bureau of Transportation Statistics (BTS) Local Area Transportation Characteristics for Households (LATCH). The comparison shown below in Table 1 provided confidence that the updated local model closely approximated empirical daily household travel for the base 2020 year.

Table 1: VisionEval vs. LATCH validation results

	MIN	1Q	MEDIAN	3Q	MAX	MEAN
BTS LATCH 2017	14.9	34.2	39.3	46.1	57.9	40.0
Validation Model Run (Regional Base Model 2020)	7.5	34.0	41.9	49.9	66.7	41.5

This produced a model adequate for evaluating the conditions in the 2023 RTP in future years. Two versions of the future are created to represent different trajectories based on state-led policy and pricing actions as described above.

- An **adopted plans (AP) model** that uses the adopted trajectory for state-led pricing, and the adopted-plan trajectory for vehicles and fuels. The AP model provides a goal post that can demonstrate anticipated changes over time as a result of currently adopted policies and actions, both at the regional and the state levels. This scenario is meant only to inform what a future would look like in the absence of changing policies and investments intended to reduce GHG and VMT.
- A **target rule model (also referred to as the STS model)** the STS state-led trajectory for state-led pricing, and the STS trajectory for vehicles and fuels. The Climate Smart

Strategy and subsequent updates to RTPs, including the 2023 RTP, account for regional actions (investments and policies that can be done at the regional level) while also assessing the effects of the state-led actions adopted in the STS in 2018. The combination of RTP and STS actions are what is assessed relative to the state target rule, and whether or not the region is complying with the OAR 660-044 (Targets Rule).

Table 2 outlines key inputs to the Metro Target Rule Model, which primarily reflect the vehicle- and fuel-related assumptions provided by the state to capture the policies and programs in the STS.

Table 2: Key greenhouse gas emissions estimation assumptions and VE inputs

Measure and Description	**Year**		**VisionEval RSPM – Metro Target Rule Model (RTP+STS Scenario)**
Model version(s)		-	RSPM v3.0 "Next Gen"
Vehicle activity captured		-	VMT from households that live within the MPA boundary regardless of where driving occurs
GHG emissions captured		-	Vehicle operation using the carbon intensity of EV/PHEV electricity consumed in EV/PHEVs and carbon intensity of fossil fuels.
Vehicles analyzed		-	Light-duty- vehicles only
Fleet mix Calculated from the following VE inputs: azone_lttrk_hh_prop: Proportion of household vehicles that are light trucks by Azone and specified model year.	2010	Household: 54.5% passenger car 45.5% light truck	Commercial Service: 68.3% light truck 32.7% automobile
	2020	Household: 58% passenger car 42% light truck	Commercial Service: 55% light truck 45% automobile
	2030	Household: 63% passenger car 37% light truck	Commercial Service: 41% light truck 59% automobile
	2035	Household: 66% passenger car	Commercial service: 35% light truck

Measure and Description	Year	VisionEval RSPM – Metro Target Rule Model (RTP+STS Scenario)
region_comsvc_lttrk_prop: Proportion of commercial service vehicles that are light trucks throughout the model region by model year.		34% light truck 65% automobile
	2040	Household: 69% passenger car 31% light truck Commercial Service: 35% light truck 65% automobile
	2045	Household: 72% passenger car 28% light truck Commercial Service: 35% light truck 65% automobile
Average vehicle age (Age distributions available upon request) Calculated from VE Outputs: Vehicle, "Age"	2010	8.1 years light-duty vehicle
	2020	7.7 years light-duty vehicle
	2030	7.1 years light-duty vehicle
	2035	6.8 years light-duty vehicle
	2040	6.6 years light-duty vehicle
	2045	6.3 years light-duty vehicle
Fuel mix Calculated from VE RSPM inputs: hh_fuel and comsvc_fuel.	2010	98% gas, 2% diesel
	2020	95% gas, 2% diesel, 3% CNG
	2030	88% gas, 2% diesel, 10% CNG
	2035	79% gas, 1% diesel, 20% CNG
	2040	69% gas, 1% diesel, 30% CNG
	2045	49% gas, 1% diesel, 50% CNG
Average fuel economy (miles/gallon) Calculated from VE outputs: internal combustion, electric and hybrid engines from Vehicle, "average of MPG" and "MPGe."	2010	22.2
	2020	32.2
	2030	53.0
	2035	62.8
	2040	70.6
	2045	78.4
Fuel carbon intensity Calculated from VE outputs: grams CO2 Equivalent/Mj, from Vehicle, Electricity Carbon Intensity	2010	175.2
	2020	140.4
	2030	105.5
	2035	88.1
	2040	70.7

Measure and Description	Year	VisionEval RSPM – Metro Target Rule Model (RTP+STS Scenario)
	2045	53.3
Average GHG emissions rate (Grams CO2 Equivalent/mile)	2010	524
	2020	357
	2030	180
Calculated from VE output: Daily CO2e/DVMT	2035	145
	2040	126
Rates are fleet-wide composites	2045	100

Source: Metro (VE Target Rule Model Results)

RTP AND TARGET RULE RESULTS

The two models, Adopted Plans and the STS/Target Rule Model, were used during development of the 2023 RTP to illustrate how scenarios consisting of different assumptions, policies, and investments performed relative to the region's climate targets, as allowed in the target rule analysis process. Metro presented five scenarios that were based on the state assumptions reflected in either the Adopted Plans and STS Vision scenarios (the latter of which reflects the Target Rule) created by ODOT, as well as different levels of pricing, infrastructure and transit service that come from the RTP and are based on different regional planning scenarios:

- **RTP23 + STS:** Includes adopted 2023 RTP investments, transit service, and throughway pricing, as well as all additional pricing and revenue mechanisms adopted in the STS Vision in 2018 and assumed by the state when setting the region's climate targets in 2017. These consist of a combination of fees and taxes that are modeled as per-mile fees. This is the scenario that is used in the RTP climate analysis and based on the adopted 2023 RTP.
- **RTP23 + adopted plans (AP):** Includes adopted 2023 RTP investments, transit service, and throughway pricing, as well as currently adopted plans and policies adopted in the STS in 2018. It includes a lower level of additional state-led throughway pricing than the RTP23+STS Vision scenario and excludes the pricing and revenue mechanisms described as "additional" under that scenario. This is one of several illustrative scenarios developed during the RTP process to help Metro and agency partners identify the final RTP23+STS scenario described above.
- **Target 1:** adopted 2023 RTP investments, transit service, and throughway pricing, as well as the amount of additional pricing and revenue mechanisms from the STS that are necessary to meet regional climate targets by using pricing to manage travel demand. This is one of several illustrative scenarios developed during the RTP process to help Metro and agency partners identify the final RTP23+STS scenario described above. RTP-related inputs for this scenario come from the public review draft RTP.
- **Target 2:** Includes adopted 2023 RTP investments, transit service, and throughway pricing, as well as the amount of additional pricing and revenue mechanisms from the STS that are necessary to meet regional climate targets by using pricing to manage travel demand—assuming that all revenues from these new pricing mechanisms generated within the region are reinvested in increasing transit service.[6] To create

[6] This scenario assumes that 50% of revenues from the STS pricing and revenue mechanisms for toward funding increases in transit service, and that investments in transit service would be consistent with the mix of transit

this scenario, the consulting team supporting this analysis tested several different levels of pricing and corresponding increases in transit service until they identified the scenario that meets regional climate targets using the smallest amount of additional pricing. This is an illustrative scenario that did not consider the many nuances and policy constraints involved in using pricing revenues to fund transit service. It is one of several illustrative scenarios developed during the RTP process to help Metro and agency partners identify the final RTP23+STS scenario described above. RTP-related inputs for this scenario come from the public review draft RTP.

- **RTP23 + STS + current fleet:** adopted 2023 RTP investments, transit service, and throughway pricing, as well as all additional pricing and revenue mechanisms included in the STS but replaces two of the assumptions in the STS—the mix of light/heavy duty vehicles in the fleet and the amount of time that people hold on to their vehicles—with current trends. Metro developed this illustrative scenario to address concerns raised by partner agencies and community members that the values assumed for these inputs in the STS are not reflective of current trends.[7] RTP-related inputs for this scenario come from the public review draft RTP. Refer to Exhibit A to this appendix for a more detailed discussion of this scenario and its results.

Table 3 describes the assumptions behind these five scenarios.

modes (e.g., local bus, frequent bus, light rail) and transit service costs reflected in the 2023 RTP constrained investments.

[7] The STS projects that people will replace their vehicles sooner and that most passenger vehicles will be cars instead of light trucks and sport utility vehicles when in fact people are generally hanging onto their vehicles for longer and light trucks and sport utility vehicles are dominating the passenger vehicle market. See Exhibit A in RTP Appendix J for more background information on this scenario.

Table 3: Climate scenarios, assumptions and results

	RTP23 + STS	RTP23 + AP	Target 1 (pricing)	Target 2 (pricing + transit)	RTP23 + STS + Current Fleet[8]
Scenario Description	Official RTP climate scenario for the purposes of target analysis / state rule compliance	Illustrative bounding scenario showing the GHG impacts of "business as usual" defined by the state; assumptions about clean vehicles and pricing are based on adopted plans	Illustrative pathway to meeting climate targets by assuming the minimum level of state-led pricing needed to close the gap between RTP23 GHG reductions and targets	Illustrative pathway to meeting climate targets by assuming the minimum level of state-led pricing needed to close the gap between RTP23 GHG reductions and targets if revenues are used to expand transit service	Illustrative bounding scenario that explores the GHG impacts of using current values instead of STS values for vehicle age and mix
Throughway pricing	STS pricing on the entire throughway network, averaging $0.17/mile	RTP pricing on portions of I-5 and I-205 averaging $0.11/mile	$0.11/mile on the entire throughway network	$0.08/mile on the entire throughway network	STS pricing on the entire throughway network, averaging $0.17/mile
Other STS per-mile fees	$0.20/mile	None	$0.12/mile	$0.10/mile	$0.20/mile
Pay-as-you drive (PAYD) insurance[9]	State requires PAYD insurance with 40% participation[10]	State leaves PAYD insurance to the market with 6% participation	State requires PAYD insurance with ~68% participation	State requires PAYD insurance with ~27% participation	State requires PAYD insurance with 100% participation
Transit service	RTP level of transit service	RTP level of transit service	RTP level of transit service	77% increase above RTP level of transit service	RTP level of transit service
Clean fuels and vehicles	STS assumptions	State AP (adopted plans) assumptions	STS assumptions	STS assumptions	STS assumptions except current fleet vehicle age and mix (32% car / 68% SUVs and light-duty trucks)

[8] Refer to Exhibit A to this appendix for a more detailed discussion of this scenario and its results.

[9] Per guidance from ODOT, pay-as-you-drive insurance is assumed to effectively create an additional per-mile fee on driving that is equivalent to $0.08/mi in 2020 and increases to $0.22 in 2045.

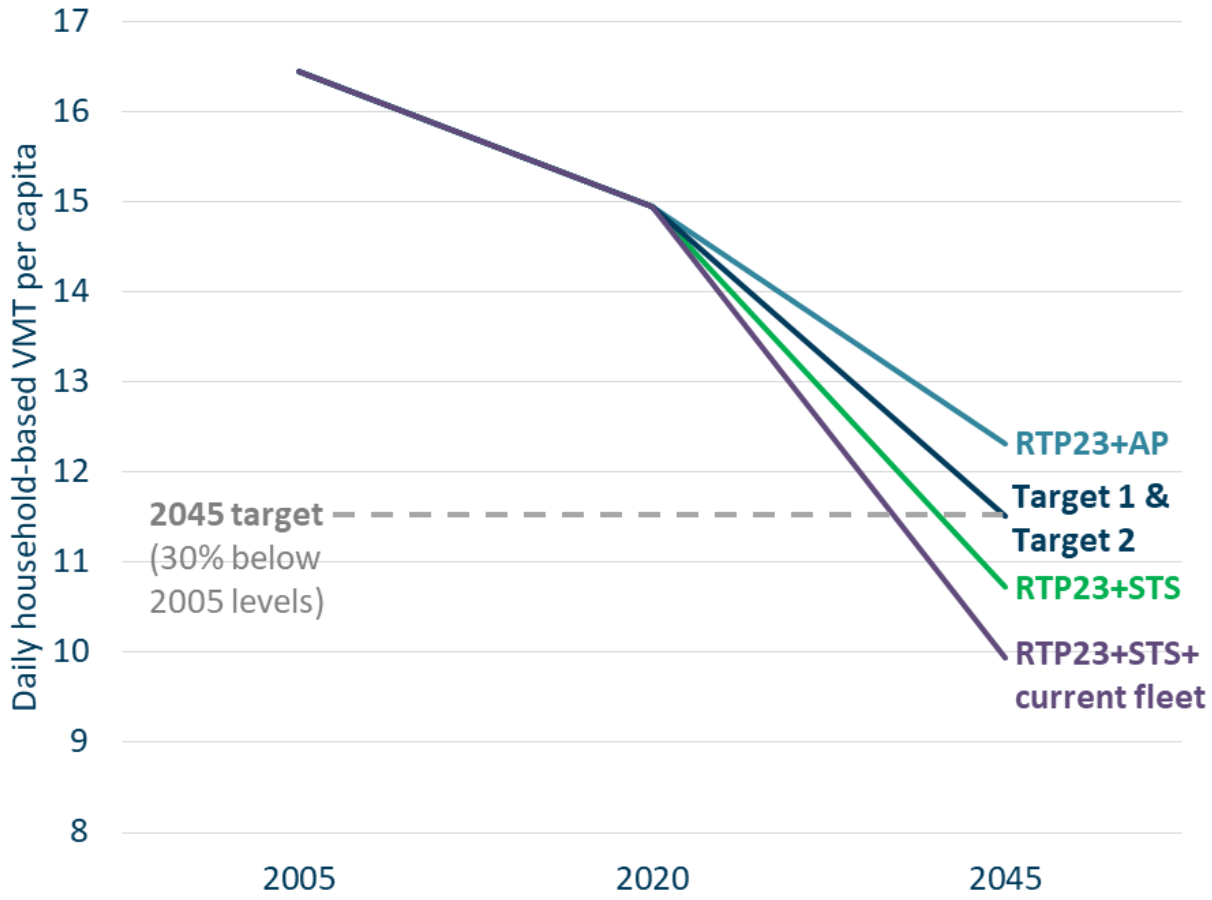
[10] The original Climate Smart Strategy was adopted in 2014 when pay-as-you-drive insurance was growing more popular and assumed 40% market-driven adoption of PAYD. Since then, insurers have scaled back their PAYD offerings and fewer consumers are using them, which makes it seem unlikely that the market will provide a path to 40% adoption. However, the State has the power to regulate auto insurance sold in Oregon, and for the 2023 RTP update Metro assumed that the state would implement PAYD by requiring Oregon drivers to use it. Though it would be feasible to apply such a requirement to 100% of Oregon drivers and would also support progress toward meeting Oregon's climate goals, Metro assumed 40% adoption of PAYD for consistency with the original Climate Smart Strategy adopted in 2014, which is the basis for the required progress reporting under the RTP climate analysis.

	RTP23 + STS	RTP23 + AP	Target 1 (pricing)	Target 2 (pricing + transit)	RTP23 + STS + Current Fleet[8]
GHG/capita reductions (from 2005 levels)	89%	70%	85-89%[11]	85-89%[11]	87%
VMT/capita reductions (from 2005 levels)	35%	25%	30%	30%	40%
Meets targets?	Yes (surpasses)	No	Yes (meets)	Yes (meets)	Yes (surpasses)

[11] The Target 1 and Target 2 scenarios were developed as informational scenarios during the RTP process to identify the minimum level of pricing and additional transit revenues needed to meet regional climate targets.

Figure 4 shows the VMT per capita results for each of the scenarios discussed above.

Figure 4: Daily VMT per capita by scenario vs. regional climate target (source: Metro/RSG VisionEval analysis)[12]



These results demonstrate that there are multiple paths to meeting regional climate targets through a combination of increased pricing and other climate strategies including demand management, system management, and increased investment in alternatives to driving. The fact that the RTP23+STS scenario significantly surpasses the target for 2045 while the RTP+AP scenario falls about 5% far short of meeting the target for 2045 illustrates the extent to which state-led actions may be needed for the RTP to achieve the target rule. But most importantly, these results show that the 2023 RTP update will meet regional VMT per capita reduction targets through the policies and investments included in the RTP in concert with state-led actions in the STS, including pricing. There is a

[12] Historical 2005 and 2020 VMT per capita vary slightly (i.e., by less than 0.5 VMT/capita/day) between the STS and AP scenarios provided to Metro by the state. For the purposes of this chart, Metro uses the more conservative AP scenario-based values for 2005 and 2020 across all scenarios.

minimum degree to which state-led actions are needed, as reflected in the Target 1 and 2 scenarios, but the RTP23+STS exceeds targets to such an extent that it creates a buffer—even if the state were not able to achieve the full suite of policies included in the STS, it would still be possible for the region to meet its climate targets.

Climate Smart Strategy implementation monitoring

To monitor and assess implementation of the Climate Smart Strategy, Metro will continue to use observed data sources and existing regional performance monitoring and reporting processes to the extent possible. These processes include regularly scheduled updates to the Regional Transportation Plan and Urban Growth Report and reporting in response to ORS 197.301 and ORS 197.296. When observed data is not available, data from regional or state models may be reported. Metro staff will continue to consult with DLCD, DOE, DEQ and ODOT on the assumptions and methods used and on the presentation of results.

If future assessments find the region is deviating significantly from the Climate Smart Strategy performance monitoring targets, then Metro will work with local, regional and state partners to consider the revision or replacement of policies and actions to ensure the region remains on track with meeting adopted targets for reducing greenhouse gas emissions.

In addition, Metro staff will monitor future changes to fleet and technology assumptions in collaboration with DLCD, DOE, DEQ and ODOT and continue to improve emissions analysis methods, data and tools through its air quality and climate change program.

Table 4 below shows current implementation and performance monitoring results.

Table 4: Climate Smart Strategy implementation and performance monitoring

	Climate Smart Strategy Baseline (2010)	Climate Smart Strategy Monitoring Target (2035)	2023 RTP Base Year (2020)	RTP 23 +STS Target Scenario Constrained (2045)
1. Implement the 2040 Growth Concept and local adopted land use and transportation plans				
a. Share of households living in a walkable mixed used development in the UGB	26%	37%	29%	37%
b. New residential units built through infill and redevelopment in the UGB	58%	65%	54%	75%
c. New residential units built on vacant land in the UGB	42%	35%	46%	25%
d. Acres of urban reserves	Not applicable	12,000	Not applicable	4,739
e. Household-based daily vehicle miles traveled per capita	20	16	15	11
2. Make transit convenient, frequent, accessible and affordable				
a. Daily transit service revenue hours (excluding C-TRAN service hours)	4,900	9,400	6,803	9,059
b. Share of households within 1/4-mile all day frequent transit service	30%	37%	47%	53%
c. Share of low-income households within 1/4-mile all day frequent transit service	39%	49%	66%	81%
d. Share of employment within 1/4-mile all day frequent transit service	41%	52%	55%	67%
3. Make biking and walking safe and convenient				
a(1). Daily trips made walking	505,000	768,000	464,312	622,201
a(2). Daily trips made biking	179,000	280,000	216,912	293,153
b(1). Per capita biking miles per week	2.1	3.4	2.7	3.0
b(2). Per capita pedestrian miles per week	1.3	1.8	1.1	1.1
c(1 and 2). See 4a(2) and 4a(3) below				
d(1). New miles of bikeways	623 existing miles	421	626	132
d(2). New miles of sidewalks[13]	5072 existing miles	Data not available	597	131

[13] Metro is only able to forecast new sidewalks added on the regional network that is covered in the RTP. These forecasts are not consistent with the baseline data collected during development of the Climate Smart Strategy,

	Climate Smart Strategy Baseline (2010)	Climate Smart Strategy Monitoring Target (2035)	2023 RTP Base Year (2020)	RTP 23 +STS Target Scenario Constrained (2045)
d(3). New miles of regional trails	229 existing miles	140	248	82
4. Make streets and highways safe and reliable[14]				
a(1). Fatal and severe injury crashes - motor vehicles	398	199	358	No forecast data
a(2). Fatal and severe injuries – pedestrians	63	32	107	No forecast data
a(3). Fatal and severe injuries - bicyclists	35	17	19	No forecast data
b. Change in travel time and reliability in regional mobility corridors	Data not available	Not evaluated	Data not available	No forecast data
c. Share of freeway lanes blocking crashes cleared within 90 minutes	Data not available	100%	Data not available	No forecast data
5. Use technology to actively manage the transportation system				
a. Share of arterial delay reduced by traffic management strategies	10%	35%	Data not available	No forecast data
b. Share of regional transportation system covered with system management/TSMO	Data not available	Data not available	Data not available	No forecast data
6. Provide information and incentives to expand the use of travel options[15]				
a. Share of households participating in individual marketing	9%	45%	0.2%	0.5%
b. Share of workforce participating in commuter programs	20%	30%	6%	5%
7. Manage parking to make efficient use of vehicle parking and land dedicated to parking				
a(1). Share of work trips occurring in areas with actively managed parking	13%	30%	17%	32%

which covered sidewalks on both local and regional roads. Both the RTP Base Year and 2045 results only cover the regional network so that the two values can be compared, but they are not comparable to the original Climate Smart Strategy baseline.

[14] See Chapter 7 for a discussion of Metro's approach to setting performance targets for safety.

[15] The RTP values reported in this section are more modest than the original Climate Smart Strategy assumptions because the amount of funding available for transportation demand management programs is significantly lower than the amount needed to meet those assumptions. Until the Climate Smart Strategy is updated, Metro recommends using the more modest assumptions to reflect coverage at available levels of funding.

	Climate Smart Strategy Baseline (2010)	Climate Smart Strategy Monitoring Target (2035)	2023 RTP Base Year (2020)	RTP 23 +STS Target Scenario Constrained (2045)
a(2). Share of non-work trips occurring in areas with actively managed parking	8%	30%	7%	30%
8. Support transition to cleaner low carbon fuels, efficient fuels and pay-as-you-go insurance				
a(1). Share of registered passenger cars that are electric or plug-in-hybrid electric	1%	8%	2%	35%
a(2). Share of registered light trucks that are electric or plug-in-hybrid electric	1%	2%	0.4%	32%
b. Share of households using pay-as-you-go insurance	1%	40%	6%	40%
9. Secure adequate funding for transportation investments				
a. Address local, regional, and state transportation funding gap	Not evaluated	Not evaluated	See note[16]	Not evaluated
10. Demonstrate leadership on climate change				
a. Region-wide annual tons per capita greenhouse gas emissions (MTCO2e) from household light-duty vehicles within the Target Rule area	3.7	1.2	2.3	0.4
b. Region-wide annual tons per capita greenhouse gas emissions (MTCO2e) from all vehicles within the Target Rule area	Not evaluated	Not evaluated	4.2	0.7
11. New metrics[17]				
NA. Current / new lane miles	4,832	474	5,461	292
NA. Current / new throughway lane miles	550	52	627	36
NA. Current / new arterial lane miles	4,282	386	4,834	256
NA. % of workers who telework 1-4 days per week	Not evaluated	Not evaluated	37%	29%
NA. % of workers who telework full time	Not evaluated	Not evaluated	17%	33%

[16] JPACT and the Metro Council have advocated for more funding to increase transit service and implement the Climate Smart Strategy in multiple ways since it was adopted in 2014, including preparing annual federal and state legislative agendas that advocate for these resources. The Metro Council worked with regional and community partners to develop a regional transportation funding measure in 2020 (which voters did not approve). Oregon House Bill 2017 significantly increased funding for transit to allow for the region to increase service to the levels envisioned in the Climate Smart Strategy. However, the impact of the COVID-19 pandemic, ongoing challenges hiring drivers, and inflationary project costs have prevented these resources from achieving the envisioned levels of transit service and ridership.

[17] Metro included these measures in this report to provide additional context for interpreting the results of the climate analysis.

MODEL DEVELOPMENT SUPPORTING DOCUMENTATION

Input re-calculations

Multiple inputs were re-calculated to align with forecasts from ODOT and future projections of land use changes that are reflected in the growth distribution adopted by the Metro Council.

Lane miles

The lane miles input was re-calculated to align with ODOT values. ODOT provided HPMS 2020 data. Links were filtered to those with AADT values and aligned with ODOT's own calculations. The 2020 values were adjusted to reflecting the addition of 35 lane miles on freeways by 2045 as reflected in the RTP financially constrained project list. All remaining values were interpolated.

Table 5: Updated lane-mile inputs

Geo	Year	Updated Freeway Lane Miles	Updated Arterial Lane Miles
Metro	2005	538	1867
Metro	2010	549	1934
Metro	2020	577	2090
Metro	2025	584	2114
Metro	2030	591	2138
Metro	2035	597	2154
Metro	2040	602	2171
Metro	2045	607	2188
Metro	2050	613	2205

Land use changes: mixed-use residential

The input showing the proportion of households within mixed use zones was updated to reflect changes under the RTP 23 scenario (see Section 3.1 of Appendix M for more information on the adopted growth distribution used in the RTP analysis). The proportion was calculated for projected years 2020, 2030, and 2045. Values for intermediate, past, and future years were interpolated from these data points.

Table 6: Updated mixed-use residential results

Year	June 23 Asserted Mixed Use (Average) for the Model Region	Target Rule Area
2005	18%	27%
2010	19%	28%
2020	20%	29%
2025	21%	31%
2030	22%	32%
2035	22%	33%
2040	23%	35%
2045	23%	35%
2050	28%	38%

Transit service

The transit service input uses a Smart Location Database (SLD) variable (D4C) to estimate transit services within one-quarter mile of a transit line. This was developed using transit frequency data provided by TriMet for the region and its transit lines. Historical and 2020 calculated values and then scaled using TriMet's previous estimates.

Table 7: Updated transit service inputs

	Initial Transit Frequency (D4C)	Interim Transit Frequency (D4C)	Updated Transit Frequency (D4C)
Average	251.9	10.2	34.3
Median	215.3	6.7	24.5
Standard Deviation	246.6	13.9	38.6
Min	0	0	0
Max	2566.2	118	302.5

Intersection density

The intersection density input uses a SLD variable (D3bpo4) to estimate the density of four-leg pedestrian-oriented intersections per square mile. This input was updated using the latest SLD database and the spatial extent of the model.

Table 8: Updated intersection density results

	Original Intersection Density (D3bpo4)	Updated Intersection Density (D3bpo4)
Average	32.7	38.2
Median	17.0	18.3
Standard Deviation	38.5	52.4
Min	0.1	0.0
Max	174.7	347.2

Multimodal module

The multimodal module was originally developed by Portland State University to update the methodology for daily household VMT estimation and improve on the estimation of non-vehicular travel demand. The original module was estimated using the 2009 National Household Travel Survey (NHTS). The module was updated during the spring of 2022 by RSG for use in the Oregon Transportation Plan after evaluating the estimates of daily VMT and non-vehicular PMT relative to more recent travel surveys, namely the 2017 NHTS. The 2017 multimodal module includes new coefficient values for the two core models within the module. The module accounts for additional land use sensitivities in the calculation of daily household VMT including NHTS variables of life cycle and EPA Smart Location Database variables such as population density, mixed use neighborhoods, residential/job mix, worker density, intersection density, and transit accessibility. The module introduces new data to enable safety metrics to be produced as well as person miles traveled and trip lengths for transit, biking, and walking trips. The multimodal module provides for greater insight into the behavior changes associated with specific network changes, land use changes, and improved sensitivity to the land use/transportation nexus.

Teleworking module

The teleworking module used within the VisionEval model was originally developed for the Massachusetts Department of Transportation for a statewide scenario planning evaluation of how teleworking affects travel behavior. The module was later used in the Oregon VisionEval Statewide model for the Oregon Transportation Plan. The module has been adapted to work within the regional context of the Metro VisionEval VERSPM. The module asserts one of three 'teleworking categories' for each worker in the model by using available occupation data either from BLS, or in the case of Metro, the Oregon SWIM was used to determine a distribution of occupations at a sub-county resolution. Each worker in the VE model also has a commute distance along with other household characteristics (vehicle availability, etc.). A new probability of teleworking model was estimated based on explanatory variables including occupation (or more specifically the

teleworking category), commute distance, and other household characteristics. A second model accounts for the change in daily household travel as a result of that probability of teleworking. This model is estimated on empirical rMove (smart phone based) survey data based on a statewide household travel survey of individuals teleworking part-time and full-time prior to the COVID-19 pandemic. Therefore, the change in VMT associated with teleworking is not linear and not only connected to the change in the commute trip, but accounts for the variety of travel needs that remain regardless of a physical commute.

Teleworking has been identified as important behavior in the greater Portland region that should be accounted for when estimating and forecasting GHG emissions in relation to the state target rule. The next section describes existing research and model development examples regarding teleworking, which will inform the development of a teleworking module for the VisionEval model developed for the RTP.

Overview

Teleworking has become ubiquitous for a sizeable share of the US workforce as a consequence of and response to the COVID-19 pandemic. Before the pandemic, teleworking was largely considered a worthwhile travel demand management (TDM) action intended to reduce travel miles associated with commutes to a fixed place of work.

Accounting for teleworking in travel demand models, including the strategic demand model VisionEval, is challenging given the relationships between individual employee – employer dynamics, the household composition (represented as "life cycle" in National Household Travel Data), the occupation, distance and travel options to work, etc.

RSG has been studying teleworking behavior as part of household travel surveys conducted on the behalf of regions and states often as part of a travel demand model update. RSG expanded the survey program in May 2020 to create a longitudinal panel survey to monitor travel behavior changes during the significant upheaval associated with the COVID-19 pandemic. The following notable changes in travel behavior were observed in the data of survey responses[18]:

- Grocery pickup and delivery will likely continue to supplement in-store shopping, particularly among high-income and zero-vehicle households.

[18] The RSG COVID panel started in May 2020. It continued through Sept 2021 with nine waves. Additional surveys were later administered and added to the data sample. Each wave had over 3000 participants, and weighted to be statistically representative of the national population. See this survey summary for additional information: https://rsginc.com/wp-content/uploads/2022/01/How-COVID-19-Necessities-Have-and-Havent-Changed-the-Way-People-Travel.pdf

- Similarly, telehealth will likely continue to supplement in-person appointments, especially among adults in households with children.
- Income continues to significantly influence telework access, which in turn impacts telework access among Black and Hispanic residents.

RSG also initiated a study for the Massachusetts DOT for evaluating various future scenarios and the impact on travel behavior and investment decisions as a result of teleworking in the state. This remains an on-going study comprised of an extensive literature review on teleworking, defining the actions, setting the status quo, and creating a model to better understand who might be teleworking and what resulting travel behaviors may result. An important outcome of this study is the production of a VisionEval Teleworking module that has since been integrated into the VisionEval-State model for Oregon and is being tested for use within the VE-RSPM for Metro and the RTP.

RSG used the Bureau of Labor Statistics (BLS) Standardized Occupational Codes (SOC) to classify the employed persons into the three categories associated with their propensity to telework. The categories were defined based on the literature review done in Massachusetts, the COVID-19 Survey, and an extensive analysis of a longitudinal household travel survey in Ohio using an rMove dataset made available to relate workers' occupation to travel behavior. Occupational data had a stronger relationship with teleworking as compared to industry classification (i.e., NAICS), however, occupational data is less frequently sampled or available as industry data.

The teleworking category assigned to each of the 2-digit BLS SOC labels is shown in Table 9 along with the number of workers in each occupation per the 2021 BLS summary for the Portland MSA.

Table 9: Teleworking rate category by BLS SOC

BLS Occupations	SOC	Teleworking Category (RSG)	Number of Workers for the Portland MSA
Business and financial operations occupations	13-0000	remote	160,790
Computer and mathematical occupations	15-0000	remote	92,590
Architecture and engineering occupations	17-0000	remote	68,660
Arts, design, entertainment, sports, and media occupations	27-0000	remote	32,580
Office and administrative support occupations	43-0000	remote	287,870
Educational instruction and library occupations	25-0000	on-site	110,510
Healthcare practitioners and technical occupations	29-0000	on-site	119,410

BLS Occupations	SOC	Teleworking Category (RSG)	Number of Workers for the Portland MSA
Healthcare support occupations	31-0000	on-site	81,680
Food preparation and serving related occupations	35-0000	on-site	172,420
Building and grounds cleaning and maintenance occupations	37-0000	on-site	54,660
Personal care and service occupations	39-0000	on-site	40,990
Farming, fishing, and forestry occupations	45-0000	on-site	6,890
Construction and extraction occupations	47-0000	on-site	107,930
Installation, maintenance, and repair occupations	49-0000	on-site	77,150
Production occupations	51-0000	on-site	130,980
Transportation and material moving occupations	53-0000	on-site	199,080
Management occupations	11-0000	mixed	161,000
Life, physical, and social science occupations	19-0000	mixed	24,900
Community and social service occupations	21-0000	mixed	45,310
Legal occupations	23-0000	mixed	19,020
Protective service occupations	33-0000	mixed	35,190
Sales and related occupations	41-0000	mixed	194,930

Source: https://www.bls.gov/oes/current/oes_38900.htm

The share of workers in each teleworking category is used to understand the overall makeup of the worker fleet and the typical commuting patterns of each of the three categories.

Table 10 shows the share of workers by teleworking category. The data indicates that 50 percent of the workers across the MSA are in the on-site category, which has the lowest level of teleworking.

Table 10: Share of workers by teleworking category

Teleworking Category	Number of Employees	% of MPO Regional Employees
Remote	642,490	29%
Mixed	480,350	22%
On-site	1,101,700	50%

Source: BLS SOC for the MSA

The three teleworking categories are used in the VisionEval module to identify how travel behavior may change for workers within each group as a result of changes in the overall level of teleworking. The base data, aligning with national pre-COVID commute trends, for the three teleworking categories and the commute patterns is displayed in Table 11.

Table 11: Teleworking rates by teleworking category

	Days per week Teleworking	Raw Mode Shares (100% within each category)	Weighted Share of All MSA Workers
Remote	Commute only	63.0%	18.20%
	full time home	13.0%	3.8%
	1-2 days	10.0%	2.89%
	3-4 days	14.0%	4.04%
Mixed	Commute only	65.8%	14.2%
	full time home	12.0%	2.6%
	1-2 days	9.2%	2.0%
	3-4 days	12.9%	2.8%
On-Site	Commute only	79.5%	39.4%
	full time home	7.2%	3.6%
	1-2 days	5.5%	2.7%
	3-4 days	7.8%	3.8%

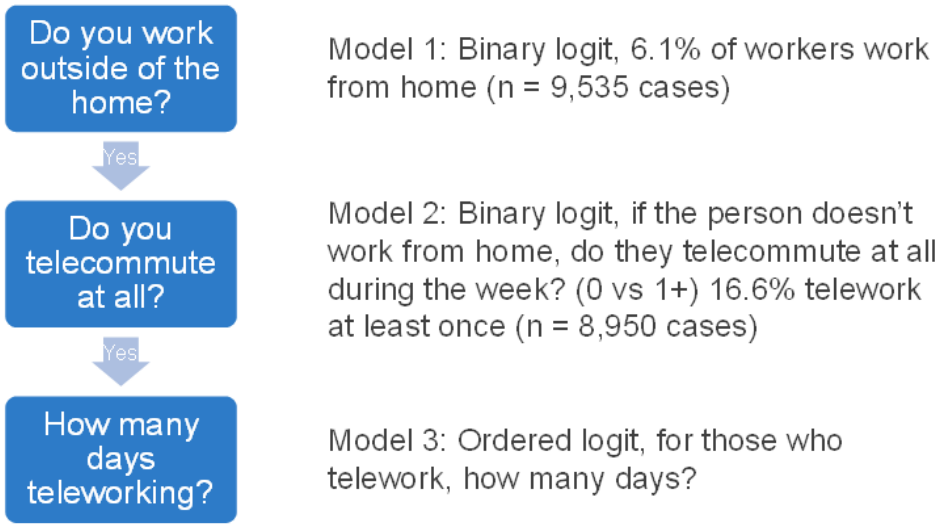
Source: RSG

Modeling teleworking travel behavior

The VisionEval strategic travel model was enhanced as part of the on-going Massachusetts Teleworking Study to account for teleworking rates among the workers in the model. The VisionEval model estimates the average daily travel behavior for households with a specific sub-routine focused on employed members of the household. Important explanatory variables that affect teleworking rates and frequency include: occupation, commute distance, nearby land use, income, vehicle availability, age, and household composition (life cycle).

RSG used a robust multi-year rMove sample from a household travel survey to estimate the relationship between occupation, teleworking category, and average daily travel that Ohio DOT made available for this research purpose. The data informed a new Teleworking Module within the VisionEval models. The teleworking module includes three core models as shown in Figure 5.

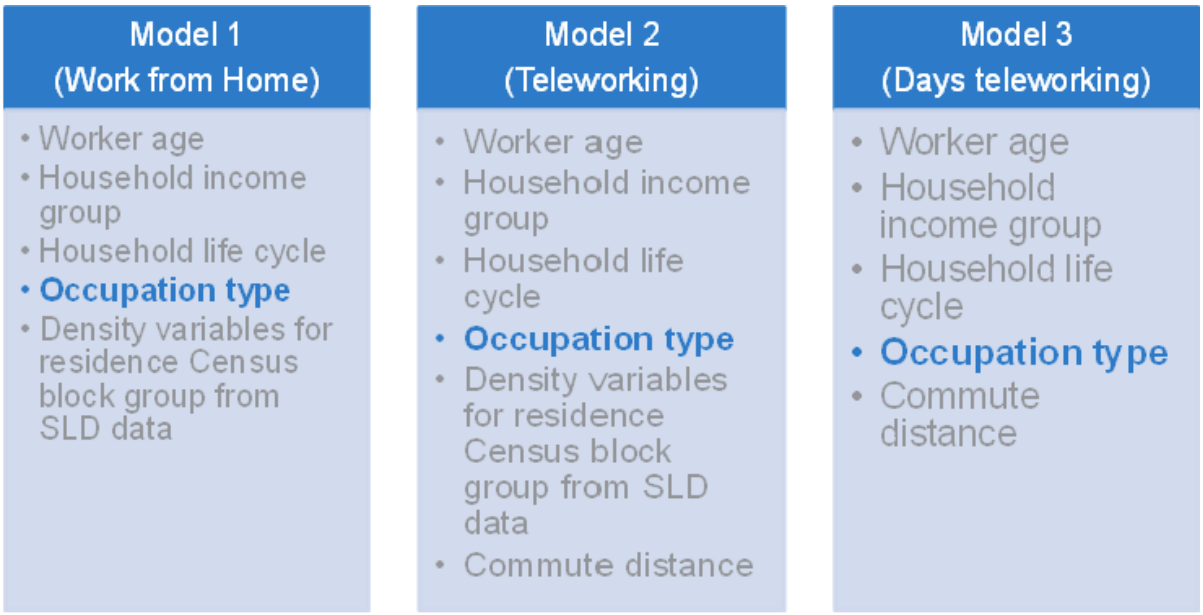
Figure 5: Teleworking model sequence



Source: RSG

Each of the three models uses a similar set of explanatory variables as shown below. The Occupation Type is the new assertion that needs to be added to the VisionEval model through a new model input.

Figure 6: Teleworking model components



Source: RSG

The models are included in the VisionEval Teleworking Module structure using an input file that estimates the percentage of workers within each of the three teleworking categories by the location type in the VisionEval model.

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EXHIBIT A: SUPPLEMENTAL CLIMATE ANALYSIS FINDINGS AND RECOMMENDATIONS

Summary

This document summarizes policy and technical background about the required, state-defined vehicle and fuel assumptions used in the 2023 Regional Transportation Plan (RTP) climate analysis and reports the findings of a supplemental climate analysis conducted about these assumptions. **This information is intended to provide a more detailed understanding of why certain vehicle and fuel assumptions were used in the RTP climate analysis and how changes to these assumptions impact the progress toward the region's greenhouse gas emissions reduction targets** set in OAR 660-044 (Metropolitan Greenhouse Gas Reduction Targets Rule). This document provides a basis for recommendations to the State of Oregon about updating statewide technical assumptions used in setting greenhouse gas reduction targets for each of Oregon's metropolitan areas.

Purpose and background

The Climate Friendly and Equitable Communities (CFEC) update to the Transportation Planning Rule OAR 660-012-0160(6) requires Metro to adopt a regional transportation plan in which the projected vehicle miles traveled per capita of the financially constrained project list is consistent with the region's metropolitan greenhouse gas (GHG) reduction target. The climate analysis prepared by Metro for the 2023 RTP indicates that using the RTP financially constrained project list investments and Statewide Transportation Strategy (STS) levels for state-led pricing, fleet and technology policies will achieve a vehicle miles traveled per capita reduction that surpasses the metropolitan GHG target. The RTP target for 2045 is a 30 percent reduction (below 2005 levels) in vehicle miles traveled per capita.

When measuring progress on the region's greenhouse gas emissions reduction targets through each update to the RTP, Metro is directed to use certain assumptions and must use emissions rates that reflect future state-led STS actions that were assumed when the targets were first adopted by the Land Conservation and Development Commission (LCDC) in 2011 and updated in 2017. [19] These assumptions include state-led pricing and

[19] As required, the RTP climate analysis followed the analysis methodology provided by state agencies in the Scenario Planning Guidelines Technical Appendix Target Rules Methodology. The guidelines and analysis methodology are available at: https://www.oregon.gov/odot/Planning/Documents/Oregon-Scenario-Planning-Guidelines-Tech-Appendix.pdf

energy policies and are in addition to state-led actions on vehicle and fuel technology advancements, including vehicle mix, vehicle fuel efficiency, fuel mix, and fuel carbon intensity. As defined in OAR 660-044-0030(3), projections of greenhouse gas emissions must use emission rates based on the STS as adopted by the Oregon Transportation Commission (OTC) that reflect the reductions likely to result by the use of improved vehicle technologies and fuels. Metropolitan area greenhouse gas target modeling efforts must rely on emission rates agreed to by the Oregon Department of Transportation (ODOT) and the Department of Land Conservation and Development (DLCD) to ensure this compliance. Using these assumptions for state-led actions allows the evaluation of meeting the metropolitan GHG target to focus on the actions to reduce vehicle mile traveled (VMT) that are within local and regional authority, in combination with the supportive actions within federal and state authority and that were assumed when the targets were first adopted by LCDC.

Adopted by the OTC in 2018, the STS is Oregon's roadmap to reduce emissions from the transportation sector and achieve the state's GHG reduction goal and metropolitan GHG reduction targets. The STS was cooperatively developed by state agencies, and state agencies work in partnership to implement the STS. When LCDC adopted original metropolitan GHG targets in 2011, the STS was still being developed by ODOT requiring the original targets to be set independent of the final STS. During the 2017 Metropolitan Target Rule update, LCDC reviewed and updated the metropolitan GHG reduction targets based on the future vehicle fleet, fuel, and technology assumptions set forth in the adopted STS (built in collaboration with the Departments of Energy and Environmental Quality), as well as other state-led actions adopted in the STS. These actions include state-led pricing programs such as pay-as you-drive insurance, mileage based road user fees to replace the gas tax (e.g. vehicle miles traveled fees), social cost recovery pricing (e.g., carbon tax), and congestion pricing in the Portland area. Even though the state, which has the authority to implement these actions, had made limited progress on these actions, the updated targets were set at a level that assumed that some combination of these forms of pricing would be implemented in Oregon by 2050. The RTP climate analysis assumed the levels of pricing assumed by the state agencies when setting the region's targets. **At that time, state agencies acknowledged that significant changes to the fleet, fuel, and technology assumptions, such as significant vehicle advances or repealing of existing vehicle or fuel emission reduction programs, could prompt review of the Metropolitan GHG Reduction Targets Rule. In addition, the Targets Rule directs LCDC to review the targets and assumptions upon which they are based every four years; the next review is due by June 1, 2025.**[20]

[20] The process for this review is described in OAR 660-044-0035.

Clean vehicle and fuel assumptions in the RTP climate analysis

Reviewing STS vehicle and fuel assumptions

Greenhouse gas emissions from transportation are primarily driven by three factors: the GHG content of fuels, vehicle fuel efficiency, and the amount of vehicle miles traveled (VMT) by drivers and freight haulers. The fuel efficiency of a vehicle, commonly measured in how many miles it can travel per gallon of fuel used, is largely driven by vehicle technology, but can also be affected by congestion and driving efficiency. **Plans to meet Oregon's climate goals must account for the relationships between these factors.** As vehicles and fuels become cleaner, vehicles emit fewer GHGs per mile, and therefore reducing VMT and creating conditions where vehicles can operate more efficiently become less effective GHG reduction strategies. The reverse is also true; VMT reductions and efficient travel will need to account for a larger share of GHG reductions in Oregon if vehicles and fuels do not turn out to be as clean as projected.

In order to ensure coordination between the State of Oregon, which plays a primary role for making fuels and vehicles cleaner, and Metro and its partners, which play a primary role for reducing per capita passenger vehicle VMT in the Portland region (except in the case of pricing actions where the state has implementation authority), **both the regional climate targets to reduce VMT per capita and the RTP's analysis of progress toward these targets are required to use the same underlying set of inputs about vehicles and fuels as were used when the region's targets were adopted by LCDC in 2017.** Specifically, the Metropolitan GHG Reduction Targets Rule specifies an emissions rate (in grams of CO_2 equivalent emitted per mile of travel) for each year that must be used in regional climate analysis, and this rate is based on underlying assumptions about vehicle mix, turnover rates and other assumptions. [21]

Three key inputs used in determining the emissions rate include:

- **Sales by powertrain type**, which estimates the share of new vehicle sales that are gas powered vehicles versus electric vehicles (EVs) for both cars and trucks. The proportion of vehicle types, along with underlying projections about the efficiency of different types of powertrains, defines how efficient the new vehicles that are for sale each year will be.

[21] The GHG emissions rates (grams per mile) are the vehicle emissions projected to result from the use of improved vehicle technologies and fuels for each year through 2050. The emissions rates are reflected in the model assumptions about mix of vehicles sold each year and rates of vehicle turnover specified for the target rules analysis. When the model is run, households are assigned vehicles of a certain age, and the attributes of those vehicles determine emissions, fuel consumption, and household travel cost.

- **Household vehicle mix**, which estimates the share of household vehicles that are cars versus trucks and sport utility vehicles (SUVs). This input helps to estimate the fleet efficiency of the new vehicles that consumers purchase each year. There are fewer EV models available for trucks and SUVs than for cars, and the truck/SUV EV models that are available tend to be less energy efficient (e.g., more kilowatt-hours per mile). Buyers who have a strong preference for trucks and SUVs are less likely to purchase the most efficient vehicles that are available.
- **Average vehicle age**, which estimates the number of years that the average consumer retains a vehicle after purchasing it. This variable influences the length of time it takes for newer, cleaner vehicles to enter the fleet and begin reducing GHG emissions.

These assumptions combine within VisionEval to influence the average fuel efficiency of vehicles in the transportation system, the average GHG emissions rate, and other assumptions used in the RTP climate analysis. Table 3 above contains a complete summary of these assumptions.[22]

Table 12 summarizes the values used in the RTP climate analysis for the three assumptions listed above. For each assumption, the table includes the values assumed by the STS adopted in 2018, which is the source of the assumptions used in the climate analysis, for both 2020 and 2045. It compares these values to current observed values and recent trends and summarizes policies and programs that could influence current trends to conform more closely to the projections contained in the STS.

[22] VisionEval include separate assumptions for passenger and commercial vehicles. This section focuses on passenger vehicles, which are the focus of the RTP climate analysis and also contribute a higher share of the region's GHG emissions.

Table 12: Key fuel- and vehicle- related assumptions in the RTP climate analysis

Input	2020 STS assumption	2045 STS assumption	Current observed values[23]	Notes on recent trends	Policies and programs that could influence trends
Sales by powertrain type[24]	Cars: 59% gas, 41% EV Trucks: 69% gas, 31% EV	Cars: 1% gas, 99% EV Trucks: 11% gas, 89% EV	All U.S. vehicles (2021): 93% gas, 7% EV[25] OR vehicles (2022): 89% gas, 11% EV[26]	The market share of electric vehicles has been climbing rapidly. EVs' share of sales grew from 3% to 12% between 2011 and 2021.[25] Analysts expect this growth to continue such that EVs could account for 40-50% of new U.S. vehicle sales in 2030.[27] This falls short of the projections in the STS, which estimate EV market shares of 86% for cars and 67% for trucks in 2030.	The Advanced Clean Cars II rules require that all light vehicles sold in Oregon be EVs by 2035 with some credit allowances. Other state and federal programs to accelerate EV adoption include rebates and tax credits for EV buyers, and funding and deployment for EV chargers. The state projects that these policies and programs put Oregon on track to meet its target that of at least 90 percent EV market share by 2035.[28]

[23] Based on research conducted by Metro staff and consultants. Data may not always align with the definitions or the 2020 base year used in the STS and RTP climate analysis and may reflect post-2020 trends and changes that are not accounted for in the 2020 base year projections. The goal of this exercise is to highlight base year assumptions that may be in need of updating prior to the next RTP update (due in 2028) – not to recommend revisions to the current base year assumptions.

[24] The term "EV" (electric vehicle) as used here includes hybrid electric vehicles (HEVs), plug-in hybrid electric vehicle (PHEVs), battery electric vehicle (BEVs) unless otherwise noted. Though these vehicles emit GHGs at different rates (i.e., BEVs and PHEVs tend to be much cleaner than HEVs because they are capable of traveling long ranges in electric mode), the available data does not always distinguish between these 3 different powertrains. This table uses a general definition of EVs in order to compare data from different sources.

[25] https://www.bts.gov/content/gasoline-hybrid-and-electric-vehicle-sales and https://www.bts.gov/content/new-and-used-passenger-car-sales-and-leases-thousands-vehicles.

[26] https://www.autosinnovate.org/resources/insights/or. The selected data source combines gas-powered vehicles with HEVs, which is inconsistent with how other sources reviewed present this data. Other data sources place the percentage of EV sales in Oregon at 16% in 2023 (https://www.oregon.gov/energy/energy-oregon/Pages/BIZEV.aspx). Though the data vary, it is clear that PHEVs and BEVs account for a much higher share of new sales in Oregon than nationally.

[27] https://www.bls.gov/opub/btn/volume-12/charging-into-the-future-the-transition-to-electric-vehicles.htm

[28] https://www.oregon.gov/energy/energy-oregon/Pages/BIZEV.aspx

Input	2020 STS assumption	2045 STS assumption	Current observed values[23]	Notes on recent trends	Policies and programs that could influence trends
Household vehicle mix	58% car, 42% SUV / truck	72% car, 28% SUV / truck	As of 2022 Oregon's passenger fleet is 32% car, 68% SUV / truck.[29]	More and more people are picking SUVs or trucks over cars. Prior to 1983, trucks and SUVs made up less than 25% of new passenger vehicle sales in the U.S.; by 2023 that figure increased to 80%.[30]	As the state's monitoring shows,[31] Oregon is on track to meet the STS goal to "clean up every mile," because the faster-than-expected roll-out of EVs compensates for the slower-than-expected uptake of EVs and older, larger vehicles remaining in use. In the future, DMV registration fees could be set to incentivize smaller vehicles.
Average vehicle age	7.7 years	6.3 years	As of 2022, the average lifetime of passenger vehicles in Oregon is 14.2 years.[26]	People are keeping their vehicles longer that previously assumed. The average age of U.S. passenger vehicles increased from under 9 years in 2000 to over 12 years in 2022,[32] and Oregon drivers tend to keep their vehicles longer than average.[26]	As noted above, the state expects the faster-than-expected roll-out of EVs to compensate for the slower-than-expected uptake of EVs and older, larger vehicles remaining in use. In the future, increased use of car and ride sharing services could shift miles to newer vehicles that are more fuel efficient. New "cash-for-clunkers" programs incentivize drivers to trade in older vehicles that pollute more.

[29] https://www.autosinnovate.org/resources/insights/or

[30] https://fredblog.stlouisfed.org/2021/03/long-term-trends-in-car-and-light-truck-sales/

[31] The Oregon Transportation Emissions website monitors the state's progress on the Statewide Transportation Strategy, including "Emissions per Vehicle mile" on the Progress page, and further actions by category. https://www.oregontransportationemissions.com/progress

[32] https://www.bts.gov/content/average-age-automobiles-and-trucks-operation-united-states

All three of the 2020 STS assumptions shown in Table 12 are out of step with current observed values. The 2045 values are also out of step with current trends, though in different ways. **Both the STS and other data sources estimate that EVs are going to account for a significantly larger share of vehicle sales in the future – they just differ on the anticipated increase – whereas the STS assumptions that people will increasingly favor cars over trucks and keep their vehicles for less time directly contradict current trends.** Furthermore, there are a number of state policies and programs designed to increase the number of electric vehicles for sale, including a robust requirement that all vehicles sold in Oregon be zero-emission vehicles by 2035, whereas the state is not currently implementing any policies and programs designed to increase the popularity of cars over trucks and SUVs or to incentivize people to shorten the time that they keep their vehicles – though the state has identified potential trends and actions to address these issues, as noted in Table 12.

This raises questions about whether the RTP climate analysis is overly optimistic because the STS assumptions differ from observed data in a way that increases projected GHG emissions reductions due to clean vehicles and fuels. These assumptions are used both in setting regional VMT per capita reduction targets (which are based on the total VMT reductions that the state estimates are necessary to meet Oregon's climate goals after accounting for GHG reductions due to clean vehicles and fuels) and in the RTP climate analysis to ensure that the analysis is comparable to the targets. **If the assumptions discussed above remain off-track, a review of the state's assumptions and process for defining regional climate targets and measuring progress is warranted.** This would require significant coordination between Metro and the state and may result in revisions to the region's climate targets that would inform future RTP climate analyses. This could include adjusting the level of regional targets or changing the metrics that are used to define those targets. The Transportation Planning Rules and Metropolitan Greenhouse Gas Reduction Target Rules (as amended by LCDC in August 2022 during the CFEC rulemaking process) define regional targets in terms of reductions in VMT per capita. This means that changes to vehicle fuels and technology that affect the average GHG emissions rate, such as those discussed in Table 12, do not directly affect the region's progress toward its climate targets. These changes do have an impact on total GHG reduction and GHG emissions rates, and these factors are documented in Exhibit A and RTP Appendix J for the purpose of ensuring that the climate analysis is using required assumptions from the STS correctly, but any action to make fuels and vehicles cleaner – or lack of progress in meeting the STS assumptions – does not bear on the region's VMT per capita targets.

2023 RTP + STS + Current Fleet scenario analysis

As an interim step, Metro staff and consultants examined how it would impact the results of the RTP climate analysis if the analysis holds vehicle mix and vehicle age constant at today's levels instead of using the assumptions provided by the STS. These are the two STS assumptions shown in Table 12 that appear most at risk of remaining off track given current data and the lack of supportive policies and programs. As discussed above, changing these assumptions will not have a significant effect on VMT per capita, which is the key metric used in the RTP climate analysis, because the age of people's vehicles and whether those vehicles are cars or trucks generally does not have a strong influence on how much people drive. However, these changes will have a change on the carbon intensity of driving (which is measured in grams of GHG emissions per mile driven) and the overall GHG results in the RTP analysis. These results can be used in future RTP climate analyses to calculate the additional VMT reductions that would be necessary to compensate for the increase in GHG emissions due to assuming that vehicles will be older and heavier than projected in the STS.

Table 13 compares the assumptions and results of this new 2023 RTP + STS + Current Fleet scenario to the other scenarios used in the RTP climate analysis.

Table 13: Summary of climate scenarios and assumptions used in the 2023 RTP update

	RTP23 + STS	RTP23 + AP	Target 1 (pricing)	Target 2 (pricing + transit)	RTP23 + STS + Current Fleet
Scenario Description	Official RTP climate scenario for the purposes of target analysis / state rule compliance	Illustrative bounding scenario showing the GHG impacts of "business as usual" defined by the state; assumptions about clean vehicles and pricing are based on adopted plans	Illustrative pathway to meeting climate targets by assuming the minimum level of state-led pricing needed to close the gap between RTP23 GHG reductions and targets	Illustrative pathway to meeting climate targets by assuming the minimum level of state-led pricing needed to close the gap between RTP23 GHG reductions and targets if revenues are used to expand transit service	Illustrative bounding scenario that explores the GHG impacts of using current values instead of STS values for vehicle age and mix
Throughway pricing	STS pricing on the entire throughway network, averaging $0.17/mile	RTP pricing on portions of I-5 and I-205 averaging $0.11/mile	$0.11/mile on the entire throughway network	$0.08/mile on the entire throughway network	STS pricing on the entire throughway network, averaging $0.17/mile
Other STS per-mile fees	$0.20/mile	None	$0.12/mile	$0.10/mile	$0.20/mile
Pay-as-you drive (PAYD) insurance[33]	State requires PAYD insurance with 40% participation[34]	State leaves PAYD insurance to the market with 6% participation	State requires PAYD insurance with ~68% participation	State requires PAYD insurance with ~27% participation	State requires PAYD insurance with 100% participation
Transit service	RTP level of transit service	RTP level of transit service	RTP level of transit service	77% increase above RTP level of transit service	RTP level of transit service
Clean fuels and vehicles	STS assumptions	State AP (adopted plans) assumptions	STS assumptions	STS assumptions	STS assumptions except current fleet vehicle age and mix (32% car / 68% SUVs and light-duty trucks)

[33] Per guidance from ODOT, Pay-as-you-drive insurance is assumed to effectively create an additional per-mile fee on driving that is equivalent to $0.08/mi in 2020 and increases to $0.22 in 2045.

[34] The original Climate Smart Strategy was adopted in 2014 when pay-as-you-drive insurance was growing more popular and assumed 40% market-driven adoption of PAYD. Since then, insurers have scaled back their PAYD offerings and fewer consumers are using them, which makes it seem unlikely that the market will provide a path to 40% adoption. However, the state has the power to regulate auto insurance sold in Oregon, and for the 2023 RTP update Metro assumed that the state would implement PAYD by requiring Oregon drivers to use it. Though it would be feasible to apply such a requirement to 100% of Oregon drivers and would also support progress toward meeting Oregon's climate goals, Metro assumed 40% adoption of PAYD for consistency with the original Climate Smart Strategy adopted in 2014, which is the basis for the required progress reporting under the RTP climate analysis.

	RTP23 + STS	RTP23 + AP	Target 1 (pricing)	Target 2 (pricing + transit)	RTP23 + STS + Current Fleet
GHG/capita reductions (from 2005 levels)	89%	70%	85-89%[35]	85-89%[35]	87%
VMT/capita reductions (from. 2005 levels)	35%	25%	30%	30%	40%
Meets targets?	Yes (surpasses)	No	Yes (meets)	Yes (meets)	Yes (surpasses)

[35] The Target 1 and Target 2 scenarios were developed as informational scenarios during the RTP process to identify the minimum level of pricing and additional transit revenues needed to meet regional climate targets. These scenarios did not undergo the same level of detailed development and analysis as the other scenarios, which prevented Metro from forecasting precise 2045 GHG results for these scenarios that are comparable to the other results shown in this table. Metro estimated a range of potential GHG reductions for these scenarios based on the RTP23 + STS + Current Fleet scenario. The two Target scenarios contain less pricing than the Current Fleet scenario and significantly cleaner vehicles, such that GHG emissions under these scenarios would likely be within +/-2% of those under the Current Fleet scenario.

Findings of the supplemental climate analysis

Holding vehicle mix and age constant in the RTP23 + STS + Current Fleet scenario has a mixed impact on progress toward Oregon's GHG reduction goals and the region's targets. On one hand, this scenario produces fewer overall GHG reductions than the two Target scenarios because it assumes that the vehicle fleet will be significantly less efficient. On the other hand, the RTP23 + STS + Current Fleet scenario produces larger reductions in VMT per capita than the Target scenarios because VisionEval (which is the model used to quantify progress toward regional climate targets) assumes that less efficient cars are more expensive to operate and maintain, and therefore that **people drive slightly less if their car is less efficient and more costly to operate.** In other words, **this scenario actually supports progress toward regional climate targets, because those targets are defined only with respect to VMT per capita** (as per 2020 CFEC DLCD Rule updates), even though it increases overall per capita GHG emissions.

Based on these results, Metro estimates that **the region would need to achieve an additional 11% reduction in VMT per capita on top of the 39% reduction that is forecasted to occur under the RTP 23 + STS + Current Fleet scenario** (i.e., the region would need to achieve a total 50% reduction in VMT per capita) **to compensate for the older, less efficient vehicles assumed therein and maintain per capita GHG reductions that are consistent with state targets.** However, the process set by the State for monitoring progress toward regional climate targets does not allow for more detailed examination of the potential need to increase VMT per capita reductions to compensate for slower-than-anticipated progress in greening the vehicle fleet. This is because the process makes the State responsible for setting vehicle- and fuel-related assumptions and the region responsible for achieving VMT per capita reductions. **This division of roles between the region and state does not currently allow for a collaborative analysis of the relationships between vehicle technology and VMT per capita, and even if it did, the State has not documented its vehicle- and fuel-related assumptions in sufficient detail to support such an analysis.**

Recommended updates to future climate analysis assumptions and process

The results above reveal three important findings:

1. If State assumptions regarding clean vehicles and fuels turn out to be unrealistic, additional state, regional and local actions will be needed to further reduce VMT per capita to close the gap to achieve the Oregon's GHG reduction goals.

2. Under the current target monitoring process, dialing back State-level assumptions regarding clean vehicles and fuels supports progress toward regional climate targets because it makes driving more expensive, reducing how much people drive.
3. The current target monitoring process and the available information on State assumptions does not allow for a detailed analysis of the trade-offs between VMT per capita reductions and progress toward greening the vehicle fleet.

Though the analysis above only focuses on two of the many assumptions that are provided by the State for the RTP climate analysis, it raises broader questions about whether the changes to the assumptions discussed above need to be reflected in setting regional climate targets in the Metropolitan GHG Reduction Targets Rule as well as in future RTP climate analyses. Significant updates to the process for setting and evaluating progress toward regional climate targets would be needed to address these issues and are recommended to be addressed by the State in advance of the next update to the RTP (due in 2028).

Metro encourages the State to:

- Conduct a detailed, comprehensive review of the STS assumptions used to set the metropolitan GHG reduction targets as part of the next STS Implementation Monitoring Report, as described in OAR 660-044-0035.[36] The most recent STS Monitoring Report, completed in 2023,[37] reports back on general progress on categories of actions like improving passenger vehicle technology – it does not examine whether specific individual assumptions used in the STS are consistent with current trends and policy changes, as Table 12 does. This level of detail is necessary to ensure the validity of the assumptions and targets used in the RTP climate analysis. Metro encourages the State to make this a transparent process and to collect robust public and policymaker feedback on underlying assumptions so that it does not fall to Metro and other agencies to communicate the State's assumptions as part their climate analysis and monitoring. This review should also identify actions needed to achieve STS assumptions that are not on track.
- Update the Statewide Transportation Strategy, as needed, if the implementation monitoring report reveals that assumptions are significantly off-track, and subsequently update the Metropolitan Target Rule using updated STS assumptions. This process would need to be completed by 2026 to inform the climate analysis that will be conducted as part of the next RTP update (due in 2028).

[36] The next Commission review of the targets is due by June 1, 2025 per OAR 660-044-0035.
[37] https://www.oregontransportationemissions.com/

EXHIBIT B: ODOT MEMO ON STATEWIDE TRANSPORTATION STRATEGY STATE-LED PRICING ACTIONS FOR METRO RTP ANALYSIS

Oregon
Tina Kotek, Governor

Department of Transportation
Policy, Data and Analysis Division
Climate Office
555 13th Street NE
Salem, Oregon, 97301

To: Kim Ellis, RTP Project Manager
Eliot Rose, Senior Transportation Planner

From: ODOT Climate Office
Suzanne Carlson, Climate Office Director

Date: June 29, 2023

Subject: Statewide Transportation Strategy State-Led Pricing Actions for Metro RTP Analysis

This memo describes the state-led pricing actions that Metro is allowed to assume for analysis to demonstrate Regional Transportation Plan compliance with the metropolitan greenhouse gas reduction targets (OAR 660-044 or target rules). The Climate Friendly and Equitable Communities updates to the Transportation Planning Rules OAR 660-012-0160 (6) requires Metro to adopt a regional transportation plan in which the projected vehicle miles traveled per capita of the financially-constrained project list is consistent with the region's metropolitan greenhouse gas (GHG) reduction target.

Metro is allowed to utilize assumptions on future state actions that affect auto operating costs, including state-led pricing and energy policies. These are in addition to state-led actions on vehicle and fuel technology advancements, including vehicle mix, vehicle fuel efficiency, fuel mix, and fuel carbon intensity. Utilizing these assumptions for state-led actions allows the metropolitan GHG target to focus on the actions to reduce vehicle mile traveled (VMT) that are within local authority, in conjunction with the supportive actions within federal and state authority.

The target rules assumptions for state-led pricing actions are developed based on the Statewide Transportation Strategy using the ODOT VisionEval tool. The VisionEval tool is used to measure progress towards achieving the state GHG reduction goal and metropolitan GHG reduction targets set in OAR 660-044-0020 and 660-044-0025. The Statewide Transportation Strategy (STS) is Oregon's roadmap to reduce emissions from the transportation sector and achieve the state's GHG reduction goal and metropolitan GHG reduction targets. The STS was cooperatively developed by state agencies and adopted by the Oregon Transportation Commissions, and state agencies work in partnership to implement the STS. The STS includes strategies and trajectories related to congestion pricing, road coast recovery gas tax equivalent fees, pay as you drive insurance, and carbon pricing.

Initial analysis presented by Metro indicate that using STS levels for state-led pricing policies will achieve a vehicle miles traveled per capita reduction that exceeds the metropolitan GHG target. ODOT recommends that Metro utilize STS level assumptions for state-led pricing actions for analysis towards achieving the GHG target.

Congestion Pricing

Congestion pricing is a type of road pricing that reduces traffic congestion by shifting some trips to non-driving means, alternative destinations, or to other times of day. Congestion pricing works best on heavily congested roads. It uses tolls that vary in cost depending on the time of day. Toll prices are higher at peak driving times (like rush hour) and lower at less busy driving times (like late at night.) This

encourages drivers to use the road during less-congested periods — or travel by non-driving means — and allows traffic to flow more freely during peak times.

ODOT is developing a congestion pricing program for the Portland region along Interstate 5 and I-205, based on direction from the Oregon Legislature. The Oregon Transportation Commission sets both flat rate and congestion pricing fees.

Congestion pricing will have several benefits for Oregonians:

- Less traffic during peak rush hour times, leading to more reliable travel times.
- More people choosing non-driving ways to get around, which leads to less greenhouse gas emissions.
- A tool to address latent demand and induced demand.
- More reliable and efficient goods movement.

Road Cost Recovery

Road cost recovery prices are gas-tax-equivalent fees including taxes, per mile fees, registration fees, and other additional fees that pay for the wear and tear on roadways. Oregon has to date relied on a fuel tax at the gas pump to pay for the costs of the transportation system. Vehicle registration fees also help cover road maintenance costs. However, as people buy more electric, or fuel-efficient vehicles it results in less revenue from the fuel tax. Which means less funding to maintain roadways, and to help recover the external social-environmental costs of the transportation system. These types of fees can also be set to help recover the social-environmental costs of driving, such as vehicle registration fees that provide incentives for drivers to choose lower-emission modes of travel. The social-environmental cost of driving can include higher health care costs for individuals and a lower quality of life for communities. In some disadvantaged communities, the cost is higher, relative to other communities. State agencies can help reduce the harm and frequency through pricing programs that encourage travel with lower social costs. This approach is called “user pays true cost” and ensures that activities that create pollution or result in negative impacts have more transparent costs because of these impacts.

Shifting to “road use charging,” which is a system that asks drivers to pay for the miles they drive, not the fuel they use. ODOT has a voluntary road use charging program in place since 2015 for cars, trucks and SUVs called the OReGO program. It ensures all vehicles pay their fair share for using Oregon’s roads, including electric vehicle drivers. People who drive farther or more often will pay more. People who drive shorter distances or less often will pay less. ODOT has good data on how to scale the program to the entire state, leveraging the technology available in newer model vehicles, and is working with the legislature to make the program mandatory for certain vehicles.

In 2017 the legislature increased gas taxes and vehicle registration fees to cover the drop in road funding as Oregon shifts to electric vehicles and vehicles that are more efficient. Current registration fees are based on vehicle fuel efficiency.

Pay as You Drive Insurance (PAYD)

To complement the shift to mileage-based fees, other existing transportation related costs can be shifted to a per-mile basis. Pay as you drive insurance programs charge insured drivers based on the miles they drive.

Pay as you drive insurance programs charge insured drivers based on the miles they drive, instead of paying an annual insurance premium. If you drive less, your rates are lower, which encourages people to drive less to save money. Which in turn translates into less greenhouse gas emissions and less time on the road, reducing the chance of crashes and injuries.

Pay as you drive insurance programs aren't solely based on miles driven — they also factor in variables like age, location, etc. to calculate rates — and for people who are able to drive less often, they can save insurance costs.

Today, about 1% of insured drivers statewide are enrolled in pay as you drive programs. Future steps to reach increase participation include public education about these programs and Oregon state government working with insurance companies to increase adoption through tax incentives, and legislative mandates. Enrollment in PAYD insurance can be combined with road use charging via a "mobility marketplace" to enhance the user experience and increase adoption.

Carbon Pricing

Regulations can influence fuel prices based on how much greenhouse gas emissions those fuels emit. Governments can apply carbon pricing through regulations in different ways. In Oregon, the Department of Environmental Quality runs the Climate Protection Program (adopted in 2021), which sets decreasing limits from fossil fuels used in the state and generates revenue through issuing credits on those emissions. Oregon DEQ also runs the Clean Fuels Program (adopted in 2016 and extended in 2022), which sets decreasing limits for lifecycle emissions from transportation fuels use statewide. The program has a marketplace for high-emission fuel providers to buy credits from low-emission fuel providers. This lowers the cost of low-emission fuel options.

Both programs incentivize replacing higher-emission fossil fuels with lower-emission fuels like biofuels, renewable natural gas, and electricity. These market-based regulations have varying impacts on fuel prices, which also encourages less driving. Fuel price impacts of the Clean Fuels program is estimated and tracked by the DEQ (see Clean Fuels Program).

Additionally, funding generated from the Climate Protection Program can potentially be reinvested in travel options that produce less greenhouse gas emissions — like public transit, biking, and walking. While the STS assumed funding from carbon pricing would generate dedicated transportation funding to support multi-modal investments, the Climate Protection Program covers all sectors.

EXHIBIT C: ODOT OREGON TRANSPORTATION EMISSIONS WEBSITE ANALYSIS FACTSHEET, APRIL 2023

OREGON TRANSPORTATION EMISSIONS Website
Analysis Factsheet, April 2023

The Model: VisionEval

Oregon Department of Transportation (ODOT) uses a tool called VisionEval to forecast Oregon greenhouse gas emissions from transportation. VisionEval is a long-range strategic planning tool that forecasts how community development and transportation investment choices could influence planning goals, land use goals, and other community livability outcomes. You can learn more about the VisionEval tool, including national awards (ODOT Tools webpage), and how it is used in Oregon (VisionEval factsheet) with these links.

The Process

ODOT leads the VisionEval forecast process and relies on expert review and inputs from partner agencies at the local and state level to produce the best forecasts given future uncertainties.

- Vehicle and fuel assumptions are coordinated with Oregon Departments of Environmental Quality (DEQ) and Energy (DOE), with historic data pulled from Department of Motor Vehicle (DMV) registration data.
- Local policy inputs are coordinated with metropolitan areas, e.g., adopted plans, surveys, travel models.
- Official state and national sources are used for population forecasts and fuel prices.
- VisionEval model functionality is maintained as part of an FHWA-hosted pooled fund partnership.
- Historic years are validated to ODOT statewide miles travelled (HPMS) and fuel sales (Highway Statistics).
- 2015 is the last historic year reported, given the complications of pandemic conditions in 2020.

Two Scenarios

ODOT maintains two scenarios in the VisionEval model, which make assumptions about policies and investments within Oregon's eight largest metropolitan planning areas (MPOs) and statewide.

1. **STS Vision** – The preferred set of policies from a two-year stakeholder process to meet statewide GHG reduction goals, published in the 2012 Statewide Transportation Strategy (STS).
2. **Plans & Trends** – The current set of policies reflected in adopted plans and market trends.

Assumptions for the STS Vision scenario are reflected in Appendix 5 of the Statewide Transportation Strategy. The Plans & Trends scenario values are updated over time; 2022 assumptions are noted below. The focus of updates since the 2018 STS Monitoring report were the Vehicle Technology and Fuel Technology action assumptions.

2022 Plans & Trends Assumptions

Actions: Vehicle Technology and Fuel Technology.

- **Vehicle powertrain mix** reflects Oregon's 2021-22 new laws, as shown in **Figs. 1-3**:
  - Advanced Clean Cars II rule (Dec 2022). Requires an increasing percentage of cars, light trucks, and SUVs sold in Oregon to have zero tailpipe emissions, starting at 35% in model year 2026 rising to 100% by 2035.
  - Advanced Clean Trucks rule (Nov 2021). Requires an increasing percentage of truck sales in Oregon to have zero tailpipe emissions by model year 2035 – 55% of new Class 2b–3 (pickup trucks and vans); 75% of new Class 4-8 (rigid trucks); and 40% of new Class 7-8 (tractor trucks).

  Oregon DMV vehicle registration data are used for historic years' powertrain mix (combustion, gas-hybrid, plug-in electric, battery-electric). Forecasts and historic truck data used 2021 DEQ rulemaking Illustrative Compliance Scenarios assumptions (Scenario 1a) in the Argonne National Lab's VISION model. ODOT made adjustments to accelerate statewide light vehicle sales to 100% ZEV vehicles from 2035 (ACCII), dampened adoption to account for credit trading allowed in the regulations (through 2030), dampening adoption given that some state vehicle miles travelled use vehicles purchased out of state.

- **Vehicle fuel efficiency (MPG)** comes from Oregon DMV vehicle registration data for historic years. Federal Corporate Average Fuel Economy (CAFÉ) standards from VISION model assumptions (Scenario "All") from the 2021 DEQ rulemaking Illustrative Compliance Scenarios. See **Fig. 4** for passenger vehicles.
- **Fuel Technology** assumptions reflect Oregon's 2021-22 new laws, as shown in **Figs. 5-6**:
  - Clean Fuels Program Expansion (Sept 2022). Requires Oregon fuel providers to almost triple the carbon intensity reductions required through 2035. These changes will continue to drive the transition to lower carbon renewable and alternative fuels, an almost 50% reduction in tailpipe GHG emissions.
  - Clean Energy Targets (HB2021). Requires reduced electricity emissions for the two largest Oregon electricity utilities, meaning nearly all electricity used in Oregon will be emissions-free by 2040.

  Oregon DEQ Clean Fuels reporting is used for historic years' carbon intensity, reflecting transportation fuels sold and electricity used statewide. Forecasts use VISION model assumptions (Scenario "All") from the 2021 DEQ rulemaking Illustrative Compliance Scenarios. DEQ combined the forecast fuel quantities by type and vehicle group through 2035 by fuel carbon intensities, adjusting for EV credits.
- **Transit Vehicle and Fuel Technology** is based on 2020 National Transit Database fleet reporting, along with ODOT OPTIS data, and reviews by metropolitan areas for 2018 STS monitoring. Forecasts were updated to reflect purchased EV transit buses in Portland (TriMet) and Eugene (LTD) in 2020. Assumes both agencies' commitments to renewable diesel continue (all Trimet buses and demand response vehicles, all LTD buses).

Actions: Transportation Options and Parking in Metropolitan areas reflect adopted plans. Assumptions on short trip diversion to non-driving modes, funding/participation in Transportation Demand Management programs (TDM), and parking coverage and rates were reviewed by MPOs in the 2018 STS Monitoring report. Updates in 2022 included Portland Metro's parking and TDM programs for consistency with Portland's VisionEval model.

Actions: Transit service for the Metropolitan areas used service miles reported to the National Transit Database (NTD). Forecasts are based on historical federal funding and Oregon's Statewide Transportation Improvement Fund forecasts from payroll taxes. NTD analysis provided assumptions to estimate transit service levels from forecast transit funding, such as share of capital expenditures spent on transit vehicles and cost-per-service-mile.

Actions- System Operations: Historic road lane-miles reflect state and metropolitan area reporting (Highway Performance Monitoring System data, 1990-2015) and future changes pull from funding-constrained adopted long range transportation plans in the eight MPOs. Freeway (ramp metering, incident response, active traffic management) and arterial (signal coordination, access management) operations program coverage rely on data from ODOT System Operations & ITS unit and city public works departments.

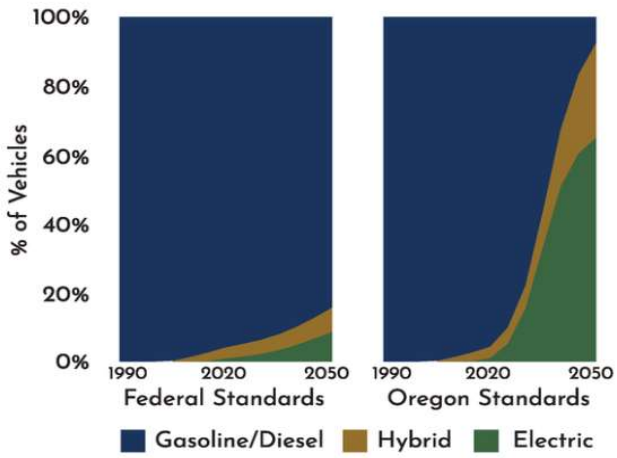
Actions: Land use – ODOT and Department of Land Conservation and Development (DLCD) evaluated the growth in Urban Growth Boundaries (UGB) across all MPOs for 1990-2015 and found overall growth of land within the eight Metropolitan areas tracked with the STS Vision assumption of UGB growing at 15% of population growth.

Actions – Pricing: Gas taxes and annual vehicle registration fees reflect historic rates held constant after Legislative changes allowed in 2017 and decline with inflation over time. Electric vehicles are assumed to shift to OReGO road user fee. No congestion fees assumed. Low levels of pay-as-you-drive auto insurance.

Energy Prices: Oregon historic fuel and electricity prices are indexed to forecasts from the US Energy Information Administration's Annual Energy Outlook (2021 for fuel, 2015 for electricity). Estimates of fuel price impacts of the Oregon Clean Fuels program were added per DEQ historic impacts and obligation forecasts.

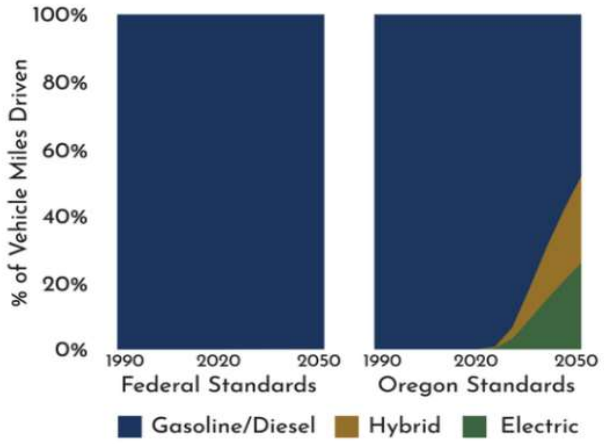
Demographics: Official state and urban growth boundary population forecasts come from Portland State University's (PSU) Population Resource Center (January 2022), and Portland Metro forecast (February 2022). Household size assumptions come from US Census (February 2022 ACS 5-year and Decennial tables). ODOT statewide per capita income growth is assumed to be roughly 1% per year 2015-2050.

1) Passenger Vehicle Powertrains



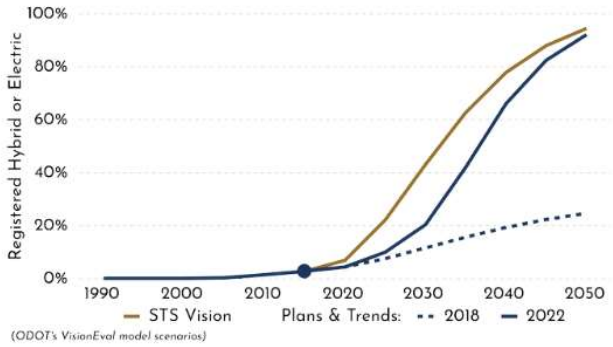
Source: Federal numbers from 2021 Annual Energy Outlook Reference Scenario. Oregon numbers are adjustments to 2021 Oregon VISION Scenarios. Forecasts are subject to uncertainty.

2) Heavy Duty Vehicle Powertrains

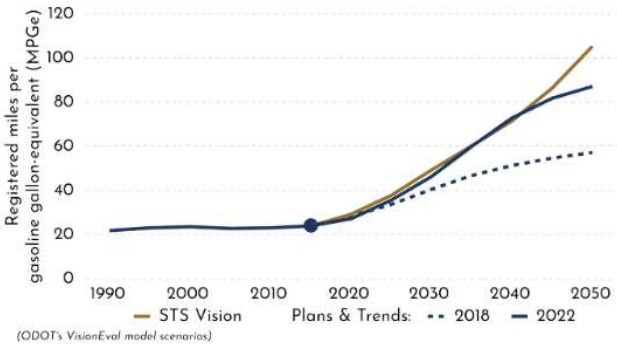


Source: Federal numbers from 2021 Annual Energy Outlook Reference Scenario. Oregon numbers are adjustments to 2021 Oregon VISION Scenarios. Forecasts are subject to uncertainty.

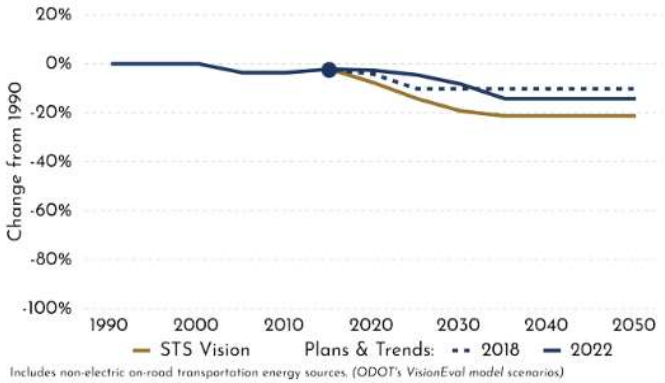
3) Passenger Vehicle Powertrain



4) Passenger Vehicle Efficiency



5) Passenger Fuel Carbon Intensity



6) Electricity Carbon Intensity

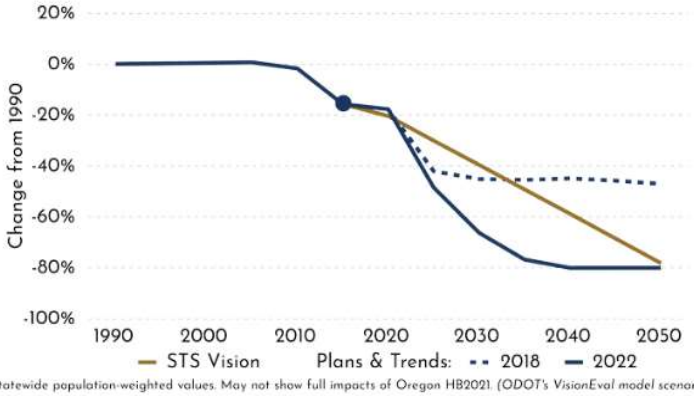


EXHIBIT D: SCENARIO PLANNING GUIDELINES TECHNICAL APPENDIX: TARGET RULES METHODOLOGY, AUGUST 2017

Target Rules Methodology

This document summarizes the policy and technical background for the Metropolitan Greenhouse Gas (GHG) Reduction Targets and outlines in detail the target calculation methodology using example model results. The information presented apply to the updated Target Rules (OAR 660-044) as adopted by the Land Conservation and Development Commission (LCDC) in 2017, with progress measured using the Oregon Department of Transportation's (ODOT) Regional Strategic Planning Model (RSPM). This information is intended to provide a more detailed understanding of the targets and modeling. However, application of the information provided here should be done in coordination with both ODOT and the Department of Land Conservation and Development (DLCD).

Policy Framework

This section presents the policy framework in which the Metropolitan GHG Targets relate to other state and federal policies and programs.

Oregon's Overall GHG Reduction Goals

HB 3543 (ORS 468A.205)
Adopted in 2007 by the Oregon Legislature, sets a 2050 goal for GHG emissions reductions across all sectors as follows:

- By 2010, arrest the growth of emissions and begin to reduce emissions.
- By 2020, achieve levels that are 10 percent below 1990 levels.
- By 2050, achieve levels that are at least 75 percent below 1990 levels.

GHG Reduction Targets for Metropolitan Areas

HB 2001 (Section 37 (6), chapter 865, Oregon Laws 2009), and SB 1059 (Section 5 (1), chapter 85, Oregon Laws 2010) direct the Oregon Land Conservation and Development Commission (LCDC) to adopt rules identifying greenhouse gas emissions reduction targets for emissions caused by ***light vehicle travel*** for each of the state's metropolitan areas. These statutes direct that the rules must:

- Reflect greenhouse gas emissions reduction goals set forth in ORS 468A.205 (described above)
- Take into consideration the reductions in vehicle emissions that are likely to result from the use of improved vehicle technologies and fuels
- Take into consideration methods of equitably allocating reductions among the metropolitan areas given differences in population growth rates

The legislation requires scenario planning and adoption of a preferred scenario to reach the reduction target for Portland Metro and required scenario planning to identify a scenario to reach the reduction target for the Central Lane Metropolitan Planning Organization (MPO). For all other metropolitan areas, scenario planning is voluntary.

2011 Metropolitan GHG Reduction Target Rules (OAR 660-044)

In accordance with the Metropolitan GHG Reduction Target Rules, LCDC first adopted GHG reduction targets for the state's metropolitan areas (OAR 660-044) in 2011. The rules establish the percentage reductions (from 2005 to 2035) in metropolitan area light vehicle GHG emissions beyond the reductions expected to occur due to changes to light vehicle technologies and the fuels they use. The establishment of these targets was informed by technical analysis performed by ODOT, Oregon Department of Environmental Quality (DEQ), and Oregon Department of Energy (ODOE) on future assumptions of vehicle technologies and fuels. In short, the analysis made recommendations on:

1. An overall light vehicle per capita emissions reduction goal
2. A range of forecasts for reductions in light vehicle emission rates due to changes in light vehicles and the fuels they use
3. The target percentage reductions needed to meet the per capita emissions reduction goal given the vehicle emission rate forecasts

Development of the targets was supported by the Agencies Technical Report (ATR) and the Target Rulemaking Advisory Committee (TRAC). The TRAC selected an emissions rate forecast they thought to be sensible and would result in achievable metropolitan area targets. This low-end emission forecast and the resulting targets were then adopted in the target rules.

2017 Metropolitan GHG Reduction Target Rules Update (OAR 660-044)

In January of 2017, LCDC adopted amendments to the Target Rules based upon the recommendations presented to the commission from a Target Rulemaking Advisory Committee (RAC) in the RAC Recommendations Report. In summary the updates to the Target Rules are as follows:

- Extends horizon year, providing flexibility in offering a schedule of targets for all years between 2040 and 2050
- Emission rates are specified more simply given new information and studies since the 2011 Target Rule. A single grams per mile rate for each year replaces details on vehicle mix, turnover rates, etc.
- Establishes one target for the Portland metropolitan area, and separate target for all other metropolitan areas. Prior rule distinctions among the smaller MPOs were attributed to adjustments in moving from the statewide 1990-based reduction goal, to the metropolitan targets 2005-based reduction goal. In retrospect, these distinctions in 1990 to 2005 vehicle and emissions variations by MPO were uncertain, given the age of this data. Thus, a common target is used for all non-Metro MPOs.
- Includes two new metropolitan areas, Albany Area and Middle Rogue MPOs
    - Relies upon the Statewide Transportation Strategy (STS) for future vehicle technology and fuel assumptions that align with state and federal policies.
    - Updated the latest county population forecasts. (Portland Metro 3-county, PSU Population Research Center where available, Office of Economic Analysis otherwise)
- Changed the definition of light vehicle travel to be considered; from light-duty vehicle travel on metropolitan area roadways to light-duty vehicle travel by metropolitan area households (and related light-duty commercial service vehicle travel).

The adopted targets for the state's metropolitan areas are identified in OAR 660-044-0020 (Portland Metro) and 660-044-0025 (other MPOs) for various planning years. The targets are in units of GHG percentage reduction per capita resulting from light vehicle travel in a metropolitan area needed in the planning year in order to meet the state goal of a 75 percent reduction in greenhouse gas emissions from 1990 levels by the year 2050. They represent reductions in GHG emissions from light vehicle travel beyond what is expected to occur from improvements to vehicle technologies and fuels.

The per capita units account for the differences in population growth rates among the metropolitan areas. The larger reduction targets for Portland Metro, reflect the capabilities demonstrated in scenario planning efforts in Metro relative to Strategic Assessments in Corvallis and Rogue Valley. Larger than all other metropolitan areas combined, Portland Metro can implement policies that would be difficult in other metropolitan areas since it contains areas of significantly higher density supported by high baseline levels of transit service and parking management.

OAR 660-044-0020 (Portland Metro), 660-044-0025 (other MPOs)

(a) Local governments in metropolitan planning areas may use the relevant targets of this rule as they conduct land use and transportation scenario planning to reduce greenhouse gas emissions.

(b) This rule does not require that local governments or metropolitan planning organizations conduct land use and transportation scenario planning. This rule does not require that local governments or metropolitan planning organizations that choose to conduct land use or transportation scenario planning develop or adopt a preferred land use and transportation scenario plan to meet targets in section (2) of this rule.

Statewide Transportation Strategy

The Statewide Transportation Strategy (STS) was developed in response to legislative direction in Senate Bill 1059 (Chapter 85, Oregon Laws 2010), which required ODOT to develop a strategy on greenhouse gas (GHG) emission reductions to aid the state in achieving the reduction goals set forth in ORS 468A.205 (a 75% reduction below 1990 levels by 2050). The STS identifies short- and long-term actions and strategies to reduce transportation-related GHG emissions in Oregon while supporting other important goals such as livable communities, economic vitality, and public health. Three key travel markets included in the STS are ground passenger and commercial services, freight, and air passenger. The STS was completed in 2013, and an ODOT Short-Term Implementation Plan created shortly thereafter. Among other efforts, the Implementation Plan calls for ODOT and DLCD to support scenario planning in metropolitan areas.

When the original metropolitan GHG targets were adopted by LCDC in 2011, the STS was still being developed requiring the targets to be set independent of the STS. The metropolitan GHG reduction targets adopted in 2017 were set assuming the future vehicle fleet, fuel, and technology assumptions set forth in the STS (built in collaboration with the Departments of Energy and Environmental Quality), as well as the statewide actions identified in the preferred scenario.

Technical Considerations

The following are technical considerations when calculating a metropolitan area's anticipated GHG reduction against the Target Rule OAR 660-044. Some are requirements identified in the rule, while others are best practices with more flexibility.

1. Household-based Travel,

The targets capture emissions from light-duty vehicle travel related to the activities of households (and university group quarters populations) that live within the metropolitan area regardless of where the driving occurs. This includes the full extent of the solid-line trips shown in Figure 1 (excluding "External-Internal" and "Through" trips). These are assumed to be the trips that are most fully influenced by policy actions of the local metropolitan area. In addition to the travel of household members, the GHG Target rule travel definition also includes travel by light duty commercial vehicles related to household members or household demand (for example household deliveries

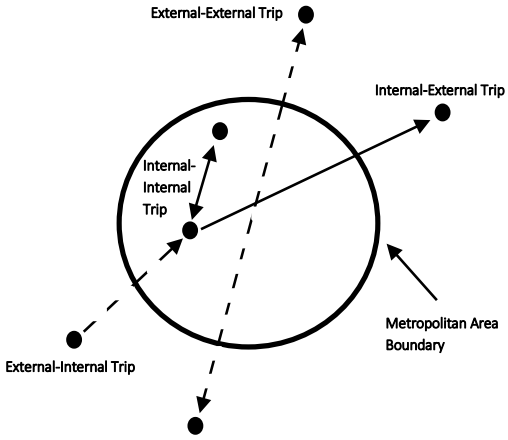


Figure 1. Example of Household Trip

OAR 660-044-0005 Definitions (selected)

(4) "Greenhouse gas" has the meaning given in ORS 468A.210. Greenhouse gases are measured in terms of carbon dioxide equivalents, which means the quantity of a given greenhouse gas multiplied by a global warming potential factor provided in a state-approved emissions reporting protocol.

(5) "Greenhouse gas emissions reduction target" or "target" means a reduction from 2005 emission levels of per capita greenhouse gas emissions from travel in light vehicles. Targets are the reductions beyond reductions in emissions that are likely to result from the use of improved vehicle technologies and fuels.

Travel in light vehicles includes all travel by members of households or university group quarters living within a metropolitan area regardless of where the travel occurs, and local commercial vehicle travel that is a function of household labor or demand regardless of where the travel occurs. Examples include commuting to work, going to school, going shopping, traveling for recreation, delivery vehicles, service vehicles, travel to business meetings, and travel to jobsites.

(7) "Light vehicles" means motor vehicles with a gross vehicle weight rating of 10,000 pounds or less.

(9) "Metropolitan planning area" or "metropolitan area" means lands within the planning area boundary of a metropolitan planning organization.

(10) "Metropolitan planning organization" means an organization located wholly within the State of Oregon and designated by the Governor to coordinate transportation planning in an urbanized area of the state pursuant to 49 U.S.C. 5303(c). The Longview-Kelso-Rainier metropolitan planning organization and the Walla Walla Valley metropolitan planning organization are not metropolitan planning organizations for the purposes of this division.

(11) "Planning period" means the period of time over which the expected outcomes of a scenario plan are estimated, measured from a 2005 base year, to a future year that corresponds with greenhouse gas emission targets set forth in this division.

(13) "Statewide Transportation Strategy" means the statewide strategy accepted by the Oregon Transportation Commission as part of the state transportation policy to aid in achieving the greenhouse gas emissions reduction goals set forth in ORS 468A.205 as provided in chapter 85, section 2, Oregon Laws 2010.

and work travel by household members). This allows metropolitan areas to get credit for vehicle programs such as compressed natural gas and renewable natural gas used in local commercial fleet and public transit vehicles.

2. Taking Credit for State-led Actions

The Target Rules specify that metropolitan areas may take credit for allowable state-led actions found in the Statewide Transportation Strategy (STS), which are reflected in the default emissions rates. These actions include pricing programs such as pay-as you-drive insurance, mileage based taxes (e.g. vehicle miles traveled fees), social cost recovery fee pricing (e.g., carbon tax), and congestion pricing (Metro area only).

In evaluating whether scenarios meet the GHG reduction target, the rules allow metropolitan areas to take credit for selected state-led policies and programs included in the STS other than those from vehicle technologies and fuels), implying local support for these policies and programs. These actions, although orchestrated at the state level, are unlikely to be adopted or successfully implemented without support from communities across the state. To include these in the analysis, support for these policies should be explicitly mentioned in the scenario planning report when comparing to Target Rule reductions. Absent local support for these state-led actions, metropolitan areas are allowed to propose an alternative set of policy actions in an attempt to reach the target requirement.

> ***660-044-0030(3) (a)***
> Projections of greenhouse gas emissions may include reductions projected to result from state actions, programs, and associated interactions up to, but not exceeding, the levels identified in the STS; however local governments may choose to assume a lower level of state actions.
>
> ***044-0030(3) (b)***
> Projections of greenhouse gas emissions may include local or regional actions similar to actions in the STS if the local governments have authority to and have adopted plans that would implement the actions.

A list of the key allowed state-led policies and actions are identified below. For the most current information, please contact DLCD/ODOT:

- **Full Cost Pricing**, including *Pay-as-you-Drive (PAYD) insurance*, *Mileage-based fees* (e.g., gas tax replacement, expected surcharge from the Oregon Renewable Fuels Program), **Social cost recovery fees** (e.g., through a carbon tax), and *Electricity prices* (reflecting costs to clean up the electric grid, important with the shift to electric vehicles)
- **Driving Efficiency Programs**, including *Eco driving* and *Low-rolling-resistance tire* programs.

3. Default Statewide Emission Rates for Vehicle Technologies and Fuels

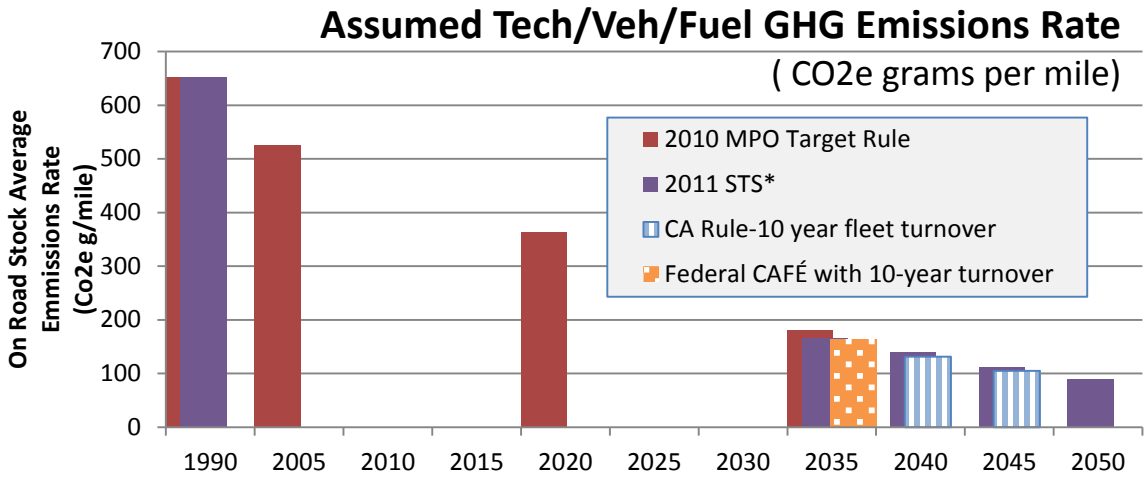
Policies that move vehicular travel to newer vehicle technologies (with higher fuel efficiency and or electrification) and fuels (with lower emissions) are critical to achieving state and metropolitan GHG reduction goals. Since these policies affect every mile of emissions, they are the most impactful in meeting GHG targets. Default GHG emission rates (grams per mile) are specified in 660-044-0030(2), shown in the last column of Table 3 below. These are the vehicle emissions projected to result from the use of improved vehicle technologies and fuels through 2050. The emissions rates are reflected in the model assumptions about mix of vehicles sold each year and rates of vehicle turnover specified for the target rules analysis. When the model is run, households are assigned vehicles of a certain age, and the attributes of those vehicles determine emissions, fuel consumption, and household travel cost. The metropolitan GHG reduction target only considers light duty vehicle emissions.

> 660-044-0030(2) (a)
> Projections of greenhouse gas emissions may use the emission rates listed below, which are based on the Statewide Transportation Strategy and reflect reductions likely to result by the use of improved vehicle technologies and fuels. Rates are measured in grams of carbon dioxide equivalent (CO^2e**)** per vehicle mile.
>
> *See the last column in Table 3 for the Statewide Default Emission Rates*

During the 2017 Metropolitan Target Rule update, DOE and DEQ confirmed these default statewide emission rates were consistent with statutory long term state programs and requirements. However they also cautioned that there are risks and challenges as policies are not fully in place to reach these emission rate goals by 2050. ODOT, along with DOE and DEQ, is monitoring progress in achieving the assumed emissions rate reductions. Significant changes, such as significant vehicle advances or repealing of existing vehicle or fuel emission reduction programs could prompt review of the metropolitan area GHG target rule.

Comparing Emission Rates – Oregon, California, and Federal Projections

Although the vehicle and fuel assumptions in the STS are aggressive, they are not out of line with other state and federal policies, including the federal CAFE standards and California Rule/multi-state Zero Emission Vehicle (ZEV) standards. The figure below approximates comparable values over time against the STS emission (all metropolitan areas, as used in the 2017 Metropolitan Target Rule update). To do so, the 2025 CAFE and 2030/2035 ZEV new car sales standards were simply assumed to represent average fleet values 10 years later (2014 Bureau of Transportation Statistics data notes the national average vehicle age of 11.4 years).



* STS only reported on years 1990 and 2050, although interim years were modeled.

4. More Ambitious Vehicle Technologies and Fuels Assumptions

There are actions within a metropolitan area that can result in emission rates that differ from the statewide actions, noted above. OAR 660-044-0030(2) (b) allows for this option.

660-044-0030(2) (b)

Projections of greenhouse gas emissions may use emission rates lower than the rates in 660-044-0030(2) (a) if local or regional programs or actions can be demonstrated to result in changes to vehicle fleet, technologies, or fuels above and beyond the assumption in the Statewide Transportation Strategy (STS). One example would be a program to add public charging stations that is estimated to result in use of hybrid or electric vehicles greater than the statewide assumption in the Statewide Transportation Strategy.

This is an important point, since vehicle technologies and fuel assumptions do not just affect the emissions rates; they also affect the operating cost and ultimately the amount of vehicle travel. Indeed, many metropolitan area land use and transportation scenarios are likely to include programs or actions that may impact emission rates. Below are a couple of examples of possible reasons a metropolitan area emission rate (grams per mile) might differ from the statewide default:

- **Local Actions on Vehicles and Fuels**: Localities can adopt policies that have a direct impact on local emission rates. These include provision of alternative fuels for light duty vehicles, such as Rogue Valley's Clean Cities efforts that have developed a compressed natural gas (CNG) station that fuels government/ commercial vehicle fleets and buses, with plans to shift to cleaner renewable natural gas (RNG) (capturing landfill gas for fuel usage), or alternatively providing subsidies to increase adoption of hybrid or electric vehicles within the metropolitan area.

- **Operating Cost Impacts**: Miles driven can be affected by the significantly lower operating costs with higher MPG and Electric Vehicles (on average gas-powered cars cost around three times as much per mile as electric vehicles, depending upon gas prices), or pricing policies that affect per mile fees. This is called the rebound effect and is important to account for in emissions models. That is, policies implemented to reduce vehicle miles traveled (VMT) can have positive or negative impacts on emission rates (grams per mile).
- **Land Use Impacts**: Plug-in hybrid electric vehicles (PHEVs) are powered both by electricity from the grid and by on-board fuels. The relative portions depend on the amount of use each day as well as the battery range. In general, households who live in denser areas are more likely to own PHEVs and these PHEVs will be more likely to power a larger portion of their travel using electricity rather than fuel because they have fewer daily miles traveled and/or shorter trips. The extent to which electricity can replace on-board fuel use, then those households will have lower emission rates as well as lower operated costs.
- **Congestion Impacts**: Emissions rates for internal combustion engine vehicles are affected significantly by congestion because of efficiency losses due to idling and to frequent acceleration and deceleration. In contrast, the "stop-start" technology included in newer hybrid vehicles of all sizes, means idling, such as in congestion, emits significantly less emissions Local Policies can affect congestion and hence emissions rates.
- **ITS/Op Impacts**: Newer Advanced Traffic Management programs, such as implemented on OR217 in Portland, including variable speed signs, changeable message signs and advance ramp metering, are designed to reduce congestion and incidents, but also have impact on emissions. "Speed harmonization" which limits acceleration and deceleration also reduce emissions from vehicles on the roadway.
- **Other Impacts**: VMT-reducing policies consistently reduce emissions, but have an indirect and thus varying effect on congestion. For example, a policy which reduces VMT by limiting roadway capacity does so by increasing congestion (people make fewer vehicle trips or drive shorter distances to avoid spending more time on the road). On the other hand, a road pricing policy can reduce both VMT and congestion. If metropolitan areas identify other actions with substantial impact on emissions rate, estimation of the amount of GHG emissions reductions expected to result within the metropolitan area from these programs and actions may be allowable if analysis and methods are made in consultation with DLCD and ODOT.

Because the rate of emissions and amount of travel are bound together (i.e., local actions can enable decreases in both VMT and emissions rate) localities can reach their target by either reductions in travel demand or, emission rates.

5. Analysis Tool for Estimating Greenhouse Gas Emissions and Emissions Reductions

The Regional Strategic Planning Model (RSPM) is the recommended tool, given its use in setting the GHG reduction targets. RSPM is a metropolitan version of the GreenSTEP strategic planning model, developed by ODOT for use in the STS, and is part of the VisionEval suite of tools, supported by cities and state transportation departments with help from the FHWA. Beyond consistency with other state and local efforts, using RSPM in Target Rule calculations provides the following advantage over other tools (e.g., application of emission rates to travel demand model VMT):

660-044-0040(2) - Applies only to Portland Metro

(d) Use evaluation methods and analysis tools for estimating greenhouse gas emissions that are:

(A) Consistent with the provisions of this division;

(B) Reflect best available information and practices; and,

(C) Coordinated with the Oregon Department of Transportation.

- Matches the Target Rule's definition of household-based travel emissions
- Captures impact of pricing and policy actions on travel and emissions
- Captures interaction of policy actions on travel behavior and emission rates (e.g., see Consideration #4 above)

ODOT supports the use of RSPM for metropolitan area GHG target rule calculations. This may include running the tool, working with MPOs to gather data, design scenarios, and interpret results, as well as efforts that work to build such capacity through training.

6. Fiscal Constraints

The target rules requirements for Portland Metro allows their preferred scenario meeting the targets to include projects without programmed funding if a discussion of estimated costs and sources is identified. For other metropolitan areas, there is no fiscal constraint. However, best practices are for a metropolitan area to assess the GHG impacts of their fiscally constrained "Adopted plans", as a gauge for progress towards the target. This scenario would include the region's best assessment of anticipated funding and policies, as represented in Regional Transportation Plans (RTP) and Transportation System Plans (TSP), and anticipated funding sources for transit and transportation options programs. It is recommended that other scenarios be run as well, reflecting more ambitious policies (e.g., longer time frame with more funding), as well as resilience testing of policies under alternative conditions (e.g., different economic growth and fuel price scenarios). This scenario planning approach can provide a basis for understanding "what would it take" to meet the targets, and provide the basis for discussion of GHG as well as other regional performance measures, resulting in a desired long term policy mix that meets the region's goals.

660-044-0040 - Applies only to Portland Metro

(i) Evaluate if the preferred scenario relies on new investments or funding sources to achieve the target, the feasibility of the investments or funding sources including:

(A) A general estimate of the amount of additional funding needed;

(B) Identification of potential/likely funding mechanisms for key actions, including local or regional funding mechanisms; and,

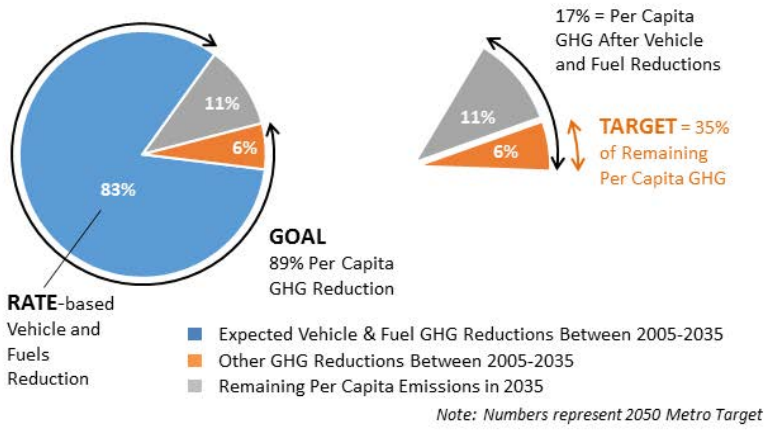
(C) Coordination of estimates of potential state and federal funding sources with relevant state agencies (i.e. the Oregon Department of Transportation for transportation funding); and,

(D) Consider effects of alternative scenarios on development and travel patterns in the surrounding area (i.e. whether proposed policies will cause change in development or increased light vehicle travel between metropolitan area and surrounding communities

Target Rule Calculation-Technical Detail

Figure 2 illustrates how the metropolitan area GHG reduction **TARGET** is calculated from the per capita emissions reduction **GOAL** and the forecast for reduction in the light vehicle emissions **RATE**. It uses the Portland Metro 2050 target reductions from Table 3, as an example. The circle represents total metropolitan area per capita emissions from light duty vehicles in 2005 while the grey slice shows per capita emissions that still remain in 2050 after reductions from all sources. Since the overall **GOAL** is to reduce per capita emissions by 89% from 2005 to 2050, the remaining per capita emissions in 2050 (gray slice) would be 11% of the 2005 emissions (100%-89% = 11%). The blue slice indicates the reduction in per capita emissions due to the forecasted change in the light vehicle emissions **RATE**, i.e., expected improvements in vehicles and fuel policies. Since forecasted change in the emission rate would reduce per capita emissions by 83%, the remaining emissions in 2050 would be 17% of the 2005 emissions (100% - 83% = 17%) if only the forecasted changes to light vehicles and the fuels they use occur. An additional 6 percentage point reduction is necessary to meet the overall 89% reduction goal (89% – 83%). That represents 25% of the remaining emissions (6% ÷ 17%). This 35% is the 2050 Metropolitan **TARGET** for Portland Metro; the percentage reduction in emissions beyond the reductions expected from changes in vehicle technologies and fuels.

Figure 2. Calculating Metropolitan Area Target from the Goal



The overall **GOAL** (89% in figure 2), emission RATE (results in 83% reduction in figure 2), and resulting metropolitan **TARGET** (6% in figure 2) are shown in Table 3 for each year, reflecting Target Rule OAR 660-044. Analysis showing a metropolitan area meets either the **TARGET** or the **GOAL** is mathematically equivalent. Analysis must compare local light-duty GHG reductions relative to 2005, and show that the metropolitan region meets (A) the **TARGET** reduction of GHG reduction per capita beyond vehicle technologies and fuels (or equivalent GOAL reduction) as well as (B) comparing the change in the average vehicle emissions per mile to the default **RATE**.

Targets vs Goals

Communicating what the existing targets mean and how they relate to other expressed goals (e.g. reducing total emissions statewide by 75%) is challenging. The **TARGET** is not a percent of total emission reductions or a percentage point portion of the overall reduction. In some circumstances, it may be useful to communicate using the **GOAL**, i.e., the overall reduction in total per capita emissions, including the impacts from vehicles and fuels. In contrast, the **TARGET** makes an additional step to remove reductions from vehicle and fuel policies to be comparable to the Target Rule Table 3 values. Using the RULE (overall emissions reductions per capita) rather than the **TARGET** (emission reductions beyond the default vehicle and fuels emission rate) may be easier to explain given that it involves less steps (skips step 4) and is somewhat more comparable units with the statutory statewide GHG emissions reduction requirement (75% between 1990 and 2050 in total state emissions, which translates to 89% in *per capita* emissions just within *metropolitan* areas between *2005* and 2050). Since the **RULE** and **TARGET** are mathematically equivalent, either can be used in communication.

Table 3. Metropolitan Target Rule Values

Year	PER CAP: GHG Reductions (% Light-Duty Vehicle emissions relative to 2005)				PER MILE: Default Emission RATE (CO^2e grams per mile)
	Metropolitan TARGET (beyond vehicles & fuels)		Overall GOAL		
	Portland	Other MPOs	Portland	Other MPOs	
2040	-25%	-20%	-80.1%	-78.7%	140
2041	-26%	-21%	-81.2%	-79.9%	134
2042	-27%	-22%	-82.3%	-81.0%	128
2043	-28%	-23%	-83.2%	-82.0%	123
2044	-29%	-24%	-84.2%	-83.0%	117
2045	-30%	-25%	-85.1%	-84.0%	112
2046	-31%	-26%	-85.9%	-84.9%	108
2047	-32%	-27%	-86.7%	-85.7%	103
2048	-33%	-28%	-87.4%	-86.5%	99
2049	-34%	-29%	-88.1%	-87.3%	94
2050	-35%	-30%	-88.8%	-88.0%	90

To determine whether a metropolitan area meets the GHG reduction target involves the following steps:

1. Model the Metropolitan Area Travel & Emissions using RSPM, Reflecting the Following:

- **Base Year and Trend Scenarios**: 2005 base year and future year Adopted Plans scenarios. Future year should reflect fiscally constrained adopted plans (e.g., RTP or TSP)
- **Emission Rates**: Statewide default emission rates (i.e., carbon intensity of technology and fuels) shown above in Table 3 for the future year Trend Scenario (adopted plans). These rates can be used directly or as part of a series of tables (vehicle sales mix by vehicle age plus fuel carbon intensity tables by year), as used in the RSPM.
- **Units**: GHG emissions are measured in carbon dioxide equivalents (CO_2e), reflecting the calculations of combining the various man-made GHGs with different heat retention capabilities created with the combustion of fossil fuels. The quantity of man-made GHG emissions is typically represented in terms of the weight of CO_2e emitted. Only household and commercial light duty vehicles (less than 10,000 lbs.) are included in the Metropolitan Target Rule calculations.

  GHG emissions are expressed in metric tons of CO_2e per person.
  Emission rates are expressed in grams of CO_2e per mile of travel.

2. Using the Model Results:

a) Calculate the modeled GOAL (overall percent change in per capita GHG emissions)
b) Calculate the modeled RATE (change in the average GHG emissions per mile)

3. Compare per Capita Emissions

a) Calculate the modeled TARGET: percent change in per capita GHG emissions beyond vehicle technology and fuels, by dividing the modeled GOAL reduction by the modeled RATE reduction, as follows:

Target = Goal / Rate

b) Compare the modeled TARGET change to the rule specifications (Table 3 first column). The modeled change should be equal to or less than the change specified in the rule.

4. Compare per Mile Emissions

Compare the calculated 2005 emissions to the future year change in the modeled RATE with the default statewide rule specification (Table 3 last column). The modeled emissions rate change should be equal to or greater than the change specified in the rule.

Comparison to statewide default emission rates is necessary in order to determine that the TARGET is not being met just because more ambitious assumptions are being made about improvements to vehicle technologies and fuels. However, a metropolitan area may assume a greater reduction in the modeled emissions RATE than the rule default if the difference is due to synergistic interactions due to local policy actions (see Technical Consideration #3 above). To use a lower rate, the cause for the difference must be explained in a manner acceptable to DLCD.

Example Calculation

The Example Calculation in Table 4 below walks through a hypothetical assessment of GHG emission reductions for a non-Portland MPO based on possible RSPM model outputs, providing formulas to calculate model-based GHG reduction estimates. The shaded box to the right hand side of Table 4 shows the comparable Target Rule values from Table 3.

To start, 2005 and 2050 RSPM scenarios would be run using the assumptions noted above. These include assumptions on vehicle, fuels, state-led actions, etc.

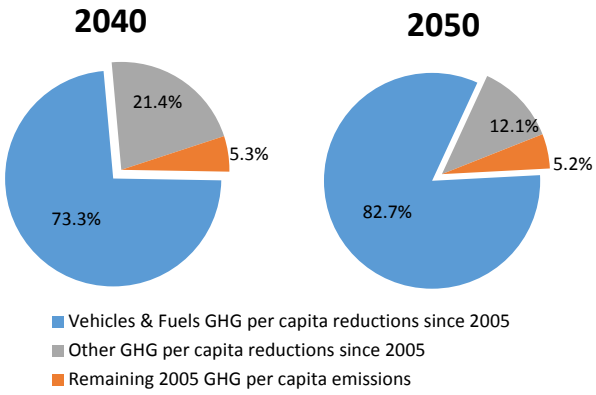
The hypothetical 2005 and 2050 results from the model runs are shown in the top two sections of Table 4. This includes the MPO population (households and university group quarters), as well as GHG emissions and vehicle miles travelled (VMT) for light duty vehicles (all travel by residents and local commercial vehicle distribution). In each year, the GHG per capita and GHG per mile are calculated by dividing emissions by population and VMT, respectively. The emission rates (g/mile) are compared to Table 3 values. The 2005 emissions rate is slightly lower but a reasonable match to the average metropolitan value after accounting for local vehicle mix variations (e.g., due to a lower share of light trucks or higher share of hybrid/electric vehicles than average metropolitan values). The estimated 2050 emission rate is below the allowed 90 g/mile. Thus, further justification is provided that the 2050 vehicles and fuels inputs reflect the region's investment in CNG infrastructure, which provides 6000 GGEs at 15% lower carbon intensity than diesel that fuel a portion of the region's light duty fuel needs, mostly commercial vehicle fleets. Additional GHG reductions from CNG use by the region's (heavy duty) public transit buses (tabulated elsewhere in the model), does not count in the light duty vehicle target rule.

After that, the 2005-2050 reductions are calculated and compared to the Target Rule values. This includes taking the ratio of the 2005 and 2050 GHG/cap and GHG/mile values, resulting in the colored cell values. Collectively these colored cells correspond to the pie slices of Figure 2, where the full pie represents the 2005 emissions per capita. In this example the region does not meet the 2050 target rule values of Table 3. The model-estimated 84.8% combined or 8.7% beyond vehicles and fuels do not meet the Rule's 88% GOAL or equivalent 30% TARGET (Table 3). However the CNG programs have contributed significantly to the region's emission reductions, and other non-vehicle & fuel policies, both local actions (e.g., transit service, bike diversion, ITS policies) and the region's endorsement of state-led policies (e.g., PAYD insurance, carbon tax, eco-driving programs) reduce daily VMT per capita from 25.7 to 24.0 accounting for the remaining GHG emission reductions.

Targets over Time

The state mandated GHG reductions for the transportation sector will be a challenge to meet and will require collaborative federal, state, and local efforts. However, continued progress in shifting to cleaner vehicles and fuels led by the federal and state governments will take the burden off of local agencies.

To emphasize that point, the charts below show the 2005 emissions per capita (full pie) and the reductions expected from vehicles and fuels (blue) under anticipated policies, along with reductions from "Other" actions (orange) beyond those affecting vehicle and fuels. A small slice of the original 2005 emissions remains (gray) in future years.



Looking over time, the emission reductions from vehicles & fuels (blue) grows, while reductions from "other policy actions" (orange) stays roughly the same. This highlights how, although the Metropolitan GHG reduction target values (Table 3) increase over time, this is due to a shrinking amount of emissions "beyond vehicle and fuel reductions" (orange plus gray), not the need to further push "Other" policies (orange). It is also important to note that the chart is in units of emissions per capita, and the effort required to maintain the "Other" policies given anticipated population growth is not insignificant.

Table 4. Example Target Rule Calculation

Step	Variable Definition	Units	Variable	MODEL					2050 non-Metro TARGET RULE
		2005							2050 Emission per mile
1	Population[1]	---	A	85,500					
1	LDV GHG[2]	MT/day	B	1,147					
1	LDV VMT[2]	miles/day	C	2,196,798					
1	LDV VMT/Cap[3]	miles/day	D	25.7					
1	LDV GHG/Population	MT/cap/yr	E	4.90					
1&4	LDV GHG/VMT	g/mile	F	522					
		2050							
1	Population[1]	---	G	163,700					
1	LDV GHG[2]	MT/day	H	334					
1	LDV VMT[2]	miles/day	I	3,928,800					
1	LDV VMT/Cap[3]	miles/day	J	24.0					
1	LDV GHG/Population	MT/cap/yr	K	0.74					
1&4	LDV GHG/VMT	g/mile	L	88				M	≥ 90 g/mile
		2005-2050 reduction							2005-2050 Emission per capita
			formula	ratio	%				
2&4	GHG/Cap ratio	---	N=(1-K/E)	0.152	84.8%	GOAL			≥ 88%
2		---	O = (1-N)		15.2%	Remaining emissions			
2	GHG/Mile ratio	---	P = (1-M/F)	0.172	82.8%	V&F Policies-Default[4]			
2	GHG/Mile ratio	---	Q = (1-L/F)-P	0.169	0.4%	V&F Policies-Local[4]			-or-
3		---	R = 1-(O+P+Q)		1.6%	Other Policies[6]			
3					100.0%				
4	Local GHG/Cap beyond default Vehicles & Fuels	---	S = (Q+$)/(O+Q+R)		11.8%	TARGET			≥ 30%

[1]Population includes persons in households and university group quarters

[2] LDV GHG & VMT include "household-based" light duty vehicle travel, from residents & locally-based commercial vehicles to all locations

[3] RSPM VMT is not comparable to VMT from regional travel demand models. For instance, household-based travel in RSPM differs from a travel demand model that captures all VMT within the MPO boundary. RSPM also captures different policy actions and uses a more aggregate representation of roadway capacity and congestion which avoids the network details of a travel demand model.

[4] Vehicle & Fuel Policies that reduce emission rates, includes "Default" using Rule's 2050 RATE, and added reductions due to "local" policies

[5] Policies beyond vehicles and fuels that reduce VMT per capita, including local and allowed state actions

Note: 1 Metric Ton = 1,000,000 grams of Co2e; 1 year = 365 days

LDV = Light Duty Vehicles (autos and light trucks less than 10,000 lbs)

GHG = Carbon Dioxide-equivalent (CO2e) emissions

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If you picnic at Blue Lake or take your kids to the Oregon Zoo, enjoy symphonies at the Schnitz or auto shows at the convention center, put out your trash or drive your car – we've already crossed paths.

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