Oregon Transportation Related Greenhouse Gas Analysis

White Paper: Foundational Information

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Oregon Modeling Steering Committee

Greenhouse Gas Subcommittee

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1 INTRODUCTION

1.1 Oregon's Commitment to Greenhouse Gas (GHG) Reduction

The State of Oregon has been working to reduce the production and impacts of greenhouse gas (GHG) for most of the 21st century. More recently, several notable GHG policy actions have occurred at the state level:

- In 2009, the Oregon Jobs and Transportation Act (HB 2001)[1] included several key measures related to transportation related GHG, setting the stage for significant metropolitan scenario planning and policy work to follow.
- Also in 2009, the Oregon Legislature enacted House Bill 2186, which authorized the Oregon Environmental Quality Commission to adopt a low carbon fuel standards program for Oregon, with considerable emphasis on medium-duty and heavy-duty trucks. This bill also created a Metropolitan Planning Organization Greenhouse Gas Emissions Task Force.[2]
- In 2010, the Legislature enacted Senate Bill 1059[3], establishing the Oregon Sustainability Transportation Initiative (OSTI), and providing a collaborative framework for state agencies to work together to identify ways to reduce GHG emissions from transportation sources.
- The launch of the OSTI and Oregon's leadership on the national level prompted development of the Statewide Transportation Strategy (STS), a two-year stakeholder effort to identify a vision and strategies for reaching statewide GHG goals. Additional rules were adopted and administered by the Oregon Department of Land Conservation and Development that set, with the exception of the Portland region, largely voluntary GHG reduction targets for household travel in Oregon's metropolitan areas to meet the statewide goals.
- In 2020, Governor Kate Brown elevated the state's GHG reduction responsibilities through an executive order[4] that requires development of specific actions, strategies, and analysis methodologies across multiple state agencies, and associated guidance. In response to the executive order, the Oregon Departments of Transportation (ODOT), Energy (ODOE), Environmental Quality (DEQ), and Land Conservation and Development (DLCD) worked together to develop an STS Multi-Agency Implementation Work Plan for 2020-2022 known as "Every Mile Counts" to make progress toward the

[1] Oregon State Legislature, 2009 Regular Session, HB 2001. Effective date September 28, 2009. Retrieved from https://olis.leg.state.or.us/liz/2009R1/Measures/Overview/HB2001
[2] Oregon State Legislature, 2009 Regular Session, HB 2186. Effective date July 22, 2009. Retrieved from https://olis.leg.state.or.us/liz/2009R1/Measures/Overview/HB2186
[3] Oregon State Legislature, 2010 Special Session, SB 1059. Effective date March 18, 2010. Retrieved from https://olis.oregonlegislature.gov/liz/2010S1/Measures/Overview/SB1059
[4] Executive Order 20-04, March 10, 2020, https://www.oregon.gov/gov/Documents/executive_orders/eo_20-04.pdf

STS vision.[5] The plan focuses on objectives and priority actions that can benefit from collaborative relationships and programs already established among the agencies.

1.2 The OMSC's Role

The Oregon Modeling Steering Committee (OMSC)[6] was formed in 1996 to improve the state of the practice and promote state-of-the-art land use and transportation modeling in Oregon. OMSC members include managerial and technical staff from multiple state agencies, metropolitan planning organizations across Oregon and southwestern Washington, and Oregon universities. The group's mission is to ensure Oregon continues to have the right data, tools, skills, and expertise needed to answer important questions about our transportation systems, land use patterns and economy.

In 2018, the OMSC's Technical Tools Subcommittee updated Oregon's GHG Tools Overview report[7], which outlines the capabilities and uses of current models and tools for GHG analysis. Then in 2020, an OMSC GHG Subcommittee was formed, to continue interagency coordination on GHG analysis needs. The GHG subcommittee is helping to identify the potential roles of various agencies related to transportation GHG data and analysis, and to provide recommendations for developing and maintaining consistent tools and data that can support efforts to reach state, regional and local GHG reduction goals.

The terms "mitigation" and "adaptation" are often used to frame GHG discussions. Mitigation involves reducing the magnitude of GHG in the earth's atmosphere. For example, mitigation may reduce GHG by changing travel behavior to reduce vehicular modes and trip lengths, promoting low-carbon vehicles operating at optimum fuel efficiency, and encouraging low-carbon methods and materials in constructing and maintaining infrastructure. Adaptation involves limiting human and transportation system vulnerability to the effects of GHG. For transportation, this typically means considering how infrastructure can be made more resilient to the effects of extreme weather associated with climate change. For the OMSC's purposes, we are primarily focused on *mitigation*. That is, our aim is to make sure that Oregon has adequate tools for analyzing various strategies and actions that can be implemented by government at state, regional and local levels *to reduce GHG*.

1.3 Intended Audience and Purpose of this Paper

This paper has been prepared to provide a common understanding of terms, requirements, issues, and challenges for transportation related GHG analysis in Oregon. The document's audience includes OMSC GHG subcommittee members, as well as other staff from state agencies, metropolitan planning organizations, cities and counties who may not be serving on the GHG subcommittee but may have GHG planning or analysis responsibilities for their organizations.

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[5] Oregon Departments of Transportation, Environmental Quality, Energy, and Land Conservation and Development, *Every Mile Counts: STS Multi-Agency Implementation Work Plan (2020-2022),* retrieved from https://www.oregon.gov/odot/Programs/Pages/Every-Mile-Counts.aspx

[6] OMSC information is available on ODOT's website at https://www.oregon.gov/ODOT/Planning/Pages/OMIP.aspx

[7] Bettinardi, A. and Weidner, T, (2018) *Oregon Greenhouse Gas Modeling and Analysis Tools*, retrieved from: https://www.oregon.gov/odot/Planning/Documents/GHG_Tools_Overview.pdf

The primary purposes of the paper are to:

- Explain the GHG analysis spectrum.
- Explain current laws, rules and statewide policies affecting transportation related GHG in Oregon.
- Explain how transportation related GHG measures are currently defined in the policy nexus, including known issues with different definitions.
- Explain what Oregon has already learned about GHG production from the transportation sector and government's ability to influence them ("what actions move the needle")
- Provide additional references that may help the audience build knowledge.

2 ANALYSIS SPECTRUM

Governmental agencies have transportation GHG analysis needs that range from very broad to very focused. The Oregon Department of Transportation (ODOT) uses the "STORM" acronym, to generally describe typical transportation analysis levels, including *strategic, tactical,* and *operational* analyses, plus *reporting* and *monitoring* (Figure 1).

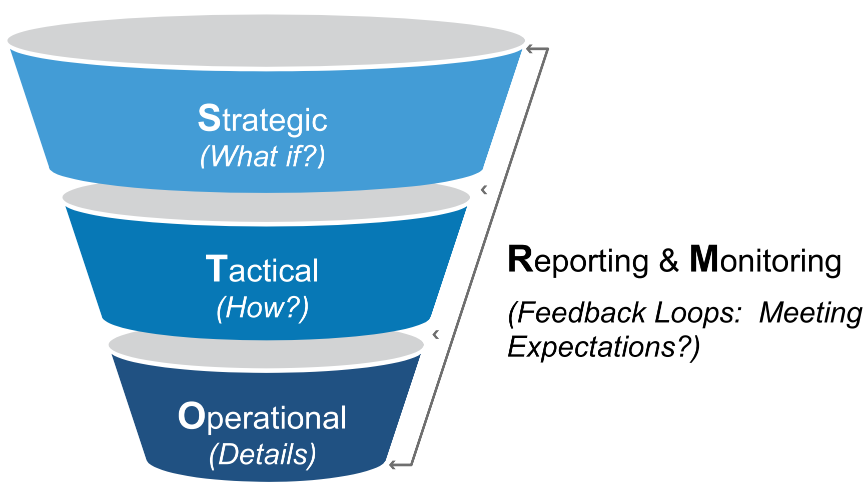
Strategic analysis explores the potential effects of major paradigm shifts and broad policy and investment decisions by evaluating many possible futures. At the strategic level, decision-makers can look at "what if" scenarios to help with long-term visioning, policymaking, or resilience planning to address uncertainty.

Tactical analysis helps to assess the impact of potential statewide or regional investment programs. Analysis at the tactical level helps decision-makers work out how best to implement funding under a limited set of future scenarios. For example, a single or limited set of assumptions for land use, economic conditions, fuel prices, etc. is typical of tactical-level analysis.

Operational analysis helps with short-term decisions in more narrowly focused geographic areas; for example, assessing the effects of localized traffic control strategies, safety improvements, or ITS/system management strategies.

Reporting and monitoring involve measuring the impact of decisions made at each level and confirming that expectations are met or determining if adjustments are needed to improve progress toward goals. Feedback loops, ideally fed by observed rather than modeled data, can inform future strategies, tactics, operational plans, and associated planning tools.

Figure 1. "STORM" Analysis Levels



ODOT, MPOs and local agencies have analysis needs that may fall within multiple STORM categories. Table 1 illustrates how typical planning and project-level activities may correlate with the broad STORM analysis levels. Please note that Table 1 is merely intended to help illuminate common terms for use in GHG analysis discussions. Not every plan or project is the same, and some activities may not fit neatly into a single STORM category.

Table 1. Planning and Project Phases and Typical STORM Analysis Levels

TRANSPORTATION PLANNING AND PROJECT DEVELOPMENT ACTIVITIES	TYPICAL HORIZON TIMELINE	TYPICAL ANALYSIS LEVEL(S)			
		Strategic	Tactical	Operational	Reporting/ Monitoring
PLANNING					
Long Range Scenario Planning	20 to 50 years	✓			
System Planning • ODOT Mode and Topic Plans • MPO Regional Transportation Plans • Regional, City and County Transportation System Plans	Typically 20 years		✓		
Corridor or Sub-Area Planning	10 to 20 years		✓	✓	
PROGRAMMING					
Determining short-term project priorities and funding commitments • Statewide Transportation Improvement Program (STIP) • MPO Transportation Improvement Programs (TIPs) • City and County Capital Improvement Programs (CIPs)	Typically 20 years*		✓	✓	
PROJECT DEVELOPMENT					
NEPA / Environmental Studies	25+ years**			✓	
Project Design	3 to 75 years***			✓	
PROJECT IMPLEMENTATION					
Construction	Immediate			✓	
Maintenance and Operations	Retrospective, typically looking back 1 to 5 years			✓	✓

* While programming is typically done every 2-6 years, analysis of projects within a given program would likely have a 20-year horizon.

**NEPA studies typically look 20 years beyond the opening date of the project. Project environmental studies can begin several years before the project opening date.

TRANSPORTATION PLANNING AND PROJECT DEVELOPMENT ACTIVITIES	TYPICAL HORIZON TIMELINE	TYPICAL ANALYSIS LEVEL(S)			
		Strategic	Tactical	Operational	Reporting/ Monitoring
***Project design horizons can range widely depending on the purpose. For example, a simple operational improvement such as a new traffic signal may use a 3-year design horizon; a roadway improvement project may assume a 20-year design life; a new bridge design may need to consider future conditions 50-75 years out.					

3 CURRENT GHG ANALYSIS REQUIREMENTS

Oregon has several policies, laws and rules that are foundational to understanding current transportation GHG analysis monitoring and reporting requirements (Table 2). There are no federal requirements for GHG analysis in transportation plans and projects at this time, although GHG analysis concepts are being considered at the federal level.[8]

Table 2. Summary of Oregon's Transportation-Related GHG Policies, Laws, Rules and Regulations

Oregon GHG Policy Nexus	
Policy, Law, Rule or Regulation	**Description**
National Environmental Policy Act (NEPA)	Draft guidance has been prepared by the national Council on Environmental Quality on how NEPA analysis and documentation should address GHG emissions.[9] Broadly, the guidance states that, "Agencies should attempt to quantify a proposed action's projected direct and reasonably foreseeable indirect GHG emissions when the amount of those emissions is substantial enough to warrant quantification, and when it is practicable to quantify them using available data and GHG quantification tools."

[8] The draft Fixing America's Surface Transportation (FAST) Act included a GHG reporting metric which was dropped from consideration in July 2018: The proposed metric was percent CO2 reduction relative to 2017, due to on-road mobile sources on the National Highway System. (82 FR 5970, 1/18/17)

[9] Federal Register, June 26, 2019. *Draft National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions: A Notice by the Council on Environmental Quality.* Retrieved from https://www.federalregister.gov/documents/2019/06/26/2019-13576/draft-national-environmental-policy-act-guidance-on-consideration-of-greenhouse-gas-emissions

Oregon GHG Policy Nexus	
Policy, Law, Rule or Regulation	**Description**
ORS 468A.205 **Legislative Policy**	Declares Oregon's policy to reduce GHG from all sources: ▪ By 2020, arrest the growth of Oregon's GHG emissions and begin to reduce them ▪ By 2020, achieve GHG levels that are 10% below 1990 levels ▪ By 2050, achieve GHG levels that are at least 75% below 1990 levels (Note: The Governor's March 2020 Executive Order 20-4 set slightly more stringent targets. See details below.)

2009 Legislative Session, House Bill 2001	This bill laid the foundation for GHG scenario planning processes in Oregon.
	• Required DEQ and ODOE to work with ODOT to estimate the historic and forecast light-duty GHG emissions for each MPO region, considering improvements in vehicle technologies.
	• Created requirements for scenario planning in the Portland Metro and Eugene/Springfield metropolitan areas, per GHG targets identified by the Land Conservation and Development Commission (LCDC):
	  o Required Metro and the local governments in the Portland metropolitan area to prepare, cooperatively select, adopt, and implement (through comprehensive plans and land use regulations) a land use and transportation scenario that meets the GHG target
	  o Required the Central Lane Metropolitan Planning Organization (CLMPO) that serves the Eugene-Springfield area to identify, and local governments to cooperatively select (not adopt or implement), a scenario that meets the GHG target.
	• Specified that DLCD and ODOT provide technical and financial support to the scenario planning efforts.

2010 Legislative Session, Senate Bill 1059	Required the Oregon Transportation Commission (OTC) to develop a Statewide Transportation Strategy (STS) on GHG emissions, identifying state and local actions needed to make progress toward the emission reduction goals in ORS 468A.205. Required ODOT and DLCD to work collaboratively to: ▪ Develop guidelines for scenario planning (developing and evaluating alternative land use and transportation scenarios) that may reduce GHG emissions.

Oregon GHG Policy Nexus	
Policy, Law, Rule or Regulation	**Description**
	▪ Provide analysis tools and case studies to help local and regional decision-makers understand the effectiveness of their actions and programs for reducing GHG. Required LDCD to adopt and periodically review rules setting GHG reduction targets for metropolitan areas, reflecting locally led actions.
Statewide Transportation Strategy (STS)	Completed in 2012 and incorporated into the Oregon Transportation Plan (the state's overarching transportation policy document) on August 16, 2018. Successful implementation of the STS requires actions at the national, state, local and personal level across industry and government. Included a 2-year stakeholder process to agree on a 2050 vision for transportation GHG emission reduction. Covers ground transportation, freight, and air travel and considers a mix of actions that state agencies, with support of local agencies, can do to help meet the state's GHG emission goals. Strategies span actions related to vehicle and fuel technologies, pricing, transportation options, and land use patterns. The STS and on-going monitoring reports are used to inform statewide multi-agency plans. The STS near term implementation plan calls for ODOT and DLCD to support scenario planning in metropolitan areas.
OAR 660.012 **LCDC Transportation Planning Rule (TPR)**	Intended to support Oregon Statewide Planning Goal 12 which includes "avoiding principal reliance on any one mode of transportation" by providing "variety of transportation choices for moving people". Does not currently have specific GHG analysis requirements. Rather, long range transportation system plans are required to reduce VMT per capita, with a focus on short trips served by non-auto modes. Prescribes a 5% internal VMT per capita reduction target over a 20-year planning period for city, county, and regional transportation system plans in metropolitan areas. Scope is limited to trips that start and end in the metro area. If the 5% target cannot be met, allows regions to propose alternative standards with supporting performance measures that must be tracked. Local cities and counties are principally charged with meeting the requirements of the Transportation Planning Rule in metropolitan areas. Revisions to this rule may be coming in the near term. See Governor's Executive Order No. 20-04 below.

Oregon GHG Policy Nexus	
Policy, Law, Rule or Regulation	**Description**
OAR 660.044 **LCDC** **Metropolitan GHG Reduction Targets Rule**	Establishes GHG reduction targets for Oregon's metropolitan areas, with a focus on local policies. Local cities and county jurisdictions within metropolitan areas are principally charged with the reduction of GHG, not MPOs directly. However, local jurisdictions may elect to work cooperatively with the MPO to set targets. Targets under this rule are defined as reductions from 2005 emission levels of per capita GHG emissions from household-based travel and supporting commercial services. The focus is on household-based emissions, both personal travel and local delivery. Requires scenario planning activities for the Portland Metro region. This region must adopt a preferred land use and transportation scenario that supports the region's GHG target. The Portland Metro region is further required to implement their preferred scenario and monitor progress. Scenario planning and implementation is voluntary for other metropolitan regions. Provides light duty vehicle emission rates to be used for scenario planning analyses, by year, in grams of carbon dioxide equivalent per vehicle mile. Prescribes methods and processes to be used for calculating a region's progress relative to the GHG reduction target including state-led policies that can be assumed. Guidelines have been developed to support the scenario planning process and how to calculate the GHG Target Metric for this rule.[10]
OAR 340.215 **DEQ** **Oregon GHG Reporting Program**	Requires owners or operators of emission sources to obtain operating permits or air contaminant discharge permits from DEQ. Transportation-related industries subject to these rules include fuel suppliers (gas, diesel, aircraft dealers, natural gas, propane, and electricity).
ORS 468A.250 **Oregon Global Warming Commission**	The Oregon Global Warming Commission mandate includes tracking and evaluating progress toward the state's GHG reduction goals (ORS 468A.205). In response, DEQ produces annual inventories of GHG emitted by various sectors of the state economy, including but not limited to industrial, transportation and utility sectors. DOE staff support the Commission's work.

[10] Further guidance on tools and assumptions for GHG Target Rule can be found in Oregon's Scenario Planning Guidelines Technical Appendix (pp. 110-124). Retrieved from https://www.oregon.gov/ODOT/Planning/Documents/Oregon-Scenario-Planning-Guidelines-Tech-Appendix.pdf

Oregon GHG Policy Nexus	
Policy, Law, Rule or Regulation	**Description**
Governor's Executive Order No. 20-04 **Directing State Agencies to Take Actions to Reduce and Regulate GHG Emissions**	Establishes new GHG reduction goals for the state:[11] ▪ 45% below 1990 levels by 2035 ▪ 80% below 1990 levels by 2050 These goals represent reductions 5% greater than currently prescribed in legislative policy (ORS 468A.205). (At this time, however, legislative policy goals under ORS 468A.205 are still used to develop Metropolitan Greenhouse Gas Reduction Targets.) Directs state agencies to use any and all authorities to help reach the goals, prioritize work to accelerate GHG reductions, and integrate climate impacts and reductions into policy decisions. On Transportation Specifically: Directs ODOT, DLCD, ODOE and DEQ to establish GHG reduction performance metrics. Directs DLCD to change the Transportation Planning Rule to require transportation plan amendments in metropolitan areas to meet GHG goals. Directs ODOT to develop and apply a process for evaluating GHG impacts of transportation projects as part of regular capital improvement programming processes. Additional general and individual agency directives.

[11] The goal change reflects changes in Intergovernmental Panel on Climate Change (IPCC) guidance for limiting global warming to 2 degrees Celsius by 2050.

4 HOW DO WE MEASURE GHG?

As the policy nexus outlined in Section 3 indicates, transportation related GHG in Oregon is expressed differently for different purposes.

4.1 GHG Accounting Methods

The following quantification concepts have been used to tell the GHG story from different analysis perspectives.

Sector-based. GHG emissions can be described for broad economic sectors, either in combination or individually. A transportation sector based GHG estimate would tally GHG emissions from all forms of transportation: ground passenger and light duty commercial vehicles, plus multi-modal freight, and air passenger transport.

Vehicle-based. GHG emissions may be tallied for all transportation vehicles, or may be quantified for a specific category, such as light duty vehicles alone.

Household-based. GHG emissions can be quantified based on household activity. By default, household-based quantification is typically focused on light duty vehicles. When a spatial analysis is done using a household-based emissions quantification method, all GHG due to household travel is assigned to a household's geographic location, regardless of where travel-related emissions actually occur, including inter-city travel.

Roadway-based. GHG emissions can be estimated for a given stretch of road, based on the number and types of vehicles that use the road over a specified time period. This can be extended to cover emissions generated by vehicles on all roadways within a certain geographic boundary.

Carbon dioxide equivalent (CO2e). GHG emissions are typically measured in carbon dioxide equivalents, reflecting the calculations of combining 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 CO2e emitted (often in metric tons).

Emissions beyond vehicles and fuels. Vehicle and fuel policies are largely set by federal and state legislative regulations (such as federal CAFÉ standards, Zero Emission Vehicle mandates, clean fuels programs). Because vehicle and fuel policies are mostly outside the control of regional and local governments, the Metropolitan GHG Reduction Target Rules focus on regional and local policies over and above any benefits achieved through state-led vehicle and fuel initiatives. Examples of "emissions beyond vehicles and fuels" strategies are VMT reduction strategies, encouraging alternative modes, and some pricing policies.

Well to wheels (lifecycle) emissions. Like a "cradle to grave" approach, a "well to wheels" method accounts for the GHG contribution of fossil fuels from the point of extraction from the ground to discharge into the air in the form of vehicle emissions.

Tank to wheels (tailpipe) emissions. A "tank to wheels" method accounts for the GHG contribution of fossil fuels only as vehicle emissions. That is, the amount of GHG generated from a given volume of fuel after it is placed in the fuel tank.

Project life or specific project period. Life-of-project and project opening year information are used for federal air quality conformity analyses (a process that regulates criteria air pollutants, not GHG). Air quality criteria pollutant standards established by the Environmental Protection Agency (EPA) are used to protect human health and the environment from exposure to pollutants that may dissipate with weather patterns that may vary hourly, daily, or seasonally. Both emission and dispersion modeling plus existing background concentrations are used to assess this impact in both the project opening year and design year. In contrast, a GHG is not an exposure threat; rather it has a cumulative impact. As such, a life of project GHG quantification requires summing the emissions from all hours, all days across the life of a project. (This is rarely done.)

Consumption-based. A consumption-based approach assigns GHG production based on consumption of goods, rather than by vehicle group. A consumption-based perspective assumes each item or service used by a household has GHG emissions associated with its production, movement, and ultimate disposal.

Total vs. per capita emissions. For a given geographic area, GHG can be presented as total emissions contributed by all activity, or as a per person value. GHG estimates that are developed using many of the accounting methods listed above can also be presented as total or per capita values (or similarly, on a per mile basis).

Other GHG accounting considerations. GHG quantification methods are often selected based on the geographic scope of the study in question, and the specific reporting requirement or question that the study is intended to address. For example, different quantification methods are used for DEQ's GHG inventory than for metropolitan area target setting, or regional or local transportation system planning. Some data is not available or useful at all scales. For example, fuel sales information is typically not available at sub-state levels, and there is less confidence in data at smaller scales because people may buy fuel in one geography and burn it in another.

Similarly, analysis periods may also differ due to different purposes, depending on the perspective required. For example, Oregon's Metropolitan Greenhouse Gas Reduction Target rules require a comparison of future annual GHG emissions to 2005 levels, whereas the state's Transportation Planning Rule requires VMT analysis using a rolling 20-year planning horizon.

Quantification results can also be significantly influenced by the presence or lack of financial constraint. For example, Oregon's Metropolitan Greenhouse Gas Reduction Targets rule and Transportation Planning Rule require plans to reflect "reasonably likely" financial plans, whereas the STS and scenario planning processes allow broader "what if" analyses.

Table 3 summarizes various GHG definitions currently used for different purposes in Oregon.

Table 3. Example GHG Definitions and Quantification Methods for Transportation Related Analysis

Quantifying GHG	
Analysis Purpose	**GHG Estimation Approach**
Metropolitan Greenhouse Gas Reduction Targets and the Statewide Transportation Strategy	For Metropolitan Greenhouse Gas Reduction Targets, OAR 660.044 defines GHG reductions as the change in per-capita emissions from travel activities using light vehicles relative to the fixed year of 2005, covering the metropolitan region. Targets are defined as "emissions beyond vehicles and fuels" (GHG reductions that can be made over and above reductions anticipated through advances in vehicles and fuel technologies). ODOT's VisionEval[12] tools were used for setting and tracking targets in several metropolitan areas. These tools are set up to account for annual metric tons of lifecycle household-based carbon-dioxide equivalent (CO2E) GHG per capita.
Transportation System Plans (TSPs) **and** **Regional Transportation System Plans (RTSPs)**	Oregon's Transportation Planning Rule (OAR 660.012) does not require transportation system plans to forecast or estimate GHG emissions. Rather, transportation plans must demonstrate regional reductions in average weekday vehicle miles travelled (VMT) per capita. We include a description of how VMT reductions are quantified for Transportation Planning Rule compliance here, since VMT is sometimes perceived as a proxy for GHG (see further discussion in Section 4.2.2.). With application of emission rates, VMT might be used to track GHG in general or potentially to the GHG Target Rule if definitions are aligned. In the Transportation Planning Rule, VMT is defined as miles of travel for "automobiles", which are further defined as "automobiles, light trucks, and other similar vehicles used for movement of people." [13] The definition does not include buses, heavy trucks and trips that involve commercial movement of goods.[14] Also, VMT calculations for this purpose include only trips with an origin and a destination within the metropolitan planning boundary. Pass through trips (trips with a beginning and end point

[12] VisionEval is a national initiative to develop an open source programming framework for disaggregate strategic planning models. This work is supported by a multi-agency partnership that includes ODOT. For more information, see https://github.com/visioneval/visioneval.
[13] Transportation Planning Rule, OAR 660-012-0005.
[14] Although only automobile trips are included in VMT calculations used for Regional Transportation System Plans, only some regional travel demand models in Oregon can differentiate between auto, transit, commercial and freight trips.

Quantifying GHG	
Analysis Purpose	**GHG Estimation Approach**
	outside of the boundary) and external trips (trips with either a beginning or an end point outside of the boundary) are excluded. While only a portion of a region's VMT is considered for Transportation Planning Rule compliance, travel demand models used for local and regional planning can typically forecast travel of all vehicle types on the roadway network within a given geographic boundary for a 20-year rolling horizon. Travel demand models typically do not include weekends, and do not account for non-recurring incidents as well as other GHG reducing policies (i.e. TDM, Eco Driving, ITS/Operations policies), however. The EPA MOVES model has been used as a post-processor to estimate GHG and other pollutants from the VMT estimated by a travel demand model. MOVES emission rates are tank-to-wheels and vary by vehicle speed, drive cycle and meteorological conditions. However, MOVES models are currently available only in areas under federal air quality conformity regulations. Emissions are reported for the federally recognized air quality maintenance boundary for metropolitan areas designated as attainment or maintenance. Emissions reported are for vehicle travel occurring within the federally designated metropolitan planning area boundary, regardless of where trips begin or end.
Sector-Based Inventory	A sector approach accounts for GHG emissions associated with activities occurring within a geography of interest by multiple economic sectors. For example, DEQ estimates tank-to-wheels (except for the electricity sector) GHG emissions based on data collected through their GHG Reporting Program from certain facilities, fuel importers, electricity and natural gas suppliers and landfills[15], and modeled emissions estimates from EPA's State Inventory Tool (SIT)[16] Statewide GHG contributions are summarized from broad economic sectors including transportation, electricity use, natural gas, residential and commercial, industrial, and agricultural. Results are expressed in total annual metric tons of carbon dioxide equivalent.

[15] Oregon Department of Environmental Quality, Oregon Greenhouse Gas Sector-Based Inventory Data, https://www.oregon.gov/deq/aq/programs/Pages/GHG-Inventory.aspx.
[16] United States Environmental Protection Agency, Energy Resources for State and Local Governments, State Inventory and Projection Tool, retrieved from https://www.epa.gov/statelocalenergy/state-inventory-and-projection-tool#:~:text=EPA's%20State%20Inventory%20Tool%20(SIT,or%20complete%20a%20new%20inventory.

Quantifying GHG	
Analysis Purpose	**GHG Estimation Approach**
	Local Climate Action Plans also are multi-sector. Some local inventories have used the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions[17] and Greenhouse Gas Protocol[18] methods that comply with international commitments associated with membership in the C40 cities.
Consumption-Based Inventory	A consumption-based approach accounts for life cycle (i.e. production to disposal) GHG emissions associated with the consumption of goods and services by residents and businesses within a geography of interest. DEQ produces a statewide consumption-based inventory[19] every five years that measures GHG emissions produced locally, nationally and internationally due to the state's consumption of goods and services like cars, food, fuels, appliances, and clothing, many of which are produced in other states or overseas. While DEQ's sector-based inventory is a tank-to-wheels approach, their consumption-based approach is well-to wheels. It considers the purchase of a final good or service by an Oregon consumer as the act that determines whether a commodity's life-cycle emissions should be in or out of the inventory, regardless of where the consumption or emissions actually occur. Like other inventories, GHG is expressed as annual lifecycle metric tons of carbon dioxide equivalent. In 2010, Metro developed a systems-based approach to estimate GHG emissions within their jurisdictional boundary. This inventory, blended sector- and consumption-based approaches to establish a carbon footprint of the region to focus planning efforts on achieving long-term GHG emissions reductions from all sectors. The inventory estimated the annual lifecycle GHG contribution of locally consumed materials (i.e., goods and food), energy and transportation from all domestic and international source where possible. Relying on evolving EPA data and analysis methods, this hybrid inventory was considered provisional and experimental because it did not reflect a fully vetted protocol for

[17] ICLEI USA, Local Governments for Sustainability, US Community Protocol is available online at https://icleiusa.org/publications/us-community-protocol/
[18] Greenhouse Gas Protocol, GHG Protocol for Cities: An Accounting and Reporting Standard for Cities, retrieved from https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities
[19] Oregon Department of Environmental Quality, Consumption-based Greenhouse Gas Emissions Inventory for Oregon, retrieved from https://www.oregon.gov/deq/mm/Pages/Consumption-based-GHG.aspx

Quantifying GHG	
Analysis Purpose	**GHG Estimation Approach**
	GHG accounting at the regional level. There are no plans to update this inventory in its current form.[20]

4.2 Issues with Current GHG Estimation Approaches and Measures

It is important to understand that each approach described above in Table 3 serves a different policy purpose. Different assumptions, tools and calculation methods pertain to each approach.

4.2.1 Comparability of Results from Different Stages of the Planning Spectrum

Quantification of GHG using one approach may not be comparable with GHG estimation findings using another approach. This is a challenge for transportation analysts and planners who may desire to compare estimated GHG outcomes of transportation system plans and air quality conformity analyses against metropolitan GHG reduction targets. These numbers are not directly comparable. For example, significant methodological differences in how VisionEval and RTP-level tools estimate on-road vehicle emissions do not currently allow for direct comparison of forecasted on-road vehicle emissions results, for sub-state areas. These differences have been documented by Metro in Appendix J to Metro's 2018 RTP[21]

Analysis for local and regional transportation plans is focused on the transportation system performance and related needs and improvements by location and type (all modes). These planning processes use travel demand models that were developed to plan for average-weekday future infrastructure needs counting all vehicles. Travel demand models use a *roadway network* accounting method limited to travel within the region's boundary.

Conversely, Oregon's Metropolitan Greenhouse Gas Reduction Targets look at a variety of policy issues beyond those typically accounted for in regional travel demand models used in the RTP process. Within the target setting process, GHG is defined as all days, *household-based*, light duty vehicle GHG regardless of where the travel occurs (inside or outside the planning area). This is done to capture cumulative impacts attributed to GHG-producing activity where reduction policies can be effectively implemented. Further the Metropolitan Greenhouse Gas Reduction Targets focus on emissions reductions *beyond vehicles and fuels* and allow regions to account for ambitious *state-led policies* that are not typically included in local and regional transportation plans (e.g., pricing, accelerated vehicle electrification).

The issue is further complicated when looking at the per capita VMT reduction that must be addressed in transportation system plans to comply with Oregon's Transportation Planning

[20] Oregon Metro (2018), *2015 Consumption-Based Greenhouse Gas Emissions for the Metro Wasteshed*.
[21] Metro, 2018 Regional Transportation Plan Appendix J: Climate Smart Strategy implementation and monitoring, https://www.oregonmetro.gov/sites/default/files/2019/04/02/RTP-Appendix_J_Climate_Smart_Strategy_Monitoring181206.pdf

Rules. The purpose of the VMT reduction requirement in Oregon's Transportation Planning Rule is to reduce reliance on the automobile, so a more restrictive *internal* VMT definition is used that only counts trips that both start and end within the city or region boundary.

Because of these differences, GHG outcomes calculated based on VMT information from local and regional transportation plans cannot be easily extended for comparison with the region's Metropolitan Greenhouse Gas Reduction Targets.

Similarly, in the monitoring stage, there is a need for consistency in methods and accounting approaches for GHG inventories, so they are comparable across the state and best align with policy actions (e.g., by vehicle group). As important tools to track progress, DEQ's statewide Sector- and Consumption Based inventories are valuable templates for local inventories.

More work is needed to understand the differences in definitions, assumptions, and quantification methods, and to create guidance for aligning GHG estimates generated at different stages of the planning spectrum. A key discussion question for the OMSC's GHG subcommittee is whether strict comparability of results from two or more planning levels is essential, or if we primarily need tools to assure that the magnitude of GHG reductions from investment decisions are adequately moving Oregon toward the ultimate GHG goals.

4.2.2 VMT as a Proxy for GHG

Caution is prudent in the use of any of the various VMT definitions as a proxy for GHG because the relationship between VMT and GHG changes over time as vehicle powertrain technology and fuel efficiency ratings change.

For example, the GHG produced by an electric vehicle travelling a certain number of miles is different than the GHG produced by a gasoline vehicle that gets 9 mpg travelling the same distance.[22] Odometer data that would allow tracking of VMT by powertrain type and help to inform policy or pricing choices is not widely collected in Oregon. Also, emission rates are sensitive to both vehicle speed and future vehicle mix assumptions.

4.2.3 Converting VMT to GHG: Defining Emission Rates

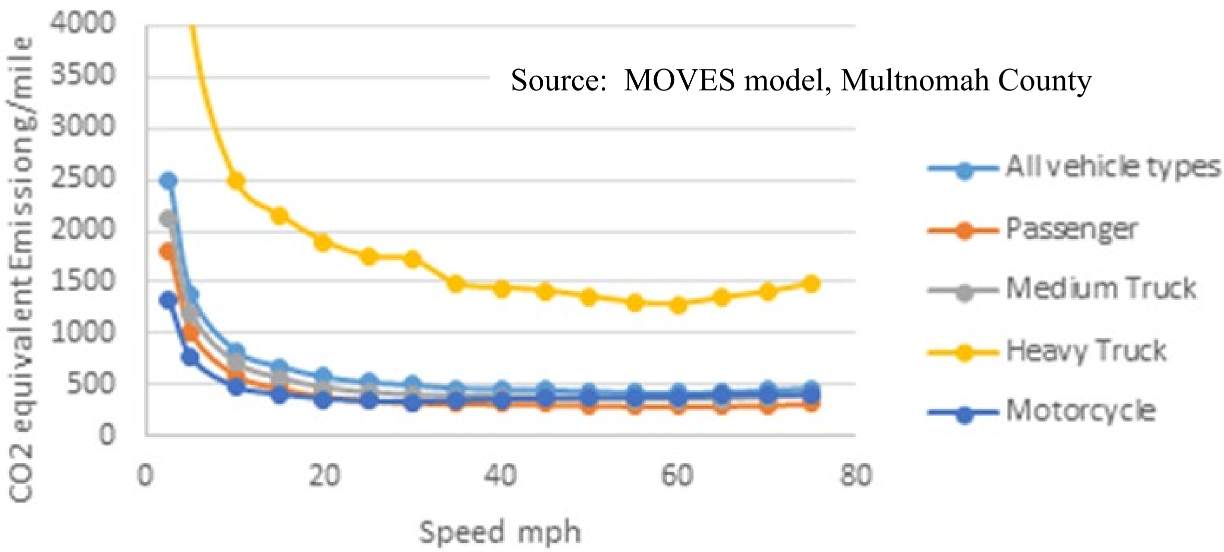
Most transportation planning efforts in Oregon do not currently report on GHG. In large part this is due to a lack of universally used assumptions and standard calculation methods for GHG emission rates. If emission rates were developed for use statewide, they could potentially be applied to existing study outputs of VMT to estimate GHG.

Vehicle speed considerations. Figure 2 shows how GHG is sensitive to speed using an example from Multnomah County in the Portland Metro region. Fuel efficiency varies with speed (more so for combustion engines), so simply looking at VMT discounts the emission reduction of more optimal speeds. Thus, GHG analysis methods should account for VMT by speed, with sensitivity to eco-driving or speed smoothing of advanced vehicles and ITS/Operational policy actions, including congestion due to incidents. Obtaining accurate forecasted speed information

[22] This website compares EV fuel efficiency to other vehicles: https://evtool.ucsusa.org/

for urban areas is a challenge since most travel demand models are not validated to vehicle speed.

Figure 2. GHG Emissions by Vehicle Speed: Example from Multnomah County



Future vehicle mix considerations. GHG emissions per mile travelled also vary by vehicle type and model year. An old car or even a newer SUV emits considerably different (higher) amounts of CO2 per mile travelled than newer passenger cars.

There are questions about the level of refinement needed when representing future vehicle mix to meet various analysis purposes. Less refinement is needed when simply comparing between alternative scenarios, more accuracy is needed when absolute values of total emissions are used. Conservative estimates that meet a target, are sufficient without further refinement, but may not be the most accurate or current in reporting for other purposes. For example, a conservative assumption that assumes little change from today's higher emitting vehicle mix may be sufficient for confirming that regional air pollutants are below an established threshold, but further refinement may be needed to meet tighter GHG targets.

Further complicating matters, the Metropolitan Greenhouse Gas Reduction Target Rule allows local agencies to assume future vehicle and fuel actions outlined in the STS Vision will occur. These actions reflect more ambitious vehicle electrification than the current trend policies assumed in the MOVES model.

For the most accuracy, emission rates would reflect local vehicle mix data (i.e., from DMV records) and vary by year, given the anticipated fleet electrification over time. In more detailed project-level efforts, since travel models are not validated to speed, speed outputs should come from microsimulation models, or be adjusted using real-time speed data to be more realistic. Assumptions may need to be made about the proportion and type of heavy-duty vehicles.

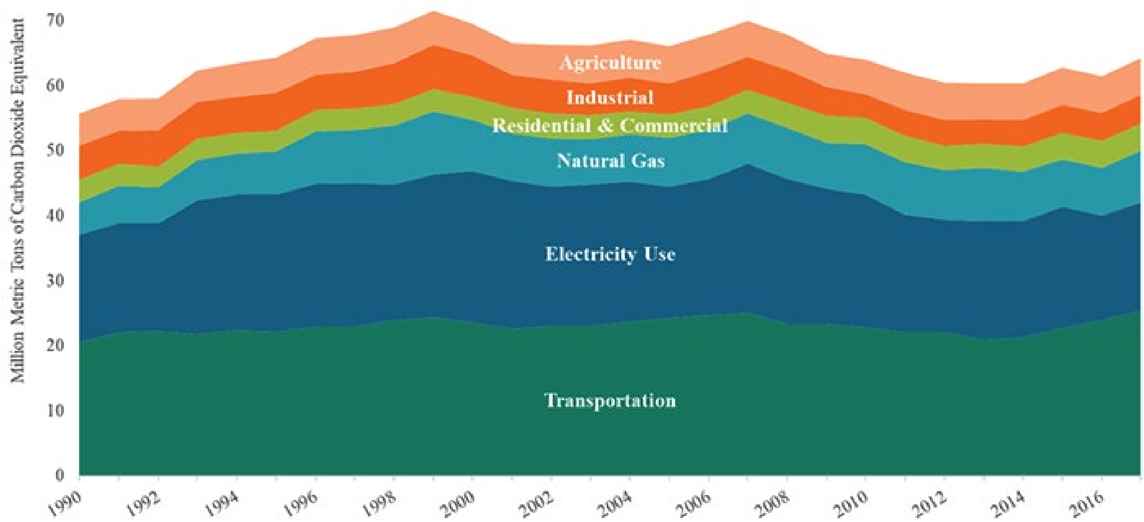
5 WHAT HAVE WE ALREADY LEARNED?

5.1 GHG Contributions from the Transportation Sector

5.1.1 Transportation's Historic Contribution to GHG

DEQ's GHG inventory indicates that the transportation sector overall in Oregon has comprised up to 40% of the state's annually reported GHG emissions over the last two decades (Figure 3).

Figure 3. Oregon GHG Emissions by Broad Economic Sector, 1990-2017[23]



However, ground transportation concerns (those dealing with passenger vehicles and light/medium duty commercial delivery trucks) dominate transportation system planning and decision making at the state, regional and local level. Historically, according to the STS 2018 Monitoring Report, these modes have comprised roughly half of the transportation sector's total GHG (Figure 4). This is an important point in understanding the amount of influence that local governmental agencies can realistically have on reducing future GHG. Meaningful strategies to reduce GHG from ground passenger vehicles and light trucks will be helpful; however, significant GHG reduction strategies for modes that have been less actively pursued by governmental agencies, such as air, rail, water transport, and long-haul heavy truck freight, will also be required.

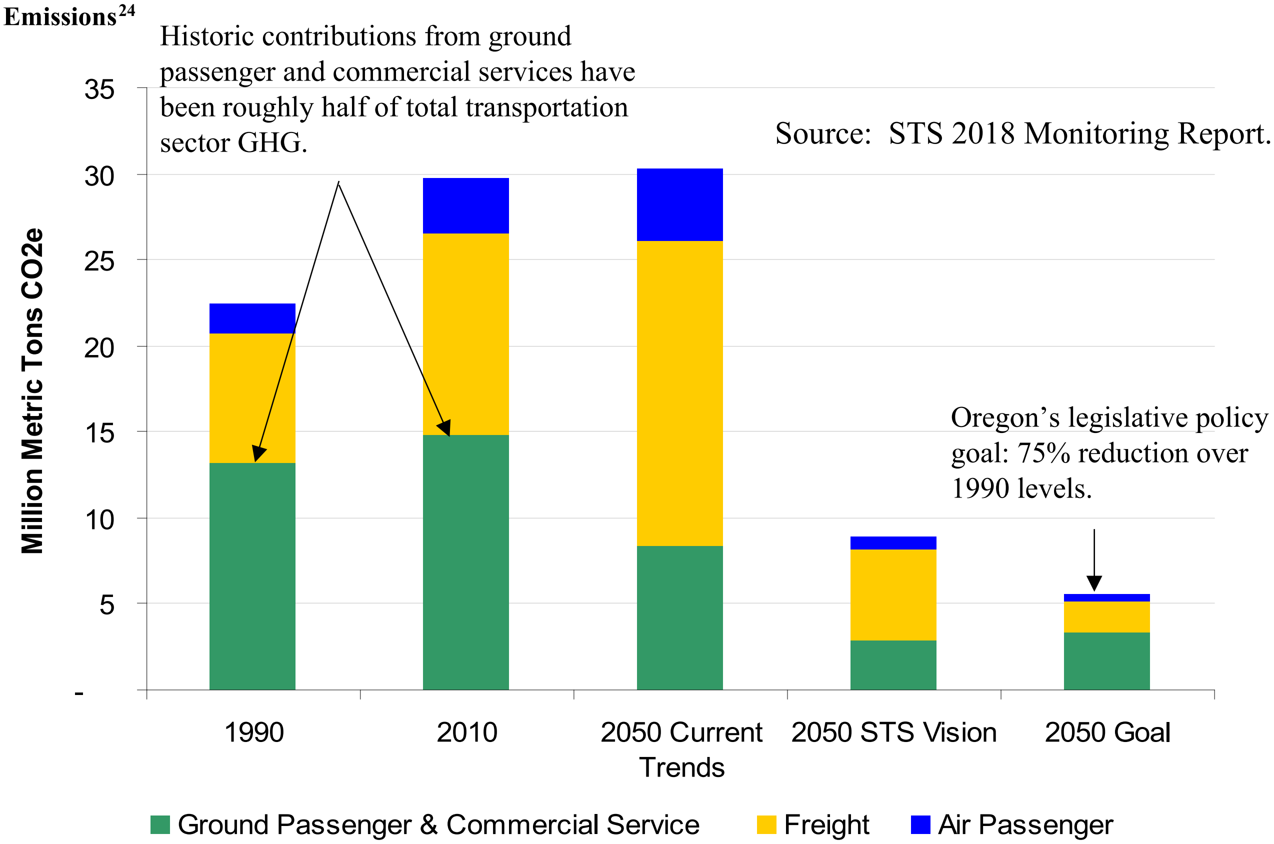
As Figure 4 implies, significant action will be required to meet or approach Oregon's legislative policy goal of reducing GHG production to 75% of 1990 levels by the year 2050. Since the STS was launched in 2010, we have learned much about how best to influence GHG in the planning and project development process, and the actions that have the greatest benefit.

Notably, Figure 4 indicates that while GHG from ground passenger and commercial service is expected to decline under current trends, GHG from freight activities is expected to grow

[23] Oregon Department of Environmental Quality, Oregon Greenhouse Gas Sector-Based Inventory Data, https://www.oregon.gov/deq/aq/programs/Pages/GHG-Inventory.aspx

significantly. This is chiefly because electric vehicle rollout for passenger vehicles is expected to outpace fuel technology innovations for other modes. Also, state, regional, and local governments have less ability to affect freight and air modes than light duty vehicles.

Figure 4. Estimated (1990 and 2010) and Projected (2050) Statewide Transportation Sector GHG Emissions[24]



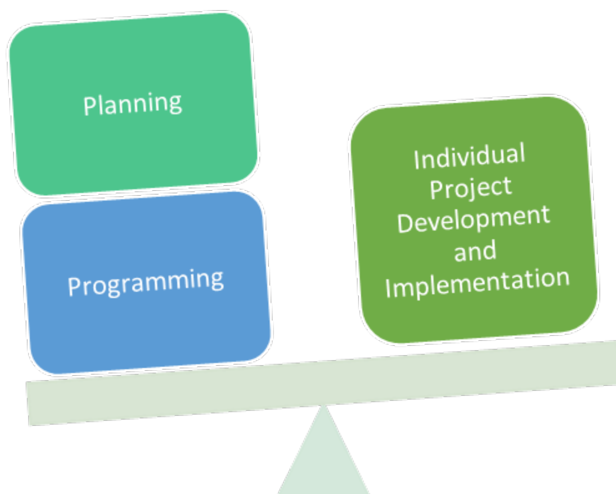
The general public may incorrectly perceive that ground passenger transport contributes a majority of the state's GHG emissions. However statewide inventories indicate passenger vehicles are less than half of all transportation sector emissions. These findings provide a reality check on the amount influence that strategies focused solely on light duty vehicles can be expected to have. This highlights the need for action on multiple transportation fronts, and other consumption behaviors outside of the OMSC's purview (e.g., food waste, goods consumption, and energy efficiency of residential, commercial, and industrial buildings).

[24] Oregon Department of Transportation (2018), *Oregon Statewide Transportation Strategy 2018 Monitoring Report*. Retrieved from ODOT website at: https://www.oregon.gov/odot/Planning/Documents/STS-2018-Monitoring-Report.pdf

5.1.2 When Do Agencies Have the Greatest Ability to Influence GHG?

Reducing GHG requires investment decisions that make progress toward Oregon's long term GHG reduction goals. At the planning stage, broader, policy-level decisions can create large-scale changes in how investments are prioritized and how transportation projects and strategies are developed and implemented. Thus decisions made during planning (for example identifying long-range strategies for a system-wide plan) and programming (for example selecting a package of near-term capital investments for funding and implementation) have a greater ability to impact future GHG levels than decisions made later as individual projects are developed and implemented (Figure 5). This is not to say that planning and programming matter more than following through with implementation, since we cannot move the needle if plans are not ultimately implemented.

Figure 5. Influencing GHG in Planning and Project Processes



For this reason, tools designed specifically for transportation GHG evaluation so far (such as ODOT's VisionEval tools) have focused on supporting statewide and regional scenario planning, to help decision makers understand the broad scale benefits and impacts of future potential actions. ODOT is currently working on GHG analysis methods and processes, (mandated in Executive Order 20-04), that can be used during programming, when capital investments are selected for near-term funding.

5.2 Governmental Interventions to Reduce Transportation Related GHG

5.2.1 What Moves the Needle Statewide?

State, regional, and local agencies have varying processes and tools at their disposal for reducing transportation related GHG. The STS looked at how GHG emissions may be reduced through vehicle and fuel technology, pricing, system and operations strategies, transportation options, and land use. Figure 6 shows the relative magnitude of broad categories of strategies from a statewide perspective.

Figure 6. STS 2018 Monitoring Report: What Moves the GHG Needle?

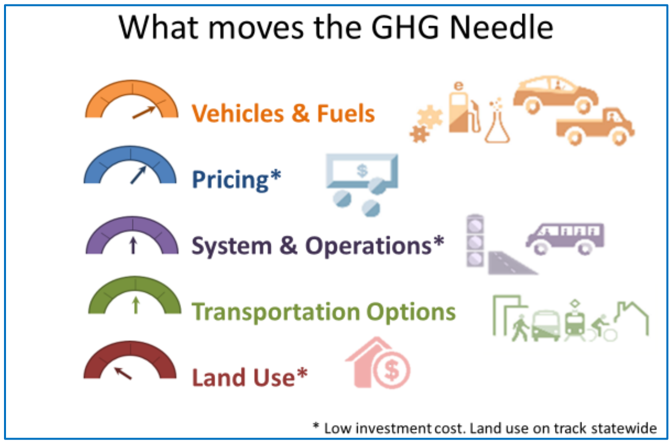


Table 4 shows the state's progress in achieving the policy actions called for in the STS based on adopted state and regional transportation plans. Government policies can encourage GHG reduction, but the choices made by individuals and businesses will largely determine whether GHGs are ultimately reduced. The recovery from the 2008 recession and low gas prices, for instance, are powerful headwinds that increased the challenge in reaching GHG reduction goals according to the 2018 STS-Monitoring Report.

Table 4. Potential of Ground Transportation Strategies to Move Toward Oregon's GHG Goals[25]

Effects of Governmental Strategies on Transportation Related GHG[26]

● On track with or exceeding the STS Vision
◖ Moving in the direction of the STS Vision
○ Little to no progress toward the STS Vision
⊗ Moving away from the STS vision / trending in a negative direction

	STS Strategy	Short Term	Long Term
VEHICLES & FUELS	Vehicle Mix	◖	○
	Fuel Efficiency (MPG)	◖	○
	Battery Range	●	●
	SUV/Light Truck Share	⊗	⊗
	Vehicle Age	⊗	⊗
	Fuel Carbon Intensity	◖	○
	Electric Carbon Intensity	●	◖
	Bus Fuels	⊗	◖

[25] ODOT Presentation to State Agency Directors, "*Statewide Transportation Strategy 2018 Monitoring Report Findings, Key Messages and Progress Relative to STS Vision*",(previously unpublished work from April 2018)
[26] STS strategies presented in this table are for ground passenger vehicles and commercial services rather than freight or air modes.

Effects of Governmental Strategies on Transportation Related GHG[26]

● On track with or exceeding the STS Vision
◖ Moving in the direction of the STS Vision
○ Little to no progress toward the STS Vision
⊗ Moving away from the STS vision / trending in a negative direction

	STS Strategy	Short Term	Long Term
PRICING	More Sustainable Funding Source (e.g. OReGo)	◖	○
	Congestion Fee (Portland Area)	◖	◖
	Pay-As-You Drive Insurance	◖	○
	True Cost Pricing (e.g. Carbon Fee)	⊗	⊗
SYSTEMS AND OPERATIONS	Intelligent Transportation Systems	◖	◖
	Managed Road Growth	●	●
	Parking Fee Coverage	●	●
	Parking Price	⊗	⊗
	Fuel Efficient Driving	⊗	⊗
TRANSPORT-ATION OPTIONS	Public Transportation Service	◖	○
	Biking and Walking	◖	◖
	Carshare	●	◖
	Demand Management Programs	●	◖
LAND USE[27]	Urban Growth Boundary Expansion	●	●
	Mixed Use Areas	●	●

5.2.2 Metropolitan Area Considerations

Scenario planning activities to date in Portland-Metro, Eugene-Springfield, Corvallis, and Rogue Valley, indicate that regional GHG strategies are relatively consistent with those recommended in the STS. That is, strategies developed for these metropolitan areas typically include full support for state-led transition to cleaner vehicles and fuels, funding of local modal options (projects often already on the books for transit, walking, and biking), associated marketing programs, options to ease congestion, and land use laws to restrain the footprint of urban growth.

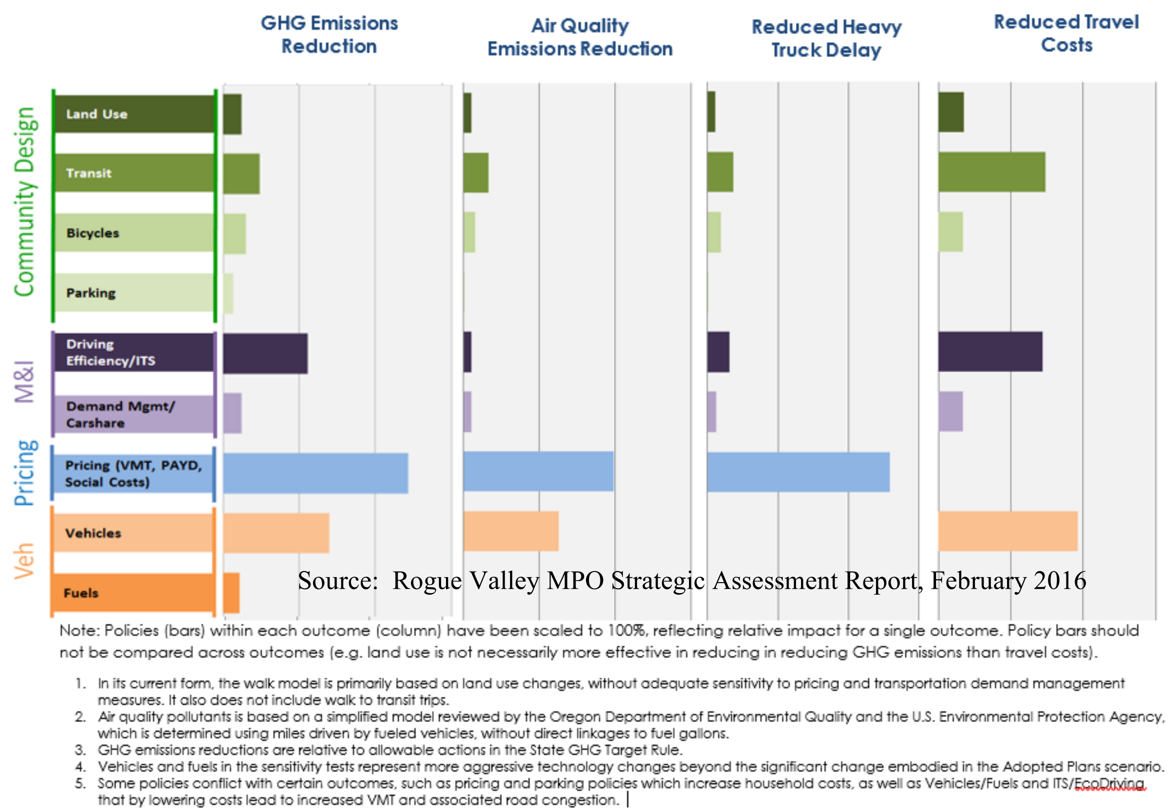
Multi-modal options are important elements of MPO planning for many reasons, such as considering the needs of protected population and addressing congestion issues. While modal strategies alone may not have a significant effect on GHG, modal strategies can provide

[27] Land use can be a significant aid to GHG and other multi-modal policy benefits. This table summarizes progress relative to the mix of policies identified in the two-year stakeholder process that developed the STS Vision. The agreed-to mix of policies balanced meeting GHG reduction goals with other impacts. STS stakeholders chose to assume that Oregon's historical land use growth restrictions would continue through 2050. From a statewide view, land use metrics of UGB growth and population living in urban mixed-use areas remain on track per the STS Vision, albeit the bulk of the progress comes from land use trends in the Bend and Portland metropolitan areas. Given its key role on GHG goals, it is essential to keep land use on-track with the STS Vision.

significant value when combined with other GHG reduction strategies. For example, pricing policies were embraced with more trepidation by policymakers in metropolitan areas. The role of modal options was seen as critical for GHG reduction – not only to reduce VMT, but perhaps more importantly to buffer the equity impacts of rigorous pricing strategies needed to reach GHG and congestion reduction goals.

Sub-areas of the state may be more or less sensitive to specific policy actions than the state as a whole, and each metropolitan area has placed a slightly different emphasis on the package of policies and strategies to be implemented for GHG mitigation. Figure 7 provides the relative impacts of potential policy adjustments that were discussed in the Rogue Valley metropolitan area (Medford region).

Figure 7. Relative Impacts of Policies by Outcome Measures for the Rogue Valley MPO



Source: Rogue Valley MPO Strategic Assessment Report, February 2016

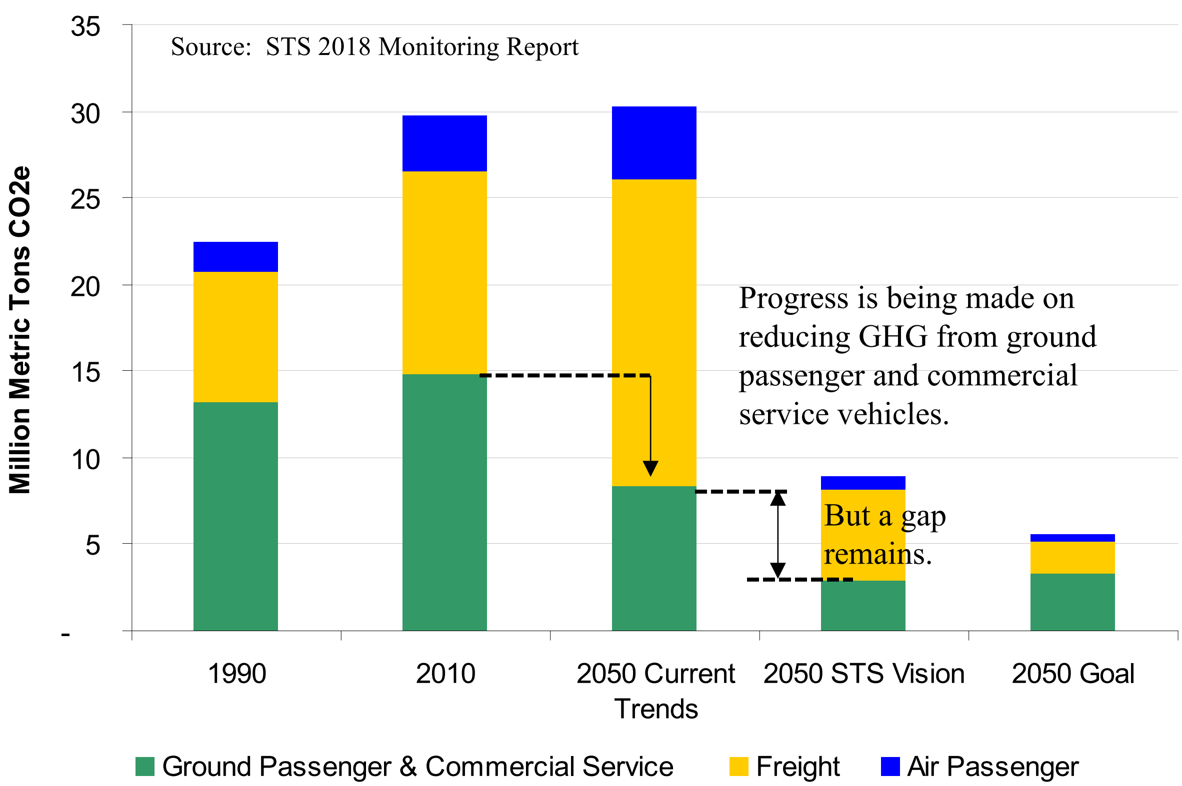
6 LOOKING AHEAD

6.1.1 Addressing the Gap Between Current Plans and Oregon's GHG Goals

Oregon as a state will need to reduce overall annual transportation related GHG emissions by roughly 22 to 25 million metric tons of carbon dioxide equivalent to achieve the state's goals by the year 2050.

Regional and local governments have more influence on strategies associated with ground passenger vehicles and light duty delivery trucks than on heavy freight and air transportation. An STS analysis of current trends (Figure 8) indicates that significant strides toward GHG reduction goals for ground passenger vehicles and light duty trucks are anticipated by 2050. This is chiefly because electric vehicle rollout for passenger vehicles is expected to outpace fuel technology innovations for other modes. Nonetheless, a gap remains, and further strategies across many authorities will need to be implemented to meet the state's vision for 2050.

Figure 8. Progress Toward Oregon's GHG Vision



For light-duty ground transportation modes, addressing the gap between the STS Vision and Plans & Trends, as reported in the STS-Monitoring report, will require a mix of statewide policies related to vehicles and fuel, system operations, transportation options and pricing. (Figure 9 and Figure 10).

Figure 9. Gap Between STS Vision and Current Trends

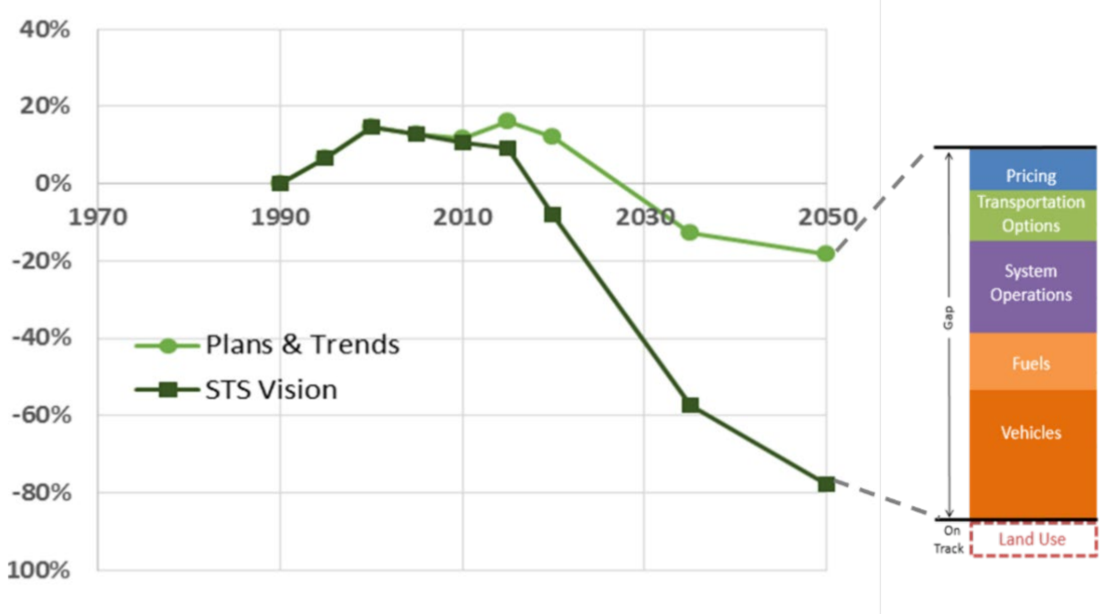
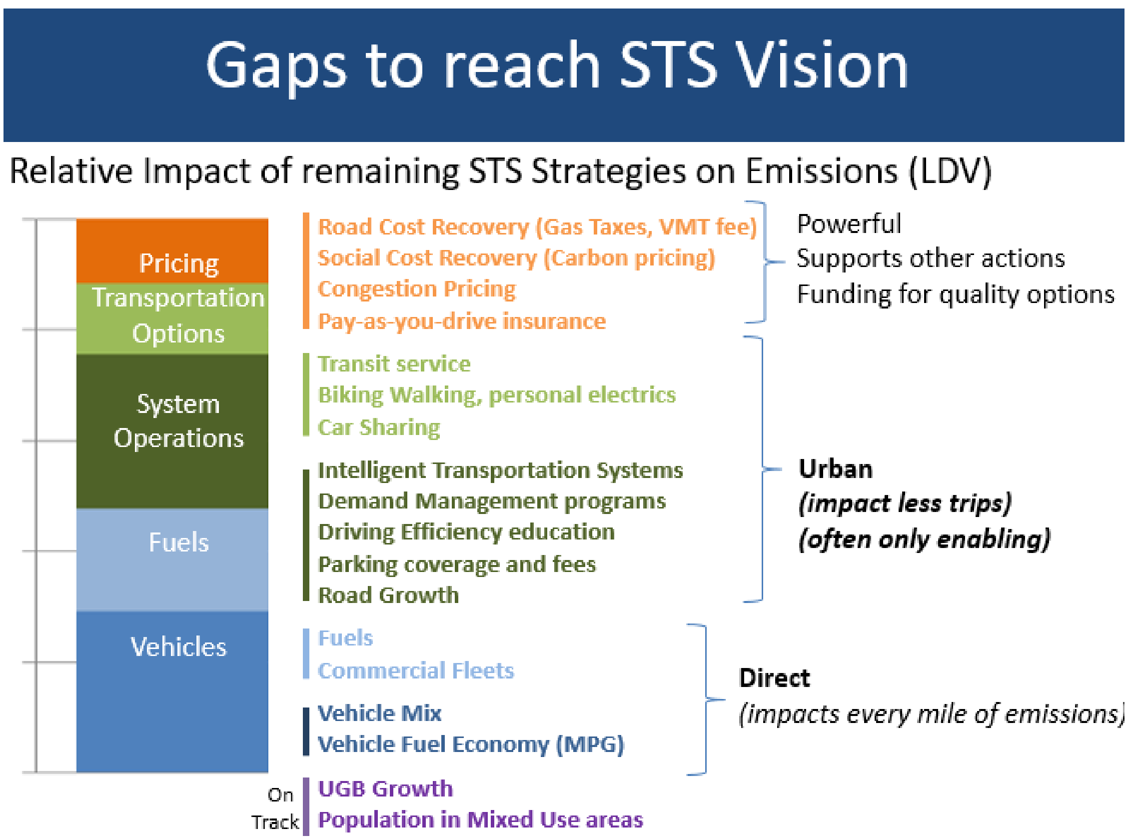


Figure 10. Addressing the Gap to Meet the STS Vision



6.1.2 Inter-Relationships Affecting GHG Reduction Planning

Government agencies at different levels each have a role to play in achieving the STS vision. And, while governments can enable behavioral choices through investments in infrastructure and policies that provide incentives and disincentives, ultimately consumers and businesses determine GHG levels through their choice of home and work locations, vehicle purchase decisions, mode choice, and travel distances.

6.1.3 Shared Responsibilities

While we have gathered some understanding of roles and responsibilities in GHG production, further analysis is needed to support concepts for sharing the GHG mitigation burden among various economic sectors, geographies, authorities, and project contexts. Given future uncertainties, roles and responsibilities may not be static. Rather, flexibility will likely be needed with opportunities to revisit and adjust roles and responsibilities as we learn more over times. Some initial concepts for data to support these burden sharing concepts are outlined here.

<u>Sector burden</u>. The STS lays out a clear roadmap for reducing state GHG in the transportation sector, and comparable roadmaps for other sectors do not exist to date. However, from financial or political standpoints, GHG reductions may be easier to achieve in one economic sector than another. For example, non-transportation sectors may be able to take on a disproportionately larger share of mitigation responsibility, allowing a lower mitigation burden for the transportation sector.

Policy makers may also need information to help deal with uncertainties in policy effectiveness. For example, within the transportation sector, Oregon's Metropolitan Greenhouse Gas Reduction Targets allow metropolitan regions to include credit for ambitious state-led actions such as vehicle and fuel technology shifts that lead to less GHG reduction per mile driven. If legislation necessary for that broad paradigm shift on vehicles and fuel or pricing is hindered, or federal fuel efficiency standards are rolled-back, the importance of collective action by state, regional, and local governments, and potentially other sectors across Oregon will increase. Conversely, if more GHG reduction can be accomplished through vehicle and fuel related strategies, less action may be needed from state, regional, county and city governments.

<u>Varied burden by transportation mode</u>. Looking at ground transportation, heavy duty freight vehicles are anticipated to lag light duty vehicles in the implementation of electric vehicle and alternate fuel technology. So, a disproportionate share of the mitigation burden may fall on the light duty fleet, at least in the near term.

Strategies and ongoing actions aimed to reduce freight emissions as well as commercial delivery and transit vehicles, could be shared and communicated in local plans. (Transit vehicles are increasingly moving to cleaner technologies but drive fewer miles than other vehicle groups.) More analysis is needed to forecast GHG by <u>all</u> modes over time.

<u>Varied burden for state, regional and local transportation agencies.</u> Authorities for implementing the STS Vision are split across state, regional, and local actions. The Governor's Executive Order 20-04 outlines a mix of authorities for transportation related GHG actions, such

as clean fuels strategies led by DEQ and electric vehicles adoption led by ODOE. Other actions recommended in the STS, such as cap and trade concepts or fuel taxation, require legislative action.

Collaboration is required as no one level of government alone can mitigate GHG to target levels. However, within the range of governmental entities with transportation jurisdiction, some agencies may be in position to have a larger influence over GHG emissions than others.

Regional and local governments are best positioned to implement other strategies such as land use planning, multi-modal options (transit, bike, walk, car sharing), congestion management (ITS, road growth), and urban pricing policies (congestion pricing, parking fees, local gas taxes and registration fees). Many of these have less direct impact on GHG on their own but are important to enable implementation of other policies with greater impacts. For example, providing multi-modal options in urban areas may or may not change how a person chooses to travel depending on the cost and quality of other mode options. But multi-modal options have significant value in helping to address equity issues that may surface with implementation of pricing policies.

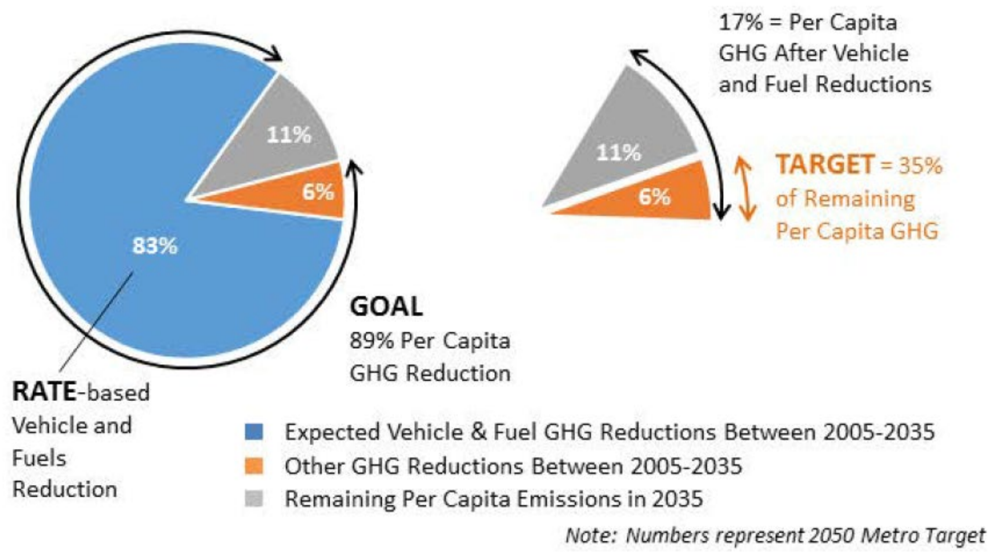
Analysis is starting to help us understand authorities for the light duty household-based vehicle emissions. For example, the STS found that vehicle and fuel policies, and many pricing policies, are important for all areas to meet GHG goals. Federal and state governments have the greatest influence in these policy areas. Because vehicle and fuel technologies are largely outside the policy purview of MPOs, benefits from these strategies are excluded in the GHG targets set for metropolitan areas (Figure 11). The remaining local actions primarily result from VMT reduction through pricing policies, shorter trips, and robust multi-modal transportation options.

More analysis will likely be needed to understand the role of emerging modes on GHG, both micro-mobility and connected/automated vehicles, as well as incentives and disincentives for pricing to achieve public goods, e.g., limit vehicle miles travelled, and maximize use of low-carbon vehicles. Resource limitations may require analysis to better focus investments, e.g., EV subsidies for non-urban households with fewer multi-modal options and longer trip lengths.

Geographic context. Strategies for mitigating GHG are context sensitive. Due to geography and supportive conditions, some locations or agencies may have greater success with a given mitigation strategy than others. In the past, governmental resources (and thus responsibilities) are often distributed between state, regional and local government according to population. However, draft Oregon Cap and Trade legislation debated in 2019 suggested GHG reduction take a different approach, implementing regulation on large urban areas first, suggesting a sliding scale of responsibility according to the amount of impact that can be made by each level of government. Policy leaders may ask for further analysis to assess the impact of such policy approaches.

Similarly, Oregon's GHG planning and target setting processes are focused on metropolitan areas, and no equivalent processes currently exist for small urban and rural areas. Metropolitan areas contain roughly 60% of the state's population and 70% of employment, justifying a focus on these areas.

Figure 11. Calculating Metropolitan Area Target from the Goal[28]



Source: Scenario Planning Guidelines Appendix

[28] Figure 12 shows how a GHG reduction *target* is calculated from the per capital emissions reduction *goal* and the forecast for reduction in the light vehicle emissions *rate*. This example is for the Portland Metro region.

The circle represents total metropolitan area per capita emissions from light duty vehicles in 2005. The overall goal is to reduce per capita emissions by 89% from 2005 to 2050.

The blue slice indicates the reduction in per capita emissions due to advances in vehicle and fuel technology. In Metro's case, the forecasted change in the emission rate would reduce total per capita emissions by 83%. 17% of the original total (100% - 83%) would remain if no further action were taken.

An additional 6 percentage point reduction is thus necessary to meet the overall 89% reduction goal (89% – 83%). This 6 percent of total emissions represents ***35%*** of the remaining emissions (6% ÷ 17%) after reductions due to vehicle and fuel advancements are excluded. Thus, 35% is the 2050 Metropolitan *target* for Portland Metro: the percentage reduction in emissions "beyond vehicles and fuels".

7 NEXT STEPS FOR THE OMSC

7.1 Executive Order 20-04 and the OMSC

In the near term, state agencies represented on the OMSC will be working under swift timelines to address the requirements of Governor Brown's Executive Order 20-04. The OMSC's GHG subcommittee and other OMSC forums may serve as sounding boards for agencies as they develop analysis methods and guidance to support near-term processes aimed at GHG reduction.

Specific topics in the Executive Order for which interaction between the OMSC and responsible state agencies may be particularly helpful, including:

- Work by ODOT to develop and apply a process for evaluating the GHG emissions implications of transportation projects as part of its regular Statewide Transportation Improvement Program processes.
- Work by ODOT, DEQ, DLCD and ODOE to establish GHG emissions reduction performance metrics.
- Work by DLCD and ODOT to implement local planning guidelines for GHG emission reductions.
- Work by DEQ to amend low carbon fuel standards and implementation schedule and actions to cap and reduce GHG emissions from transportation fuels (this information may be helpful in establishing future assumptions to be used in transportation related GHG analysis tools).

The near-term work currently underway by state agencies should provide a good foundation for the GHG Subcommittee to make longer-term recommendations for the OMSC. The subcommittee can make the most of these near-term efforts by:

- <u>Understanding background, definitions, and context setting</u>. Subcommittee members can help promote a common understanding of terms and GHG analysis issues, by educating themselves and others on the concepts outlined in this white paper.
- <u>Participating in a GHG peer exchange</u>. The Oregon Modeling Users Group (OMUG), which serves as the OMSC's outreach arm, is planning a forum for sharing useful case studies of how others have incorporated a GHG lens into planning decisions. Subcommittee members can attend this forum to help build professional knowledge and identify needs and potential best practices for GHG analysis.
- <u>Providing feedback on state agency work related GHG analysis tools and data</u>. Much of the work of state agencies in response to the Executive Order on investment planning parallels OMSC objectives. The GHG subcommittee could assist with:
    - Developing, maintaining, and implementing consistent GHG emission rates to be used in various planning efforts across different regions.

- Developing tools guidance for GHG policy actions that currently lack GHG calculation methods (e.g., actions not covered in traditional tools, construction emissions, projects outside modeled areas).
- Identifying roles & responsibilities for developing, maintaining, and implementing vehicles and fuels pathways that can be used in STS performance tracking (for example, electric vehicle adoption targets) and roll-up into emission forecasts for use in planning.
- Identifying data analysis/needs and next steps, for tackling significant gaps in transportation GHG emissions analysis. This could include heavy duty vehicles, air travel, etc.

7.2 Next Steps for the GHG Subcommittee

7.2.1 Subcommittee Work Plan

Figure 12 briefly summarizes the work outlined in the GHG Subcommittee's Charter, showing next steps.

Following the publication of this white paper, the subcommittee's next deliverable will be an assessment of transportation related GHG analysis needs and gaps.

7.2.2 Developing Subcommittee Recommendations

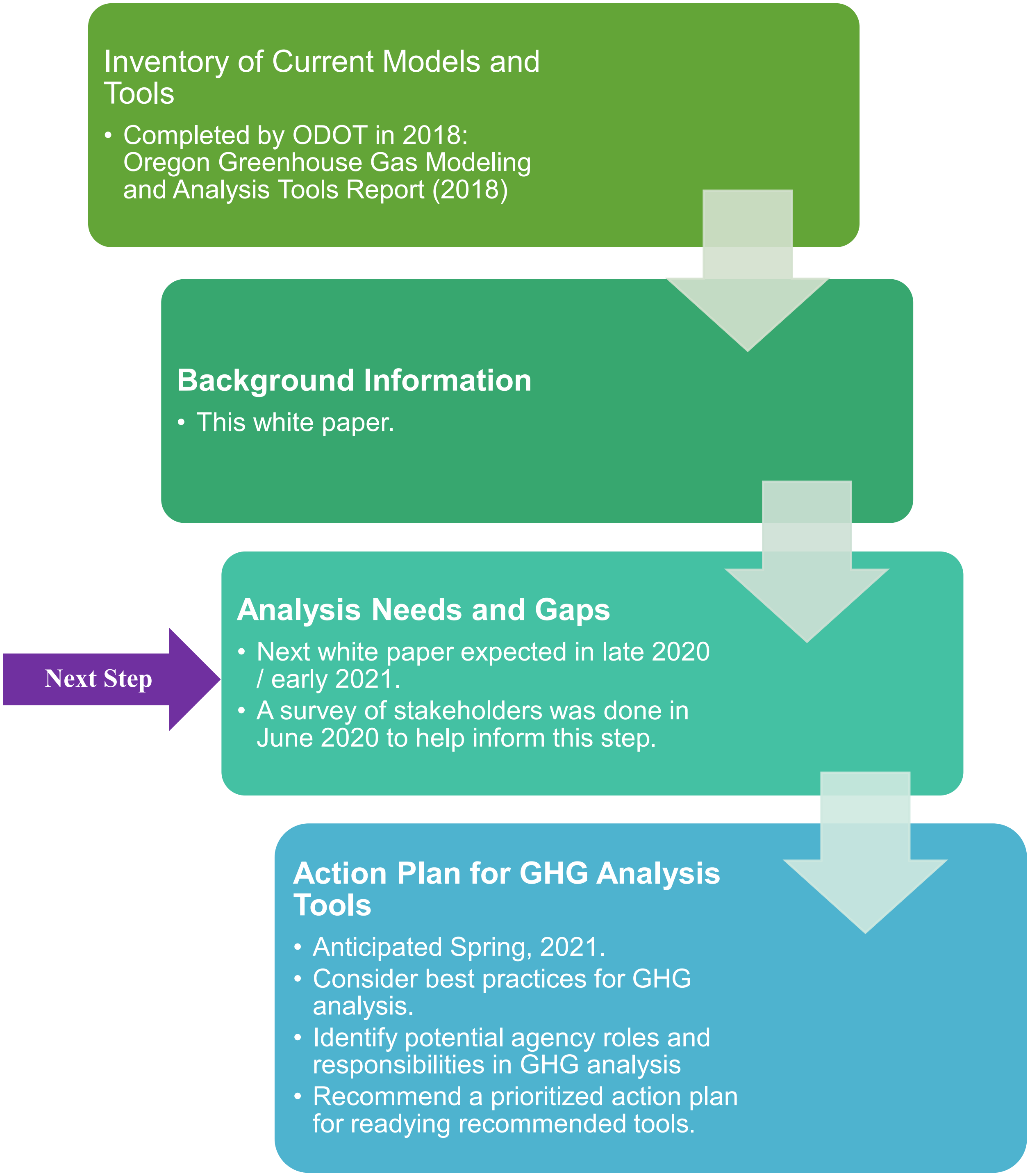
The subcommittee's ultimate deliverable is a prioritized action plan, to be approved by the OMSC's Executive Committee, with recommendations for getting GHG analysis tools ready for implementation. In working to prepare these recommendations, the OMSC's GHG Subcommittee can address key questions such as:

- What are the best tools and processes for forecasting and reporting GHG emissions?
- What common data and inventories will state and local agencies need?
- What potential policies may need analytic support and what best practices in transportation and GHG modeling could support those policy decisions?

7.2.3 Implementing GHG Subcommittee Recommendations

Depending on the technical expertise needed to implement the GHG Subcommittee's recommendations, work to prepare specific analysis tools may be assigned to the OMSC's Technical Tools Subcommittee or farmed out to individual OMSC member agencies. GHG Subcommittee members may be asked to continue to serve as a sounding board during the implementation process.

Figure 12. OMSC GHG Subcommittee Work Plan Overview



8 FURTHER GUIDANCE

The OMSC GHG Subcommittee is tracking relevant resources that may be of interest to the reader. This includes information on national tools, experiences of other states, and Oregon-specific guidance documents and reports. Some highlights are provided below.

8.1 Oregon-Specific Guidance

The Oregon Sustainable Transportation Initiative (OSTI) Greenhous Gas Emissions Reduction Toolkit, available on ODOT's website[29], details individual actions that local and regional governments could consider for reducing transportation related GHG emissions. Several case studies that highlight specific actions taken by cities and transit agencies are also provided.

In addition, Table 5 lists a number of recent planning efforts that may be of interest to those looking for information on processes used to identify strategies and actions for mitigating GHG.

Table 5. Recent Planning Examples with Transportation Related GHG Components

Planning Study	Description
Oregon Statewide Transportation Strategy Monitoring Report, 2018	A recommended short-term implementation plan for the STS was first published in 2014. In 2018, a monitoring report looked back at progress made, and described additional reduction efforts by ODOT.
Metro Climate Smart Strategy, 2014	Adopted in 2014, this strategy fulfilled a mandate by the Oregon Legislature requiring the Portland region to develop and implement a strategy to reduce the region's per capita GHG emissions from cars and light trucks to at least 20 percent by 2035. The strategy included a set of performance measures and monitoring targets for tracking implementation actions and whether the strategy is achieving expected outcomes. Metro's analysis, confirmed in its 2018 RTP,[21] determined they can exceed this target if the region continues to work together to fully invest in plans that Metro and local communities have adopted.
Central Lane Scenario Planning, 2015	The Central Lane MPO (Eugene/Springfield region) examined multiple combinations of land use and transportation strategies to reduce GHG and improve community livability. The process considered planned investments, fleet and fuels, transit, pricing, parking, and roadway infrastructure, and investing beyond existing plans in areas of active transportation, education, and marketing.

[29] Oregon Department of Transportation, Planning and Technical Guidance, Greenhouse Gas Emissions Reduction Toolkit, retrieved from https://www.oregon.gov/ODOT/Planning/Pages/GHG-Toolkit.aspx, April 23, 2020.

Planning Study	Description
Rogue Valley MPO Strategic Assessment of Transportation and Land Use Plan, 2016	This study was a voluntary assessment of adopted local and regional land use and transportation plans, to estimate the likely outcomes of these plans on several community and livability factors, including GHG. It assessed how close the region's existing plans come to meeting the state's GHG emissions reduction target.
Corvallis Area MPO Scenario Analysis Report, 2016	The Corvallis metropolitan area underwent a two-phase scenario analysis process, beginning with a strategic assessment to determine the trajectory of current plans. This was followed by scenario planning exercises that looked at the effects of different potential policy changes, both in isolation and in combination with other potential policies.
Bend Community Climate Action Plan, 2019	This planning process addressed multi-sector GHG reductions from buildings, fuels, waste disposal and local industrial processes. Transportation related elements included reducing fossil fuel consumption for travel by supporting a transition to electric vehicles; increasing non-motorized travel, transit trips and car sharing; and conversion of public agency vehicle fleets to electric and alternative fuel technologies.
Additional Climate Action Plan Examples	Several other local agencies in Oregon have developed climate action plans with transportation components. Examples include the cities of Portland (2015), Corvallis (2016), Ashland (2017), Milwaukie (2018), and Eugene (2020).

8.2 National and International Guidance

The National Cooperative Highway Research Program (NCHRP) is developing a guidebook for state DOTs, outlining methods for reducing GHG emissions from the transportation sector.[30] This guidebook, scheduled for publication in Fall 2020, is anticipated to provide processes and strategies that can be implemented at appropriate points throughout the cycle of policy making, planning, programming, project development and project implementation.

At the international level, the need for global consistency in GHG quantification methods is being promoted by an international group led by the World Resources Institute, known as the GHG Protocol.[31] The GHG Protocol emphasizes six core principles, listed in Table 6, that should underpin all aspects of GHG accounting, quantification and reporting. The OMSC could

[30] National Cooperative Highway Research Program Report 25-56 [Active], *Methods for State DOTs to Reduce Greenhouse Gas Emissions from the Transportation Sector*. Abstract information retrieved from https://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=4384, April 27, 2020.

[31] Greenhouse Gas Protocol, https://ghgprotocol.org/

consider embracing these principles when recommending approaches for GHG analysis in Oregon.

Table 6. The GHG Protocol: GHG Accounting Principles

The GHG Protocol GHG Accounting Principles	
Relevance	**Use data, methods, criteria, and assumptions that are appropriate for the intended use of reported information.** The quantification and reporting of GHG reductions should include only information that users—both internal and external -- need for their decision-making.
Completeness	**Consider all relevant information that may affect the accounting and quantification of GHG reductions and complete all requirements.** That is, all GHG effects of a proposed action should be considered.
Consistency	**Use data, methods, criteria, and assumptions that allow meaningful and valid comparison.** The credible quantification of GHG reductions requires that methods and procedures used to assess a given action are always applied in the same manner, and that data collected and reported will be compatible enough to allow meaningful comparisons over time.
Transparency	**Provide clear and sufficient information for reviewers to assess the credibility and reliability of GHG reduction claims.** Transparency is critical for credibility. Information should be compiled, analyzed, and documented clearly and coherently. Specific exclusions or inclusions should be clearly identified, assumptions explained, and references provided for all data and assumptions used.
Accuracy	**Reduce uncertainties as much as is practical.** Acceptable levels of uncertainty will depend on the objectives of a given action and the intended use of quantified GHG reductions. Greater accuracy will generally ensure greater credibility. Where accuracy is sacrificed, data and estimates used to quantify GHG reductions should be conservative.
Conservativeness	**Use conservative assumptions, values, and procedures when uncertainty is high.** GHG reductions should not be overestimated. Where data and assumptions are uncertain and where the cost of measures to reduce uncertainty is not worth the increase in accuracy, conservative values and assumptions should be used. Conservative values and assumptions are those that are more likely to underestimate GHG reductions.
Source: Adapted from World Resources Institute and World Business Council for Sustainable Development, *The GHG Protocol for Project Accounting.* **https://ghgprotocol.org/sites/default/files/standards/ghg_project_accounting.pdf**	