



Oregon Statewide Transportation Strategy

A 2050 Vision for Greenhouse Gas Emissions Reduction

Volume 1



Oregon Department of Transportation

March 20, 2013

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OREGON STATEWIDE TRANSPORTATION STRATEGY

**A 2050 Vision for
Greenhouse Gas Emissions Reduction**

**Accepted by
the Oregon
Transportation
Commission**

March 20, 2013



**Oregon Department of
Transportation**

**Transportation Development
Division**

Planning Section

Oregon Transportation Commission

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*Dedicated to the legacy of Gail Achterman's
leadership for Oregon's natural resources and
sustainable transportation*

OREGON STATEWIDE TRANSPORTATION STRATEGY

Developed under the guidance of:

Statewide Transportation Strategy Policy Committee

Statewide Transportation Strategy Technical Advisory Committee

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Preface

The Statewide Transportation Strategy (STS) was initiated out of legislative direction to examine ways that transportation can reduce greenhouse gas (GHG) emissions and help achieve Oregon reduction goals. The document charts a potential broad path for reducing emissions and is comprised of transportation and land use strategies that modeling and analysis have shown to have measurable GHG reduction results. Those chosen for inclusion in the report reflect the mix of options with the fewest apparent negative impacts and that advisory committees felt were worth further consideration. Additional work is needed to identify which of the strategies should be pursued, and when, given economic considerations, resource implications, and political will. As a whole, the Statewide Transportation Strategy represents a vision for a future Oregon with substantially less transportation related GHG emissions than today.

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EXECUTIVE SUMMARY

Why was the Statewide Transportation Strategy Developed?

The Statewide Transportation Strategy (STS) was developed in response to legislative direction. In 2010, the Oregon Legislature passed Senate Bill 1059 (Chapter 85, Oregon Laws 2010, Special Session) which requires:

“...the Oregon Transportation Commission, after consultation with and in cooperation with metropolitan planning organizations, other state agencies, local governments and stakeholders...shall adopt a statewide transportation strategy on greenhouse gas emissions to aid in achieving the greenhouse gas emissions reduction goals set forth in ORS 468A.205 [a 75 percent reduction below 1990 levels by 2050]...”

What is the STS?

In accordance with the legislative direction, the Statewide Transportation Strategy: A 2050 Vision for Greenhouse Gas (GHG) Emissions Reduction describes what it would take for the transportation sector to get as close to the 2050 goal as is plausible. The STS, itself, is neither directive nor regulatory, but rather points to promising approaches for further consideration by policymakers at the national, state, regional, and local levels. Policymakers will need to decide if all or select strategies are to be pursued, how, and when. Many of the strategies in the STS require further analysis and consideration before the right approach can be chosen or action taken.

The STS examines all aspects of the transportation system including the movement of people and goods, and identifies transportation system, vehicle and fuel technology, and urban land use pattern strategies. Based on policy discussions and analysis, the STS 2050 Vision results in a future with 60 percent fewer GHG emissions than 1990.¹ The broad 40 year course of action charted in the STS is agile and can be adapted to an evolving future and unforeseen opportunities. Progress will be monitored over time and the course adjusted accordingly. The STS allows flexibility in what strategies and actions may be pursued and points to those projected to be effective at achieving the intent of the legislation. The STS does not assign responsibility for implementation.

By mandate, the STS focus is on prevention and mitigation of climate impacts rather than adaptation.²

¹ The 60 percent reduction in emissions is projected to occur from the implementation of the entire STS, meaning, to reach even this level, all of the strategies would need to be considered.

² Separate from the STS, ODOT has engaged in adaptation planning activities which are further described on the following site: <https://www.oregon.gov/ODOT/Programs/Pages/Climate-Change.aspx>.

How was the STS Developed?

A Policy Committee and a Technical Advisory Committee guided the development of the STS over a two year period. Committee members represented a wide range of transportation stakeholders including state, regional and local governments, other state agencies, businesses, and advocacy groups. Based on extensive research, technical analysis using the best available data, and issue papers, the committees crafted the vision, strategies and strategic priorities.³

To inform the process, staff and consultants used analysis tools to model the outcome of plans and trends to determine what the future would potentially look like if the state continued on the current path (business as usual). Alternative scenarios were then created that represented different configurations of technology, pricing, land use, and transportation system conditions. Indicators were used to provide information on the amount of GHG reduced as a result of a scenario, as well as to understand other potential impacts on important societal considerations like health, economic costs, air quality, and transportation system performance. Scenarios were compared to the business as usual projection to understand differences in outcomes. Those strategies included in the STS represent the mix of options with the largest GHG reductions and greatest potential positive impacts on the other goal areas.

Because there are many unknowns about the future, there will be a need to monitor and adapt the strategies as the work moves forward. However, it was also recognized that it is important that the state start exploring or working on what can be achieved; the key to this is an agile and iterative process that responds to and takes advantage of what is learned along the way.

³ A two year extensive analysis process was conducted using a peer-reviewed and nationally recognized tool, GreenSTEP, and assumptions were reviewed by and agreed to by various state agencies, industry and technical experts. The advisory committees assessed the plausibility of assumptions and decided what to include in the STS and how hard things needed to be pushed. Additional details on the STS technical analysis and development process are detailed in the Oregon Statewide Transportation Strategy Volume II: Technical Appendices, which can be accessed at: <https://www.oregon.gov/ODOT/Planning/Pages/STS.aspx>

What does the STS Call for?

In line with the legislative direction, the STS identifies a possible path forward for the transportation sector to aid the state in achieving its GHG emissions reduction goal. Transportation and land use strategies are included that modeling and analysis have shown to have measurable results. Those chosen for inclusion reflect the mix of options that advisory committees and researchers considered to be plausible and that had the fewest apparent negative impacts. Decision makers will need to agree on which strategies to pursue, and when, given economic considerations, resource implications, and political will. The Oregon Transportation Commission (OTC) is an important decision making body in the effort, for those strategies falling under the authority of the Oregon Department of Transportation, and their approval is required before strategies are further explored or action taken. Additionally, many other strategies will require buy off and commitment by other decision making bodies at the national, state, regional, local, and private sector levels.

Many of the strategies in the document are about providing low carbon transportation options which allow individual choice of the alternative that works best for the situation. Some strategies may be well understood and have the support to move directly into implementation (e.g. eco-driving), while others will require further analysis to determine economic impacts (e.g. pricing) and the appropriate course of action, if any. In total, the STS contains 18 distinct strategies, with 133 potential elements that generally fall into the following categories:

- *Vehicle and Engine Technology Advancements* - Strategies in this category increase the operating efficiency of multiple transportation modes through transition to more fuel-efficient vehicles, improvements in engine technologies, and other technological advances.
- *Fuel Technology Advancements* - Strategies in this category increase the operating efficiency of fuel-powered transportation modes through transitions to fuels that produce fewer GHG emissions or have a lower lifecycle carbon intensity.
- *Enhanced System and Operations Performance* - Strategies in this category improve the efficiency of the transportation system and operations through technology, infrastructure investment, and operations management.
- *Transportation Options* - Strategies in this category increase opportunities for travelers and shippers to use transportation modes that are more energy efficient and produce fewer emissions.
- *Efficient Land Use* - Strategies in this category promote more efficient movement throughout the transportation system by supporting compact growth and development. This development pattern reduces travel distances and increases opportunities for using lower energy and zero energy transportation modes.

- *Pricing and Funding Mechanisms* - Strategies in this category support a transition to more sustainable funding sources to maintain and operate the transportation system, pay for environmental costs of climate change, and provide market incentives for developing and implementing efficient ways to reduce emissions.

While a given strategy will fall into one of the categories above, it is often interdependent, and will achieve its greatest potential for GHG emissions reductions when implemented in conjunction with complementary strategies. For example, strategies that facilitate greater use of transportation options such as public transportation, personal electric vehicles, bicycling, and walking will be far more effective if implemented in conjunction with land use efficiency strategies such as compact, higher-density mixed-use developments that provide proximate destinations and “complete streets” that accommodate multiple modes safely and efficiently.

The STS found that substantial reductions are plausible, but actions by the transportation sector alone cannot reduce transportation emissions enough to meet Oregon’s 75 percent reduction goal. Since the demands for transportation services are derived from demand from other needs and desires of people and businesses, solutions for effectively reducing transportation emissions will require cooperative efforts across sectors. This was found to be particularly the case for freight emissions. Much work will be needed to move forward and significant breakthroughs will be required in a number of disciplines. The STS notes and stresses that some of the most effective elements require state and national cooperation.

Many of the strategies in the STS are not new concepts but rather continue the direction brought forward in the Oregon Transportation Plan.⁴ Additionally, the Governor’s 10-Year Energy Action Plan⁵ calls for many of the same strategies highlighted in the STS including: increasing the proportion of fuel-efficient vehicles; continuing investment in compact, multimodal, mixed-use communities; implementing intelligent transportation system (ITS) technology; and innovatively financing a cleaner transportation system.

How will the Future be Different as a Result of the STS?

The STS represents an aspirational vision for a cleaner future that would greatly aid Oregon in achieving its 2050 GHG emission reduction goal, and achieve other benefits. Performance indicators were used to help understand the impacts of the STS Vision on travel and system performance, land use and natural resources, public health, and the economy, in addition to GHG emissions. Results were compared to what Oregon’s future would look like if the trends and plans of today continue and

⁴The Oregon Transportation Plan, adopted by the Oregon Transportation Commission, is the statewide policy document guiding transportation decisions and investments. For additional information, visit the Plan website at: <https://www.oregon.gov/ODOT/Planning/Pages/Plans.aspx>.

⁵The Governor’s 10-Year Energy Plan can be accessed at the following website: <https://www.oregon.gov/energy/energy-oregon/Pages/Climate-Change.aspx>

nothing changed. Overall, the STS Vision shows Oregonians better off than the status quo. However, the STS will produce greater benefits for some activities and greater costs for others. Analysis showed that the STS Vision would be likely to produce the following benefits relative to today and the trends of tomorrow:

- *Improved public transportation service, bicycling, and walking* – Throughout the state, Oregonians would have better access to a range of transportation options (e.g., transit, carpool, bicycling, walking). Communities would have good walking paths, bicycle facilities, and transit service. Improvements in bicycling and walking facilities would increase physical activity and help improve public health and reduce obesity rates. These transportation options, along with carsharing services, would improve mobility while enabling many households to save money by owning fewer cars.
- *Fuel-efficient / alternative energy vehicles* – Great strides in technology would allow for the widespread adoption of cleaner and more efficient vehicles by Oregonians. Automobiles powered by electricity would be able to travel hundreds of miles without recharging and an extensive network of recharging stations would extend across the state. Other vehicles would run on compressed natural gas (CNG) and locally-produced biofuels that would be readily available. Most heavy-duty trucks would run on liquefied natural gas (LNG), and commercial aircraft would run largely on biofuels. These changes would improve air quality dramatically while reducing dependency on foreign oil.
- *Enhanced information technology* – People would be able to use technology to easily plan and update their travel routes combining modes as needed such as public transportation, bicycling, and walking in addition to personal vehicles. Improved communication systems would enable individuals and organizations to meet and collaborate virtually, while reducing the need for physical travel. In-vehicle communications technologies and collision avoidance systems in cars and trucks would greatly reduce the number and severity of crashes, resulting in saved lives, reduced damage, improved travel time reliability, and elimination of hundreds of hours of roadway delay each year. New vehicle-to-vehicle communications advancements allow cars and trucks to drive closer together and use less space on the roadway, resulting in more efficient use of existing infrastructure.
- *More efficient movement of goods* – Fewer personal vehicles on Oregon roadways frees up capacity for the transportation of goods that support a growing economy. When possible, goods are moved by more efficient modes such as rail and water. New technologies allow freight vehicles to emit lower emissions. Urban consolidation centers allow for more efficient distribution of freight deliveries to final destinations in urban areas.
- *Walkable mixed-use communities* – Within Oregon cities, a large share of residents live in walking distance of jobs, stores, services, entertainment, and transit stops. Because of this mix of uses in a geographically small area, commute times are

shorter, limiting time spent in traffic. Residents of such communities are afforded increased opportunities to “buy local,” supporting local businesses. Communities across the state are recognized for vibrancy, livability, and safety.

While there are benefits of the STS Vision, there are also costs. For example, building infrastructure and providing services necessary to make multimodal travel options available would be costly. The total magnitude and effect of the various costs on Oregon’s economy could not be predicted because of the uncertainty of economic changes across the nation and world and technological and social changes that occur. These things are very uncertain. For example, who 40 years ago would have predicted the impact of the internet and cell phones today? Because of this uncertainty, the pathway forward to implement the STS will include continued monitoring and evaluation of trends that affect the validity of the vision and its implementation. In addition, as implementation of STS strategies moves forward, the potential economic effects of candidate implementation measures will be analyzed to determine the likely effects during the implementation timeframe and to develop programs that minimize adverse effects.

How does the STS Move Forward?

Through acceptance, the OTC agrees with the findings of the advisory committees, that the general course of action presented in the STS for reducing transportation related emissions is in line with fulfilling the legislative requirements and that the strategies should be further considered. Before any one strategy or group of strategies move forward, however, further buy-in may be required from appropriate decision making groups, including not only the OTC but other public and private sector bodies as well. Some strategies are well understood and are likely to have a high-degree of political acceptance, which can then be acted on quickly. Other strategies, however, will require additional exploration to better understand economic and societal impacts, and if, when, or how it should be pursued. A work plan will be developed detailing potential next steps. Required throughout the decision making process are inclusive and collaborative efforts at the federal, state, and local levels, as well as with businesses and individuals.

Oregon is already pursuing some of the strategies in the STS but the STS identifies ways to augment and build on the good work already being done and planned, and provides additional and new approaches to consider. Current local and regional plans provide a strong foundation for achieving GHG emissions reductions. Additionally, cities and counties in Oregon are already implementing many of the elements to achieve other economic, social or environmental goals. Lastly, industries and companies are making business-driven decisions that have an added co-benefit of emissions reduction. The work that has been done and ongoing efforts provide a foundation to build on as Oregonians move forward to further reduce transportation related GHG emissions.

In developing the STS implementation plan and undertaking actions to realize the STS Vision, the following strategic priorities should be the first considered by decision makers to assess what to pursue, how, and when:

- *Funding* - Successful implementation of the STS relies on adequate funding to maintain and improve system performance, provide transportation options, and enhance operations. Projections show gas tax revenues falling short of the money needed to maintain and operate the current transportation system, let alone fund new infrastructure. The lack of sustainable and adequate funding is an issue across all states and current local and national efforts can be built on to find appropriate mechanisms. In addition to a sustainable funding source, the STS points to charging users the true cost of travel including transportation systems costs and social costs. The costs, benefits, and impacts of true cost pricing will need to be assessed.
- *Efficient Vehicles and Clean Fuels* - State and national programs and incentives that encourage the use of more efficient vehicles and cleaner fuels are important mechanisms for lowering emissions and should be investigated and supported. Technological advancements that result in more efficient designs of vehicles and ability to use less carbon intensive fuels or alternative propellants, such as electricity help to achieve the STS Vision. Infrastructure that supports such advancements, like electric vehicle charging stations, should be explored.
- *Low Carbon Transportation Options* - The least carbon intensive mode of transportation is not always desirable or practical. However, when it is feasible to take a trip by transit, walking or biking, or to ship freight by barge or rail, it is important to have viable options available. Work can be done to identify potential barriers and opportunities to those modes.
- *Land Use* - The configuration of land uses to transportation systems can support reduced trips and fewer miles driven. Careful siting of industrial lands and provision of mixed-use areas can make for more efficient land uses and livable communities. Potential for sites can be assessed at the regional and local level and state policies investigated.

Each of these priorities is supported in the short term by the Governor's 10-Year Energy Plan, which sets out actions for the next decade. Additionally, other ongoing work will help advance the strategic priorities, including: efforts by the Road User Fee and Non-Roadway Funding Task Forces, and the Oregon Legislature to secure sustainable transportation funding; work by the Departments of Energy and Environmental Quality on standards and incentives for efficient vehicles and clean fuels; and through the Department of Land Conservation and Development (DLCD) management of land uses. Upcoming work on modal plans, such as the Rail Plan, Bicycle and Pedestrian Plan, and eventually the Public Transportation Plan, will look to support the STS through provision of transportation options.

As the Agency and others move forward there will be additional opportunities to incorporate the STS into existing work, such as eco-driving messages into driver education curriculum and public outreach messages, and to consider STS concepts as the future is planned, such as supporting infrastructure technology to allow vehicle to infrastructure communications. To fully aid in achieving the STS Vision, the full array of the strategies, not just the strategic priorities or the other strategies mentioned here, will have to be explored further in order to provide a diversity of choice for the Legislature and other policymakers.

As some of the strategies may be controversial, especially in the short-term, a key to success of the STS will be public acceptance and support that results from participation in implementation planning. Transportation related GHG emissions reduction will require strong partnerships and close collaboration between jurisdictions at the local, regional, state and national levels, as well as with businesses and individuals.

How does the STS Affect Transportation and Land Use Planning?

At this stage, the STS contains no specific policies or goals and was not developed to be a policy document like the Oregon Transportation Plan (OTP). The OTP is the umbrella policy plan that fulfills the statutory planning requirement for the Oregon Transportation Commission. As strategies in the STS are further considered, the timing and breadth of any needed update or amendment of the OTP and related modal (e.g. Rail) or topic (e.g. Freight) plans will be assessed. The STS furthers and supports the OTP and its goal to provide a safe, efficient and sustainable transportation system that enhances Oregon's quality of life and economic vitality. Many of the strategies in the STS align with the broad policies and strategies in the OTP, particularly Goal 4: Sustainability. The OTP Goal 4 includes strategies that support creation of an environmentally responsible transportation system (including development and use of technologies that reduce GHG), a more diversified and cleaner energy supply, and compact and mixed-use development.

Integrating the STS into regional and local planning processes is important to the successful implementation of the STS. For those areas required (Portland Metro and Central Lane) or choosing to undertake scenario planning for GHG emission reduction, the STS provides information on potential actions that can be undertaken to aid metropolitan areas in meeting their GHG emission reduction targets set by the DLCD. Additionally, the STS will point to efforts that may be engaged in at the state or national level that help the metropolitan areas meet their targets.

1 INTRODUCTION

The Statewide Transportation Strategy (STS) was developed in response to Legislative direction⁶ and identifies the most promising approaches for reducing transportation related greenhouse gas (GHG) emissions. The STS forms a vision for a cleaner future with actions for substantially reducing emissions to aid the state in achieving the 2050 goal⁷, established by the legislature, of reducing GHG emissions by 75 percent below 1990 levels. Founded on the best available information at the time, it describes what it would take to get as close to the 2050 goal as is plausible. Based on policy discussions and analysis, the STS Vision results in a future with 60 percent fewer GHG emissions than 1990. To reach even this level, over time all the strategies in this document would need to be pursued. Depending on goals and priorities, the STS may be pursued in its entirety or specific strategies selected.

How was the STS Developed?

A Policy Committee and a Technical Advisory Committee guided the development of the STS. Based on extensive research, technical analyses using the best available data, and issue papers,⁸ the committee crafted the vision, strategies and strategic priorities which comprise the STS. As a result of that work, this document points to the most promising GHG emissions reduction strategies in transportation systems, vehicle and fuel technologies, and urban land use patterns, which offer some of the best tools available to help meet the state's goal. Indicators were used to provide information on potential impacts of the strategies on important societal goals like better health, more efficient transportation system performance, and cleaner air. Those strategies included in the STS represent the mix of options with the largest GHG reductions and greatest potential positive impacts on the other goal areas. The committee recognized, that given the long time frame between now and 2050, many things will likely change. While there are challenges and unknowns ahead that will require continuous adaptation and development of additional creative solutions, the groundwork established in the STS provides a firm base from which to build.

This STS is the first phase in a multi-year process. Implementation planning efforts will follow the approval of this document. During the implementation planning process many of the strategies will be analyzed in greater detail and some will need to be further assessed to better understand potential economic impacts and opportunities. The third and final phase will consist of monitoring and adjusting the strategy over time, as needed.

⁶ Chapter 85 Oregon Laws 2010 Special Session (Senate Bill 1059), Section 2: (1) The Oregon Transportation Commission, after consultation with and in cooperation with metropolitan planning organizations, other state agencies, local governments and stakeholders, as a part of the state transportation policy developed and maintained under ORS 184.618, shall adopt a statewide transportation strategy on greenhouse gas emissions to aid in achieving the greenhouse gas emissions reduction goals set forth in ORS 468A.205. The commission shall focus on reducing greenhouse gas emissions resulting from transportation. In developing the strategy, the commission shall take into account state and federal programs, policies and incentives related to reducing greenhouse gas emissions. (2) The commission shall actively solicit public review and comment in the development of the strategy.

⁷ Oregon Revised Statute (ORS) 468A.205 (<https://www.oregonlaws.org/ors/468A.205>).

⁸ The tools and technical analysis process used to develop the STS are detailed in the Oregon Statewide Transportation Strategy Volume II: Technical Appendices, which can be accessed online at: <https://www.oregon.gov/ODOT/Planning/Pages/STS.aspx>.

What is the Intent of the STS?

The STS is neither directive nor regulatory, but rather points to promising approaches that should be further considered by leaders and policymakers. It is an important milestone in establishing a long-term course to help reduce transportation related GHG emissions. While the STS is focused on GHG, many of the same actions may also position Oregon to compete strongly in a changing global economy. Over the next 40 years - the planning horizon of the STS - Oregon will face a number of challenges that will require creative solutions. Factors such as population growth, a changing economy, and aging transportation infrastructure will require attention whether or not there is comprehensive action on climate change. The STS seeks to reduce transportation related GHG emissions while also improving the efficiency and effectiveness with which people and goods are moved.

The STS provides a proposed roadmap for the Oregon Department of Transportation, other state and local agencies, and policymakers from around the state to reduce transportation related GHG emissions. It will require champions to move important issues forward. The process of further defining the STS strategies and addressing challenges and opportunities will be inclusive and engage stakeholders from diverse backgrounds to allow a variety of perspectives to be shared and considered. Members of the committees, agencies and other participants in the development of the STS recognize that there are many unknowns and that there will be a need to monitor and adapt as the work moves forward. The key to achieving the goals is an agile and iterative process to respond to and take advantage of what is learned along the way. This work will require strong partnerships and close collaboration with local, regional, state and federal partners, as well as with individuals and businesses.

Consistent with Goal 4 of the Oregon Transportation Plan, the STS looks to provide a transportation system that meets present and future needs, and broadly attempts to consider the environment, economy, and other community objectives.⁹ More broadly, many of the strategies in the STS mirror direction set forth in the Oregon Transportation Plan, such as providing travel options, optimizing operational efficiency, and increasing land use efficiencies.

What is Climate Change?

Climate change refers to a global effect whereby GHG emissions such as carbon dioxide, resulting in large part from the combustion of fossil fuels like oil, coal and natural gas, trap extra heat in the atmosphere. This leads to increases in average global temperatures, extreme weather events, and other changes in the global climate. According to scientists, retained heat affects global climate in ways that adversely impact humans and natural ecosystems. Global climate changes can lead to extended warm spells and drought, as well as more frequent flooding. These changes have consequences for Oregon agriculture, hydropower, public health, infrastructure vulnerability, and watershed and forest health.

⁹ Strategies in the STS, such as pricing, will require further analysis to more accurately assess impacts to the economy and other objectives. Unlike the Oregon Transportation Plan, the STS is focused on a single goal area, GHG emissions, and the GHG-reducing benefits of the strategies must be considered together with other potential positive benefits or negative impacts before determining what strategies to move forward with, how, and when.

Scientists agree “that the warming of Earth’s climate is unequivocal and largely due to human activity. Earth’s climate has changed in the past, though the recent magnitude and pace of changes are unprecedented in human existence. Recent decades have been warmer than at any time in roughly 120,000 years. Most of this warming can be attributed to....primarily burning fossil fuels (coal, oil and natural gas) for energy.”

- Oregon Climate Change Research Institute¹⁰

Scientists can’t say exactly how intense these effects will be, how rapidly they will emerge or what exactly their geographic distribution will be, but there is broad agreement that GHG emissions must be reduced, and societies must prepare to react to some of these effects even if timely reductions are achieved.

The concentration of carbon dioxide in the atmosphere has increased by nearly 40 percent since industrialization, subsequently, the Earth has continued to gradually warm. Data supporting the warming of the earth and the linkage to human activities are compelling. Since 1895 the U.S. has experienced a long-term temperature increase of about 0.12 degree Fahrenheit per decade and average precipitation is increasing at a rate of about 0.18 inch per decade.¹¹ Nine of the 10 warmest years have occurred since the year 2000.¹²

Why should Oregonians Care?

According to the Oregon Climate Change Research Institute (OCCRI), Oregon Department of Energy, Oregon Global Warming Commission, and others, the effects of global warming have serious implications for Oregon’s people, environment, and economy. A seemingly small increase in average temperature can produce large changes in our climate system, leading to unwelcome changes in Oregon.¹³ OCCRI identifies a number of future regional changes in climate and secondary effects that will arise from unchecked GHG emissions, including:¹⁴

- **Sea level rise** - Rising global temperatures may result in additional melting of polar ice caps, causing higher sea levels and stronger storm surges that could encroach upon beaches, bluffs, coastal wetlands, roadways, and railways. Coastal areas would be at greater risk of floods; damage to roads, buildings, bridges, and water and sewer systems might occur; and Oregon’s coastal tourism industry might suffer as a result.
- **Changes in precipitation patterns** - Rain and snowstorms are likely to be more severe, with less snow accumulating in the mountains. Flooding might increase due to faster melting of snowpacks. Water supplies used for drinking, recreation, irrigation, and fisheries could be threatened. During the summer and fall, water temperatures and the

¹⁰ Oregon Climate Change Research Institute, Oregon Climate Assessment Report (2010); citing the Intergovernmental Panel on Climate Change (2007).

¹¹ NOAA National Climatic Data Center, State of the Climate: National Overview for Annual 2011, published online December 2011, retrieved on March 14, 2012 from <http://www.ncdc.noaa.gov/sotc/national/2011/13>.

¹² Research News: NASA Finds 2011 Ninth Warmest Year on Record, Jan. 19, 2012, <https://www.giss.nasa.gov/research/news/20120119/>.

¹³ Oregon Department of Energy, Climate Changes in Oregon, <https://www.oregon.gov/energy/energy-oregon/Pages/Climate-Change.aspx>

¹⁴ Oregon Climate Change Research Institute, Climate Assessment Report, Legislative Summary, 2011.

concentration of pollutants in the water are likely to increase.

- **Diminished water supply and agricultural productivity** - Warmer temperatures, dwindling water supply, and drier soils could affect Oregon's crops and livestock. Crops that can withstand warmer temperatures might thrive, but others such as potatoes could suffer. Additionally, less available water for irrigation could pose a problem for the agriculture industry.
- **Harm to forests** - Changes to the climate would cause changes to Oregon's forests. Different types of trees would thrive and some forests might be replaced by grasslands. Climate change would leave some trees more susceptible to pests, disease and fire damage. A greater risk of more and larger intense forest fires is likely, which could damage rather than renew forest ecosystem health. Forest related industries could decline.
- **Adverse health impacts** - Heat related illnesses and fatalities would likely increase due to an increase in the number of heat waves. Warmer temperatures could result in an increase of insects carrying tropical diseases such as malaria and dengue fever. Respiratory diseases, such as asthma are likely to become more frequent and severe.
- **Suffering ecosystems** - Oregon's native forest, grassland and watershed species will suffer as temperatures rise. Salmon, for example, could be harmed as a result of warmer streams and rivers. Invasive species might replace the native species upon which parts of Oregon's economy are based. Oregon's tribal cultural practices may be negatively impacted, as might other stakeholders who rely on the state's native species, including businesses and the recreation industry.



Oregon has been a national leader in policies that create and preserve livable communities that have resulted in improved energy efficiency and helped to stop growth in GHG emissions.

Oregonians already embrace many of the strategies that will mitigate climate change, and already see many of the co-benefits that result, such as lower

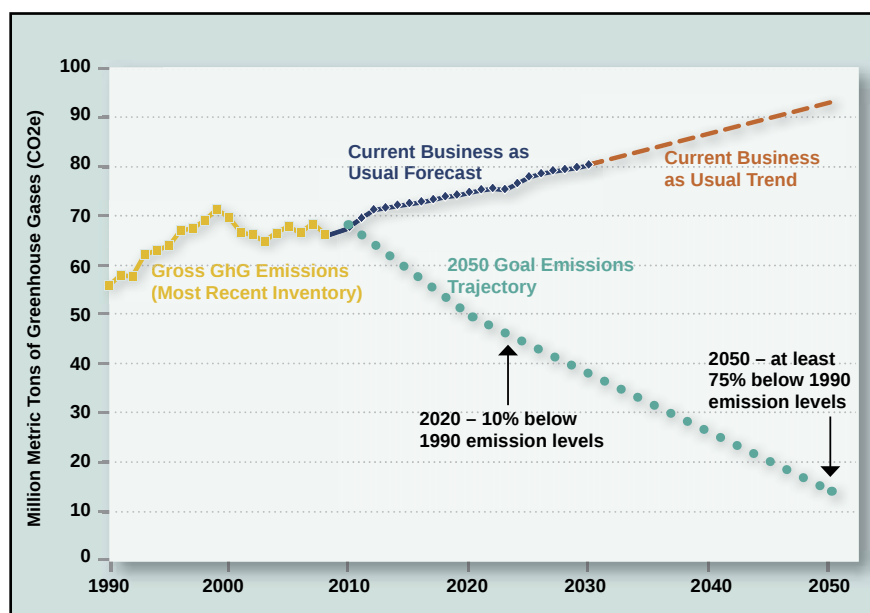
energy costs in homes and businesses. The same plans and policies that create and preserve vibrant, livable communities, promote public health, increase energy independence, and create jobs for Oregonians in clean technology industries often contribute to reducing GHG emissions. There is opportunity and ambition to continue those efforts and try some new strategies to help achieve substantial GHG emissions reductions. Initial focus will be to seek out the least cost, most efficient strategies and techniques, and start to pave the way for those strategies foundational to reducing emissions.

What will it Take?

In Oregon, annual GHG emission rates increased significantly from 1990 through about 2000, as illustrated by data from the Oregon Global Warming Commission (Figure 1). Actions taken over the past decade have likely helped to keep GHG emissions relatively flat since 2000, and thus appear to have helped meet the state's first legislatively set goal of arresting the growth in GHG emissions by 2010. The remaining goals – reducing emissions to 10 percent below 1990 levels by 2020 and 75 percent below 1990 levels by 2050 – represent a significant challenge.¹⁵ As reported by the Oregon Climate Change Research Institute, without substantial changes in activities that produce greenhouse gases, future regional change will likely see continued increases in average temperature that appear small but have potentially serious long-term consequences.¹⁶ Further progress will result from existing policies, but much additional work is needed to put Oregon on track to meet Oregon's emissions reduction goals and mitigate future impacts of climate change.

The STS is a comprehensive response to that challenge, and focuses on what needs to be done within the transportation sector to contribute proportionally to the legislative goals. Achieving the state's goals cannot be done by any single strategy. It will require a multi-faceted approach and significant cooperation between the federal government, state agencies, regional planning entities, local governments, the private sector, and the public.

While Oregon is prepared to be in the forefront in addressing climate change, it cannot face this challenge alone. Limiting the impacts of climate change must ultimately be a global effort, requiring actions from other states, the federal government, other countries, and private industry.



Source data: *Oregon Global Warming Commission Report to the Legislature: 2011*.¹⁷

Figure 1: Historical and Projected GHG Emissions Trends (1990 – 2050)

¹⁵ Oregon Global Warming Commission, Report to the Legislature, 2011.

¹⁶ Oregon Climate Change Research Institute, Oregon Climate Change Assessment Report, December 2010.

¹⁷ From Appendix 2: Update and Revision of Oregon Greenhouse Gas Inventory & Forecast.

How well is Oregon Positioned to Reduce Emissions?

Oregon is not starting from scratch but has created a strong foundation to build on. The state has been a leader in planning communities and transportation infrastructure to support expanded transportation options that not only create livable communities, but have also gone a long way in reducing greenhouse gas emissions. Additionally, technological innovations and operational efficiencies have further reduced emissions in the state. In total, Oregon is well situated for reducing emissions as implemented and planned work have created a strong foundation to build on.

The importance of the linkage between transportation and land use planning has been acknowledged for many years and has helped to manage transportation travel and demand. Oregon was a leader 40 years ago, when the Legislature put in place management techniques to help reduce transportation related emission by controlling sprawl.¹⁸ To date, all Oregon cities have adopted Urban Growth Boundaries (UGBs). Oregon is one of the few states with such management measures.

Planning efforts such as the development of Regional Transportation Plans have included multimodal elements, providing transportation options to the single-occupant vehicle and managing the system for optimized travel.

As a result of past efforts to plan for compact growth and build in transportation options, metropolitan Oregonians already drive less, and emit fewer GHG emissions, than residents of comparably sized metropolitan areas around the country. Beyond the metropolitan areas, other local governments around the state have accomplished much through their planning efforts.

As indicated in Figure 2, planned and implemented policies and actions across the state have helped reduce emissions in the Ground Passenger and Commercial Services transportation sector.

- Current trends show vehicle ownership is at or near market saturation levels so auto and light vehicle ownership is no longer growing in market share. Oregon's transportation and land use planning has helped increase the feasibility and attractiveness of other travel options like walking, biking, and public transportation.¹⁹

¹⁸ In 1973, the Oregon Legislature adopted Senate Bill 100, a bipartisan bill to protect farmland, natural resources, and manage land uses.

¹⁹ Stacy C. Davis, Susan W. Diegel, Robert G. Boundy; Transportation Energy Data Book, Edition 31; July 2012; Table 8.2, Vehicles and Vehicle-Mile per Capita, 1950-2010; pages 8-3.



- Recent national policy changes will further increase the fuel economy and reduce GHG emissions rates of light vehicles over the next decade.²⁰
- For over 40 years, funding for bicycle and pedestrian facilities has been ensured for use by cities, counties, and the agency through the Bike Bill.²¹ This has supported the establishment of a foundation of bicycle and pedestrian infrastructure through funding for implementation.
- The recognition that enhanced incident management is an effective tool to help reduce congestion and increase roadway efficiency has led the agency to take steps to help decrease the impact of incidents. In the Oregon Transportation Plan it was found that non-recurring incidents (stalled vehicles, vehicle crashes, weather and work zone) cause about 50 percent of travel delay. Currently, the Oregon Department of Transportation (ODOT) has staff dedicated to incident management and has developed a Traffic Incident Management Strategic Plan.



Note: Figure not to scale. See Figure 5 in this document for Metric Tons of CO₂e.

Figure 2: Emissions Reduced from Planned Actions for the Ground Sector

In both the Freight and Passenger Air travel markets, Oregon agencies and businesses have made a number of capital investments and operating changes to reduce fuel consumption and emissions, including GHGs.

- At the Port of Portland, ultralow sulfur diesel fuel has been in use since 2005 for fueling container handling equipment at marine Terminal 6. A computer system upgrade at the Terminal 6 truck gate has reduced truck idling and emissions.
- Oregon also participates in the federally funded Shorepower Truck Electrification Project (STEP), which allows truck drivers to plug into the electrical grid at a truck stop rather than idling their diesel engines. This provides benefits including GHG reductions, cost

²⁰ The final CAFÉ standards announced in August 2012 are projected to increase fuel economy to the equivalent of 54 MPG for cars and light-duty trucks by Model Year 2025 (U.S. Environmental Protection Agency and Department of Transportation, National Highway Traffic Safety Administration; 40 CFR, Parts 85, 86 and 600; 49CFR, Parts 531, 533, 536, et al).

²¹ Oregon Revised Statute (ORS 366.514), adopted in 1971.

savings for the operator, and health and environmental benefits in the immediate truck stop area. Truck stops in Baker City, Pendleton, Portland, Coburg, and Canyonville are currently equipped with STEP technology.

- Southwestern Oregon has also contributed to reduction of freight GHGs through its work in reopening the Coos Bay Rail Link, a key segment in the transportation network that joins communities and businesses in and around Coos Bay with Eugene, allowing businesses in the region the option to use rail instead of trucks to transport their goods, reducing GHG emissions.

On the passenger air travel side, the Port of Portland has taken numerous steps to reduce emissions generated by ground passengers traveling to and from the Portland International Airport (PDX), as well as by on-site operations.

- The Quick Pay parking system installed at PDX helps to reduce passenger vehicle idling and emissions.
- Cleaner biodiesel fuel and compressed natural gas are used in the Port's vehicle fleet, and all electric and hybrid-electric cars are used for administrative operations.

The private sector is a major initiator of existing programs to reduce aircraft fuel consumption and emissions.

- Alaska Airlines, for example, has for several years been using preconditioned air units and ground power units to condition cabin air and provide power to aircraft at the gate, rather than relying on traditional on-board auxiliary power units that consume up to 10 times more fuel for the same tasks.
- Alaska Airlines, the Boeing Company, the Port of Portland, and several other public and private stakeholders created the Sustainable Aviation Fuels Northwest (SAFN) program to identify opportunities and challenges of producing safe, low-carbon aviation fuels from sustainable regional biomass, and to develop an action plan to help overcome key commercial and sustainability challenges to biofuel production.

As a state, Oregon is moving in the right direction. Current local and regional plans provide a strong foundation for achieving GHG emissions reductions. Additionally, cities and counties in Oregon are already implementing many of the elements to achieve other economic, social or environmental goals. Lastly, industries and companies are making business decisions that have an added co-benefit of reducing emissions. The work that has been done and the ongoing efforts provide a foundation to build on as Oregonians move forward with efforts to further reduce transportation related GHG emissions. The Statewide Transportation Strategy examines ways to augment, and build on, the good work already being done and planned, and looks for additional and new approaches for reducing emissions, and supporting other societal goals.

Why Focus on Transportation?

The travel of Oregonians and movement of goods consumed by Oregon's households and businesses produce a large amount of GHG emissions;²² estimated to be approximately 24 million metric tons per year in 2010. That is about 80 pounds of GHG emissions per person per day. This is a sizable proportion of the total estimated GHG emissions compared to other studies which estimate that transportation sector GHG emissions are about a third of all GHG emissions. However, due to differences in how transportation GHG emissions are accounted for in the STS, the 24 million metric ton figure cited above equates to about a third of all emissions.²³ Reducing emissions from transportation can make a sizable contribution to reducing climate change impacts in Oregon.

While transportation must do its part to reach the state's goal, it cannot achieve the goal alone and work in other sectors is needed. The Governor's Office and the Oregon Department of Energy through the Governor's 10-Year Energy Action Plan, the Oregon Global Warming Commission, the Oregon Department of Environmental Quality, and others are addressing GHG emissions from other sources, such as electrical power generation and industrial energy use, to help meet the state's GHG emissions reduction goal by 2050. Achieving this goal will require leadership, champions, planning, innovation, and coordination among many sectors and communities across the state.

What's in it for Oregon?

The benefits of reducing GHG emissions from transportation extend far beyond arresting the impacts of climate change. Many actions that can be taken to reduce GHG emissions may also help create new jobs while positioning Oregon to compete strongly in a changing global economy. Over the next forty years - the planning horizon of the STS - Oregon will face a number of challenges that will require creative solutions. Factors such as population growth, a changing economy, and aging transportation infrastructure will require attention whether or not there is comprehensive action on climate change.

²² Oregon's GHG emissions reduction goals are not sector specific. For the purpose of this strategy, it was assumed that the reduction would be based on transportation's percentage of overall GHG. Transportation sources make up about 34 percent of Oregon's GHG emissions today, followed by industrial sector emissions (25 percent), residential sector emissions (17 percent), the commercial sector (14 percent), agricultural sources (7 percent) and processing of waste (3 percent). Source: ODOT. Background Report: The Status of Oregon Greenhouse Gas Emissions and Analysis. October, 2009.

²³ The STS accounting methodology differed from other accounting methodologies. Refer to the Technical Appendices for the STS analysis methodology.



As this document demonstrates, the same actions that can be employed to reduce carbon emissions also appear to:

- Reduce delay and inefficiency on Oregon’s roadways;
- Support clean air and protect natural resources;
- Improve public health;
- Accommodate new state residents;
- Provide for the efficient movement of goods and services;
- Reduce Oregon’s dependency on foreign energy sources; and
- Keep the proportion of household expenditures on transportation from rising.

The STS seeks to reduce transportation related GHG emissions while also improving the efficiency and effectiveness with which people and goods are moved, sustaining a strong economy while creating healthier, more livable communities, and new economic opportunities for Oregonians. The actions identified in this document are intended not only to mitigate the impacts of climate change, but also to strategically position Oregon to adapt to a changing world, ensuring quality of life and a resilient economy in the decades to come.



2 THE 2050 VISION

In setting the context for a statewide transportation strategy to address transportation related GHG emissions reduction, it is necessary to envision a future Oregon that accommodates an expanding population and maximizes the potential for a thriving economy, while maintaining Oregon's quality of life and natural beauty. Looking ahead 40 years and planning for a cleaner and more sustainable transportation and land use system also supports a multitude of societal benefits beyond reducing GHG emissions, including more efficient transportation systems that help people and goods travel more quickly and easily; reduced transportation costs for individuals and businesses proportional to today (as opposed to increased costs projected if we continue on current trends); and increased travel choices, including bicycling, walking, and public transportation.

Oregon cannot plan for a more sustainable future alone. National and international efforts will be required to solve the global problem of GHG emissions and climate change. Still, Oregon is well positioned to be in the forefront for climate change mitigation strategies, and to enjoy the benefits that accompany them. Indeed, the strategies that limit GHG emissions also support societal benefits far beyond arresting the impacts of climate change. While some of the mitigation strategies may have potentially negative impacts on a particular segment of the population or industry, these may be offset by more significant long term benefits to the state economy and quality of life, compared to a "business as usual" approach. Working collaboratively to address these land use and transportation issues can go far toward ensuring the state has no shortage of dynamic, livable communities that are well-positioned to engage in and adapt to a changing global marketplace.

This chapter presents a 2050 Vision for Oregon. It is not intended to be a prediction, but rather a description of a potential future that may be realized through the collective commitment and effort of stakeholders across the state.



Oregon in 2050: The Statewide Transportation Strategy Vision

The Statewide Transportation Strategy (STS) provides an opportunity to build a future that provides many of the same amenities enjoyed today, while incorporating profound technological and community advancements that will improve lives. The STS envisions a future Oregon that features:

- **Improved public transportation service, bicycling and walking** – Throughout the state, Oregonians have better access to a range of transportation options (e.g., transit, carpool, bicycling, walking). Communities feature well-lit walking paths, bicycle facilities, and more frequent transit service. Improvements in bicycling and walking facilities help encourage physical activity and foster reduced obesity rates and overall improvements in public health. Carsharing services provide households with a convenient way to forgo vehicle ownership entirely and save money.
- **Fuel-efficient / alternative energy vehicles** – Great strides in technology allow for the widespread adoption of cleaner and more efficient vehicles by Oregon residents. Vehicles powered by electricity, compressed natural gas (CNG) and locally-produced biofuels are able to travel hundreds of miles without recharging or refueling, and are supported by an extensive network of fueling and charging stations. Heavy-duty freight vehicles have evolved from diesel fuel to liquefied natural gas (LNG), and commercial aircraft run largely on biofuels. These changes improve air quality dramatically while reducing dependency on foreign oil.
- **Enhanced information technology** – People can use technology to easily plan and update their travel routes using multiple modes as needed such as public transportation, bicycling and walking in addition to personal vehicles. Improved communication systems enable individuals and organizations to meet and collaborate virtually, while reducing the need for physical travel. In-vehicle communications technologies and collision avoidance systems in cars and trucks greatly reduce the number and severity of crashes, resulting in saved lives, reduced damage, improved travel time reliability, and elimination of hundreds of hours of roadway delay each year. New vehicle-to-vehicle communications advancements allow cars and trucks to drive closer together and use less space on the roadway, resulting in more efficient use of existing infrastructure.
- **More efficient movement of goods** – Fewer personal vehicles on Oregon roadways frees capacity for the transportation of goods that support a growing economy. When possible, goods are moved by more efficient modes such as rail and water. New technologies allow freight vehicles to emit lower emissions. Urban consolidation centers allow for more efficient distribution of freight deliveries to final destinations in urban areas.
- **Walkable mixed-use communities** – Within Oregon cities, a large share of residents live in walking distance of jobs, stores, services, entertainment, and transit stops. Because of this mix of uses in a geographically small area, commute times are shorter, limiting time spent in traffic. Residents of such communities are afforded increased opportunities to “buy local,” supporting local businesses. Communities across the state are recognized for vibrancy, livability, and safety.

Benefits of the 2050 Vision

The potential benefits of achieving the Statewide Transportation Strategy 2050 Vision extend far beyond the critical goal of limiting the adverse effects of climate change. In fact, bringing about these advancements could result in a broad array of positive impacts to society when compared to a “business as usual” future. Such benefits include:

- **Household savings** - Lower vehicle miles traveled, lower household vehicle ownership rates, and the ability to enjoy amenities through mixed-use developments and access to public transportation, bicycling, and walking help households to spend a lower percentage of their incomes on transportation. Less vehicle travel, improved fuel economy, and more transportation options help to protect households from dramatically increasing petroleum fuel costs. More compact communities and less sprawl reduce the costs associated with providing electricity, water and other utilities per resident, while improved public health has the added benefit of lowering health care costs for Oregonians.
- **A stronger economy** - Reductions in petroleum fuel consumption frees more money to be spent locally and invested in the Oregon economy. A reduced dependence on petroleum and a shift to more diverse fuel sources helps insulate Oregon’s economy from shocks due to instability in world oil markets. Substantial reductions in the amount of fossil fuels consumed per capita result in household cost savings and more investment in the state economy. Reduced delay and congestion improves the reliability of travel, benefiting employers, employees, and shippers. More efficient transportation and land use systems allow existing roadways to accommodate a growing economy. Lower pollution levels and more active travel help lower health care costs.
- **Safer roads** - Bicycle and pedestrian improvements are designed to maximize visibility to motorists. Additionally, on Oregon’s roadways, lower rates of vehicle travel and new intelligent transportation systems significantly reduce crash rates. Reduced crashes also result from slower speeds on some routes.
- **A healthier public** - Mixed-use communities, increased transit service levels, and more transportation options (e.g., bicycling, walking) lead to more active and healthy communities, including lower obesity rates. Improvements to air quality result in lower incidences of asthma and other related diseases.



- **Less time wasted in traffic** - Shorter travel distances and more convenient travel options result in greater transportation system performance. Lower personal vehicle travel frees capacity for freight and other commercial travel that is important to the state's economy. Delays are reduced by improved traffic management and reductions in the number of crashes.
- **Energy savings** - Improved vehicle efficiency, new alternative fuels, and lower vehicle usage result in energy savings.
- **Cleaner air and water** - Heavy trucks, aircraft and private vehicles run on cleaner and more efficient energy, thus, lowering per capita emissions from the burning of fossil fuels. This results in cleaner air and fewer environmental impacts from the extraction, refinement and transportation of fossil fuels. By burning and distributing less gasoline and diesel and by accelerating adoption of alternatively fueled vehicles, other toxic air pollutants, such as benzene, are reduced, improving overall air quality.

While there are benefits of the STS Vision, there are also costs. For example, building infrastructure and providing services necessary to make multimodal travel options available would be costly. The total magnitude and effect of the various costs on Oregon's economy could not be predicted because of the uncertainty of economic changes across the nation and world and technological and social changes that occur. These things are very uncertain. For example, who 40 years ago would have predicted the impact of the internet and cell phones today? Because of this uncertainty, the pathway forward to implement the STS will include continued monitoring and evaluation of trends that affect the validity of the vision and its implementation. In addition, as implementation of STS strategies moves forward, the potential economic effects of appropriate candidate implementation measures will be analyzed to determine the likely effects during the implementation timeframe and to develop programs that minimize adverse effects.

A Vision that is Bold, but Plausible

Viewed from today, the 2050 Vision for transportation may seem ambitious. Indeed, many of its components will require significant advancements in technology and infrastructure. But to imagine what is possible in 40 years, simply look to the past. Who in 1970 could have predicted the technological and infrastructural wonders enjoyed today? Fiber-optic and wireless networks spanning the nation; the power of a room-sized computer in the palm of the hand; vast quantities of the world's information accessible with the click of a mouse or the tap of a finger; the ability to order merchandise from around the world and have it delivered over night. Many achievements that would once have seemed impossible are now ubiquitous, commonplace parts of daily life.

Each of the elements in the Statewide Transportation Strategy 2050 Vision were carefully selected for plausibility based on existing research, development, and practice. In fact, much of the groundwork for the 2050 Vision has already been laid, such as:

- **Alternative fuels** - The first electric vehicles and electric fueling stations are already available throughout the state and the nation, while research continues to expand the battery power and driving distance of electric vehicles.
- **ITS and other technologies** - Many of the intelligent transportation systems (ITS) technologies needed to improve detection of roadway and traffic conditions and to provide drivers with real-time cost and delay information have already been developed, and require only deployment and integration with existing facilities and vehicles. Smart phone applications are already providing users with convenient public transportation information, connecting commuters with carpooling options, and offering many other services.
- **Air traffic modernization** - Congress has taken up the Federal Aviation Administration's *NextGen* program, which will convert radar-based air traffic control to satellite technology, improving the efficiency and reducing the delay of commercial and freight aircraft.
- **Freight efficiencies** - The Oregon trucking industry has made significant strides in improving fuel economy in recent years and continues to seek innovative ways to increase efficiencies, which are tied directly to revenues.
- **State planning efforts** - State agencies continue to engage in long-range planning efforts such as the Oregon Transportation Plan, Oregon Freight Plan, and other current and ongoing plans that explore the feasibility of actions required to prepare for the future of transportation in Oregon.



Some of these advancements, such as widespread adoption of new technologies, will require investment and innovation by the federal government and private industry. Developing new and ongoing funding sources for infrastructure will remain difficult, as unforeseen circumstances and other societal priorities continue to compete for attention and dollars. Overcoming these obstacles will require a range of actions at state, regional, and local levels, as well as cooperation from public and private entities beyond Oregon's borders.

The challenges may be great, but the opportunities are greater. Achieving the 2050 Vision will help continue Oregon's legacy of leadership and yield far-reaching benefits for generations to come.



3 DEVELOPMENT OF THE STATEWIDE TRANSPORTATION STRATEGY

Development of the STS focused on a singular goal (reduce GHG emissions) and a set performance target (75 percent reduction), as directed and defined by the Oregon Legislature. A need was recognized in the development process, however, to look beyond just GHG emissions, and to assess broad impacts to other goal areas. The STS explores all aspects of the transportation system, including the movement of people on the ground and in the air, and freight and was developed through rigorous analysis and research, and through technical and policy discussions by stakeholders. The development process led to the identification of strategies within transportation systems, vehicle and fuel technologies, and urban land use patterns that consider not just GHG emissions reduction potential, but economic, social, and other environmental impacts. Together, these strategies are intended to help achieve the state's transportation related GHG emissions reduction goals while contributing to a more livable and economically viable future for Oregon.

Analysis and Process

Two committees guided the STS development process, providing direction and oversight (committee members are listed in Appendix A: Statewide Transportation Strategy Committees):

- **The Technical Advisory Committee**, consisted of technical experts from state, federal and metropolitan agencies and others who provided insight and guidance on GHG emissions reduction strategies and potential impacts; state and local conditions that might impact the plausibility or effectiveness of certain strategies; assistance in developing statewide scenarios; guidance and oversight of agency technical analysis procedures; and review of scenario analysis results.
- **The Policy Committee**, included stakeholders from Oregon cities, metropolitan planning organizations (MPOs), state commissions, academia, and industry, who offered policy related oversight at each step of the STS development process, including scenario specification, analysis results, and political and policy implications of evaluation indicators.

The STS was developed through a scenario based planning process. In scenario planning, a reference case is developed to show what the future will look like if nothing is changed, and the trends and plans of today continue. Alternative scenarios are then developed to test how changes can affect that future.

For the purposes of the STS, scenarios were developed that consisted of changes to the configuration of transportation and land use, such as better fuel economy, increased deployment of intelligent transportation system (ITS) technologies, and more mixed-use and multimodal neighborhoods. The outcome of these changes, or how they impact the future, was assessed using indicators, which provided information such as the amount of GHG emissions and household costs. This analytical process is illustrated in Figure 3.

The Figure illustrates a single scenario being fed into the research and analysis process to evaluate potential outcomes. Committees looked for those strategies showing the greatest potential for positive outcomes, with fewest apparent negative impacts.

Over 150 scenarios were tested during the development process. Each scenario represented different levels of intensity of transportation and land use actions. During the refinement process, bundles were created to test scenarios stressing technology, urban and land use actions, system optimization, and pricing. None of these bundles, alone, were close to the legislative GHG reduction target, so effective actions had to be combined and enhanced. The level of intensity for many of the actions had to be pushed to the outer range of plausibility. Intensity levels were deemed plausible when other countries or locations have reached such levels, when trends and market forces indicate that such levels could be achieved, or when industry experts agree it is feasible. Industry experts such as the Department of Environmental Quality and Department of Energy, in addition to the STS advisory committees were consulted.

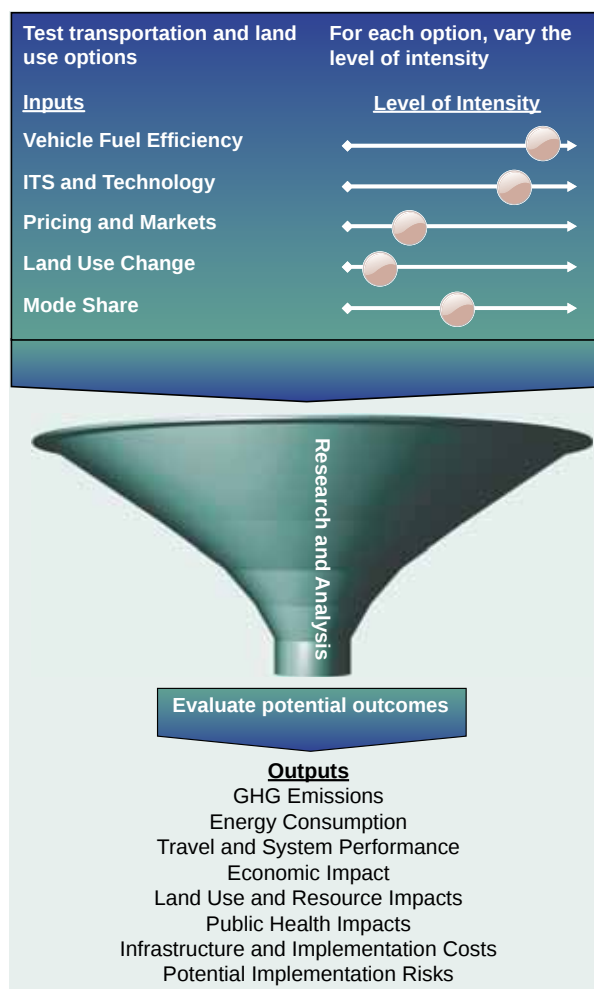


Figure 3: STS Scenario Planning Process

The reference case and alternative scenarios were analyzed using sophisticated tools. One of the primary tools used in the development process was GreenSTEP.²⁴ GreenSTEP was developed by Oregon Department of Transportation (ODOT) for the specific purpose of estimating and forecasting the effects of transportation and land use policies on GHG emissions and other goals. The GreenSTEP model was reviewed extensively by state, national, and international travel and emissions modeling experts in multiple venues. Evaluation of the model at the national level led to the Federal Highway Administration adopting GreenSTEP for dissemination and use by others.²⁵

Components of GreenSTEP were tested throughout the development process to check the reasonability of results and whether the model could replicate observed behavior and conditions. Sensitivity tests found the model was consistent with results reported by other

²⁴ GreenSTEP is an acronym for Greenhouse gas Strategic Transportation Energy Planning. In 2010, the American Association of State Highway and Transportation Officials (AASHTO) awarded ODOT staff its President's Award for the GreenSTEP model.

²⁵ The national version of GreenSTEP was named EERPAT, which is an acronym for Energy and Emissions Reduction Policy Analysis Tool.

studies.²⁶ Additional detail on GreenSTEP and the other tools and models used in the process can be found in the STS Volume II, Technical Appendices.

For the purposes of analysis, scenarios were individually analyzed based on the following type of travel movements: people on the ground, people in the air, and freight goods on the ground and in the air. These different types of movements, deemed travel markets, were distinguished because the needs, uses, and emission profiles of each were distinct and the potential outcomes of actions could be more accurately tested. The following section details the distinction between travel markets and differences in development processes.

Travel Markets

The STS explores all aspects of the transportation system, including the movement of both people and goods. The transportation sector consists of a variety of modes, markets, sensitivities, and interactions. For the purposes of the STS, the transportation sector is divided into three distinct travel markets: Ground Passenger and Commercial Services, Freight, and Air Passenger.

Ground Passenger and Commercial Services

Within the transportation sector, today's largest share of GHG emissions (over 50 percent) is generated from the Ground Passenger and Commercial Services travel market. This travel market refers to all ground passenger travel on roads and rail, as well as ground commercial deliveries made in vehicles weighing less than 10,000 pounds gross vehicle weight (GVW). This includes vehicles such as:

- Cars
- Sport utility vehicles (SUVs)
- Pick-up trucks
- Passenger travel by surface public transportation (e.g., bus and rail)
- Travel by most delivery, service, and repair vehicles

This travel market facilitates the movement of people for work, recreation, and personal business. Passenger cars and light trucks (e.g., pick-up trucks, sport utility vehicles [SUVs], and vans) produce the majority of GHG emissions for this market segment.

²⁶ For example, the sensitivity of GreenSTEP to changes in urban area population density and land use mixing was comparable to findings published in the Transportation Research Board Special Report 298, *Driving and the Built Environment: Effects of Compact Development on Motorized Travel, Energy Use, and CO2 Emissions*. September 2009.





Buses, rail, streetcars, and motorcycles are proportionally smaller GHG emissions producers. Walking and bicycling are non-emitting modes. In the future, personal electric vehicles, such as electric bicycles, are likely to provide a very low emissions alternative for many people as well. In exploring ways to reduce GHG emissions for ground passenger and commercial services travel, efforts were made to look at strategies that:

- Improve fuel economy and shift to lower carbon fuels;
- Result in lower overall emissions;
- Help reduce delay;
- Provide travelers with transportation choices other than driving alone in a car;
- Apply true cost pricing with fees commensurate with carbon intensity; and
- Facilitate access to jobs and services closer to home.

Analysis was conducted to look at a variety of approaches for reducing ground passenger and commercial services GHG emissions. Strategies targeting the urban environment (land use and development), technology, transportation system optimization, and pricing were individually analyzed to determine which methods were most effective in reducing emissions. Results showed that a combination of strategies is needed to achieve aggressive reductions over time.

Freight

Under existing conditions (year 2010), the Freight travel market represents the second largest source of transportation related GHG emissions at about 30 percent of all transportation emissions. However, freight vehicle miles traveled (VMT) and GHG emissions have been growing faster than the Ground Passenger and Commercial Services travel market. If steps are not taken to reduce the emissions from the freight sector, the freight market share of transportation GHG emissions could represent the majority of all transportation emissions in the future.

The Freight travel market analysis considers the GHG emissions of all modes of transportation used to move commodities and finished products²⁷ for consumption in Oregon. This travel market refers to the movement of goods across all transportation modes (road, air, rail, and water) on vehicles greater than 10,000 pounds GVW. Freight transportation in this context involves larger, heavier vehicles that

²⁷ Finished products do not include emissions resulting from the manufacture of goods. As an example, emissions are not calculated for the movement of materials to make a vehicle, such as steel and tires, but only for the car as a finished product.

usually travel longer distances to serve both regional and national markets. Air freight differs from air passenger travel in terms of travel purpose and other considerations.

For example, if a resident in Medford buys a car that was made in Korea, the freight analysis would consider the emissions from the ship that travels between Korea and the Port of Portland and the truck trip to move the car from the port to the auto dealer in Medford. Below is a list of the freight modes analyzed:

- Heavy duty trucks
- Trains
- Ships and barges
- Freight aircraft
- Commodity shipment pipelines

As in the Ground Passenger and Commercial Services travel market, strategies were explored to reduce Freight travel market GHG emissions in a way that would also produce other benefits. Particular attention was paid to strategies that:

- Reduce fuel costs;
- Encourage the proliferation of technology to improve freight movement efficiency;
- Encourage growth of jobs in industries that have high value-density and those that add value to basic commodities and agricultural products;
- Apply true cost pricing with fees commensurate with carbon intensity; and
- Reduce environmental and health impacts from freight movement.

Strategies were evaluated to meet the objectives above and reduce GHG emissions. However, over 80 percent of all Freight travel market GHG emissions are produced outside of the state as goods and commodities, which make their way to Oregon homes and businesses.

While outside the scope of the STS, to be successful in GHG reduction, Oregon's consumption of goods and materials should be acknowledged. Strategies will be needed at multistate, national, or even international levels. This highlights the importance of Oregon working with other states to advance the national policy discussion.

Air Passenger

As of 2010, the Air Passenger travel market generates an estimated 11 percent of the total GHG emissions in the Oregon transportation sector.²⁸ Air Passenger travel market GHG emissions are emitted by aircraft on the ground and during flight, from ground support equipment at airports such as luggage carts and gate equipment,



²⁸ Based on GHG inventory methods explained further in the Technical Appendices.

and from all vehicles accessing the airport including private vehicles, taxis, shuttles, transit vehicles, and trucks.

This travel market refers to commercial air travel, including aircraft, and ground access and support equipment at airports. Air passenger travel moves at much faster speeds and typically over much longer distances than ground passenger travel. In addition, unique fuels are required to propel aircraft. These differences subject air passenger travel GHG emissions to a different set of potential emission reduction actions.



This travel market facilitates the long-distance movement of passengers for work, recreation, and personal business. It includes all commercial air services supporting Oregonians' travel within Oregon, across the United States, and internationally. In exploring ways to reduce GHG emissions for air passenger travel, strategies were investigated that:

- Improve the efficiency of public access to the airport;
- Improve the efficiency of all vehicles and equipment operating on airport property;
- Reduce delays and improve overall efficiency of the air transportation system through Federal Aviation Administration's (FAA) *NextGen* Air Transportation System;
- Reduce the carbon intensity of air passenger travel through improved aircraft and engine technologies and use of low-carbon aviation fuels;
- Reduce overall demand for air passenger trips by improving alternative modes or eliminating entirely the need for some trips through advanced telecommunications;
- Apply true cost pricing with fees commensurate with carbon intensity; and
- Provide travelers with transportation choices for lower carbon transportation alternatives.

Analysis was conducted to evaluate a variety of approaches for reducing air passenger GHG emissions. Strategies targeting air travel demand management, air travel pricing, aviation system management, and aircraft and fuel technologies were individually analyzed to determine which methods were most effective in reducing emissions. Results showed that a combination of strategies is needed to achieve aggressive GHG emissions reductions in mid- and long-terms. However, because over 85 percent of GHG emissions related to air passenger travel are produced from aircraft (as opposed to ground operations and airport access), it is important to identify strategies that reduce the number of air passenger miles or the GHG emissions rate per passenger mile of flight, or both.

Key Development Steps

The STS development process discussed above followed these key steps (see Figure 4):

- 1. Develop analytical methods for estimating GHG emission impacts** - Under the oversight of the Technical Advisory Committee, agency personnel and industry experts developed methods for estimating the emissions impacts of a broad array of potential programs, policies, and actions.
- 2. Identify GHG emission reduction actions and develop strategy bundles** - Advisory committee members, agency personnel, and industry experts compiled a wide variety of potential GHG emission reduction actions through research and practices observed in Oregon and beyond. These actions generally fell into the following categories:
 - Transportation system and operations performance;
 - Vehicle and fuel technology advancements;
 - Transportation options, allowing shifts to more fuel-efficient modes;
 - Increased land use density and mixed-use development; or
 - Efficient pricing of transportation.

A series of initial scenarios were then developed, featuring bundles of actions organized around a strategy focus (e.g., transportation system optimization, vehicle/fuel technology advancement, pricing and markets, urban land use, etc.).

- 3. Develop evaluation framework and develop evaluation methods** - As indicated previously, reducing GHG emissions is not the sole benefit of the STS. Advisory committees helped guide the development of a detailed framework of non-GHG related factors upon which to further evaluate potential scenarios. These included evaluation criteria with indicators measuring transportation system performance, social impacts, other environmental indicators, and public health impacts.
- 4. Analyze GHG emissions and non-GHG impacts** - The set of travel market scenarios were individually evaluated based on their potential impact on both GHG emissions and non-GHG factors (e.g., transportation system performance and public health impacts).
- 5. Review and revise scenarios** - Results of travel market scenario analysis were presented to the advisory committees for review. The level and intensity of certain actions were adjusted based on analysis results. Certain scenario elements that provided insufficient GHG reductions were eliminated from consideration.
- 6. Multiple iterations of scenario development and review** - Advisory committee input was used to iteratively refine and re-analyze scenario bundles, ultimately arriving at a preferred scenario for each travel market.
- 7. Combine sector results into the final STS** - Finally, the three travel market scenarios were combined into a cumulative transportation system, forming the STS Vision.

For further detail on the development of the STS, refer to the Technical Appendices.

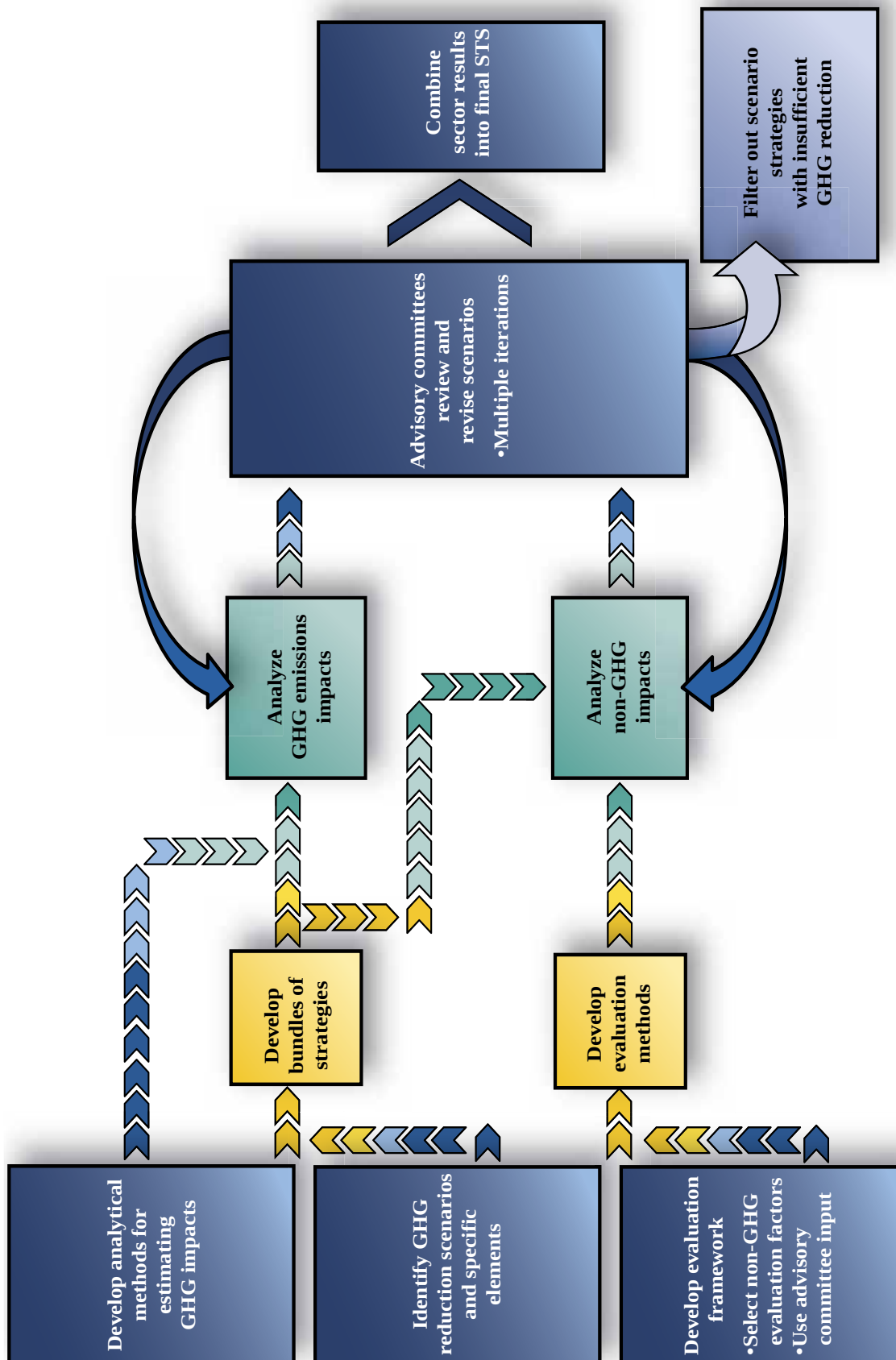


Figure 4: STS Process Diagram

Identification of Strategies

In the development of the STS, the majority of time was expended on analysis in order to identify strategies potentially most effective at reducing GHG emissions with the fewest apparent negative impacts. Through the Technical Advisory Committee and consultation with experts at organizations like the Oregon Department of Environmental Quality, STS assumptions were vetted and plausibility assessed from a technical standpoint. Assumptions and plausibility were then gauged at the policy level by the Policy Committee, who selected the strategies recommended in the STS.

Each strategy included in the STS is likely to have GHG reduction benefit if pursued at any level of intensity. However, in order to meet the legislative 2050 GHG reduction goal, a specific level of intensity is needed and was identified through modeling and analysis. Level of intensity or “what it would take” information is provided in Chapter 5: Strategies. The “what it will take” boxes describe aspirational targets necessary to near the GHG reduction goal, and act as performance measures to be tracked over time. Decision makers need to determine the priorities and objectives for transportation and how to pursue the STS. The STS is designed to be agile and modified as needed. While the targets provide useful information on level of intensity needed, the key to the STS are the strategies themselves, which offer a potential path for a cleaner future, no matter how aggressively they are pursued.

The STS development process culminated in a series of key strategies. These consist of approaches that can be taken at the local, regional, state, and national level to help meet the state’s GHG emissions reduction goals for the transportation sector.

A summary of these strategies are listed below by strategy category. For more detail on the strategies and associated potential actions (“elements”), refer to Chapter 5: Strategies. For additional details on “what it would take,” or the level of effort needed to aid the state in reaching its goal, refer to Technical Appendix 5. Potential implementation challenges are also noted in Technical Appendix 5.

Vehicle and Engine Technology Advancements
1 – More Efficient, Lower-Emission Vehicles and Engines
Fuel Technology Advancements
2 – Cleaner Fuels
Systems and Operations Performance
3 – Operations and Technology
4 – Airport Terminal Access
5 – Parking Management
6 – Road System Growth
Transportation Options
7 –Transportation Demand Management
8 – Intercity Passenger Growth and Improvements
9 – Intracity Transit Growth and Improvements
10 – Bicycle and Pedestrian Network Growth
11 – Carsharing
12 – More Efficient Freight Modes
Efficient Land Use
13 – Compact, Mixed-Use Development
14 – Urban Growth Boundaries
15 – More Efficient Industrial Land Uses
Pricing, Funding and Markets
16 – Funding Sources
17 – Pay-As-You-Drive Insurance
18 – Encourage a Continued Diversification of Oregon’s Economy

4 POTENTIAL IMPACTS OF THE STATEWIDE TRANSPORTATION STRATEGY

The STS looks out 40 years into the future to the year 2050. In projecting out so far, there are many uncertainties and unknowns. However, through modeling, analysis, and consultation with experts and stakeholders a relative picture was drawn to better understand what the future may look like with and without the STS. Precise projections could not be established but the amount of GHG emissions could be well approximated and indicators were used to get a sense of impacts to public health, the proportion of household income spent on transportation, and other outcomes as described in this section.

Greenhouse Gas Emissions Results

Together, the STS recommended strategies, listed in the previous section and discussed in Chapter 5: Strategies, are projected to achieve around a 60 percent total reduction (81 percent per capita) in transportation related GHG emissions by 2050, as compared to 1990 levels. Although the STS Vision by itself would not achieve the legislative goal of reducing GHG emissions by 75 percent,²⁹ the reduction would be substantial and would be a marked change in course from current trends.

Figure 5 compares estimated 1990 GHG emissions by travel market segment with 2050 projections for the continuation of current trends, the STS Vision, and what emissions would be if each transportation market segment reached the 2050 goal.

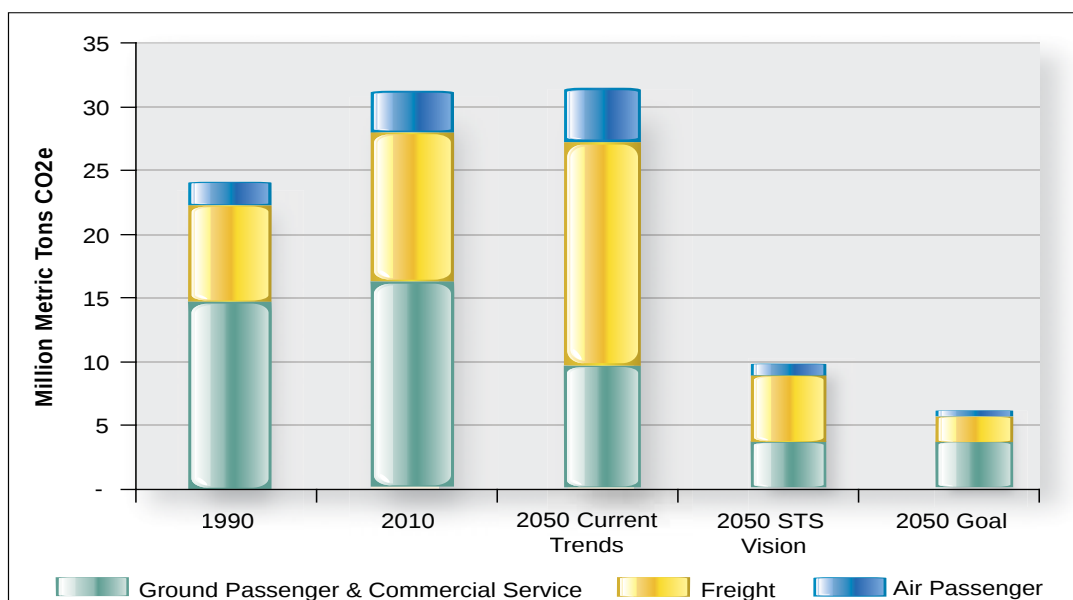


Figure 5: Projected Statewide Transportation Sector GHG Emissions

²⁹The STS recommendations, together, do not meet 2050 legislative GHG reduction goals. However, the GHG reduction goals are not sector-specific, so a lesser reduction in transportation might be offset by a greater reduction in another sector (e.g., power generation). Failing to meet the state's reduction targets in the power generation sector would result in higher emissions attributed to electric and hybrid-electric vehicles, though advancements in technology could enable greater reductions than current technology allow.

As Figure 5 shows, reductions in transportation related GHG emissions are anticipated for the Ground Passenger and Commercial Services travel market even under current trends. There are several reasons for this, including the following:

- *Market saturation* - Since the majority of GHG emissions from the Ground Passenger and Commercial Services travel market come from light vehicles, the trend in future emissions depends on the total number of light vehicles owned and used. Current estimates show vehicle ownership at or near saturation levels. Thus, autos and other light vehicles are no longer growing in market share due to the influence of competing modes and technologies such as enhanced telecommunications.
- *Availability of other modes* - Oregon's transportation and land use planning has helped increase the practicality of other travel modes like walking, bicycling, or taking public transportation. As these trends continue, and spread to a larger proportion of the state's population, market share for light vehicle travel will decrease.
- *Aging population* - The increasing share of elderly in the population will result in a reduced amount of driving.
- *Technology* - Several recent policy changes that increase the fuel economy and reduce the GHG emissions of light vehicles will greatly assist in decreasing GHG emissions.

The STS Vision identifies the potential for additional emission reductions from future improvements to vehicle fuel economy, cleaner fuels, alternative energy sources (electric vehicles), walkable mixed-use land configurations, transportation mode options, and efficiencies in the transportation system. The ability to pair these actions with existing trends allows opportunities for greater reductions in the Ground Passenger and Commercial Services travel market than can be achieved in the other two travel markets. The STS Vision for Ground Passenger and Commercial Services leads to GHG emission reductions around 75 percent below 1990 levels. The relative effect can be seen in Figure 5 by comparing the STS Vision share with the results needed to meet the 2050 goal.

Unlike the Ground Passenger and Commercial Services travel market, GHG emissions from the Freight and Air Passenger travel markets is expected to grow. The growth of freight emissions is outpacing the other two markets. Moreover, freight emissions are not limited by saturation in the ownership or use of a particular transportation mode. Freight travel will grow as long as current consumption activities and trends continue and trading distances increase. There are similar challenges for reducing air passenger emissions. Air travel is growing in market share and there are inherent difficulties in improving the fuel economy of airplanes.

Under the 2050 STS Vision, the emissions of the Freight and Air Passenger travel markets though substantially reduced, would not be reduced enough to meet the 2050 goal. The emissions reduction shortfall between the 2050 Vision and 2050 goal for the Air Passenger travel market could be compensated by the extra reductions estimated to be achievable for the Ground Passenger and Commercial Services travel market. However, it would be insufficient to address the emissions reduction shortfall in the Freight travel market.

Further reductions in freight GHG emissions will take more than transportation sector actions. It is unlikely that freight emissions could be reduced sufficiently by factors that are under the control of freight carriers, vehicle manufacturers, and others in the transportation

sector. Achieving a 75 percent reduction in freight emissions will require a broader effort which addresses the efficiency with which consumer and manufacturing materials are used and the total amount of materials used.

Primary Drivers of GHG Emissions Reduction

The STS analysis revealed several broad groups of actions as critical contributors to GHG emissions reductions across all travel markets:

- **Vehicle and fuel technology advancements** - Improvements in vehicle efficiency and reductions in the carbon intensity of vehicle power sources (fuels and electricity).
- **Improved system and operations performance** - Intelligent transportation systems, air traffic operational improvements and other innovative approaches to improving the flow of traffic, reducing delay on transportation systems, and providing travelers with information that improves driving habits and choices.
- **Transportation options, allowing shifts to more fuel-efficient modes** - Providing infrastructure and options for public transportation, bicycle, and pedestrian travel, enhancing transportation demand management programs, shifting to more efficient modes of goods movement, and providing alternatives to certain air passenger trips.
- **Increased land use density and mixed-use development** - Continue focus on infill and mixed-use development in urban areas to reduce demand for vehicle travel, expand non-auto travel mode choices for Oregonians, and enhance the effectiveness of public transportation and other modal options.
- **Efficient pricing of transportation** - Traditionally, the “user pays” principle has been an important tenant of funding the highway system. However, a sizable proportion of the costs of using the transportation system are not included in what users currently pay. These unpaid costs include the health and environmental impacts caused by motor vehicle pollution (including GHG emissions) as well as the costs of maintaining secure petroleum fuel sources, among other things. This results in marketplace distortions and inefficient uses of resources. A “user pays true cost” approach ensures that less efficient modes are responsible for the true cost of their impacts to the transportation system and environment.

Results of Other Indicators

While the legislative directive for the STS was focused on reducing transportation GHG emissions, the analysis considered a range of other potential benefits and adverse impacts that might result from implementation of aggressive GHG reduction strategies. These potential co-benefits and impacts were assessed using a number of quantitative indicators that addressed the following performance criteria:

- Travel and System Performance
- Energy Consumption and GHG Emissions
- Land Use and Natural Resource Impacts
- Public Health Impacts
- Infrastructure and Implementation Costs
- Economic Impacts

The STS Vision was developed by assessing changes in these indicators resulting from the different strategy bundles or scenarios (see “Analysis and Process”) that described different courses of action for reducing transportation sector GHG emissions. The outcomes of these scenarios were compared to the 2050 Reference Case, a default course of action reflecting the continuation of current policies and trends. In selecting strategies for inclusion in the STS Vision, these performance evaluation results were used to identify a comprehensive mix of strategies that carried the greatest apparent benefit together with the least amount of adverse impacts, in addition to their GHG-reducing potential.³⁰

In addition to the reductions in the GHG emissions produced by year 2050, the strategies contained in the STS Vision were found to result in a number of additional impacts, as detailed below.

Travel and System Performance

Travel and system performance was primarily measured through changes in vehicle miles traveled and delay for the movement of people and goods on roadways. The greatest projected impact to performance is expected from marked growth in population, estimated at 60 percent in metropolitan areas. With the business as usual trend (Reference Case) performance is expected to decline and worsen from today’s levels. Rising populations, stagnant transportation infrastructure growth, and few alternative travel options for most Oregonians, increases the use of travel by single-occupant vehicles, causing widespread and long-lasting delays on Oregon roadways, highway and freeways. By comparison, the STS Vision shows improved performance, marked by:

- **Lower levels of vehicle delay** - With compact, mixed-use land use patterns which enable shorter vehicle trips and travel by other modes, provision of travel options, efficient transportation pricing, and deployment of intelligent transportation systems (ITS) technologies, total vehicle delay on metropolitan roadways is expected to decline by about 10 percent. Despite a doubling of metropolitan truck vehicle miles traveled (VMT), truck delay would only increase by about 25 percent.

Achieving the same results by expanding the roadway system would require massive amounts of spending and the effects would be short lived. The Vision limits roadway expansion costs by providing more urban mobility options and improving overall management of urban transportation systems.



Energy Consumption and GHG Emissions

Changes in energy (fuel) consumption and GHG emissions were evaluated. Current trends show emissions for Ground Passenger and Commercial Services decreasing below current levels, but above the reductions needed for the 2050 goal. In contrast, Freight emissions are projected to increase by nearly 80 percent above today’s levels and small increases are predicted in Air Passenger travel. These Reference Case projections reflect a future dependence on petroleum fuels. Such reliance on foreign sources of transportation fuels will make travelers and shippers more vulnerable to escalating fuel prices and shortages caused

³⁰ Technical Appendix 2, Ground Passenger and Commercial Services Travel Market Analysis Methodology, pp. 38-43, describes the evaluation framework and selected indicators.

by global political events and market speculation. Fewer transportation options will reduce the ability of Oregonians to adjust to changes in fuel supplies and prices and increase the adversity of impacts to Oregon's economy. By contrast, the STS Visions shows substantial reductions in GHG emissions and a movement away from more carbon intensive energy sources like petroleum, resulting in:

- **Reduced fuel consumption and greater energy security** - More efficient vehicles, greater use of electricity and alternative fuels, shorter trip distances, and greater use of transportation options results in a near 90 percent drop in petroleum fuel consumption from today's levels. This would result in less dependence on imported fuel and potentially more money available to purchase goods and services produced by Oregon workers and manufacturers. It would also mean that Oregon's economy could be more insulated from disruptions in international oil markets and price spikes. Overall GHG emissions would be reduced substantially, to a total of 60 percent below 1990 levels.

Land Use and Natural Resource Impacts

The use and preservation of land were primary indicators used to measure how land use and natural resources might perform or look in the future. Consideration was also given to changes in water consumption as a result of sprawl or densification. Projected increases in population, again, were a primary influence of performance. In the Reference Case, substantially more land will be consumed for development at the expense of farmland and other open spaces if little is done to encourage compact, mixed-use community development. Conversely, with the STS Vision there is expected to be:

- **Reduced land consumption** - Several strategies of the STS, notably those related to development of more compact urban areas and supportive transportation systems, will reduce consumption of agricultural and forest land, as well as reduce use of water, energy, and other natural resources.

Public Health Impacts

Indicators for public health included an overall change in criteria pollutants (PM, NOX, VOC) from the entire transportation system, and, for the movement of people, a change in non-motorized travel (active transportation). Due to fewer transportation options and greater use of higher carbon intensive modes in the Reference Case, health does not perform as well as the STS Vision, which shows:

- **Improvements in public health** - Air pollution per mile of vehicle travel will decline substantially as vehicles and fuels become cleaner. Other changes such as compact community development, increased transportation options, and efficient pricing will keep VMT growth from counteracting these gains. Just as important, the transportation and land use changes that will contribute to lower VMT growth will also contribute to more walking and bicycling by urban households which is practical for many more people to get the exercise they need to be healthy by simply carrying out their daily activities.



Infrastructure and Implementation Costs

When and how strategies are implemented have a great influence on cost. As such, indicators to assess infrastructure and implementation costs produce only a snap shot in time, and may be higher or lower. Both capital and operating costs were used as indicators, measuring changes to roadway development and development of alternative modes. For the movement of people and freight, different increases and decreases in costs resulted from the Reference Case and STS Vision, as discussed below:

- Infrastructure costs** - For increased mobility, the STS Vision provides cheaper options such as improved management of the transportation system and greater use of alternative modes, as opposed to expanding the roadway system which would require substantially greater amounts of spending on infrastructure for construction and maintenance. However, with the STS Vision, greater provision of transportation options, especially transit, comes with associated increased infrastructure costs for those modes. A doubling or tripling of transit service, for example, would equate to a doubling or tripling in costs above today's levels. However, in lieu of such options, there would likely be increased maintenance and operations costs to roadways resulting from higher levels of vehicle miles traveled, and increased roadway construction costs if congestion is to be mitigated. Depending on priorities and objectives, the Reference Case may have higher infrastructure costs than the STS Vision due to road expansion, but if expansion were not pursued, infrastructure costs would be higher under the STS Vision.
- Implementation Costs** - Implementation of the STS Vision will generate a very different stream of future costs for planning, construction, operation, and maintenance of the transportation system than would the Reference Case. These include potentially lower capital and operating costs on the system of metropolitan and intercity highways and bridges, substantially higher capital and operating costs for public transportation, higher investment in local networks for non-motorized travel, and changes in capital and operating expenditures on sub-systems devoted to the movement of freight and airline passengers, such as freight terminals, rail lines, multimodal passenger terminals, etc. Implementation planning work will need to define the potential strategies at a sufficient level of detail to allow more precise and comprehensive determination of these infrastructure costs.



Economic Impacts

As with each of the performance criteria listed in this section, indicators were used to describe potential high level impacts associated with the STS Vision as opposed to comprehensive analysis of full scale impacts. In accordance, the information presented herein for “economic impacts” is not meant to represent a detailed or full economic analysis. The indicators used included changes in household costs, social costs, freight shipping costs, and general revenues.

Implementation of a long-term program as comprehensive as the STS Vision would undoubtedly have a range of impacts on the economy and population of Oregon. Below is a summary of potential impacts:

- **Economic effects on Oregon households** - Even though the STS assumes that drivers will pay the full cost of driving, the total annual vehicle ownership and operation costs per residential household would decrease relative to today, except for the very highest income households. This decrease would be greatest for low to moderate income households. Increases in road-use and parking charges would be offset by reduced VMT due to shorter trip distances, increased use of other modes, improved fuel economy, and substitution of lower cost electricity for higher cost gasoline.
- **Economic effects on Oregon business** - Relative to the Reference Case, the STS Vision is projected to result in lower future costs for businesses, primarily due to the lower cost of moving freight. The STS Vision strategies need to be sufficiently refined and specified to allow more industry-specific assessment of benefit and impact, as various commodity types and associated sectors may be impacted differently. The potential adverse impacts of carbon-based fees or other new costs to industries with heavy shipping requirements will need to be addressed in implementation planning work.
- **Economic effects on passenger air travel industry** - Advancements in fuel, airframe technology, and more efficient ground operations are anticipated to save the air industry money. Overall passenger air travel is expected to grow significantly under the Reference Case. Provision of more transportation options may slow the growth rate of air passenger travel. The strategies in the STS are highly unlikely to cause a decrease in air travel demand below today's levels. Rather, the effect would be to somewhat dampen the future growth trajectory for passenger air travel relative to the Reference Case, complementing the reductions in emission rates anticipated from aviation fuel and aircraft technology improvements.

Need for More Robust Economic Analysis

Although the performance indicators point to potential economic effects on households and businesses, the STS Policy Committee acknowledged the need for a more comprehensive economic analysis of important issues to be addressed and included in implementation planning work, including:

- **Addressing true costs** - The STS identifies a number of mechanisms for efficiently pricing the transportation system. The use of these types of "pricing signals" to influence consumers, business owners, investors, and others needs to be more carefully defined and evaluated so that the potential adverse impacts and benefits can be described on a more market specific level, rather than only at an aggregate statewide level. Care needs to be exercised in assessing transportation fees to avoid placing excessive burdens on households and businesses. Some strategies such as carbon fees may need to be addressed on a broader scale, considering the presence or absence of national and international participation, to assess the degree to which Oregon may be placed at a competitive disadvantage relative to other regions.

- ***Equity and environmental justice*** - The STS has potential equity and environmental justice impacts, as different, disproportionate impacts may fall on different populations.³¹ Implementation planning needs to consider effects, both in terms of benefits and burdens, of specific actions on transportation providers, users, and defined environmental justice populations. Equity and environmental justice will be important as the numerous strategies are considered in amending state policy documents, in local and regional planning processes, and during actual implementation. Balancing equity and environmental justice in transportation decision making involves evaluating such foundational issues as community health impacts, transportation access and affordability, and public participation from the perspective of differing groups. Consistent with state transportation policy in the Oregon Transportation Plan (Policy 7.4), Oregonians will be given equal access to transportation decision making as the STS implementation work moves forward.
- ***Economic cost of inaction*** - An objective assessment of the potential economic benefits and adverse impacts of the STS must consider those changes in relation to the costs of continuing with the status quo. Long-term economic consequences of inaction include the cost of adapting transportation infrastructure to the direct effects of climate change such as sea level rise and storm severity. Secondary effects of climate change, with potentially significant economic impacts to Oregon, include harm to forests, agricultural lands, and fisheries, and declining public health. Equity/environmental justice considerations apply to this concern as well, as the costs of inaction are not likely to fall equitably on different social and economic populations or community types.
- ***Mitigation costs*** - Additionally, implementation planning work will consider various approaches to mitigating potential unintended consequences of the proposed GHG reduction strategies. These could include temporary measures to allow businesses and households time to adjust to rising energy costs, or longer term safeguards for not singling out any particular population group or industry for inequitable treatment. Economic costs associated with mitigation of STS impacts should be anticipated where possible and included in the analysis. The analysis needs to distinguish between long-run impacts that remain even after some degree of adaptation and evolution of the economy, and short-run implementation impacts that occur as households and businesses make adjustments to new opportunities and constraints.
- ***Diversification of Oregon's economy*** - Because freight movement is so closely linked to both the state's economic output and to GHG emissions, the STS analysis finds that changes need to take place in the value-added aspect of commodities shipped in order to make significant reductions in freight GHG emissions while still supporting the shipping needs of a robust, growing state economy. Improved

³¹ Environmental justice refers to the comparative impacts of programs, policies, or activities on minority populations and low-income populations in relation to non-minority and/or higher income populations, with the goal of avoiding, minimizing or mitigating disproportionately high and adverse human health and environmental effects, including social and economic effects on minority and low-income populations and ensuring full and fair participation by potentially affected communities in the transportation decision making process. Equity may be thought of more broadly in terms of comparative impacts across modes, geographies, transportation user groups, etc.

freight fuel economy and lower-carbon fuels alone will not meet freight GHG reduction goals. The “value-density” of goods produced within the state would need to increase over time, so that every ton of freight shipped reflects a higher amount of economic output. The Oregon Freight Plan anticipates this significant shift in value density, noting that from 2010 to 2035 the value of goods will increase at twice the rate of the weight of goods shipped.³² Similarly, the Oregon Business Council acknowledges the importance of innovation and higher-value production in addressing global competition from lower-cost commodity producers, even in the agricultural and forestry sectors.³³ These types of shifts are outside of the influence of transportation and land use actions but would help to reduce transportation related emissions.

It is difficult to predict with a high degree of confidence how the STS Vision would affect the overall size or fundamental characteristics of Oregon’s economy in the long run. State economies are complex, constantly shifting arrangements of household and business activities that are subject to the influences of a wide array of regional, national, and international factors that are equally difficult to predict. Over sufficient periods of time there have always been, and will continue to be, gains and losses in any one industry or local segment of the state’s economy. Innovations are made and seized upon by some and not by others; neighborhoods and entire regions rise and fall with the arrival or departure of industries or population groups driven by any number of socioeconomic factors. This complexity and the uncertainty of future predictions is magnified by the increasingly interconnected nature of the global political economy. Much of what happens in Oregon over the next 40 years will likely be equally influenced by external forces as by policy decisions made within the state.



³² Oregon Freight Plan, 2011. Page 44, Table 2-2, Oregon Freight Tons and Value, All Modes.

³³ Oregon Business Plan, www.oregonbusinessplan.org.

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5 STRATEGIES

The STS was developed in response to legislative direction³⁴ – focusing on the reduction of GHG emissions from transportation. To achieve the GHG reduction goal set by legislation, the STS was developed to look at all components of the transportation system including: ground passenger and commercial services transportation, freight movement, and air passenger travel. Within each of these travel markets, transportation and land use options were explored in an effort to find the most effective mix of options with the fewest apparent negative impacts and with the greatest potential for substantially reducing GHG emissions, now and into the future. In total, strategies from the three travel markets combined lead to a 60 percent reduction in GHG emissions from 1990 levels, a substantial reduction in transportation sector emissions to aid the state in achieving its 2050 goal.³⁵ Strategies may be pursued individually or in bundles, but all need to be considered to reach the 60 percent reduction cited above.

The STS is neither directive nor regulatory, but provides a broad vision to meet the legislative charge and points to promising approaches for further consideration by leaders and policymakers. It is an important achievement as it establishes a long-term course to help reduce transportation related GHG emissions. The STS provides a framework for the Oregon Department of Transportation, other state, regional and local agencies, and leaders from around the state to reduce transportation related GHG emissions.

This chapter of the STS includes strategies for each of the three travel markets. While the ultimate goal is to implement each strategy to full potential for the greatest emissions reduction outcome, benefits will still be experienced no matter how far each strategy can be implemented. The level of effort to implement each strategy is discussed in detail in the travel market analysis methodology sections in the Technical Appendices.

From the technical analysis results and discussions with agency and industry representatives, the following strategies identify the mix of options with the best potential outcomes and the fewest negative impacts for reducing emissions and meeting other societal goals like good public health. It is intended that these broad strategies be further refined into specific actions during the development of an implementation plan (Phase II). Refer to Chapter 6: Summary and Next Steps, for an overview of the STS development and implementation phases.

While the strategies are listed individually, many are interdependent, meaning that some of the strategies will not achieve their greatest potential for GHG emissions reductions unless they are implemented in conjunction with complementary but distinctly separate strategies. In some cases, one strategy lays the groundwork for another. The following examples illustrate these interdependencies and the multiplicative effect.

³⁴ Chapter 85, Oregon Laws 2010 Special Session;

https://www.oregonlegislature.gov/bills_laws/lawsstatutes/2010orLaw0085.html.

³⁵ Oregon Revised Statute (ORS) 468A.205 establishes that by 2050, the state achieve greenhouse gas emission levels that are at least 75 percent below 1990 levels.

- **Land Use and Transportation:**

- *Ground Passenger and Commercial Services* – Transportation specific measures that facilitate the use of lower-carbon modes such as public transit, personal electric vehicles, bicycling, and walking will be far more effective if implemented in conjunction with land use measures such as compact, mixed-use development, and managed urban growth. Each of these strategies help reduce average travel distances and increase the number of potential destinations that are close to one’s place of residence, such as employment, shopping, schools, health care, and recreation. As another example, land use strategies that provide proximate destinations, “complete streets,” and neighborhoods will help to make parking pricing a more effective and likely more publicly acceptable strategy for reducing GHG emissions.
- *Freight* - Measures that promote more efficient industrial land uses by encouraging producers and shippers to locate in proximity to one another, or that encourage the creation of metropolitan freight consolidation centers, can also reduce the cost of building distribution networks for new low-carbon fuels. Shortening the distance that goods move, through consolidation centers and proximate location of producers and shippers, creates greater opportunity for the use of zero emission electric vehicles for short haul freight movements.

- **Cleaner Fuels:**

- Supporting the development, commercial production and distribution of sustainable, low-carbon fuels is a strategy in all three travel markets. Because of the high initial cost of research, development, and construction of transportation fuel distribution networks, it makes sense to support broad-based strategies and programs that offer the promise of benefits for all transportation sectors. Initial gains in developing alternative fuels for the private and fleet passenger car/light truck market may serve as springboards or catalysts to future gains in diesel and aviation fuels for the freight and air passenger markets. In a different way, measures that improve the ability for employees and passengers to access airports using low or zero carbon modes complements, rather than detracts from, the GHG reductions offered by lower-carbon fuels. Plus, it accommodates the anticipated future growth in air passenger travel without a corresponding increase in GHG emissions. While one strategy could be implemented independently of the other, it will be more effective to implement both in the appropriate sequence and time frame.

These are but a few examples of the many interdependencies among the GHG reduction strategies contained in the STS.

For the purposes of this document strategies are listed individually, but as noted above, many work in conjunction with one another. Each of the following strategy sections includes the following components (Figure 6):

- **Strategy Category:** Strategies are grouped under one of the following six categories based on similarities.

- **Vehicle and Engine Technology Advancements** - Strategies in this category increase the operating efficiency of multiple transportation modes through transitions to more fuel-efficient vehicles, improvements in engine technologies, and other technological advances.
- **Fuel Technology Advancements** - Strategies in this category increase the operating efficiency of fuel-powered transportation modes through transitions to fuels that produce fewer GHG emissions or have a lower lifecycle carbon intensity.
- **Systems and Operations Performance** - Strategies in this category improve the efficiency of the transportation system and operations through technology, infrastructure investment, and operations management.
- **Transportation Options** - Strategies in this category encourage a shift to transportation modes that produce fewer emissions and provide for more efficient movement of people and goods.
- **Efficient Land Use** - Strategies in this category promote more efficient movement throughout the transportation system by supporting compact growth and development. This development pattern reduces the distances that people and goods must travel and provides more opportunities and incentives for people to use zero or low energy transportation modes.
- **Pricing, Funding, and Markets**³⁶ - Strategies in this category support a transition to more sustainable funding sources to maintain and operate the transportation system, pay for environmental costs and provide market incentives for developing and implementing efficient ways to reduce emissions.
- **Strategy (shaded box):** Each strategy was found to be effective in reducing GHG emissions and helping to achieve other desirable outcomes. Many strategies were tested, but only those with measurable impacts on GHG reduction were included (refer to the Technical Appendices for further details).
- **Elements:** Under each strategy, a number of elements are listed which represent potential actions that would help achieve the strategy. Inclusion of a given element was primarily driven by committee and public feedback. The elements represent some of the key actions that will be further explored in Phase II (development of the implementation plan), but are not a comprehensive list. Some of the elements will likely be dropped from consideration in Phase II, while the strategies are likely to remain. The check boxes next to each element indicate which travel market(s) the element is applicable to.
- **What it Will Take:** A box follows most strategies describing “what it will take,” or the level of effort, needed in order to realize the 60 percent GHG emission reduction projected from the overall STS. The level of effort is discussed in three trajectory periods: short-term (by 2020), mid-term (by 2035), and long-term (by 2050). Additional details along with implementation challenges are discussed in Technical Appendix 5. General challenges and opportunities are at the end of this chapter.

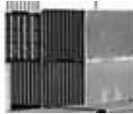
³⁶ Strategies in this category will require further study, particularly economic analysis, to more fully understand the potential impacts.

- **The STS is Not One-Size-Fits-All:** Some strategies are followed by shaded boxes, highlighting that a strategy may be implemented in different ways, and can vary depending on local preference and the size or make-up of the community.

Strategy Category (*vehicle, fuel options, etc.*)

Strategy 12 – Strategy Title

Strategy Language



Ground

Freight

Air



Element 12.1



Element 12.2



Element 12.3

What it will take...

Figure 6: Layout of STS Strategies for Each Travel Market

Vehicle and Engine Technology Advancements

Strategy 1 – More Efficient, Lower-Emission Vehicles and Engines

Transition to lower emission and fuel-efficient vehicles, enhanced engine technologies, and efficient vehicle designs.

- **Ground Passenger/Commercial Services:** Transition to vehicles, such as plug-in hybrids, electric cars, and alternative fuel vehicles, and encourage the purchase of newer technology vehicles that are more fuel-efficient and/or are not dependent on higher emission fuels.
- **Freight:** Support industry transition to more efficient engine technologies, alternative fuel technologies, vehicle designs, and rail car/truck trailer, barge, and car designs.
- **Air Passenger:** Support aircraft and engine advancements that result in operational efficiency and lower emissions.

Each of the following elements will require further analysis of costs, benefits, and other impacts associated with the element's ability to achieve the strategy.



Ground	Freight	Air		
☒	☒	☒	1.1	Developing fuel-efficient vehicle technologies and alternative fuels that are compatible with the engine technologies.
☒	☒	☐	1.2	Reducing the GHG emission rates of vehicles. • Establishing vehicle emission standards and zero emission vehicle programs (e.g. California's vehicle emission standards and Oregon's Clean Diesel Program).
☒	☒	☐	1.3	Participating in the Environmental Protection Agency's (EPA) SmartWay program. • SmartWay program participation by carriers and commercial service providers. • Encouraging fleet operators that operate long-haul trucks to purchase vehicles with certified energy/fuel saving technologies such as the EPA's SmartWay Program.
☒	☒	☐	1.4	Establishing state and national incentive and tax credit programs to encourage the purchase of more fuel-efficient vehicles.



Ground



Freight



Air



1.5 Pursuing federal grants (e.g., Department of Energy) that support transition to lower emission vehicles in Oregon.



1.6 Establishing financing, tax credit and incentive programs (e.g., “feebates”) to incent purchase of fuel-efficient vehicles and to encourage more rapid adoption of new technologies (e.g., electric vehicles, hybrid vehicles, alternative fuel vehicles such as natural gas powered vehicles, high-efficiency internal combustion engines).



1.7 Pursuing public-private partnerships.

- Leveraging funding opportunities. Involving relevant agencies and organizations to ensure successful coordination and implementation of fuel-efficient vehicle programs.
- Identifying partnerships as possible sources of funding.



1.8 Developing electric vehicle charging station infrastructure.

- Investing in Oregon’s electric vehicle charging network, through projects like West Coast Green Highway.
- Installing charging stations at business locations.
- Installing wiring for electrical vehicle charging stations in new residential or commercial parking garages.



1.9 Improving efficiency of electric vehicles (e.g., allowing for greater range between charging stations).



1.10 Reducing GHG emissions by at least 75 percent below 1990 levels by 2050 in the electrical power generation sector, which will be critical to reducing emissions from electric vehicles.



1.11 Transitioning transit and light- and heavy-duty commercial fleets to low or zero emission powered vehicles, such as compressed natural gas (CNG), liquefied natural gas (LNG), renewable natural gas (RNG), and electric.


Ground
Freight
Air

☒	☐	☐	1.12	Increasing the proportion of lighter weight vehicles on the road that are more fuel-efficient. “Right sizing” vehicle fleets so that vehicles are not larger and heavier than what is needed for the task.
☒	☐	☐	1.13	Increasing the use of zero emission travel mode options such as walking, bicycles, electric bikes, and neighborhood electric vehicles (NEV).
☒	☐	☐	1.14	Establishing differential vehicle registration fees based on fuel (or GHG) efficiency, with lower fees for more efficient vehicles.
☐	☒	☐	1.15	Establishing a vehicle tiered weight-mile fee (or carbon efficiency/weight-mile tax) to encourage the purchase of more efficient engine technology.
☐	☒	☐	1.16	Quickening adoption of technological improvements in vehicles and fuels.
☐	☒	☐	1.17	Electrifying rail corridors.
☐	☒	☐	1.18	Establishing freight fuel economy standards for all freight modes, specifically targeting more efficient rail car and truck trailer designs.
☐	☒	☐	1.19	Establishing heavy-duty engine standards to lead to efficiency improvements.
☐	☒	☐	1.20	Supporting national or multistate efforts to consider efficient truck length and weight standardization while remaining consistent with the Federal Bridge Formula.
☐	☒	☐	1.21	Developing advanced vehicle/vessel/rail car designs to improve overall fuel economy.
☐	☐	☒	1.22	Improving engine and airframe efficiency to help meet NASA’s Environmentally Responsible Aviation (ERA) and Ultra Efficient Engine Technology (UEET) program goals.
☐	☐	☒	1.23	Establishing additional federal funding support for aircraft technology and fuel research programs.

What it will take....**Ground Passenger and Commercial Services Travel Market**

Substantial improvements in vehicle fuel economy through changes such as:

- Slowly lowering the proportion of internal combustion engines in the next decade, with drastic cuts in the mid- and long-term.
- Alternative fuel/electric/hybrid vehicles: 95 percent of new vehicles on Oregon's roads are hybrid, electric or hybrid electric by 2050; this would be 53 percent of total fleet composition.
- Transitioning of commercial service vehicle fleets to use natural gas fuels (e.g., CNG, RNG) or electricity.
- Steady increases in average gas mileage (about 60 miles per gallon in the long-term).
- Greater share of light vehicles that get better gas mileage on the road.

Freight Travel Market

Substantial improvements in engine efficiency:

- In the mid-term, engine powertrain technologies are 25 percent more efficient for trucks, trains, and ships.
- In the long-term, all freight engine/powertrain designs are at least 35 percent more efficient than existing technologies.
- Transitioning truck and other freight engine/powertrain designs, as appropriate, to use natural gas fuels (e.g., LNG).

Substantial improvements in bodies, rail cars, and truck trailers:

- In the short-term, there are higher adoption rates of the SmartWay program and other trailer and train car efficiencies.
- In the long-term, emissions efficiency per ton-mile of goods movement achieves 50 percent reduction in GHG per ton mile compared to existing conditions.

Air Passenger Travel Market

Aircraft and engine manufacturers lead the way in developing more fuel-efficient engines and aircraft resulting in:

- In the mid-term, up to a 40-42 percent target reduction based on FAA and NASA research in GHG emission rates.

Fuel Technology Advancements

Strategy 2 – Cleaner Fuels

Support the development and use of cleaner fuels, including reduction of the carbon intensity of fuels.

Each of the following elements will require further analysis of costs, benefits, and other impacts associated with the element's ability to achieve the strategy.



Ground	Freight	Air		
☒	☒	☒	2.1	Extending Oregon's renewable fuels standard to expand the use and availability of low carbon renewable fuels.
☒	☒	☒	2.2	Reducing total transportation fuel emissions, from initial resource extraction through processing, distribution, and eventual combustion.
☒	☒	☒	2.3	Using electricity, hydrogen, natural gas, propane, and other low emitting fuels in the transportation sector.
☒	☒	☒	2.4	Developing low emission power source infrastructure and alternative fuel networks, such as liquefied natural gas (LNG), compressed natural gas (CNG), renewable natural gas (RNG), and hydrogen. Prioritizing LNG production for domestic freight movement as opposed to international trade.
☒	☒	☒	2.5	Continuing Oregon Clean Fuel Standards. Reducing the lifecycle carbon intensity of transportation fuel produced or delivered for use in Oregon.
☒	☒	☒	2.6	Establishing incentives (e.g., lower carbon fees) for fuel processors to blend increasing amounts of certified sustainable bio/renewable fuels into existing fuel streams.
☒	☒	☒	2.7	Establishing federal and local bio/renewable fuel programs.
☒	☒	☒	2.8	Expanding the availability of fuels through local renewable fuel sources (biogas recovery, biodiesel refineries, cellulosic ethanol plants, etc.).
☒	☒	☒	2.9	Establishing permitting incentives to encourage more local bio/renewable fuel processors.



Ground

Freight

Air



2.10

Participating in bio/renewable aviation fuel pilot programs such as Sustainable Aviation Fuels Northwest (SAFN) to accelerate industry adoption of low carbon fuels for commercial travel.



2.11

Developing alternative aviation biofuel feedstocks and establishing incentives for the development of feedstocks and supply chains within the state.

What it will take....

Ground Passenger and Commercial Services Travel Market

Carbon intensity of fuels is reduced by 20 percent from present levels over time and GHG emissions from electricity production is reduced by 75 percent from 1990 levels.

Freight Travel Market

Substantial growth in the market share of low carbon fuels in the future:

- In the long-term, a 20 percent reduction in the freight carbon fuel intensity is required. Includes gains from LNG and renewable biofuel technologies.

Air Passenger Travel Market

Development of Oregon-based feedstocks to increase biofuels supply to a level that could lead to:

- In the mid-term, biofuels reduce emissions per mile an additional 3-5 percent over aircraft and engine technologies, and
- In the long-term, biofuels reduce emissions per mile an additional 15-20 percent over aircraft and engine technologies.

Systems and Operations Performance

Strategy 3 – Operations and Technology

Enhance fuel efficiency and system investments, and reduce emissions by fully optimizing the transportation system through operations and technology.

- **Ground Passenger/Commercial Services:** *Enhance the network through optimization techniques and deploy intelligent transportation system (ITS) technology to enhance fuel efficiency and reduce emissions.*
- **Freight:** *Regulate operations of freight vehicles at speeds that optimize GHG emissions reductions and provide incentives for technology improvements that provide drivers and operators with real time information on fuel consumption and operating costs. Encourage idle reduction technologies at ports, freight terminals, and truck stops.*
- **Air Passenger:** *Deploy efficient operations and maintenance practices and use low or zero emission equipment for all airport ground service operations. Accelerate and complete implementation of the FAA “Next Generation” (NextGen) Air Transportation System (ATS).³⁷*

Each of the following elements will require further analysis of costs, benefits, and other impacts associated with the element’s ability to achieve the strategy.



Ground

Freight

Air



3.1 Promoting technology that supports eco-driving, such as in-car displays that calculate efficiency of driving and operating costs and notify the driver of more fuel-efficient techniques.



3.2 Reducing speed limits on highways (e.g., 55 miles per hour) to increase the fuel economy of conventional combustion engine vehicles as well as reduce emissions. Setting Oregon truck speed limits at a level that minimizes long-haul truck GHG emissions. Encouraging the adoption of national energy efficient speed limits for trucks.

³⁷ In the next 10-15 years, the FAA NextGen system is the most promising approach for reducing aircraft emissions from all phases of flight and from ground operations. About 97 percent of GHG emissions from aircraft occur during aircraft cruise or during takeoff or descent, while the remaining occurs on the ground during taxi and idling. Therefore, *NextGen* strategies are split into flight and ground operations.



Ground

Freight

Air



3.3 Enhancing agency deployment of intelligent transportation systems (ITS) operations programs, such as advanced signal timing, transit signal priority, ramp metering, and adaptive traffic management.



3.4 Developing and deploying Active Traffic Management (ATM) technologies, such as variable speed limits, to improve traffic flow while maximizing the efficiency of roadway facilities.



3.5 Reducing incident delay through enhanced incident management to detect, respond to, and/or remove traffic incidents as quickly and safely as possible to restore roadway traffic flow.



3.6 Promoting traffic management solutions, such as replacing signalized intersections with roundabouts, to reduce idling and traffic delay.



3.7 Enhancing agency deployment of ITS programs for real-time traveler information (including “point-of-purchase” information) to assist travelers in making more efficient timing, route and mode choices, such as variable message signs, the 511 travel information phone line, and the *TripCheck* website and mobile application.



3.8 Supporting the development and deployment of smart phone applications and other technologies to connect commuters with carpooling options, provide users with convenient transit information, and offer many other services.



3.9 Promoting vehicle-to-vehicle communication technology that signals nearby vehicles of upcoming congestion or safety hazards (like crashes), or connects with traffic signals to reduce vehicle stopping, thus optimizing fuel efficiency.



Ground

Freight

Air



3.10 Providing information to the public on eco-driving techniques to optimize fuel efficiency such as avoiding rapid acceleration and braking, driving at lower speeds, and regular vehicle maintenance.

- Incorporating eco-driving information into the Oregon Driver Manual and in driver's education curriculums.
- Seeking opportunities for transit agencies to receive national training and accreditation, such as through the Certification for Sustainable Transportation's eRating program that teaches idle-free techniques.



3.11 Revising Oregon's anti-idling statute for medium-sized commercial trucks, and work to bring commercial bus fleets into the statute.



3.12 Testing and, if warranted, deploying autonomous vehicles, which minimize human error, improve safety, and inherently optimize fuel efficiency and reduce emissions.

- Determining if regulatory barriers exist to implementation and address as appropriate.
- Seeking opportunities to plan for road configurations and invest in infrastructure that support use of autonomous vehicles.

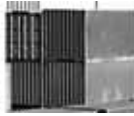
Supporting autonomous vehicle carsharing programs, where cars can be ordered and delivered from the periphery of urban centers, thus freeing urban parking areas for infill and redevelopment.



3.13 Supporting eco-driving techniques that limit idling and continue support of weigh-in-motion technologies (e.g., ODOT's Green Light program) to reduce truck travel time, operating costs, and truck idle time at weigh stations and truck stops.



3.14 Pursuing federal or multistate cooperation to outfit vehicles and vessels with supportive technology. Examples include truck and trailer power ports and standard ship power ports.



Ground

Freight

Air

☐
☒
☐

3.15 Pursuing options to install auxiliary power supplies at truck stops, shipping terminals, and ports.

☐
☒
☐

3.16 Encouraging large truck fleet operators to purchase vehicles and trailers that support ground based power or include on board low carbon auxiliary power units.

☐
☒
☐

3.17 Establishing a program to develop public-private-partnerships (PPP) for implementation of systems that allow trucks and ships to utilize electricity while at truck stops, shipping terminals, and ports. Support development with necessary changes to local codes to simplify permitting and reduce costs for early adopters.

☐
☐
☒

3.18 Working with airports and airlines to promote and support replacement of fueled airside equipment including employee shuttles, baggage tugs, belt loaders, pushback tractors, service and maintenance equipment, and jet bridges with most recent electric or ultra-low emission vehicle technology.

☐
☐
☒

3.19 Working with airports and airlines to support installation of power and preconditioned air units at gates to reduce use of aircraft auxiliary power units.

☐
☐
☒

3.20 Working with airports and airlines to install recharging/refueling equipment on airport property, ensuring that electricity sources for recharging units are from renewable sources.

NextGen Flight Operation Elements



Ground **Freight** **Air**

☐ ☐ ☒

3.21 Working with the FAA, Oregon airports, and airlines to ensure on-schedule implementation of *NextGen* ATS technologies for Oregon airports and airspace, resulting in more fuel-efficient climb, routing, and descent for passenger aircraft.

- Supporting implementation of the FAA Modernization and Reform Act of 2012, to maximize likelihood that *NextGen* procedures will be fully operational at the nation's 35 busiest airports (including Portland International Airport) by 2015.
- Working with the FAA and airlines to implement an avionics equipage incentive program to equip commercial aircraft with communications, surveillance, and navigation equipment to help achieve *NextGen* routing capabilities.

NextGen Ground Operation Elements



Ground **Freight** **Air**

☐ ☐ ☒

3.22 Prioritizing work with the FAA, Oregon airports, and airlines to improve airfield management practices (collaborative departure queue management) that lead to reductions in the time and number of aircraft idling on taxiways waiting for takeoff, or for open gate slots upon arrival.

☐ ☐ ☒

3.23 Prioritizing work with the FAA, Oregon airports, and airlines to implement Ground Based Augmentation System (GBAS) technology (precision approach, departure, and terminal operations) at all Oregon airports.

What it will take....**Ground Passenger and Commercial Services Travel Market**

Greater use of intelligent transportation system (ITS) technology, such as:

- Steady increase of already widely deployed ITS on freeways and arterials including ramp metering and incident management totaling near full deployment (95 percent) by 2050 in metropolitan areas.

Significant increase in the proportion of people who practice eco-driving so that:

- Around one in three people in the next decade (30 percent total) practice eco-driving, with around 60 percent in the mid-term, and around 70 percent of drivers using eco-driving techniques in the long-term.

Freight Travel Market

Changes in freight operator practices to focus on minimizing fuel consumption:

- In the short-term, truck speed limits are set at a level that minimizes GHG emissions. Beyond 2020, speed limits are periodically optimized to account for technological improvements.
- In the short-term, nearly all trucks travel at the posted speed limit.
- In the mid- and long-term nearly all trucks are equipped with in-vehicle fuel consumption and cost information technology.

Steady growth in the proportion of vehicles and vessels that support ground-based power:

- In the mid-term, nearly all trucks and trailers support ground-based power connections or include low-carbon auxiliary power units.
- In the long-term, 100 percent of commercial truck parking spaces (truck stops and shipping terminals) and long-term idling areas are equipped with remote power.
- In the long-term, electrical power for ships and aircraft is available at ports and airports (but not necessarily at all gates/terminals), where appropriate.

Short-term streamlining of local codes to reduce barriers to implementation.

Air Passenger Travel Market

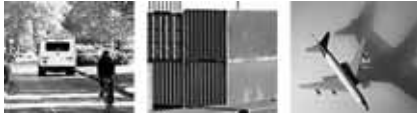
Aggressively replace equipment with new technologies and develop charging stations, such that:

- By the mid-term, 50 percent of all ground service equipment (GSE) are electric or ultra-low emission technologies.
- In the long-term, 100 percent GSE are electric/ultra-low emission technologies, with all recharging power from renewable resources.
- In the mid-term fully operational *NextGen* ATS.

Strategy 4 – Airport Terminal Access

Increase efficiency in all airport terminal access activities, including shifting to low and zero emission vehicles and modes for passengers, employees, and vendors.

Each of the following elements will require further analysis of costs, benefits, and other impacts associated with the element's ability to achieve the strategy.



Ground **Freight** **Air**



4.1 Establishing incentives for passenger use of efficient modes to access the airport, and implementing other system and operations performance and transportation options strategies that improve airport access, including: public transportation, parking management, transportation demand management, system operations enhancements, and ground vehicle fuels and technology improvements.



4.2 Working with airport and port authorities to improve efficiency of operations of all airport roadway, parking and cargo handling facilities to reduce excessive idling and circulation, through strategies such as prepaid parking, managed taxi/shuttle operations, and streamlined cargo vehicle access.



4.3 Using information technology supported baggage handling to facilitate passenger ground travel and check-in, while improving baggage transfer reliability.

What it will take....

Air Passenger Travel Market

Substantial changes in the way in which passengers, employees, and goods reach the airport, so that:

- Oregon resident passengers and employees increasingly use low or zero emission public transit and autos for airport access trips.
- Non-resident passengers primarily use low or zero emission shuttles to travel between terminal and hotels, off-site rental car facilities, etc.
- Vendors servicing airports use low emission delivery vehicles, and air cargo deliveries are increasingly handled by low emission LNG/CNG trucks.
- Idling by all vehicles is minimized through traffic management and operational strategies including pre-paid parking.

Strategy 5 – Parking Management

Promote better management and use of parking in urban areas to support compact, mixed-use development and use of other modes, including transit, walking, and bicycling.

Each of the following elements will require further analysis of costs, benefits, and other impacts associated with the element's ability to achieve the strategy.

**Ground****Freight****Air**

- 5.1** Promoting parking cash-out and employer buy-back programs, to reduce vehicle trips and increase use of other modes, by offering employees monetary incentives to use non-single occupant vehicle travel modes in lieu of free parking.



- 5.2** Updating local zoning codes to reduce requirements for off-street parking and establishing off-street parking supply maximums in urban areas, as appropriate.



- 5.3** Promoting use of parking management strategies such as parking restrictions (e.g., permit zones and on-street parking time limits) and associated enforcement/penalties.



- 5.4** Increasing shared parking at mixed commercial/ retail/ entertainment developments.



- 5.5** Promoting pricing strategies such as variable market rates for on-street (metered) parking or variable pricing (e.g., during peak hour).



- 5.6** Requiring sufficient, secure, and convenient bicycle parking at key destinations.



- 5.7** Providing timely information on parking costs (“point-of-purchase”) to influence travel behavior.

What it will take....

Ground Passenger and Commercial Services Travel Market

More employees in urban areas either pay to park or receive equivalent financial incentives to use other modes to commute to work, leading to:

- Decreases in the amount of free parking in urban areas over time.
- Incremental increases in price in the short- to mid-term and a tripling of parking rates in the long-term.

The STS is not one-size-fits-all: *Parking Management*

Parking can be managed in a way to encourage alternatives to driving alone. In this way, it can serve to both reduce emissions by promoting “carbon-lite” travel modes and help alleviate automobile congestion. Such strategies include:

- Pricing (e.g., parking meters and fees)
- Time limits for on-street parking
- Limits on parking supply
- Surface parking lots in downtowns
- Special permit zones in residential areas
- Unbundling parking costs from apartment/housing rents
- Shared parking

Parking management examples in Oregon include:



Small Community

*In **Hood River**, the city imposes fees and enforces time limits for on-street parking in the downtown. The policy promotes turnover, so customers can patronize local shops, while directing longer-term parking to off-street facilities. Hood River also imposes fees for long-term employee parking.*



Large Community

*In **Portland**, the city charges \$1.60 per hour for on-street parking in the downtown and \$1.00 an hour in nearby Lloyd District to encourage the use of transit and other modes. To avoid degrading the pedestrian environment with surface parking, Portland prohibits the development of new surface lots in the central city. Smart Park garage (photo), which charge for parking, supplement the city’s on-street parking supply. Portland has no minimum parking requirements and imposes maximum parking ratios for new development.*

Medium Community

*In **Springfield**, downtown parking is free for shoppers and visitors but employees must pay for parking in designated areas. The photo is an example of the on-street “brand.”*



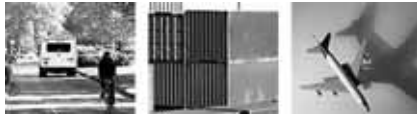
*In **Beaverton**, the city reviewed its zoning code and concluded that it required more parking than was actually needed. The code has since been revised to better match parking supply with parking need.*

Photos courtesy of Rick Williams Consulting

Strategy 6 – Road System Growth

Design road expansions to be consistent with the objectives for reducing future GHG emissions by light duty vehicles.

Each of the following elements will require further analysis of costs, benefits, and other impacts associated with the element's ability to achieve the strategy.



Ground

Freight

Air



6.1

Investigating options to divert traffic to less busy times or other facilities, or divert travelers to other modes before adding capacity.



6.2

Utilizing approaches for transportation plans, such as GHG emissions budgets, which would encourage offsetting emissions resulting from road growth with other emission reductions in the system.



6.3

Evaluating induced demand of potential road expansion projects that will lead to additional vehicle trips and sprawl.



6.4

Giving priority to development that accommodates population growth in a way that avoids road expansion.



6.5

Integrating multimodal solutions in road expansion projects to manage transportation demand.

What it will take....

Ground Passenger and Commercial Services Travel Market

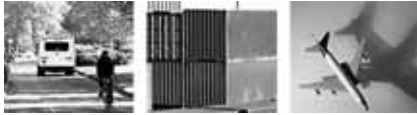
Expand road capacity strategically to match population growth and alleviate severe congestion.

Transportation Options

Strategy 7 – Transportation Demand Management

Support and implement technologies and programs that manage demand and make it easier for people to choose transportation options.

Each of the following elements will require further analysis of costs, benefits, and other impacts associated with the element's ability to achieve the strategy.



Ground

Freight

Air



7.1 Deploying video conferencing, virtual meeting technologies, and other communication technologies to decrease business travel demand.



7.2 Encouraging and recruiting early adopters, especially among government agencies and information technology or communications firms, to implement communication technologies.



7.3 Developing and implementing a state transportation demand management (TDM) program including such elements as rideshare programs, guaranteed rides home, flexible work schedules, smart phone applications, etc.



7.4 Working with employers on commute options such as: rideshare programs, alternative work schedules and telecommuting; bicycle and walking incentives; commuter incentives (e.g., transit passes), etc.



7.5 Developing TDM marketing programs and services targeting individual households.



7.6 Promoting, encouraging, and incentivizing carpool/vanpool (rideshare) program participation, such as through TDM programs.



7.7 Providing park-and-ride facilities at transit stations, bus stops, highway on-ramps, or other locations.



7.8 Promoting the use of ride matching services.



7.9 Promoting parking cash-out programs (employer offers employees a choice between paid for parking space or a cash allowance).



7.10 Supporting Guaranteed Ride Home programs that provide commuters, who use modes such as carpool/vanpool, bicycle, walk, or public transportation, with a subsidized ride home from work when an unexpected emergency arises.

What it will take....**Ground Passenger and Commercial Services Travel Market**

Steadily, more employees and households participate in TDM programs, so that:

- In the long-term, up to 50 percent of employees and 80 percent of households in urban areas participate in TDM programs.

Ground Passenger and Commercial Services and Air Passenger Travel Markets

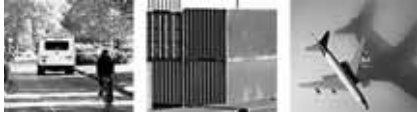
Widespread availability and acceptability of telecommunications as an alternative to in-person meetings, such that:

- By the mid-term, approximately 65 percent of business travel is replaced by virtual meeting technology.

Strategy 8 – Intercity Passenger Growth and Improvements

Promote investment in intercity passenger public transportation infrastructure and operations to provide more transportation options that are performance and cost competitive.

Each of the following elements will require further analysis of costs, benefits, and other impacts associated with the element's ability to achieve the strategy.



Ground

Freight

Air



8.1 Completing incremental improvements to the Amtrak Cascades Corridor.

- Implementing operational and geometric improvements to reduce delays and improve operating reliability. Improving passenger amenities and services with upgrades to station areas, station access, and rail cars.
- Partnering with Amtrak, the Federal Railroad Administration, the State of Washington, the Province of British Columbia, and freight rail operators on improvements that optimize existing system operations.



8.2 Upgrading corridor to high-speed rail operations (110 miles per hour [mph] maximum speeds).

- Partnering with Amtrak, the Federal Railroad Administration, the State of Washington, and the Province of British Columbia to complete final engineering and environmental documentation, securing funding partnership arrangements for construction and annual operation and maintenance costs, system deployment, and operations planning.
- Constructing new alignments, parallel tracks, and stations.

Upgrading locomotives, rail cars, and signal/propulsion systems to accommodate high-speed rail service.



8.3 Promoting increased public transportation service between metropolitan planning organization (MPO) areas and between population and job centers.



8.4 Focusing public transportation investments in high-volume corridors with potential for modal diversion.



Ground

Freight

Air



8.5 Promoting the growth of intercity and express intercity bus service to provide a well connected transportation system and support transportation options.

What it will take....

Ground Passenger and Commercial Services, Air Passenger Travel Markets

High-speed rail services (between Eugene and Vancouver, B.C.), with top speeds of 110 mph, offer a transportation alternative to the movement of people on the ground and in air, where around 10 percent of people choose to travel by train rather than by air in the short term, and 30 percent in the long-term.

Increased intercity public transportation services, such as:

- Increased bus or rail service along major existing corridors.
- Establish service where needed to connect communities with major population and job centers.

Strategy 9 – Intracity Transit Growth and Improvements

Investing in public transportation infrastructure and operations to provide more transportation options and help reduce single-occupant vehicle travel.

Each of the following elements will require further analysis of costs, benefits, and other impacts associated with the element's ability to achieve the strategy.



Ground Freight Air

☒	☐	☐	9.1	Coupling transit service with parking pricing to both incentivize mode shift and pay for expanded transit service coverage.
☒	☐	☐	9.2	Improving and increasing availability of route and schedule information for potential transit users prior to travelers making a mode choice. Continue and enhance development and deployment of smart phone applications and other technologies that provide users with convenient and timely transit information.
☒	☐	☐	9.3	Providing transit payment options (e.g., electronic fare [e-fare] cards) to increase convenience and flexibility of using transit.
☒	☐	☐	9.4	Seeking state funding sources for public transportation, and alternative local funding mechanisms such as a transit operations fee, that can be added to individual utility bills, or property taxes.
☒	☐	☐	9.5	Developing strategies for extending transit service into areas with demand.
☒	☐	☐	9.6	Promoting pickup, delivery, and routing efficiency software to optimize trips.
☒	☐	☐	9.7	Increasing transit service within MPO areas and other cities with sufficient demand and interest.
☒	☐	☐	9.8	Utilizing existing infrastructure where possible (e.g., bus-rapid transit for high-capacity transit passenger service).

What it will take....

Ground Passenger and Commercial Services Travel Market

Improved urban area public transportation service such as:

- Increased service levels in the Portland metropolitan area similar to that of the current San Francisco/Oakland urbanized area.
- Expanded public transportation service in other metropolitan areas to levels that are as high as present levels in comparably sized urban areas in the U.S.

The STS is not one-size-fits-all: *Transit*

Transit connects communities, providing transportation options for commuters, shoppers, and travelers. Transit vehicles vary including rail, bus, and streetcar with services ranging from express, to local, to regional. Successful transit systems provide reliable service to meet demand and customer needs – varying with respect to frequency of service and time of day.

Transit examples in Oregon include:



Small Community

Baker City is a small community that has developed transit services to meet community needs. This system is managed by a private non-profit, Community Connection of Northeast Oregon (CCNO). Baker, Union, and Wallowa county CCNO offices coordinated planning and capital development with each other and the counties where they are located. In Baker City, there is a downtown trolley circulator, a commuter connector to La Grande in the morning and evening meeting the Greyhound schedule, a weekly shopper service to Halfway, and a day care/Head Start shuttle for low-income parents. With a small community, new services are built on the needs CCNO clients tell them about every day. CCNO also provides low-income housing, senior nutrition, low-income heating assistance, and the food bank.



Medium Community

Basin Transit Service provides public transit services in **Klamath Falls** and the surrounding communities located in south-central Oregon. The service provides over 400,000 rides a year on five fixed routes, operating six days a week. They also provide Paratransit and Dial-A-Ride services on three buses.

Basin Transit started in the late 1970s and early 1980s when the Oregon Institute of Technology approached the city and the Oregon Department of Transportation to ask them to consider creating a transit service. The resulting test runs proved so popular that the creation of a transit district was put to a vote, which passed with a comfortable 62 percent.

Today Basin Transit employs 32 people, has a publicly elected board of directors, and is funded through a combination of local property taxes, state and federal grants, and fare box revenues.

Strategy 10 – Bicycle and Pedestrian Network Growth

Encourage local trips, totaling twenty miles or less round-trip, to shift from single-occupant vehicle (SOV) to bicycling, walking, or other zero emission modes.

Each of the following elements will require further analysis of costs, benefits, and other impacts associated with the element's ability to achieve the strategy.



Ground Freight Air

- | | | | |
|-------------------------------------|--------------------------|--------------------------|--|
| ☒ | ☐ | ☐ | 10.1 Building infrastructure and urban design elements that facilitate and support bicycling or walking. |
| ☒ | ☐ | ☐ | 10.2 Investing in bicycling and walking signs, lighted paths, striping, and other features designed to promote a sense of safety. |
| ☒ | ☐ | ☐ | 10.3 Promoting bicycle sharing and bicycle parking programs. |
| ☒ | ☐ | ☐ | 10.4 Promoting zero emission technological innovations (e.g., electric bikes and neighborhood electric vehicles). |
| ☒ | ☐ | ☐ | 10.5 Developing funding sources and alternative local funding mechanisms for bicycle and pedestrian infrastructure. |

What it will take....

Ground Passenger and Commercial Services Travel Market

Steadily, many more short-distance³⁸ SOV trips shift to bicycling, walking, or other zero emission modes (e.g., personal electric vehicle – such as Segway), so that:

- In the long-term, there is a substantial shift (about 40 percent) of short-distance SOV miles to these other modes.

³⁸ Short-distance SOV trips that have a total round-trip distance less than or equal to 20 miles.

Strategy 11 - Carsharing

Enhance the availability of carsharing (short-term self service vehicle rental and/or peer-to-peer) programs to reduce the need for households to own multiple vehicles and to reduce household vehicle miles traveled.

Each of the following elements will require further analysis of costs, benefits, and other impacts associated with the element's ability to achieve the strategy.



Ground

Freight

Air



11.1 Incentivizing carsharing programs.



11.2 Exploring formal and informal mechanisms for carsharing that will enable greater reliance on carsharing.

What it will take....

Ground Passenger and Commercial Services Travel Market

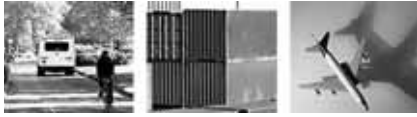
A greater number of urban households participate in carsharing programs, so that:

- Slowly, carsharing becomes more popular, with 2-4 percent participating in the mid-term and 2-12 percent in the long-term.

Strategy 12 – More Efficient Freight Modes

For the commodities and goods where low carbon modes are a viable option, encourage a greater proportion of goods to be shipped by rail, water, and pipeline modes.

Each of the following elements will require further analysis of costs, benefits, and other impacts associated with the element's ability to achieve the strategy.



Ground	Freight	Air	
☐	☒	☐	12.1 Relieving bottlenecks and modernizing infrastructure to support more energy efficient modes like rail, waterway/ marine, and pipelines.
☐	☒	☐	12.2 Supporting infrastructure investments to link Oregon ports to regional road and rail networks to support low carbon intermodal shipping options. Supporting infrastructure to facilitate short sea shipping. Supporting Federal efforts to remove barriers to the shipment of domestic containers by vessels, and the development of the Federal Marine Highways.
☐	☒	☐	12.3 Optimizing packaging and minimizing extraneous shipping materials.
☐	☒	☐	12.4 Developing public outreach and informational materials about the carbon efficiencies of different freight modes to assist shippers and consumers in balancing transit time, cost, and other considerations against carbon emissions.
☐	☒	☐	12.5 Supporting railroad grade separation projects in key corridors to allow for longer trains and reduced disruption to other travel modes.
☐	☒	☐	12.6 Supporting efforts for the preservation of rail lines and rail right-of-way for potential future capacity needs.

What it will take....

Freight Travel Market

In the long-term, around half of Oregon-bound domestic freight ton-miles are moved by truck, and the majority of the remainder moved by rail (around 40 percent), followed by pipeline, then air, then barge.

Efficient Land Use

Strategy 13 – Compact, Mixed-Use Development

Promote compact, mixed-use development to reduce travel distances, facilitate use of zero or low energy modes (e.g., bicycling and walking) and transit, and enhance transportation options.

Each of the following elements will require further analysis of costs, benefits, and other impacts associated with the element's ability to achieve the strategy.



Ground

Freight

Air



13.1 Developing complete communities, which contain jobs, housing, amenities and travel options, all of which are accessible by bicycle, by walking, or by transit within 20 minutes.



13.2 Supporting mixed-use development in urban planning, including metropolitan area scenario planning and other local and regional planning efforts.



13.3 Pairing mixed-use development with expansion of transit, walking, and bicycle networks to facilitate availability of transportation options. Providing “point-of-purchase” information to travelers that enables more low emission and energy efficient mode and time of travel choices.



13.4 Adjusting zoning codes to remove barriers to mixed-use development.

What it will take....

Ground Passenger and Commercial Services Travel Market

Greater shares of urban households live in compact, mixed-use neighborhoods.

- Steadily more people move to these areas and by the long-term many urban households (30 percent total) live in mixed-use areas as compared to today.

The STS is not one-size-fits-all: *Compact, Mixed-Use Development*

In a compact, mixed-use development, housing, stores, services, schools, employment centers, and institutions are located close together so that it's practical to walk or bike – or drive just a short distance – from one place to another. “Compactness” contrasts with “sprawl,” a type of development that usually requires people to drive everywhere because buildings are far apart, often randomly scattered, separated by large parking lots, and oriented to automobile travel.

Mixed-use development is a building, or group of buildings in the same neighborhood, used for more than one purpose – e.g., housing, stores, and offices. Such development differs from segregated land uses – that is, separated places for housing, stores, offices, and industry. By incorporating multiple uses into a single building or neighborhood, the distances people must travel are shortened. Compact, mixed-use development examples in Oregon include:



Small Community

*Mill Pond Village, a compact housing development in **Astoria**, sits on a former brownfield, a once contaminated site cleaned up by the city and redeveloped. The village is located just four blocks away from a grocery store and less than a mile from the heart of downtown. Residents enjoy a pocket park, as well as a trolley line, or walk along a path that takes them into the center of town.*

It is zoned for mixed-use family day-care centers, single- and multi-family homes, professional service establishments, and ground floor retail with residential lofts. Design standards were applied to the development to enhance the attractiveness of the homes and provide views of the Columbia River. To allow for more compact, high-density development, standards did away with minimum lot size requirements. Narrow streets and alleys contribute to the village's pedestrian friendliness.



Medium Community

*Northwest Crossing, a compact, mixed-use development project in **Bend**, is comprised of housing on small lots with access to nearby green spaces. A coffee shop and restaurant give residents a place to dine and socialize. Children can walk or bike to an elementary school embedded in Northwest Crossing.*



Large Community

*This is a photo of compact development in downtown **Salem**. It's easy to walk from one place to another in a traditional downtown, such as this one, where buildings are within easy walking distance and blocks are shorter. Sidewalks provide pedestrians a safe place to walk.*

Strategy 14 – Urban Growth Boundaries

Create full-service healthy urban areas to accommodate most expected population growth within existing Urban Growth Boundaries (UGB) through infill and redevelopment.

Each of the following elements will require further analysis of costs, benefits, and other impacts associated with the element's ability to achieve the strategy.



Ground



Freight



Air



- 14.1** Expanding urban growth boundaries by no more than 15 percent the rate of population growth. Allow for greater flexibility to accommodate industrial land (and associated transportation infrastructure) needs that support economic development opportunities and compact growth while also considering equity concerns.

Strategy 15 – More Efficient Industrial Land Uses

Encourage and incentivize more efficient use of industrial land through closer proximity of shippers and receivers, consolidated distribution centers, and better access to low carbon freight modes.

Each of the following elements will require further analysis of costs, benefits, and other impacts associated with the element's ability to achieve the strategy.



Ground

Freight

Air

☐
☒
☐

15.1 Incentivizing industrial development in efficient locations (e.g., along rail/water lines, near other major industrial sites) and eco-industrial parks (industrial parks where producers and consumers are co-located to share resources and reduce the need to ship shared resources).

☐
☒
☐

15.2 Planning for urban consolidation centers, which reduce GHG emissions, by providing for a single distribution point for common goods within a metropolitan area.

☐
☒
☐

15.3 Planning for efficient freight traffic movement in key transportation corridors that serve urban consolidation centers or other major industrial uses (e.g., bottleneck removal, consider tolling non freight modes, minimize cross traffic impacts, etc.).

What it will take....

Freight Travel Market

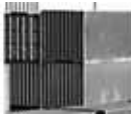
- In the mid-term, urban consolidation centers are active in the Portland area.
- In the mid- and long-term, the majority of industrial growth occurs in energy efficient freight transportation corridors.

Pricing, Funding and Markets³⁹

Strategy 16 – Funding Sources

Move to a more sustainable funding source that covers the revenue needed to maintain and operate the transportation system and accounts for the true cost of travel.

Each of the following elements will require further analysis of costs, benefits, and other impacts associated with the element’s ability to achieve the strategy.



Ground

Freight

Air



16.1 Structuring user fees to be economically efficient by addressing the true cost⁴⁰ of travel, including fees commensurate with carbon intensity. Correct pricing will provide a market based mechanism for encouraging more efficient decisions such as the fuel efficiency of vehicles purchased, the modes of travel used for various trips, and how vehicles are driven.



16.2 Implementing congestion fees in major urban areas to better balance travel demand and road capacity.



16.3 Developing a system for fairly raising and equitably reinvesting true cost revenues.

- Consideration should be given to how the revenue generated is used/spent (e.g., on other modes) and the effects on different populations in Oregon.



16.4 Moving from a gas tax to a user fee (a blended vehicle miles traveled and emissions fee) that charges users for the true cost of travel.



16.5 Partnering with other states to develop national or regional mechanisms for incorporating the costs of external factors (environmental and other) into transportation user fees.



16.6 Moving to “utility” like funding approach where charges are levied based on (1) access to transportation infrastructure, (2) roadway usage, and airshed and GHG emissions shares; and (3) are varied for peak period use or in congested corridors/areas.

³⁹ Analysis of potential economic impacts will be important when considering pricing and all of the elements.

⁴⁰ True cost pricing considerations include: transportation system costs (constructing, maintaining, and operating the transportation system) and social costs (costs of air pollution and greenhouse gas emissions).


Ground
Freight
Air


16.7 Informing the public about the benefits and trade-offs of transportation choices and funding mechanisms.



16.8 Implementing true cost pricing through the existing weight-mile fee for trucks. Include variable fees that consider the vehicle efficiency of the truck. Aggressively pursue multistate or federal legislation on true cost pricing to ensure that Oregon is not at a competitive disadvantage.



16.9 Implementing true cost pricing on fuel sales to non-exempt non-road users such as rail, marine, and air freight carriers.



16.10 Developing carbon fee rates, collection mechanisms, and manage revenues through national or regional coalitions and partnerships.



16.11 Considering an initial short-term deployment for the carbon fee, with cost per ton of carbon increasing over the long-term.

What it will take....

The cost per metric ton of carbon for the three travel markets is based on:

- \$30 per metric ton in 2020
- \$50 per metric ton in 2035
- \$70 per metric ton in 2050

Ground Passenger and Commercial Services Travel Market

Restructuring the funding source to pay for primary and secondary impacts such as:

- In the short-term, users pay the full costs of construction, operation, and maintenance and a small part of social costs.
- A greater share of social costs is paid in the mid-term and completely in the long-term.

Freight Travel Market

Gradually introduce true cost pricing for all freight modes:

- In the short-term, include a portion of social costs in the price of freight movement.
- In the long-term, include full social costs in the price of freight movement.

Air Passenger Travel Market

Roundtrip aviation fuel surcharge:

- In the short-term, include a portion of the social costs in passenger fees.
- A greater share of social costs are paid in the mid- and long-term.

Strategy 17 - Pay-As-You-Drive Insurance

Promote Pay-As-You-Drive Insurance (PAYD) programs that allow drivers to pay per-mile premiums, encouraging less driving through insurance savings.

Each of the following elements will require further analysis of costs, benefits, and other impacts associated with the element's ability to achieve the strategy.



Ground



Freight



Air



17.1 Working with insurance companies to offer and encourage use of PAYD insurance.

- Revising and extending the existing tax credit for corporations that provide a PAYD insurance option. As technology advances, mandating that insurance companies offer per-mile or per-minute premiums.

What it will take....

Ground Passenger and Commercial Services Travel Market

In the long-term, a majority of people in Oregon use PAYD insurance.

Strategy 18 - Encourage a Continued Diversification of Oregon's Economy⁴¹

Maintain economic prosperity through an increase in the value per ton (the "value-density") of goods produced in the state, which is projected to reduce shipping costs and GHG emissions for any given level of economic output.

Each of the following elements will require further analysis of costs, benefits, and other impacts associated with the element's ability to achieve the strategy.



Ground	Freight	Air	
☐	☒	☐	18.1 Developing a diverse economy with more growth in value-added industries such as electronics, manufacturing, and specialty food products.
☐	☒	☐	18.2 Investing in Oregon's higher education system (including job training programs) to support new value-added industries.
☐	☒	☐	18.3 Encouraging the co-location of new value-added industries with existing resource extraction and agricultural areas, through simplified permitting or tax incentives.
☐	☒	☐	18.4 Encouraging the development of value-added industries with incentives.
☐	☒	☐	18.5 Continuing waste prevention programs to minimize the amount of commodities, garbage, and recyclables transported.

⁴¹ The focus of this strategy is on diversifying Oregon's economy through growth in value-added industries, which is consistent with the Oregon Business Plan (<http://www.oregonbusinessplan.org/>). A greater proportion of goods finished and consumed locally would reduce emissions by cutting the distance of goods shipped. Raw goods, in natural resource sectors, are important and industry growth is still expected to occur under the STS Vision.

Challenges and Opportunities

There are factors that will help and hinder the realization of any one strategy presented above or of the STS as a whole. Some of the challenges and opportunities are recognizable from today's vantage point, and others will arise along the way. Some of these opportunities can build on work that has already been done as well as ongoing efforts. The cost, level of effort, and type of actions needed, will vary by strategy and element. Some of the potential challenges and opportunities that are apparent in the more immediate timeframe are summarized below. Some additional challenges specific to strategies are discussed in more detail in Technical Appendix 5.

There is some concern that implementing strategies that can help achieve the requirement, to substantially reduce transportation related GHG emissions, may adversely affect Oregon's economy. It will be important to conduct economic analysis for appropriate strategies to consider potential impacts. Pursuing this will be especially important for those that include pricing and funding.

Financing/Funding Sources

Challenges: There is a need for new and/or more flexible revenue streams in order to build, operate, and maintain the transportation infrastructure that is consistent with the 2050 Vision.

Opportunities: There is starting to be greater flexibility at the federal level and within the state for the use of transportation funds on multimodal projects. A successful move to a more flexible funding system will provide local governments the ability to make the best overall decisions for their transportation system.

The Oregon Legislature created a Road User Fee Task Force investigating options the state might have for creating a sustainable way to generate funds to support the transportation system.

Adoption Rate of Technology

Challenges: The development and adoption of new technology – for cleaner fuels, more efficient vehicles, intelligent transportation systems, etc. – may require research and development costs, incentives to encourage their use, and significant investment to build and operate appropriate infrastructure. Some actions may have slow implementation and start-up periods.

Opportunities: Businesses, particularly those in the freight and air industries, are always looking at ways to cut costs both to stay competitive and to help their profit margin. The private sector will push development of and employ cost effective advanced technologies. Oregon and neighboring states are currently working on ways to support adoption of technology by providing supporting infrastructure, such as electric vehicle charging stations.

At the federal level, the Fuel Efficiency Standards work, developed by the U.S. Department of Transportation and the U.S. Environmental Protection Agency working with the major U.S. automobile makers, comes with targeted incentives to encourage early adoption and early introduction into the marketplace of advanced technologies to dramatically improve vehicle performance. Many of the major automobile manufacturers are already developing advanced technologies that can significantly reduce fuel use and GHG emissions. Oregon may be able to take advantage of the incentives to promote the STS Vision.

Additionally, Oregon has many entrepreneurs that are riding the crest of alternative powered vehicle technology development. Working to provide incentives and partnerships can further establish the growth of the green transportation industry in Oregon.

Land Use

Challenges:

Oregon faces the challenge of accommodating increases in population and supporting economic growth. New development that supports land uses to accommodate more infill and redevelopment, discourages sprawl, and preserves industrial lands in areas with access to transportation options will be important. Some of these actions may require consideration of policy and code changes to allow jurisdictions flexibility in changing land uses and providing appropriate infrastructure.

Opportunities:

Oregon has done much to promote good land use choices, especially in urban areas, which already support transportation efficient options like higher densities, public transportation options, mixed-use neighborhoods, and fuel efficient designs. In implementing strategies, there may be a need to re-examine some land use regulations to provide flexibility, particularly in finding the proper house-jobs balance.

Oregon has been emphasizing the need to provide suitable industrial sites to attract business to the state. Special emphasis was added during the 2011 Legislative Session when a bill (Senate Bill 766) was passed that identified an Economic Recovery Review Council made up of the Department Directors of Business Development, Environmental Quality, Land Conservation and Development, State Lands, and Transportation.

The purpose of this Council is to help expedite the review and approval of industrial development projects of state significance and regionally significant industrial areas. This Council will be in place until the annual average unemployment rate for the most recent calendar year in Oregon is less than six percent. Efforts like this help focus on high priority issues that support the business climate in Oregon and plan for industrial sites.

Public Acceptance and Participation

Challenges: Some of the strategies may be controversial, especially in the short-term, making it challenging to find public support and acceptance. For example, users may find it difficult to accept the concept of paying for the “true cost” of transportation through user fees or have privacy concerns associated with mechanisms used to track miles driven.

Opportunities: The importance of communication was recognized by the Legislature in the passage of the law that required the development of the STS as it also calls for educating the public about the need to reduce GHG emissions from transportation and the costs and benefits of doing so. There will be a need to keep a dialogue running on issues raised in the STS. The initial communication effort will have to be supported by ongoing opportunities and the use of tools to spur discussions with individuals about GHG emissions reduction, and what can be considered at the local and personal level.

Support of Decision Makers

Challenges: Some of the strategies in the STS may be controversial and politically challenging to implement. Others will require future action to establish incentives, set standards, establish policies, and encourage participation. To do so may require legislative action. Federal legislative action may be essential to implement certain strategies, particularly those for the freight and aviation sectors.

Opportunities: There has been a lot of groundwork to support the fuels and technology improvements at the national and state level. The Governor’s office and the members of the Oregon Legislature have already taken steps to move innovative efforts forward to consider such things as sustainable funding, energy security, and promotion of green technology.

The work outlined in the STS will need support at all levels, including the local level, business entrepreneurs, researchers, and those individuals and champions that have a passion to move this forward. There are several strategies in the STS which have relatively high-levels of political support and successful implementation of such strategies may help pave the way for tackling more challenging actions or those that require future legislative support.

Multi-Jurisdiction, Private Sector Coordination and Collaboration

Challenges:

The mix of public and private ownership and multiple jurisdictions responsible for the transportation system makes it a challenge to find shared goals. Transportation related GHG emissions reduction will require close collaboration between jurisdictions across the national, state, and local levels. It will be necessary to balance these relationships so that Oregon is not at an economic disadvantage, and to find synergies and collaborations that enable progress on strategies for the greater good.

Opportunities:

State, regional, and local organizations are already collaborating on difficult transportation issues. Sometimes, such as for the development of the STS, committees are developed to focus on a particular topic to make recommendations for actions. Other groups are in place that provide broader consideration of transportation issues. Some of these include:

- ODOT's Area Commissions on Transportation which are advisory bodies of local government officials, citizens, and business people that discuss all aspects of transportation.
- Advisory groups like those for Bicycle/Pedestrian, Freight, Public Transportation, Rail, and Transportation Safety, and local government transportation committees which consider critical transportation issues.
- Interagency teams and citizen's advisory groups on such subjects as sustainability, global warming, economic revitalization.
- ODOT and natural resource-related state and federal agencies that have a collaborative process in place for environmental permitting and performance.
- Regional and local governments throughout Oregon that have advisory groups for both technical and policy consideration of transportation issues.

The process of further defining the STS strategies and addressing these and other challenges and opportunities must be inclusive and engage stakeholders from diverse backgrounds to allow a variety of perspectives to be shared and considered. Members of the committees, agencies, and other participants in the state's efforts to plan for reductions in transportation related GHG emissions recognize that there are many unknowns and that there will be a need to monitor and adapt as the work moves forward. This work will require strong partnerships and close collaboration with local, regional, state, and federal partners, as well as with individuals and businesses. Key to achieving substantial GHG reductions is an agile and iterative process to respond to and take advantage of what is learned along the way.

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6 SUMMARY AND NEXT STEPS

Summary

The STS was developed in response to legislative direction that requires the Oregon Transportation Commission to approve a strategy to aid in achieving the 2050 goal of reducing GHG emissions to 75 percent below 1990 levels. While some strategies are more conducive to a particular jurisdiction or authority, the STS is only intended to illustrate effective approaches for GHG emissions reduction and to chart a general course of action to help meet state goals. The STS document assigns no responsibility or authority to any jurisdiction or entity. Local jurisdictions will have the flexibility to explore the approaches that work best for them.

The STS is an important milestone in establishing a long-term course to reduce transportation related GHG emissions. The STS was developed by the Oregon Department of Transportation (ODOT), in consultation with stakeholders representing a variety of interests in Oregon, national and local technical experts, and state agencies including the Department of Land Conservation and Development, Department of Energy, and Department of Environmental Quality. The STS includes transportation and land use strategies that modeling and analysis have shown to have measurable results in reducing GHG emissions. Those chosen for inclusion reflect the mix of options with the fewest apparent negative impacts and that advisory committees felt were worth further consideration. The strategies also support other societal goals such as promoting livable communities, economic vitality, and public health. The STS does not assign responsibility for implementation.

Approaches for Reducing GHG Emissions

Strategies for reducing GHG emissions in transportation systems, vehicle and fuel technologies, and urban land use patterns were explored through extensive research, analysis, and policy level discussions. Chapter 5: Strategies includes those strategies found to be most promising in reducing GHG emissions. As discussed in Chapter 2: The 2050 Vision, the strategies emphasize key approaches for moving Oregon forward to the 2050 Vision. Some essential pieces include:

- **Transportation Systems** - Oregon should provide a range of transportation options available to the public to allow for greater use of high capacity modes such as transit, or zero emission modes such as bicycling and walking. Providing increased and more viable low carbon transportation options for freight is also important. Provision of these options requires increased investments. In addition, Oregon should continue to utilize intelligent transportation systems (ITS) technologies, which optimize the flow of traffic and provide valuable information to travelers and movers of commodities. Furthermore, Oregon should look beyond the gas tax to new and more sustainable revenue sources that support needed infrastructure while promoting efficiencies of the transportation system.
- **Vehicle and Fuel Technologies** - Oregon must plan for, and find ways to bring about, the transition to cleaner and more efficient vehicles, and a supportive refueling

infrastructure. Enhancements in vehicle and fuel technologies are critical to reducing GHG emissions from ground passenger vehicles, freight vehicles, and passenger aircraft.

- **Urban Land Use Patterns** - Oregon needs to continue to manage how land is developed to limit sprawl, and should look for opportunities to provide transportation that links people to jobs, and amenities where they will facilitate more walkable, mixed-use communities. Additionally, development of transportation facilities that serve and optimize freight transport and distribution functions is important.

The development of the STS revealed a number of key points about GHG emissions reduction in the transportation sector:

- **No one strategy will meet state GHG emission reduction goals** - While some actions may produce greater GHG emissions reductions than others, approaching state GHG emission reduction goals will require significant efforts across all strategy focus areas, including advancements in vehicle and fuel technology, improvements in transportation options and system performance, more efficient land use practices, and a move toward more sustainable funding sources. Furthermore, since the transportation sector currently only represents approximately a third of overall statewide GHG emissions, meaningful statewide solutions must involve other sectors such as power generation.
- **Many of the strategies for reducing transportation related GHG emissions have extensive co-benefits** - Several of the strategies include broad actions Oregon is already pursuing for other reasons, such as safety, livability, and economic development. Examples include installing ramp meters on freeways, creating more compact, mixed-use neighborhoods, and building infrastructure for electric vehicles. These and other actions can help to reduce GHG emissions while providing other societal benefits. In addition, some of the strategies will likely be driven by these co-benefits (such as cost savings to freight shippers), and will not be solely reliant on state or local actions to come about.
- **Some strategies will need to take place sooner than others** - Many strategies listed in the STS are already underway and can be implemented in the short-term, while others will require significant collaboration between public and private entities over longer time periods.
- **Oregonians must all work together to make the STS Vision a reality** - State government alone cannot meet GHG emissions reduction goals, nor can the full responsibility fall on cities or MPOs. Perhaps the primary lesson of the STS process is that making the STS Vision a reality will require widespread collaboration and strong partnerships among local, regional, state, and federal partners, as well as private industry and individual Oregonians. Additional work will be needed to identify roles and responsibilities and the next steps for implementation.

Strategic Priorities

Decision makers will need to agree on which strategies to pursue, and when, based on economic considerations, resource implications, and political will. The Oregon Transportation Commission is the decision making body for those strategies falling under the authority of the ODOT, and their approval is required before strategies are further explored or action taken. An ODOT work plan for the STS will be developed that will describe what strategies should be further analyzed, including those appropriate for economic analysis, with a sense of the timing for undertaking the work. For those strategies under the authority of another decision making body, that group will need to determine what should be pursued and the timing of the effort.

Implementation of the STS will take place through supporting ongoing work, increased interagency coordination and cooperation, communication, and transportation and land use planning efforts and actions. The best courses of action for implementation will be determined through exploration of the elements in the STS, identification of other potential approaches, and assessment of opportunities that can be maximized. The pace and order of implementation will depend on funding levels, the work of partner agencies and jurisdictions, and legislative direction. In addition, opportunities may present themselves which move one action or another to the forefront.

In developing the implementation work plan and undertaking actions to realize the STS Vision, the following strategic priorities should be first considered by decision makers to assess what to pursue, how, and when. These priorities were identified, through feedback (a survey) during the public outreach process and subsequent Policy Committee discussions. In total, the STS contains 18 strategies and 133 elements. In recognition that there is neither sufficient staff nor financial resources to work on all aspects simultaneously, the strategic priorities will influence which strategies to work on first:

- **Funding** - Successful implementation of the STS relies on adequate funding to maintain and improve system performance, provide transportation options, and enhance operations. Projections show gas tax revenues falling short of the money needed to maintain and operate the current transportation system, let alone fund new infrastructure. The lack of sustainable and adequate funding is an issue across all states, and current local and national efforts can be built on to generate support for appropriate revenue mechanisms. In addition to a sustainable funding source, the STS points to charging users the true cost of travel including transportation systems costs and social costs. The costs, benefits, and impacts of true cost pricing will need to be assessed.
- **Efficient Vehicles and Clean Fuels** - State and national programs and incentives that encourage the use of more efficient vehicles and cleaner fuels are important mechanisms for lowering emissions and should be investigated and supported. Technological advancements that result in more efficient designs of vehicles and ability to use less carbon intensive fuels or alternative propellants, such as electricity, help to achieve the STS Vision. Infrastructure that supports such advancements, like electric vehicle charging stations, should be explored.

- **Low Carbon Transportation Options** - The least carbon intensive mode of transportation is not always desirable or practical. However, when it is feasible to take a trip by transit, walking, or biking, or to ship freight by barge or rail, it is important to have viable options available. Work can be done to identify potential barriers and opportunities to those modes.
- **Land Use** - The configuration of land uses to transportation systems can support reduced trips and fewer miles driven. Careful siting of industrial lands and provision of mixed-use areas can make for more efficient land uses and livable communities. Potential for sites can be assessed at the regional and local level and state policies investigated.

The strategic priorities help shape the work areas that will be tackled first in the development of the implementation plan. Some of the priorities will require further exploration while others can be implemented through ongoing efforts or by supplementing existing efforts. Generally, implementation planning work will fall in one of the following categories:

- **Explore** - Some elements in the STS may have potential economic impacts that need to be further studied or are ideas that need further research. An example is an economic analysis of true cost pricing.
- **Support** - There are efforts currently underway or that will soon be starting that have been initiated for reasons other than the STS, but complement the STS vision. Supporting these efforts will require coordination, communication of the importance of attributes that help achieve the STS, and provision of technical support where appropriate. An example is helping to enhance transportation options through the development of the Rail Plan.
- **Partner** - Implementing some of the elements will require working with the federal government, other state agencies, and private entities that have the authority to carry out a particular action. Examples include working with the federal government on incentives for cleaner fuels and working with employers on transportation demand management strategies like employee commute options.
- **Communicate** - There are some strategies that require individual action to be taken that can come about through increased awareness of an issue with targeted messaging. As an example, increasing the use of park and ride lots through communication and promotion.
- **Quick Start** - In contrast to the “explore” category, quick start items are those that are well understood and are ready to be considered in regional and local planning. An example is parking pricing.

Priorities may shift based on opportunities that arise and available resources.

The STS - A Path to Oregon's Future

Climate change is a global issue and cannot be addressed by Oregon alone – it will require work with federal, regional, local, and private sector partners. Additionally, transportation is only one contributor of GHG emissions, and solutions to substantially reduce emissions must address multiple sectors. Still, Oregon's Statewide Transportation Strategy is a critical element in moving Oregon forward on a path to a more sustainable future.

Many existing and ongoing efforts have helped to inform and complement the STS, including the Governor's Advisory Group on Global Warming (2004), the Governor's Climate Change Integration Group (2008), the Oregon Global Warming Commission's "Roadmap to 2020" (2010), and the Governor's 10-Year Energy Plan (2012). This document is a parallel effort, intended to be complementary to these other efforts, while recognizing that the STS was solely focused on transportation and included in-depth analysis and research to identify recommended approaches.

The STS is complemented by the least cost planning process (Mosaic), a method for comparing and choosing among alternatives for meeting transportation demand. It can be used to understand which alternatives may give the best value. This process can be used for many different purposes, of which GHG emissions reduction could be a consideration among other factors, such as safety and mobility.

Lastly, there are new programs within the most recent federal transportation funding bill, Moving Ahead for Progress in the 21st Century (MAP-21), which significantly consolidates the highway program structure and increases flexibility for fund usage. Federal transportation funding authorizations can impact, in a shorter time frame, the more flexible funding for alternatives that support actions that would be instrumental in moving forward the STS work. However, within the longer time frame of the STS, 40 years, many different things can change and influence future transportation funding reauthorizations so the longer term impact on activities like the STS is unknown. Each reauthorization provides an opportunity to work with Oregon's federal delegation to help shape future programs.

Planning Relationships

The STS is a visionary document that is neither regulatory nor directive but points to promising approaches for further consideration by policymakers. It provides a broad vision to meet the legislative directive to reduce transportation related GHG emissions below the 1990 level by 2050. The STS is different from long-range plans as it focuses on a singular legislatively established goal to meet a GHG emissions reduction target.

The STS may be considered in statewide, regional, and local transportation and land use planning efforts, and looked to by parties interested in effective approaches for reducing GHG emissions. The STS does not contain requirements or regulations. As a strategy it differs from the state's long-range transportation plan, the Oregon Transportation Plan (OTP), which looks out to a shorter timeframe, about 25 years, and contains broader transportation visions and goals. That said, the STS supports the OTP and its goal to provide a safe, efficient and sustainable transportation system that enhances Oregon's quality of life and economic vitality. Many of the strategies in the STS align with other broad policies and strategies in the OTP, particularly Goal 4: Sustainability. The OTP Goal 4 includes strategies on an environmentally responsible transportation system (including development and use of technologies that reduce GHG), and supports more diversified and cleaner energy supply and reinforcement of compact, mixed-use development. There are also policies identified in other modal and topic plans, such as the Oregon Freight Plan, that generally support STS strategies. There is a higher level of specificity and focus on GHG reduction strategies in the STS that will likely prompt an update or amendment of statewide transportation plans.

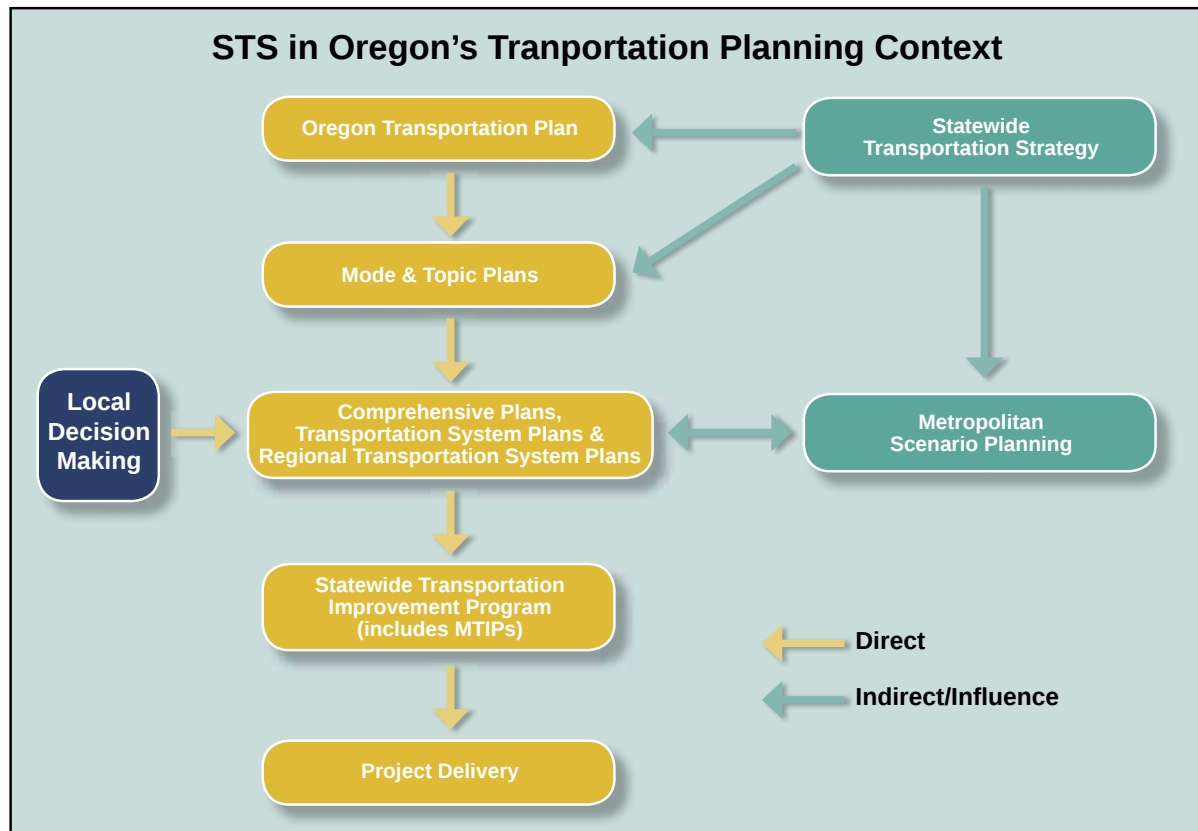


Figure 7: Statewide Transportation Strategy in Oregon's Transportation Planning Context

Within the regional and local planning context, and as stated above, the STS may be considered. For those areas choosing or required to undertake scenario planning for GHG emission reduction, the STS is an important document on what can be done to aid metropolitan areas in meeting their GHG emission reduction targets and collective approaches. Scenario planning is a critical process for identifying GHG reduction actions and exploring ways to help the state achieve its goals. It offers a way for metropolitan areas to engage in long term planning and visioning around not only GHG emissions reduction, but in achieving other community goals as well. Scenario planning is an activity that allows a community to look at potential futures and explore the possible outcomes of a variety of actions. It does not provide a specific answer, but rather allows consideration of multiple ways of reaching shared regional goals, and developing a framework for reaching those goals.

Integration into the planning processes is important to the successful implementation of the STS. It will influence and help shape future transportation planning efforts. The STS is envisioned as a dynamic document that will be monitored, adjusted, and implemented over time, and can be applied across many planning processes.

Like other ODOT long-range plans, the STS has implications to funding and programming. Some ongoing efforts, in line with the Oregon Transportation Plan (OTP), are underway at ODOT (i.e. modal plan updates) and the STS is another lens for those efforts, similar to the economy and livability. As the STS is not regulatory, funding is not bound by the strategies but efforts will be made to look within existing funding sources to identify potential funding and help prioritize strategies that support GHG reduction.

The success of the STS will be dependent on a broad range of actions at the federal, state, regional, and local levels, as well as cooperation between public and private entities both within and beyond Oregon's borders. While implementation may be challenging, the STS represents plausible approaches for helping the state meet its GHG emissions reduction goals while bringing about a future Oregon with a stronger economy, more transportation options, more affordable services, and healthier people.

Next Steps

Development of the STS is the first major step in a multi-year planning and implementation process to reduce transportation related GHG emissions from the movement of people and goods. The Oregon Transportation Commission's approval of the Statewide Transportation Strategy: A 2050 Vision for Greenhouse Gas Emissions Reduction, indicates that the Commission accepts the findings of the advisory committees that these strategies establish a general course of action that may help the state substantially reduce transportation related GHG emissions and is in line with meeting the legislative goal of a 75 percent reduction from 1990 levels by 2050.

Acceptance signals consent for staff to further examine the strategies and develop a proposed work plan for Commission discussion about next steps. The work plan will describe which strategies should be further analyzed, including those appropriate for economic analysis, with a sense of the timing for undertaking the work. For those strategies under the authority of another decision making body, that group will need to determine what should be pursued and the timing of the effort. During this collaborative process many of the strategies will be analyzed in greater detail and some will need to be further assessed to understand potential economic impacts and opportunities. Also through development of the implementation plan, the roles and responsibilities of the federal, state, regional, local, and private sectors will be identified. An element of the implementation plan will be consideration of the timing and breadth of any needed amendments to the Oregon Transportation Plan and other modal and topic plans to include appropriate goals, policies, and/or strategies about transportation related GHG emission reductions to meet the legislative direction.

Implementation will be paired with complementary efforts such as the Oregon Sustainable Transportation Initiative (OSTI) Public Outreach and Education Plan, which identifies opportunities and best practices for communications around the issues important for the implementation of the STS and scenario planning. Part of next steps will include providing the tools to facilitate discussion with individual and local areas about the benefits and costs of GHG emissions reduction and opportunities for them to consider what is important to them as a community, as well as personally.

Lastly, the STS will be monitored and adjusted over time, as needed. While there are challenges and unknowns ahead that will require continuous adaptation and development of additional creative solutions, the groundwork established in the STS provides a firm base from which to build. Strategies already underway will receive increased support and new, effective and aggressive strategies that require enhanced levels of collaboration between the private and public sectors and across all transportation markets will be implemented.

Below is a description of the full STS project timeline.

Timeline

As summarized below and illustrated in the following graphic (Figure 8), the STS will include three phases:

- Phase I:** This phase includes the development of the STS document, including establishing a vision, identifying the strategies for helping to reduce emissions, and conducting public outreach.
- Phase II:** The implementation phase will involve the development of a plan that defines specific implementation actions and clarifies institutional roles and responsibilities. This phase also includes a more detailed assessment and analysis of potential economic impacts and opportunities, identification of performance measures, policy changes, programs, timelines, and partnership opportunities.
- Phase III:** The monitoring and adjustment phase includes tracking of performance measures over time and the periodic assessment and modification of the STS and timelines as elements of the STS are implemented. The need to monitor and adapt the STS elements will be critical to ensuring its relevance in an uncertain and changing future.



Figure 8: The Statewide Transportation Strategy Timeline

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APPENDICES

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APPENDIX A: STATEWIDE TRANSPORTATION STRATEGY COMMITTEES

The Statewide Transportation Strategy (STS) was developed by a team of Oregon Department of Transportation (ODOT) staff and consultants working with two stakeholder committees – A Policy Committee and Technical Advisory Committee.⁴² Oregon stakeholders from these two committees provided direction and oversight throughout the STS development process, as was described in the Development of the Statewide Transportation Strategy chapter.

A special thank you to the following committee members for their contributions during the development of the STS. We also wish to thank the citizens of Oregon, including policy board members and their staff who provided valuable comments and assistance on the STS.

Policy Committee

The Policy Committee included stakeholders from Oregon cities, metropolitan planning organizations (MPOs), state commissions, academia, and industry, who offered policy related oversight at each step of the STS development process, including scenario specification, analysis results, and political and policy implications of evaluation indicator results.

Chair: Ken Williamson	Oregon Environmental Quality Commission
Gail Achterman	Oregon Transportation Commission
Jerri Bohard	Oregon Department of Transportation
Rex Burkholder	Portland Metro Council
Craig Campbell	AAA of Oregon/Idaho
Mark Capell	Bend City Council
Kelly Clifton	Portland State University
Angus Duncan	Oregon Global Warming Commission
Diana Enright	Oregon Department of Energy
Chris Hagerbaumer	Oregon Environmental Council
Marla Harrison	Port of Portland
Onno Husing	Oregon Coastal Zone Management Association
John Ledger	Associated Oregon Industries
John Oberst	City of Monmouth
Bob Russell	Oregon Trucking Associations
John VanLandingham	Land Conservation and Development Commission
John Vial	Jackson County

⁴² The organization indicates whom the committee member represented during the STS development process.

Technical Advisory Committee

The Technical Advisory Committee included technical experts from state, federal, metropolitan agencies, and others, who provided oversight and guidance on greenhouse gas (GHG) emissions reduction strategies and potential impacts; state and local conditions that might impact the plausibility or effectiveness of certain strategies; assistance in developing statewide scenarios; guidance and oversight of agency technical analysis procedures; and review of scenario analysis results.

<i>Chair:</i> Brian Dunn	Oregon Department of Transportation
Ali Bonakdar	Corvallis Area Metropolitan Planning Organization
Margi Bradway	Oregon Department of Transportation
Greg Byrne	City of Albany
Bob Cortright	Department of Land Conservation and Development
Bill Drumheller	Oregon Department of Energy
Scott Drumm	Port of Portland
Brett Estes	City of Astoria
Nick Fortey	Federal Highway Administration
Andy Ginsburg	Oregon Department of Environmental Quality
Brian Gregor	Oregon Department of Transportation
Vicki Guarino	Rogue Valley Metropolitan Planning Organization
Eric Hesse	TriMet
Mike Hoglund	Portland Metro
Mike Jaffe	Salem-Keizer Metropolitan Planning Organization
Tamra Mabbott	Umatilla County
Andrea Riner	Central Lane Metropolitan Planning Organization
Karen Schilling	Multnomah County
Cynthia Thompson	South Metro Area Regional Transit
Jerry Zelada	Bicycle and Pedestrian Advisory Committee

APPENDIX B:

ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
AEO	Annual Energy Outlook
APU	aircraft auxiliary power units
ATM	active traffic management
ATR	Agencies' Technical Report
ATS	air transportation system
BC	British Columbia
BLI	Bellingham International Airport
BRT	bus rapid transit
BTS	Bureau of Transportation Statistics
CCTV	closed circuit television
CNG	compressed natural gas
CO ₂	carbon dioxide
CO ₂ e	carbon dioxide equivalent
CPI	Consumer Price Index
DEQ	Department of Environmental Quality
DLCD	Department of Land Conservation and Development
DOT	Department of Transportation
DVMT	daily vehicle miles traveled
EIA	Energy Information Administration (U.S.)
EERPAT	Energy and Emissions Reduction Policy Analysis Tool
EPA	Environmental Protection Agency
ERA	Environmentally Responsible Aviation Project
ETS	European Trading Scheme
EUG	Eugene Airport
EV	electric vehicle
FAA	Federal Aviation Administration
FAF	freight analysis framework
FCV	fuel cell vehicle

FHWA	Federal Highway Administration
F-T	Fischer-Tropsch (fuels)
GAV	ground access vehicle
GBAS	Ground Based Augmentation System
GHG	greenhouse gas
GPS	global positioning system
GreenSTEP	Greenhouse Gas Strategic Transportation Energy Planning Model
GSE	ground support equipment
GVW	gross vehicle weight
HEV	hybrid electric vehicle
HRJ	hydro processed renewable jet fuel
HSR	high-speed rail
ICE	internal combustion engine
IT	information technology
ITS	intelligent transportation systems
kWh	kilowatt-hour
LAAS	Local Area Augmentation System
lbs	pounds
LEV	low emissions vehicle
LNG	liquefied natural gas
LTO	landing and takeoff
MIT	Massachusetts Institute of Technology
MPG	miles per gallon
MPH	miles per hour
MPO	metropolitan planning organization
MWh	megawatt hours
NASA	National Aeronautics and Space Administration
NEV	neighborhood electric vehicle
NOAA	National Oceanic and Atmospheric Administration
NO _x	Generic for mono-nitrogen oxide (nitric oxide [NO], nitrogen dioxide [NO ₂])
ODOE	Oregon Department of Energy
ODOT	Oregon Department of Transportation
OEA	Office of Economic Analysis (Oregon)

ORS	Oregon Revised Statute
OSTI	Oregon Sustainable Transportation Initiative
OTC	Oregon Transportation Commission
OTP	Oregon Transportation Plan
PAD	Petroleum Administration for Defense
PAYD	pay-as-you-drive insurance
PDX	Portland International Airport
PEV	personal electric vehicle
PHEV	plug-in hybrid electric vehicle
PM	particulate matter
PPP	public-private partnership
SAFN	Sustainable Aviation Fuels Northwest
SEA	Seattle-Tacoma International Airport
SOV	single-occupant vehicle
STARS	Sustainable Transportation Analysis and Rating System
STS	Statewide Transportation Strategy
SUV	sport utility vehicle
SWIM2	Oregon Statewide Integrated Model
TDM	transportation (or travel) demand management
TRB	Transportation Research Board
UEET	Ultra Efficient Engine Technology Program
UGB	urban growth boundary
ULEV	ultra low emission vehicle
VALE	Voluntary Airport Low-Emissions Program
VHF	very high frequency
VMT	vehicle miles traveled
VOC	volatile organic compounds
WRI	World Resource Institute
YVR	Vancouver International Airport

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APPENDIX C: GLOSSARY

511 travel information phone line

A phone number used by states and local jurisdictions to disseminate travel information. Users can access real-time information regarding road conditions, weather conditions, delays due to congestion and construction, advisories, etc., by dialing 511 on their phone. In Oregon, 511 phone line information is the same information provided on ODOT's *TripCheck* website.⁴³ See also *TripCheck*.

active traffic management (ATM)

Refers to tools and technologies that dynamically manage and control traffic based on real-time roadway conditions. Also referred to as smart highways.

Agencies' Technical Report (ATR)

A report required by Oregon HB 2001, Jobs and Transportation Act (chapter 865, Oregon Laws 2009), and developed by the Oregon Department of Transportation, Oregon Department of Environmental Quality, and Oregon Department of Energy, which establishes the technical basis for year 2035 light duty vehicle GHG emission reduction targets for metropolitan areas.

Air Passenger travel market

Refers to commercial air travel, including aircraft, ground access and ground support equipment.

air transportation system (ATS)

Refers to a system of operating and controlling movements of aircraft throughout all phases of flight (push-back, taxi, take-off, cruise, descent, landing). Next-Generation (NextGen) Air Transportation System.

airport ground access

Refers to any mode of travel used to access the airport, including ground transportation services (taxi, shuttles, etc.), transit service, off-airport shuttles, drop-offs by private vehicle, private vehicle parking at airport, and travel to and from the airport by employees.

airshed

Refers to an atmospheric region sharing a common air supply that faces common pollution threats.

alternative fuels

Fuels that serve as a cleaner alternative to gasoline, including but not limited to: biodiesel, liquefied or compressed natural gas, electricity, hydrogen, ethanol, and methanol.⁴⁴

⁴³ Oregon Department of Transportation *TripCheck*: <https://www.tripcheck.com>.

⁴⁴ U.S. Department of Energy: <https://www.afdc.energy.gov/fuels/index.html>.

Amtrak Cascades Corridor

Passenger rail service in the States of Washington and Oregon, connecting 18 cities in the Pacific Northwest region along a 466-mile rail corridor between Eugene, Oregon and Vancouver, British Columbia.⁴⁵

autonomous vehicle

A passenger vehicle that drives itself using artificial intelligence, sensors, and/or GPS. Also known as a “driverless car.”

bicycle sharing program

A membership based system of short term bicycle rental.

biofuel

Any alternative fuel whose energy is derived from carbon fixation, which results in lower carbon emissions per unit of fuel consumed. Examples include biodiesel (a fuel derived from animal fats and vegetable oils) and ethanol.

bottleneck

A specific section of a transportation network that experiences particularly heavy delays and reduced speeds. While random or “non-recurring” bottlenecks can occur as the result of a singular event such as a lane closure for maintenance, the term here is reserved for those locations where heavy delays occur on a recurring basis as result of a capacity or operational deficiency. The term “bottleneck” can apply to most modal systems (e.g., highways, rail networks, or air traffic approach tracks). On the highway system, bottlenecks often occur at the junction of two major routes, such as freeway-to-freeway interchange or the intersection of two major arterial roadways. Freight system bottlenecks often are caused by factors specific to freight modes, such as steep grades, insufficient weaving/merging distance at busy interchanges with high truck volumes, or operational delay at freight terminals.⁴⁶

bottleneck removal

A strategy generally referring to location specific capital construction or operational projects designed to eliminate a particular deficiency that causes significant recurring delay. Examples include construction of a truck climbing lane on steep highway grade, or metering on-ramp traffic to improve traffic merging at a busy freeway entrance.

brownfields

A property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or containment. Cleaning up and reinvesting in these properties increases local tax bases, facilitates job growth, utilizes existing infrastructure, takes development pressures off of undeveloped, open land, and both improves and protects the environment.⁴⁷

⁴⁵ Amtrak: <http://www.amtrakcascades.com>.

⁴⁶ Federal Highway Administration, “Localized Bottleneck Reduction Program.” <https://ops.fhwa.dot.gov/bn/lbr.htm#g3>

⁴⁷ Environmental Protection Agency: <https://www.epa.gov/>.

bus rapid transit (BRT)

An enhanced bus system that operates, at least in part, on dedicated bus lanes or other transit ways, combining the flexibility of buses with the efficiency of rail. Compared to conventional buses, BRT operates at faster average speeds, provides greater service reliability and increased customer convenience, and utilizes a combination of advanced technologies, infrastructure and operational investments than traditional bus service.⁴⁸

California's Low Emission Vehicle/Zero Emission Vehicle Program

California's state Low Emission Vehicle program, first adopted in 1990, is designed to promote and encourage improved emission reduction standards for automobiles. California's more recent Zero Emission Vehicle program is designed to encourage similar innovation and adoption of zero emission vehicle technology in the state.⁴⁹

carbon user fee

A conceptual fee that could be assessed on users of the transportation network. Rather than the gas tax (which is assessed per gallon of gas consumed) a carbon user fee would be assessed per unit of carbon emissions produced in the operation of the vehicle.

carsharing

A membership based system of short-term automobile rental.

collision avoidance systems

New technology that enables vehicles to sense potential crashes and automatically prevent them. In one system manufactured by Volvo, laser and radar are used to detect other vehicles directly in the path of the vehicle in question. If the collision avoidance system detects a vehicle ahead and the driver operating the vehicle does not brake as it approaches impact, the system applies the brake automatically to avoid a collision.⁵⁰

compressed natural gas (CNG)

A cleaner burning alternative to gasoline composed primarily from methane. CNG is already used in many public transportation vehicles across the country.⁵¹

congestion charge/pricing

A fee assessed upon driving under severely congested conditions, which would vary by time of day and/or traffic volumes.

eco-driving

A driving technique that reduces fuel consumption, reduces emissions, and improves automobile efficiency by accelerating and decelerating smoothly, avoiding excess idling, driving at or under the posted speed limit, and keeping tires properly inflated.

⁴⁸ Federal Transit Administration: <https://www.transit.dot.gov/>.

⁴⁹ California Environmental Protection Agency: <https://www.arb.ca.gov/msprog/levprog/levprog.htm>.

⁵⁰ Volvo: <http://wheels.blogs.nytimes.com/2009/04/09/testing-volvos-collision-avoidance-system/>.

⁵¹ U.S. Department of Energy: <https://www.afdc.energy.gov/>.

eco-industrial park

Industrial parks where producers and consumers are co-located to share resources and to reduce the need to ship.

elements

In the context of the STS, “elements” refers to potential actions that would help achieve a greenhouse gas emission reduction strategy. The strategy elements listed in Strategies chapter and Technical Appendix 5 represent some of the key actions that have been identified for further exploration, but are not a comprehensive list. Some elements may also be dropped from consideration after further study.

employer buy-back program

See “parking cash out program.”

Environmentally Responsible Aviation (ERA) Project

A project created by NASA to explore and document the feasibility, benefits and technical risk of vehicle technologies that reduce the impact of aviation on the environment.⁵²

equity

In the context of transportation, equity refers to an individual’s right to transportation options in the pursuit of satisfying essential needs such as accessing jobs, schools and other vital services.⁵³

Federal Bridge Formula

Enacted by Congress in 1975 to limit the weight-to-length ratio of a vehicles crossing a bridge.⁵⁴

feebate

A program under which the purchase of a more efficient vehicle entitles the consumer to receive a rebate, while the purchase of an inefficient vehicle is subject to an additional charge.

feedstocks

The raw or basic material used to make a product. In the context of alternative fuels, new and used vegetable oils and animal fats are feedstocks which can be processed into biodiesel.⁵⁵

Freight Analysis Framework (FAF3)

An integrated dataset maintained by the Federal Highway Administration (FHWA). The FAF3 provides a comprehensive picture of freight movement among states and major metropolitan areas by all modes of transportation, using data from FHWA’s 2007 Commodity Flow Survey and other sources.⁵⁶

⁵² National Aeronautics and Space Administration: <https://www.nasa.gov/aeroresearch>.

⁵³ Coalition for a Livable Future (Regional Equity Atlas): <http://www.equityatlas.org/>.

⁵⁴ Federal Highway Administration: https://ops.fhwa.dot.gov/freight/sw/brdgcalc/calc_page.htm.

⁵⁵ U.S. Department of Energy: <https://www.afdc.energy.gov/fuels/biodiesel.html>

⁵⁶ Federal Highway Administration: https://ops.fhwa.dot.gov/freight/freight_analysis/faf/.

Freight travel market

Refers to travel across all modes (road, air, rail and water) used in the shipment of goods. On roadways, the freight travel market includes travel by vehicles greater than 10,000 lbs gross vehicle weight, usually traveling longer distances to serve both regional and national markets.

greenhouse gas (GHG)

Emissions that trap heat in the atmosphere, contributing to global climate change. Some greenhouse gases occur naturally and some are emitted to the atmosphere through natural processes and human activities. Atmospheric gases such as carbon dioxide, methane, and nitrous oxide contribute to global climate change by absorbing infrared radiation produced by solar warming of the Earth's surface.⁵⁷

Greenhouse Gas Strategic Transportation Energy Planning Model (GreenSTEP)

A modeling tool developed by the Oregon Department of Transportation to estimate the future impacts of a variety of different strategies and other factors on travel and related greenhouse gas emissions.⁵⁸

Ground Access Vehicles (GAV)

Vehicles used to access airports by passengers, employees, suppliers, service providers, etc. Includes passenger vehicles, all forms of for-hire passenger transportation (taxi, van shuttle, etc.), trucks of all weight classes, public transit buses and trains, etc. Referred to in this strategy in emissions discussions also as surface traffic.

Ground Based Augmentation System (GBAS)

A ground based GPS system centered on airports (approximately 20-30 mile radius) that is used for aircraft precision approach, departure procedures, and terminal area operations. It broadcasts its corrections message via a radio data link from a ground based transmitter. Also referred to as Local Area Augmentation System (LAAS).⁵⁹

Ground Passenger and Commercial Services travel market

Refers to transportation for work, recreation, and personal business purposes, including travel by car, light truck (e.g., pick-up trucks, SUVs), van, motorcycle, public transportation (e.g., bus, light rail), and by delivery, service and repair vehicles.

ground support equipment (GSE)

Airside aviation support equipment, including baggage tugs, belt loaders, pushback tractors, and service and maintenance equipment.

⁵⁷ Environmental Protection Agency: <https://www.epa.gov/>.

⁵⁸ Oregon Department of Transportation: <https://www.oregon.gov/ODOT/Programs/Pages/OSTI.aspx>.

⁵⁹ Federal Aviation Administration: <https://www.faa.gov/>

Guaranteed Ride Home Program

Through a Guaranteed Ride Home program, commuters who use modes such as carpool/vanpool, bicycle, walk, or public transportation, receive a subsidized ride home from work when an unexpected emergency arises.

heavy vehicles

Vehicles exceeding 10,000 lbs gross vehicle weight (GVW). Generally involving the movement of goods.

high-occupancy vehicle (HOV)

A vehicle containing more than one person, as in a carpool or vanpool.

high-speed rail (HSR)

Passenger rail service that operates significantly faster than current conventional rail speeds, enabling it to compete with air travel in certain travel markets. High-speed rail is also typically characterized by more frequent service and dedicated right-of-way.⁶⁰

high value-density goods

Value-density refers to a good's value per ton. High value-density goods include manufactured goods such as electronics, which have a high value relative to their weight, and can therefore be shipped more efficiently per ton.

induced demand

Refers to the process whereby improvements in the transportation system intended to alleviate congestion and delay result in additional demand for the transportation segment, offsetting some of the improvement's potential benefits. For instance, when a congested roadway is expanded from 2 to 3 lanes, some drivers will recognize the increased capacity and take this roadway though they had not done so previously.

infill development

Refers to the development or redevelopment of vacant, bypassed or under utilized lands in an area that is largely developed.⁶¹ An alternative to development that occurs outside existing urban areas.

intelligent transportation systems (ITS)

Refers to advanced communications technologies that are integrated with transportation infrastructure and vehicles to address transportation problems and enhance the movement of people and goods. ITS can include both vehicle-to-vehicle communication (which allows cars to communicate with one another to avoid accidents) and vehicle-to-infrastructure communication (which allows cars to communicate with the roadway to identify congestion, accidents or unsafe driving conditions).⁶²

⁶⁰ Federal Railroad Administration: <https://www.fra.dot.gov/>

⁶¹ Oregon Department of Land Conservation and Development: <https://www.oregon.gov/LCD/docs/publications/commixedusecode.pdf>.

⁶² Oregon Department of Transportation: <https://www.oregon.gov/ODOT/>.

in-vehicle communication technologies

Refers to vehicle technology that provides real time information about roadway or driving conditions, allowing the driver to make more effective, efficient and safe travel choices.

light vehicles

Refers to vehicles under 10,000 lbs gross vehicle weight (GVW). Generally includes cars, sport utility vehicles, and pick-up trucks.

liquefied natural gas (LNG)

An alternative fuel consisting of natural gas (typically methane) that has been purified and condensed into liquid by intense cooling. LNG has a higher energy density than diesel fuel and may have promising future applications for replacing diesel fuel in heavy trucks and other vehicles.⁶³

Metropolitan Planning Organization (MPO)

A regional entity tasked with addressing multijurisdictional planning concerns. Oregon features six MPOs, representing Portland Metro, Salem-Keizer, Corvallis Area, Bend, Central Lane, and Rogue Valley. There are potential new MPOs in Oregon, Albany and Grants Pass.

mixed-use neighborhoods

Refers to portions of urban areas where commercial (e.g., retail, office, entertainment) and non-commercial uses (such as residential space), are located near one another. Different uses may be mixed vertically (e.g., housing above retail) or horizontally (e.g., housing within walking distance of retail). Mixed-use neighborhoods reduce demand for motorized transportation by locating common destinations near residences where pedestrian and bicycle access is convenient.⁶⁴

modal shift (modal diversion)

Refers to a traveler substituting one form of travel to another. For example, if a toll were imposed on single-occupant vehicles on a given roadway, some travelers might decide to travel instead via bus to avoid the charge. This would constitute a mode shift.

Modernization and Reform Act of 2012 (H.R. 658)

Authorizes budget resources for the Federal Aviation Administration (FAA) through fiscal year 2015, and encourages the acceleration of the Next-Generation (*NextGen*) Air Transportation System and air traffic control modernization.

⁶³ US Department of Energy: https://www.afdc.energy.gov/fuels/natural_gas_basics.html.

⁶⁴ Oregon Department of Land Conservation and Development: <https://www.oregon.gov/LCD/docs/publications/commmixedusecode.pdf>

neighborhood electric vehicle (NEV)

A four-wheeled vehicle with an attainable top speed of between 20 and 25 MPH. NEVs are smaller than most light-duty passenger vehicles and are usually configured to carry two to four passengers. In some states, NEVs can be driven on roads with posted speed limits of 35 MPH or less. Also referred to as low speed vehicles.⁶⁵

Next-Generation (NextGen) Air Transportation System

A Federal Aviation Administration initiative to upgrade the aviation system to satellite based technology, which will enhance the safety, reliability, and fuel efficiency of aircraft during all phases of flight (push-back, taxi, take-off, cruise, descent, landing).⁶⁶

Oregon Sustainable Transportation Initiative (OSTI)

An integrated statewide effort to reduce greenhouse gas emissions from transportation while creating healthier, more livable communities and greater economic opportunity. OSTI is the result of several bills passed by the Oregon Legislature designed to help Oregon meet its 2050 goal of reducing greenhouse gas emissions by 75 percent below 1990 levels.⁶⁷

Oregon Transportation Plan (OTP)

Oregon's long-range multimodal transportation plan.⁶⁸

parking cash-out program

Refers to programs intended to reduce vehicle trips and increase the use of alternative travel modes by offering employees monetary incentives for relinquishing their parking space. Also referred to as an employer buy-back program.

pay-as-you-drive insurance (PAYD)

A method of insuring vehicles in which premiums are based in large part on the vehicle miles traveled within a given period of time. PAYD is also sometimes referred to as distance-based, usage-based, or mileage-based insurance.

peak period

The busiest travel time of the day, also known as commute time or rush hour. There are usually two peak periods each weekday – during the morning and evening commutes.

peer-to-peer carsharing

A car sharing program where the vehicle fleet is composed of privately owned vehicles that are available to rent to others at rates set by the car owners.

⁶⁵ Idaho National Laboratory: <https://avt.inl.gov/>.

⁶⁶ Federal Aviation Administration: <https://www.faa.gov/nextgen/>.

⁶⁷ Oregon Department of Transportation: <https://www.oregon.gov/ODOT/Programs/Pages/OSTI.aspx>.

⁶⁸ Oregon Department of Transportation: <https://www.oregon.gov/ODOT/Planning/Pages/Plans.aspx>.

Phases I, II, III

Development and implementation of the STS is completed over three phases: Phase I: development of the STS document, Phase II: implementation, and Phase III: monitor and adjust. Refer to Chapter 6: Summary and Steps of the STS for more details.

price signal

A message sent to consumers in the form of a change in price intended to influence supply or demand.

public-private partnership (PPP)

A contractual agreement formed between a public agency and private sector entity.

ramp meter

A traffic signal used to regulate the flow of vehicles entering the freeway. Ramp meters smooth the merging process resulting in increased freeway speeds and reduced crashes. Ramp meters are automatically adjusted based on traffic conditions.

real-time traveler information

See TripCheck and 511 travel information phone line.

Strategy

In the context of the STS, each strategy that was found to be effective in reducing greenhouse gas emissions and helping to achieve other desirable outcomes. For a list of STS strategies, see Chapter 5: Strategies or Technical Appendix 5.

reference scenario (reference case)

A conceptual future in which current trends and conditions are assumed to continue into the future, e.g., “business as usual.” The reference case is used for analysis purposes to isolate the benefits of enacting future strategies from any potential benefits or costs associated with normal change over time.

rideshare program

Programs such as carpools and vanpools, in which multiple travelers ride together in the same vehicle.

scenario planning

A planning method that analyzes the impacts of trends, actions and policies to estimate their likely impact on future conditions. Scenario planning is often performed at the state or regional level to evaluate various future alternatives against a set of established community priorities.⁶⁹

⁶⁹ Federal Highway Administration: https://www.fhwa.dot.gov/planning/scenario_and_visualization/scenario_planning/

Senate Bill 1059

Oregon state legislation aimed at reducing greenhouse gas emissions from transportation. This bill also includes approval of a statewide transportation strategy on greenhouse gas emission reduction goals. (2010 Oregon Legislature).⁷⁰

single-occupant vehicle (SOV)

A vehicle containing only one occupant.

slow steaming

A method of maritime transportation in which sea transportation vessels slow their throttles to reduce fuel costs. This results in lower emissions but also longer transport times.

SmartWay Program

An EPA program that reduces transportation related emissions by creating incentives to improve supply chain fuel efficiency through transportation partnerships, financing, international interests, technology, and vehicles.⁷¹

social costs

In the context of the STS, social costs refer to the unintended consequences of transportation, such as carbon emissions that contribute to climate change, air pollution that causes health and environmental problems, energy security costs associated with importing fossil fuels from foreign nations, and other such impacts.

speed governor

A device used to regulate the speed of an engine. Also referred to as speed limiter or speed regulator.

Statewide Transportation Strategy Policy Committee (STS PC)

A committee comprised of stakeholders from Oregon cities, metropolitan planning organizations, state commissions, academia and industry who offered policy related oversight at each step of the Statewide Transportation Strategy development process. See Appendix A: Statewide Transportation Strategy Committees for list of committee members.

Statewide Transportation Strategy Technical Advisory Committee (STS TAC)

A committee comprised of technical experts from state, federal and metropolitan agencies and others, who provided insight and guidance on greenhouse gas emissions reduction strategies and potential impacts. See Appendix A: Statewide Transportation Strategy Committees for list of committee members.

⁷⁰ Oregon State Legislature: https://www.oregonlegislature.gov/bills_laws/lawsstatutes/2010orLaw0085.html.

⁷¹ Environmental Protection Agency: <https://www.epa.gov/smartway>.

Sustainable Aviation Fuels Northwest (SAFN)

A regional effort consisting of stakeholders from the Pacific Northwest to explore the opportunities and challenges surrounding the production of sustainable aviation fuels.⁷²

Sustainable Transportation's eRating Certification Program

A certification, education and labeling program for the passenger transportation sector. The program evaluates forms of passenger transportation using specific criteria, including greenhouse gas emissions and emissions control technologies.⁷³

SWIM2 (Oregon Statewide Integrated Model 2)

A model maintained by the Oregon Department of Transportation that was used in the STS to forecast freight and commodity flow conditions in Oregon. It has additional functions.

traffic incident management

Planned and coordinated processes followed by state and local agencies to detect, respond to, and remove traffic incidents quickly and safely in order to keep highways flowing efficiently.

transportation system costs

Any costs associated with the construction, maintenance, and operation of the transportation system.

travel (or transportation) demand management (TDM)

The application of techniques that affect when, how, where, and how much people travel, done in a purposeful manner by government or other organizations. TDM techniques include education, policies, regulations, and other combinations of incentives and disincentives, and are intended to reduce single occupant vehicle trips on the transportation network.

Travel demand (modeling/forecasts)

Travel demand modeling refers to the analytical estimation of future travel volumes and patterns performed with detailed computer models that use socioeconomic data and other key indicators to predict the number of trips that will be made in a region, where people will go, and the mode and route of travel they will take to get there.

travel market

For the purposes of GHG emissions analysis during the development of the STS, the transportation sector is divided into three travel markets – Ground Passenger and Commercial Services, Freight, and Air Passenger travel.

⁷² Sustainable Aviation Fuels Northwest: <https://www.climatesolutions.org/programs/saf/resources/safn>.

⁷³ Certification for Sustainable Transportation's eRating: <http://www.erating.org/>.

TripCheck

An Oregon Department of Transportation website⁷⁴ that displays real-time data regarding road conditions, weather conditions, camera images, delays due to congestion and construction, and other advisories. Additionally, *TripCheck* provides travelers with information about travel services such as food, lodging, attractions, public transportation options, scenic byways, weather forecasts, etc. This information is also available through the 511 travel information phone line.

true cost

Pricing that includes, in addition to all the direct costs of producing a product, the costs of the environmental and social impacts of producing the product. Examples of environmental and social costs include the health costs of air pollution (e.g. asthma), the cost of water pollution to fisheries, and the cost of climate change due to greenhouse gas emissions (e.g. flooding, droughts, severe storms). These costs are often called externalities because they are external to pricing and markets. The presence of externalities results in market inefficiencies. For example, an industry that doesn't have to pay for the cost of its pollution can offer its products at lower prices, resulting in greater demand and more air pollution. True cost pricing rectifies these market inefficiencies by internalizing the external costs into the prices of goods.

Ultra Efficient Engine Technology (UEET) Program

A NASA program to develop and create new propulsion technologies which can be turned over to US companies in the hopes of establishing a new generation of cleaner, higher performance aircraft.⁷⁵

urban consolidation centers

Facilities that allow for the consolidation of freight deliveries on the urban periphery, which enable more efficient final deliveries to the more populated urban core.

urban growth boundary (UGB)

Under Oregon law, each city or metropolitan area in the state has a UGB that separates urban land from rural land. UGBs control urban expansion/sprawl into rural lands and promote efficient use of land, public facilities and services inside the boundary.⁷⁶

utility funding/pricing model

A funding model, based on utility funding principles, that can be applied to funding transportation costs. The model includes an access charge to all who use any part of the transportation system, a usage charge (e.g., VMT charge) to reflect the amount one uses the system (including costs of infrastructure and externalities such as carbon emissions), and a congestion charge to reflect peak period use of the transportation system.⁷⁷

⁷⁴ Oregon Department of Transportation: <https://www.tripcheck.com>.

⁷⁵ National Aeronautics and Space Administration: <https://www.nasa.gov/centers/glenn/home/index.html>

⁷⁶ Metro: <https://www.oregonmetro.gov/urban-growth-boundary>

⁷⁷ Oregon Global Warming Commission, Roadmap 2020, pages 35-37: <https://www.KeepOregonCool.org/roadmap-to-2020/>

variable speed limits

Speed limits that change based on road, traffic, and weather conditions.

vehicle miles traveled (VMT)

Refers to the total distance traveled by motor vehicles in a specified area for a given period of time.

vehicle-to-vehicle communication technology

Wireless technology that allows for the transfer of information between vehicles. One major goal behind this research is to improve roadway safety. The Research and Innovative Technology Administration of the U.S. Department of Transportation is currently investigating many potential benefits of this new technology.

Voluntary Airport Low-Emissions (VALE) Program

A Federal Aviation Administration program designed to reduce all sources of airport ground emissions by helping airports meet Clean Air Act requirements. Through VALE, airport sponsors can use funds to finance low emission vehicles, refueling and recharging stations, gate electrification, and other airport air quality improvements.⁷⁸

weigh-in-motion

A truck weigh station “pre-clearance” system. Scales in the roadway weigh trucks in-motion at roadway speed as they approach the weigh station while automatic vehicle identification devices look for signals from a transponder mounted inside or on a truck. Once the computer takes in all the truck’s information, it sends a green light signal back to the transponder if the truck is “good to go” past the station. This system saves truckers time and money by not having to stop at Oregon weigh stations. Example: Oregon Department of Transportation’s Green Light Program.⁷⁹

weight-mile fees

A fee imposed on heavy vehicles based on the number of miles traveled in a state and the weight of the vehicle.⁸⁰

West Coast Green Highway

An initiative to advance the adoption and use of electric and alternative fuel vehicles along the I-5 corridor in Washington, Oregon, and California.⁸¹

⁷⁸ Federal Aviation Administration: <https://www.faa.gov/airports/environmental/vale/>.

⁷⁹ Oregon Department of Transportation: <https://www.oregon.gov/ODOT/MCT/>.

⁸⁰ Oregon Department of Revenue: <https://www.oregon.gov/DOR/pages/index.aspx>.

⁸¹ West Coast Green Highway: <http://www.westcoastgreenhighway.com/>.

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APPENDIX D:

OUTREACH PROCESS

Public Outreach

Formal public review of the draft STS began when the Oregon Transportation Commission (OTC) released the draft STS for review on May 16, 2012, with comments due by July 20, 2012.

During the public comment period (May 16 – July 20, 2012), ODOT staff made presentations at over 30 meetings across Oregon, involving approximately 500 total attendees. Outreach meetings included Area Commissions on Transportation (ACT), Metropolitan Planning Organizations (MPO), stakeholder groups, advisory committees, and other government agencies and organizations.

Written comments were accepted during the 66-day comment period. Staff received approximately 40 letters and emails commenting on the draft STS during the public comment period. The OTC heard two public testimonies at a public hearing during its meeting on July 18, 2012.

ODOT staff updated the STS in response to the comments received during the public comment period. The STS Policy Committee reviewed the recommended changes and made additional modifications. Based on feedback from the OTC, staff made final revisions to the STS. The OTC accepted the STS on March 20, 2013.

Outreach Materials and Tools

The STS Executive Summary and primer documents provided a brief summary of the draft STS. The Executive Summary was distributed at each of the outreach meetings.

The STS website included the draft STS, Executive Summary, background information, primers, contact information and information about how to provide comments. During the 10-week public comment period, approximately 550 people visited the STS website.

For major announcements, such as the start of the public comment period and documents posted to the STS website, the GovDelivery email announcements delivery tool was used. Those who subscribed to STS email announcements (approximately 500) received these types of announcements. Individual letters were sent to a number of groups including natural resource agencies and federally recognized Tribal governments. The League of Oregon Cities and Association of Oregon Counties provided information about the STS and the public outreach period to their constituents through newsletters.

Strategic Priorities Survey

As part of the outreach process, a strategic priorities survey was distributed (via Survey Monkey) to individuals of the groups ODOT staff outreached to (ACTs, MPOs, advisory committees, etc.) during the STS public comment period. Approximately 1,000 individuals received the survey invitation of which 218 responded.

Respondents were asked to answer the survey questions with responses that reflect the members of their organization, business, or the people they serve while considering:

- ***What are the most important strategies that reflect the goals, values, etc., of the members of your community/organization?***
- ***What strategies should be highest priority and should be the focus?***
- ***What strategies are most beneficial to your community/organization?***

The survey began with a brief introduction, followed by a series of demographic questions to obtain information about which organizations, communities, business affiliations or representations the respondent is associated with.

The main body of the survey asked respondents to rate each travel market strategy on a rating scale: 1 – 5; 1 representing “little benefit, little importance” and 5 representing “most benefit, most important.”

Respondents were also asked to select which strategies they would like to evaluate and discuss in more detail in future surveys and/or focus groups and to provide their email address to be contacted for future discussions.

The results of the survey were used to help identify strategic priorities to carry forward into the development of the STS implementation plan. Refer to Chapter 6: Summary and Next Steps for a discussion of the strategic priorities.