City of Seattle Office of Sustainability & Environment

Technical Advisory Group Recommendations for the Seattle Climate Action Plan Update

TRANSPORTATION & LAND USE SECTORS

Final Summary Report

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NELSON NYGAARD

ACKNOWLEDGEMENTS

TRANSPORTATION TECHNICAL ADVISORY GROUP (TTAG) MEMBERS

Jamie Cheney, Commute Seattle

Brock Howell, Futurewise

Josh Kavanaugh, Transportation Choices Coalition

Brice Maryman, Great City

John Mauro, Cascade Bicycle Club

Kevin McDonald, Seattle Planning Commission

Kelly McGourtney, Puget Sound Regional Council

Gary Prince, King County Department of Transportation

Ref Lindmark, King County Department of Transportation

Amy Shatzin, Sound Transit

Dori Costa, Seattle Department of Transportation

Jemae Hoffman, Seattle Department of Transportation

Tony Mazzella, Seattle Department of Transportation

LAND USE TECHNICAL ADVISORY GROUP (LUTAG) MEMBERS

Colie Hough Beck, Seattle Planning Commission

Josh Brower, Seattle Planning Commission

David Cutler, Seattle Planning Commission

Tom Hauger, Seattle Department of Planning & Development

Jeanne Krikawa, Seattle Planning Commission

Kevin McDonald, Seattle Planning Commission

Matt Roewe, Seattle Planning Commission

Sarah Snider, Seattle Planning Commission

Katie Sheehy, Seattle Planning Commission (Analyst)

Barb Wilson, Seattle Planning Commission (Executive Director)

CITY OF SEATTLE OFFICE OF SUSTAINABILITY AND ENVIRONMENT

Jill Simmons, Director

Tracy Morgenstern, Project Manager

NELSON\NYGAARD CONSULTING ASSOCIATES

Thomas Brennan, Project Manager

Kevin Shively, Deputy Project Manager

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EXECUTIVE SUMMARY

In 2010, the Seattle City Council established the goal of becoming a carbon neutral city. Council subsequently adopted preliminary targets to reduce total passenger vehicle miles traveled (VMT) from 2008-levels by 14% by 2020 and 20% by 2030, and to cut total greenhouse gas (GHG) emissions from 2008-levels by 30% by 2020, and 58% by 2030. The City is currently updating the Climate Action Plan (2006) to chart a path toward the target of zero net emissions by 2050. Transportation is a key focus of the plan, representing approximately two-thirds of all GHG emissions in the City of Seattle, with road transportation making up the majority of transportation emissions[1]. To inform the update of the Climate Action Plan , the Office of Sustainability and the Environment (OSE) convened both a Transportation Technical Advisory Group (TAG), and a Land Use TAG of sector experts to recommend strategies for reducing GHG emissions from transportation, while helping to achieve other key City goals, such as:

- Healthy communities
- Shared prosperity
- Social equity
- Sustainable natural environments

The focus of these recommendations is on passenger transportation, as the City and its local partners are uniquely positioned to influence this subset of transportation emissions through their land use and transportation planning roles. While marine, air, and freight emissions are significant, other entities such as the federal, state and regional governments are better positioned to impact the GHG intensity of these transportation sources.

The TAGs met from the fall of 2011 through the spring of 2012 and developed the following recommendations for consideration during the Seattle Climate Action Plan update process.

RECOMMENDED STRATEGIES

The Transportation and Land Use TAGs recommended a comprehensive set of strategic policies, programs, and projects to reduce GHG emissions from on-road passenger transportation.

Pedestrian Facilities and Services

Increase completeness and quality of the pedestrian network

- Implement Safe Routes to School (SR2S) and Safe Routes to Transit (SR2T) projects
- Enhance sidewalks, crossings and public space in Urban Centers and Urban Villages
- Connect Urban Centers and Urban Villages

[1] 2008 City of Seattle Greenhouse Gas Emissions Inventory

- Pilot Programs: (1) Safe Route to Transit (SR2T) and (2) Public Streets-Public Spaces

Bicycle Facilities and Services

Increase the extent, completeness, and quality of citywide bicycle networks, parking and supportive services to provide safe and direct bicycle access and mobility for users of all ages and abilities

- Develop cycle tracks within the Center City with connections to and through Urban Villages
- Develop a citywide network of Neighborhood Greenways
- Expand on-street bike racks and facilitate provision of more secure off-street bike parking
- Implement intersection priority and safety improvements
- Pilot Projects: (1) Center City Cycle Tracks and (2) Bike Sharing

Transit Facilities and Services

Invest in transit facilities and new service to improve frequency, reliability and user experience

- Build four High Capacity Transit (HCT) Corridors identified in Seattle Transit Master Plan (TMP)
- Increase transit service 100% by 2030 and 200% by 2050
- Implement capital improvements in 12 Priority Bus Corridors in Seattle TMP
- Pilot Project: Support development of real-time transit info/trip planner app.

Transportation Demand Management, Marketing and Education

Use pricing, policies, outreach, and incentives to shift trips to walking, cycling, transit, and other shared transport modes

- Expand and implement "Safe Routes" education programs
- Expand ORCA Passport Program; Add Neighborhood Passport Program Residents of Multi-family buildings
- Encourage shared transport: Vanpools, rideshare, carshare, fleetshare
- Require parking cashout for establishments with 100 or more employees
- Expand customized travel options tools and outreach programs.
- Pilot Projects: (1) Fleet sharing, (2) Voluntary employer/neighborhood GHG reduction programs

Congestion Pricing and other Auto User Fees

Advocate for regional authority to implement variable congestion pricing and other road user fees with a portion of revenue dedicated to multimodal transportation

- Advocate for regional congestion pricing authority, with flexibility to dedicate revenues to multimodal projects and services (including TDM)
- Advocate for and implement other user fees (e.g. a VMT-fee or other pollution taxes/fees)
- Educate the public and stakeholders about the co-benefits of pricing

Planning, Road Management, and Goods Movement

Consider GHG Emissions in transportation planning, resource allocation and right-of-way management decisions

- Adopt a transportation decision hierarchy prioritizing (1) walking, cycling and transit, followed by (2) freight and goods movement, (3) high occupancy vehicles, and (4) single occupancy vehicles
- Develop a budget prioritization tool, considering "Triple Bottom Line" factors
- Plan for multimodal mobility corridors
- Develop Freight Master Plan (FMP) and foster use of smaller delivery vehicles

Transition to Clean and Efficient Vehicle Fuels and Technologies

Transition to clean vehicle fuels and technologies; especially emissions-free electric power

- Convert transit routes to electric power
- Advocate for a state Low Carbon Fuel Standard
- Support the "Plug-in-Ready" project to enable private adoption of electric vehicles (EV's)
- Support development and adoption of next generation biofuels

Land Use Policy Reform

Adopt land use policies that support climate friendly communities

- Adopt and implement a Transit Communities Policy to align planning and zoning for transit supportive development within walking distance of high capacity transit (HCT) and nodes on the frequent bus network
- Create a Transit Communities Development Authority to facilitate/implement transit oriented development (TOD)
- Reduce cost and uncertainty of project review in Transit Communities

Zoning Reform in Transit Communities

Update zoning to foster complete, walkable Transit Communities

- Increase the diversity of housing types in single-family zones
- Increase the diversity of housing types in multi-family zones (including family-sized housing)
- Use zoning to increase affordable housing and commercial space
- Increase flexibility in Neighborhood Commercial Zones
- Pilot Project: Expand the Climate Friendly Visualization Project into an outreach tool

Incentives

Provide incentives and conduct outreach to encourage businesses to support and leverage the benefits of bicycle and pedestrian access

- Provide grants to convert parking and other areas to active uses and facilitate business access by other modes
- Promote the business benefits of pedestrian and bicycle improvements
- Target and expand grant programs to transitional commercial corridors (those becoming complete Transit Communities)

Parking Pricing and Management

Reform parking requirements and manage parking to maintain accessibility and encourage access by walking, cycling and public transit

- Expand use of on-street parking pricing where demand is high
- Reform off-street parking requirements in Transit Communities/ Urban Villages, while enacting and adjusting policies to minimize spillover impacts in adjacent areas
- Advocate for authority to develop and levy a non-residential parking space tax
- Require or incent "unbundled parking"
- Improve parking customer information (expand e-park)
- Minimize impact of parking on business district character (build/facilitate shared parking)
- Pilot Project: Develop a Parking Benefit District (PBD) in an area with high demand for on-street parking; dedicating revenues to access improvements within the District

PROJECTED OUTCOMES

To support advisory group decision-making, Nelson\Nygaard conducted a high-level analysis of the stand-alone and combined VMT and GHG emissions reduction potential of TAG recommended actions and strategies. **Implemented together, the full package of recommended transportation and land use strategies would allow the City to make substantial progress towards its adopted targets, reducing GHG emissions from on-road passenger transportation from the 2008 baseline by up to 35% by 2020, 76% by 2030 and up to 96% by 2050[2].** These estimates reflect an analysis of the combined impact of recommended actions and strategies, accounting for overlap and synergies between selected actions and strategies[3].

Figure E-1 shows estimated change in GHG emissions from on-road passenger transportation resulting from full implementation of all TAG recommended transportation and land use strategies, relative to the 2008 baseline level and to preliminary City targets for 2020 and 2030.

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[2] Note that this analysis also compared emissions potential changes in GHG emissions from strategy implementation relative to the "Business-As-Usual" or "BAU" Scenario developed for the Carbon Neutral Seattle Initiative (see "*Getting to Zero: A Pathway to a Carbon Neutral Seattle*," May 2011). That BAU Scenario, based on PSRC projections (as of 2008) for population, households, employment and income for 2020, 2030 and 2040, assumes that "no further action is taken" by the City or other levels of governments beyond "expected development and existing federal and state policies," and accounts for the US Energy Information Agency's projected changes in fuel and electricity use. The BAU scenario assumes that total GHG emissions (from all-sectors) will decline to 95% of 2008 levels by 2030; then rise slightly back to 2008 levels by 2050 (assuming an 18% increase in total VMT from 2008 to 2050).

[3] For details on the data, assumptions and methodology of this analysis, see Chapter 3 and Appendix C

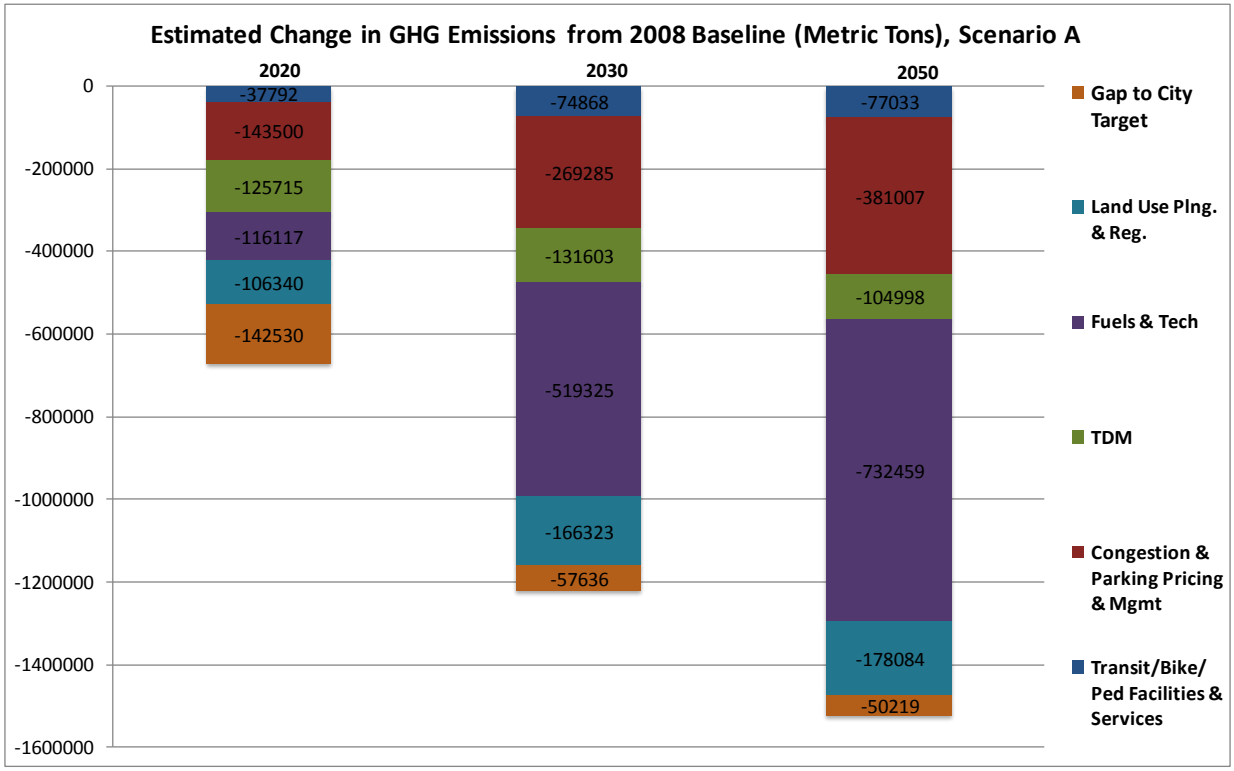
Figure E-1 Projected Outcomes vs. Preliminary City Targets

VMT / Emissions from On-Road Passenger Transportation	Change Relative to 2008 Baseline VMT/Emissions from On-Road Passenger Transportation			
	2020 Preliminary Target	2020 Projected Outcome (Scenario A)	2030 Preliminary Target	2030 Projected Outcome (Scenario A)
Vehicle Miles Traveled (VMT)	-14%	-24%	-20%	-43%
Greenhouse Gas (GHG) Emissions per Mile	-35%	-15%	-75%	-59%

Figure E-2 shows the estimated change in GHG emissions from on-road passenger transportation from the 2008 baseline, by strategy, as compared to the preliminary City targets identified in Figure E-1. This analysis reveals the relative importance of improving vehicle fuels and technologies, the strategies for which the City has the least influence and control. As it continues to support public and private sector initiatives to improve vehicle fuels and technologies, the best opportunities for the City and its regional partners to directly reduce GHG emissions passenger transportation and achieve other benefits are to:

1. Implement congestion and parking pricing and management (investing new revenue in pedestrian, bicycle and transit facilities and services and transportation demand management (TDM) programs
2. Pursue aggressive land use strategies in the near term to facilitate low-carbon travel in the future
3. Implement aggressive transportation demand management (TDM) programs that can provide substantial near-term VMT and GHG emissions reduction

Figure E-2 Estimated Change in GHG Emissions (Metric Tons) with Combined Implementation of All TAG Recommended Transportation and Land Use Strategies (Scenario A)



SYNERGIES AND INTERDEPENDENCE BETWEEN STRATEGIES

The TAG recommended transportation and land use strategies are highly synergistic and in many cases interdependent. For example:

- Land use strategies that allow the City to accommodate a larger share of regional commercial and residential development in transit accessible areas, can make the development and expansion of a citywide network of HCT and frequent bus services more cost effective, while at the same time putting more residents, jobs and services within easy walking and cycling distance.
- Parking pricing and management strategies can reduce VMT and consequent GHG emissions by eliminating hidden subsidies for driving, reducing the cost of dense/transit and pedestrian-oriented development (encouraging use of low-carbon modes of transportation), and raising limited revenues to fund other recommended transportation and land use actions and strategies.
- Congestion pricing is the most essential strategy over the long term, as it offers the benefit of substantial direct VMT and GHG reduction, while representing the single largest potential source of local or regional funding for the other actions and strategies recommended in this report.

SCALE OF CHANGE

Achieving the GHG emissions reduction potential highlighted in this report requires that all of the recommended projects, programs and services recommended in the previous chapter are implemented in a timely, coordinated, sustained way. This means that:

- All required legislative changes would be met by approval of the legislature.
- Rail lines, dedicated bus lanes (many with Electric Trolley Bus service) and cycle tracks would crisscross the City by 2030, in many places utilizing space currently allocated to general traffic or parking.
- Drivers would pay a congestion fee to use I-5, SR-99 and other major travel corridors.
- Neighborhoods surrounding every HCT Station and frequent bus node would be further transformed with a dense and diverse mix of commercial spaces and housing.
- Significantly, it also assumes that aggressive national and international efforts to develop and bring to scale improved battery technologies and second and third generation biofuels would "pay off," as intended, with substantially lower GHG emissions per mile traveled by all vehicles in the City.

Potential Funding Options
(TAG Recommended)

Vehicle License Fee (VLF)
Bridging the Gap Levy Renewal
Expanded Public Parking Pricing
Regional Congestion Pricing*
Motor Vehicle Excise Tax (MVET)*
Transit Communities Development Authority (with Tax Increment Financing)*
Off-Street Parking Space Tax*
Vehicle Miles Traveled (VMT) Fee*
Vehicle Trip Generation Fee*

**Requires State Legislative Changes*

Many of these strategies will cost several orders of magnitude more than the public resources currently available. Achieving the GHG emissions reduction potential of these strategies will only be possible with substantial new funding sources at the local and regional levels.[4] Of particular importance are TAG recommended funding and financing strategies such as congestion pricing, Vehicle Miles Traveled (VMT) fees, and non-residential parking taxes, all of which offer the dual benefits of generating new revenue for transportation, while directly or indirectly reducing VMT and GHG emissions.

Although the transportation, land use and financing strategies recommended in this report include many complex reforms, the TAG's have judged them to be technically, financially and politically feasible over the time-horizon of this plan. Most importantly, these strategies can help the Seattle achieve its GHG emissions reduction goals while promoting healthy communities, shared prosperity, social equity, and a sustainable natural environment.

[4] Additional cost estimation was not within the scope of this project.

1 INTRODUCTION

In keeping with its role as a leader in developing local solutions for global climate change, the City of Seattle is currently updating the City of Seattle Climate Action Plan (2006). Once adopted, the plan will provide a blueprint for the actions the City can take to achieve its adopted goal of becoming "Carbon Neutral" – generating zero net GHG emissions by 2050.

This report addresses opportunities for reducing GHG emissions in the road transportation sector, the largest source of emissions accounting for approximately 40% of all GHG emissions citywide. It details the evaluation process, analysis, and findings of the Transportation and Land Use Technical Advisory Groups (TAG's) for the Seattle Climate Action Plan, and presents their recommended actions and strategies for reducing transportation-related GHG emissions in the City of Seattle.

Both the Transportation and Land Use TAG's focused on reducing GHG emissions from on-road passenger transportation, which is the largest source of GHG emissions in the transportation sector and can most easily be addressed through land use and transportation policies, and programs[5]. Emissions from freight transportation, which make up 45% percentage of transportation-related GHG emissions in the City as of 2008, were not a primary focus of the Transportation and Land Use TAG's because the primary strategies for reducing freight emissions are related to vehicle fuel and technology improvements, which the City has limited ability to influence. Nevertheless GHG emissions from freight transportation can be reduced marginally as a result of many of the actions and strategies evaluated and recommended in this report – particularly those that reduce VMT and congestion.

PURPOSE AND SCOPE OF THE REPORT

The purpose of this Draft Summary Report of Transportation and Land Use Strategies for GHG Emissions Reduction is to document the Technical Advisory Group (TAG) decision-making process, key strategy analysis results, and TAG strategy recommendations for meeting GHG reduction targets in the transportation sector.

The report provides an overview of general transportation and land use strategies for emissions reduction and addresses challenges to and opportunities for developing and implementing these strategies. After providing an overview of the information and process used to evaluate the long-term benefits, co-benefits, cost-effectiveness and other impacts of each strategy (a detailed description of the methods of analysis used in this evaluation is provided in Appendix D), the report examines the projected outcomes and combined impacts of the recommended actions and

[5] According to the City of Seattle's 2008 GHG Emissions Inventory, on-road passenger transportation generated approximately 38% of all transportation-related GHG emissions ("On-Road Freight/Goods Movement" generates approximately 28%, while "Off-Road Transportation" [Passenger transportation and/or goods movement by Air/Rail/Water] generates approximately 23% of all transportation-related GHG emissions).

strategies. Finally, a number of options are provided for implementing the recommended strategies, including potential phasing, "pilot projects," and funding options.

PREVIOUS EFFORTS

The City of Seattle is a leader in developing local solutions to global climate change. In developing, evaluating, and preparing to implement high impact strategies for reduction in transportation-related GHG emissions, this effort builds upon ambitious prior and ongoing efforts to fight climate change. In 2005, Seattle committed to meet the Kyoto Protocol targets for reduction of GHG emissions, and led an effort to rally cities across the nation to commit to doing the same. . In 2006, the City developed and adopted the first Seattle Climate Action Plan. By 2008, the City had already achieved its Kyoto Protocol goal for 2012, reducing GHG emissions seven percent below 1990 levels.

In 2010, recognizing that more aggressive goals were needed to respond to climate challenge, the City Council adopted an ambitious goal of achieving carbon neutrality (net zero carbon emissions) by 2050. To understand the technical emissions reduction potential of a range of policies and actions, the City commissioned *Carbon Neutral: A Pathway to a Carbon Neutral Seattle (Carbon Neutral Seattle, or CNS)*, a report describing one possible pathway to achieving carbon neutrality.

The work and recommendations of the Land Use and Transportation Technical Advisory Groups (TAGs) summarized in this report were designed to build upon the Carbon Neutral Seattle planning effort by evaluating the technical, political and economic feasibility of implementing recommended strategies.

GREENHOUSE GAS (GHG) EMISSIONS REDUCTION TARGETS

Efforts to curb GHG emissions in the City of Seattle are advised and required by a variety of local, regional and state laws and policies. State laws adopted in 2008 (RCW 70.235.020 and RCW 47.01.440) set GHG emissions reduction goals and annual per capita VMT reduction benchmarks respectively[6]. Puget Sound Regional Council's (PSRC) Regional Growth Management Strategy, VISION 2040, established comparable regional targets for curbing GHG emissions.[7]

To establish a framework for planning and evaluation of transportation and land use strategies, the Seattle City Council adopted, by resolution, the preliminary transportation planning targets GHG emissions shown in Figure 1-1.

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[6] RCW 70.235.020 set targets for statewide reduction of GHG emissions to 1990 levels by 2020; to 25% below 1990 levels by 2035,and to 50% below 1990 levels by 2050. RCW 47.01.440 requires per capita reductions of VMT by 18% by 2020, 30% by 2035 and 50% by 2050.

[7] In particular, see VISION 2040 Appendix C, MPP-En-3, MPP-En-16 through MPP-En-25, MPPDP-45, MPP-Ec-15, MPP-T-5, MPP-T-6, MPP-T-22, MPP-T-23, MPP-T-25, MPP-PS-1, MPP-PS-12 and MPP-PS-13; and En-Action-6, DP-Action-9 and T-Action-14.

Figure 1-1 City of Seattle 2020 and 2030 GHG Targets

Sector	City of Seattle Targets for Percentage Reduction in VMT and GHG Emissions from 2008 Baseline		
	2020 Targets	2030 Targets	2050 Targets
Passenger Transportation	▪ 14% reduction in total vehicle miles traveled (VMT) ▪ 35% reduction in GHG emissions per mile of Seattle vehicles (all trip purposes)	▪ 20% reduction in total VMT ▪ 75% reduction in GHG emissions per mile of Seattle vehicles (all trip purposes)	n/a
Freight Transportation	▪ Maximum 7% increase in VMT ▪ 25% reduction in GHG emissions per mile of Seattle vehicles	▪ Maximum 15% increase in VMT ▪ 50% reduction in GHG emissions per mile of Seattle vehicles	n/a
Total GHG Emissions Reduction	▪ 30% reduction in total GHG emissions	▪ 58% reduction in total GHG emissions	▪ 87% reduction in total GHG emissions

CHALLENGES AND OPPORTUNITIES

Emissions from on-road passenger transportation are largely a function of the following four key factors:

- **Distance traveled**, measured by Vehicle Miles Traveled (VMT)
- **Average vehicle occupancy**, or the number of passengers per vehicle
- **Fuel/energy efficiency** of vehicles (e.g. Miles per gallon of fuel or per kilowatt/hour for electric vehicles). Note that the fuel/energy efficiency of vehicle transportation varies based on travel speeds which are affected by congestion[8]
- **Carbon intensity of fuel/energy** used directly or indirectly for transportation

The first three factors are influenced in large part by land use and development patterns that affect local and regional accessibility and shape travel demand. Progress toward the City's goals

[8]This factor explains some of the benefit of strategies that reduce road congestion. In corridors with less congestion, travel speeds can increase to levels that are more fuel efficient and produce fewer GHG emissions per VMT. Note that this GHG emissions reduction benefit may be off-set to some degree in some corridors by an increase in vehicle travel resulting from "latent demand." ("Latent demand" is defined by Litman (2011), as "Additional trips that would be made if travel conditions improved (less congested, higher design speeds, lower vehicle costs or tolls)." This means that in some high demand corridors, reduced congestion and temporarily higher travel speeds can attract other drivers who might otherwise use a different route, a different mode of transportation, travel at a different time of day, or avoid a trip altogether. Other travelers may opt to use the corridor for longer trips if travel speeds are improved.

will depend upon implementation of transportation and land use policies and investments that can bring about dramatic changes in one or more of these factors

Summary of Recommended Strategies

After a thorough screening and evaluation process (described in Section 3), with consideration of the emissions reduction potential, cost-effectiveness, co-benefits and other impacts of strategic alternatives, the Transportation and Land Use TAG's have recommended a comprehensive set of strategic policies, programs, and investments that specifically address one or more of these factors. Recommended strategies include:

- Reducing distance traveled (VMT) and/or increasing vehicle occupancy by
  - Investing in transit, bicycle and pedestrian facilities and services, and transportation demand management (TDM) programs,
  - Implementing congestion and parking management and pricing, and
  - Reforming land use planning and regulation, and
- Supporting advances in fuel efficiency and reductions in the carbon-intensity of transportation fuels/energy sources by
  - Converting diesel bus routes into Electric Trolley Bus (ETB) routes, and
  - Supporting the development and adoption of EV's and low-carbon fuels

2 CHALLENGES AND OPPORTUNITIES

This section provides an overview of the GHG emissions reduction strategies considered by the Transportation TAG and/or the Land Use TAG, the challenges and opportunities the City faces with implementation, and an overview of the key agencies and organizations involved in developing and initiating implementation of these strategies.

Land Use Planning and Regulation

- Concentrating more of the region's population and employment growth in Seattle's Urban Centers, Urban Villages, and along Priority Transit Corridors is a valuable and cost-effective strategy for reducing regional emissions and Seattle's per-capita emissions and yielding many co-benefits that improve quality of life. This strategy would likely increase total emissions in the City of Seattle's by increasing the City's population, but can be expected to reduce total net GHG emissions at the regional level by reducing vehicle trips associated with growth in outlying areas. This and other land use strategies recommended in this report should be considered as the City updates its Comprehensive Plan.
- Land-use strategies are necessarily long-term. Changes in travel behavior and associated GHG emissions reduction occur over time, as land and infrastructure are redeveloped and occupied. Achieving the significant long-term reductions in GHG emissions that are possible with substantial changes in urban form and development patterns is dependent upon near-term implementation of reforms to land use plans and policies. Because of the substantial changes such reforms may bring to existing communities, near-term implementation of many of the land use strategies discussed in this report require effective and clear communication of the substantial co-benefits that such reforms can yield (e.g. improved housing affordability, improved access to local retail and services, economic development, reduced costs for public infrastructure and services, social equity, etc.).

Investment in Transit, Bicycle and Pedestrian Facilities and Services

- High quality transit, bike, and pedestrian networks provide the underlying backbone of mobility that makes other strategies in this report more effective (multimodal infrastructure must be in place to attain the full benefits of compact development; TDM, and parking/congestion pricing rely on having adequate mobility choices in place to foster mobility and equity). Compared to other emissions reduction strategies, some multimodal improvements have high capital costs, and can take a long time to implement. Nevertheless, transportation facilities are a critical part of an overall strategy for reducing emissions.
- The difficult state of transportation funding in the region is a major challenge to continued expansion of multimodal transportation facilities and services in Seattle. The

transit operating agencies- particularly King County Metro- have suffered from major shortfalls in funding for transit operations and capital improvements as forecasted revenues have dipped with the economy.

Congestion Pricing and other Road User Fees

- Congestion pricing involves automatic, variable tolling of highways with rates that change based on the time of day or real-time traffic conditions (with the price per mile traveled increasing or decreasing along with traffic volumes). The congestion pricing scenarios recommended in this report aim to reduce regional VMT, while raising significant revenue to fund other transportation improvements, including pedestrian, bicycle, and transit facilities and services .To promote social equity and avoid constraining mobility, adequate transit, rideshare, bicycle, and pedestrian facilities and services should be developed in tolled corridors, as pricing is implemented.
- Although tolls have recently been initiated on SR-520, and are planned for SR-99, system-wide pricing would represent a major change for travelers and transportation agencies, while offering significant social, environmental and economic benefits (As opposed to facility-based tolling, system-wide congestion pricing offers the advantage of reducing or eliminating the impacts of diversion to alternate routes. The biggest challenge is developing regional agreement over the parameters and objectives of a pricing scheme (including the use of toll revenues) and support for necessary legislative reforms.

Parking Pricing and Management

- Both the TTAG and the LUTAG recommend reforming the way the City manages on-street and off-street parking facilities. The City's current, performance-based on-street parking program can be expanded to new areas, where surveys indicate that parking is often congested. With better management of on-street parking, Seattle can eliminate minimum off-street parking space requirements, and require or incentivize separation of parking from commercial/residential space in lease agreements to enable market-based supply and pricing of parking. These strategies reduce VMT and GHG emissions by reducing effective subsidies for driving (e.g. "free" or employer paid parking, and/or parking costs hidden in the price of rent, goods and services).
- The most significant challenges to implementing such parking reforms are neighborhood concerns about reduced parking availability in surrounding areas, and retail businesses' concerns about higher parking costs and reduced convenience for patrons (both concerns can be directly addressed by the recommended expansion of current City programs designed to maintain the availability of parking in business districts (variably priced on-street parking), and surrounding areas (permit parking zones).

Transitioning to Low Carbon Fuels/Energy for Transport

- One of the key ways the City of Seattle can contribute directly to lowering or eliminating the carbon content of transportation fuels/energy is by collaborating with King County Metro to substantially expand the City's network of electric trolley bus (ETB) routes. This technology is a particularly effective GHG emissions reduction in Seattle because ETB's can be powered with clean, zero-emissions hydroelectric power from Seattle City Light.
- With its Plug-in-Ready project, the City of Seattle is promoting conversion to electric vehicles. In the long run, adoption of EV's, biofuels and other options for reducing the

carbon content of transportation fuels/energy will largely be a function of consumer preference and state and federal regulations. Nevertheless, these strategies offer the potential for very substantial GHG emissions reduction, and the City can play an important role; supporting the market for new fuels and vehicle technologies in the early promotional phase.

Common Challenges for Strategy Development and Implementation

Common challenges for the development and implementation of many of the recommended actions and strategies in this report include:

- *Institutional and legislative barriers:* Many innovative policies and funding sources require state legislative authorization. Building coalitions to support necessary reforms will be key to implementation.
- *Limited funding opportunity:* Current resources for funding transportation infrastructure and services, and for planning, and providing incentives and other support for development of transit-oriented communities is stretched thin. The City and its local and regional partners have minimal authority to raise substantial new revenues.
- *Political /Perceptional:* Innovative concepts, such as congestion pricing, and real-time ridesharing may be perceived as unviable because they have not been demonstrated on a large scale elsewhere in the United States. Pilot projects, market analysis, education, and coalition building will be keys to building sufficient political support to overcome political and perceptional barriers.
- *Timing:* Given the nature of the overarching challenge of reducing the severity of climate change, implementation of many of the actions and strategies recommended in this report will need to be sustained over many years and decades. The City and its partners face a fundamental challenge in that the climate protection benefits of taking action may not accrue for decades and in any case are global in scope. A focus on the immediate and near-term co-benefits of recommended actions can help overcome political/perceptional challenges previously highlighted.

CO-BENEFITS

Near the top of the list of considerations of the Land Use and Transportation TAGs, are the myriad co-benefits of the GHG emissions reduction actions and strategies considered in and recommended in this report. The primary or co-benefits of many of the action and strategies in this report include:

- **Mobility and Accessibility:** The primary benefit of many of the transit, bicycle, and pedestrian facility and service improvements considered and recommended in this report is to provide new and expanded non-auto mobility choices, thereby enhancing the accessibility of people and places in the region.
- **Social Equity:** By providing affordable transportation choices, and improving accessibility and mobility for vulnerable populations, and for lower-income and transit-dependent populations, many of the recommended transportation strategies promote social equity. Moreover, many of the land use strategies promote social equity by providing more affordable and family suitable housing choices in accessible locations, lowering the combined burden of housing and transportation costs.

- **Compact, Complete Communities:** By providing well connected multimodal transportation networks, and accommodating commercial and residential development (with necessary services and amenities) in places that are accessible by walking, cycling, or transit the recommended transportation and land use strategies support the development of compact, complete communities where residents, employees and visitors can live, work, shop and interact without driving.
- **Shared Prosperity:** By improving accessibility and mobility for people and goods within the region, both transportation and land use strategies expand labor and consumer markets, and facilitate the social and economic exchange and collaboration that make the Puget Sound region a place of innovation. Construction of new transportation facilities and new Transit Communities directly creates jobs. Moreover, by providing the transportation choices, and supporting the development and maintenance of vibrant, healthy places, the strategies outlined in this report can make the region even more attractive to creative workers and entrepreneurs, making the City and the region more innovative, resilient and globally competitive.

3 EVALUATION PROCESS

This section briefly outlines the process and methods used to identify, evaluate and prioritize transportation and land use strategies for transportation-related GHG emissions reduction. Additional information on the data and methods of analysis used to generate estimates of the stand-alone and combined impacts of recommended strategies can be found in Appendix D.

Initial Strategy Scan and Feasibility Analysis

As a first step in the evaluation, the OSE and the Transportation TAG commissioned Nelson\Nygaard to develop *Transportation TAG Draft White Paper #1, Transportation Strategy Assessment* (October 2011), which:

- Summarized relevant sections of the Carbon Neutral Seattle study;
- Compiled a description of existing and relevant City, King County Metro, and Sound Transit plans, projects, programs, and data relevant to the task;
- Identified and developed planning level estimates of the amount of and timeframe for GHG emissions reductions expected to result from current plans, projects and programs;
- Identified additional appropriate candidate policies, programs, actions and strategies to be considered for evaluation of GHG emissions reduction potential and potential inclusion in the Climate Action Plan;
- Identified the potential land use and urban form implications of candidate strategies in the transportation and land use sectors; and
- Identified and summarized opportunities and barriers to implementing GHG emissions reduction strategies in the transportation sector, related to technical, funding, and legislative barriers and political feasibility/community support.

Decision Framework

As a key element of their work plans for the Transportation and Land Use elements of the City of Seattle Climate Action Plan, the Transportation and Land Use TAGs were charged with developing a decision process, or "framework," and associated criteria to guide the evaluation and selection of appropriate strategies and actions to carry forward as recommendations to the City's Green Ribbon Commission. The framework used to evaluate candidate actions and strategies for this plan is provided below.

Evaluation Framework

The Evaluation Framework provides guidance for prioritizing and developing projects, policies, and programs that support Seattle's transportation GHG reduction targets within the context of the City's broader values and goals. Since the framework is applied to a wide variety of types of initiatives, it is intentionally high-level.

Climate Change Outcome

GHG Emissions Reduction

- Short- and long-term reduction potential
- Enables a high reduction potential strategy

Community Outcomes

Mobility, Accessibility & Safety

- Provides for safe movement of people & goods
- Consistent with Transportation Strategic Plan and Transportation hierarchy
- Enhances access

Compact, Complete Communities

- Promotes vibrant mix of uses
- Fosters density necessary to support transit, local services and amenities
- Enhances connectivity

Social Justice

- Impacts to vulnerable populations (e.g. low income, recent immigrants, disabled, elderly)
- Public health benefits (e.g. supports active life style, reduces air pollution etc)

Shared Prosperity

- Fosters a sustainable economy with economic opportunity for everyone
- Reduces combined transportation and housing costs

Evaluation Criteria

Implementation Opportunity

- Synergistic impacts on other actions
- Low/high barriers to implementation (e.g. legislative barriers, necessary partnerships formed, etc.)
- Innovation opportunity

Cost

Cost Effectiveness

- High/Low initial investment, revenue generating
- Short- and long-term GHG reduction return on investment
- Enables another high return strategy
- Value of co-benefits

Funding

- Sources available
- Low/high funding potential

Economic Opportunity

- Increases person access to business districts
- Short- & long-term economic development opportunity
- Local job growth stimulator

Community & Political Support

- Low/high current support
- Low/high barriers to support
- Acts as a catalyst to build support/change culture *(e.g. demonstration project opportunity)*

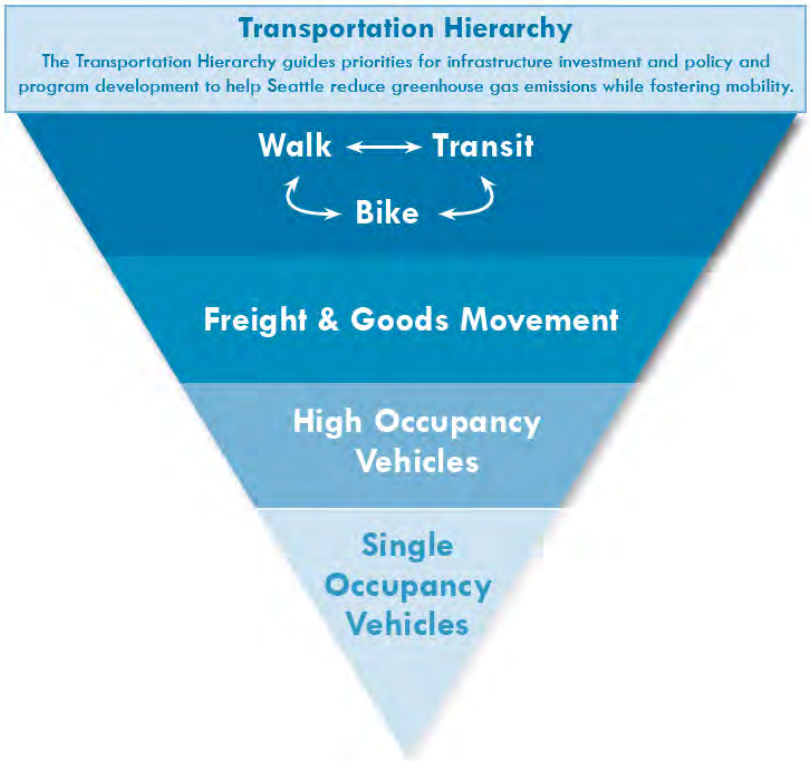
Fosters Resilience to Climate Impacts

- Employs green infrastructure strategies
- Builds adaptive capacity

Seattle Climate Action Plan
Transportation GhG Reduction Plan

Transportation Hierarchy

The following general hierarchy is intended to guide overall priorities for planning and program development; however, travel modes will be prioritized in individual corridors based on modal plan recommendations.



Analytical Work to Support TAG's

To develop a list of appropriate and effective actions and strategies for recommendation to the Green Ribbon Commission, both the Transportation and Land Use TAGs evaluated a list of candidate strategies against the criteria in this Evaluation Framework. This evaluation included consideration of available information on the potential GHG emission reduction benefits and cost-effectiveness of each strategy, using the following multi-step process (To support TAG discussion and deliberation over candidate strategies, Nelson\Nygaard developed and completed the strategy evaluation matrices provided in Appendices A, B and C):

1. **Inventory of Strategies:** An inventory of potential specific actions and strategies was developed by Nelson\Nygaard and the Seattle Office of Sustainability and the Environment, with direction and guidance from the Transportation and Land Use TAG's.
2. **Screening:** The project team conducted an initial screening evaluation of actions in the inventory to identify top-priority, feasible, high-impact strategies to carry forward for further analysis and evaluation. Planning-level, order of magnitude estimates of 2030

GHG emissions impact were generated for each action and strategy in the inventory, where data/information was readily available (Strategies with potential to reduce GHG emissions by 20,000 metric tons per year or more, below the Business-as-Usual Scenario by 2030, were identified as "High Impact" strategies, while those that promise to reduce GHG emissions at a cost of less than $30 per metric ton per year by 2030, were identified as "highly cost-effective[9]." In addition to the GHG emissions analysis, potential projects, policies, and programs were evaluated relative to the objectives and guiding considerations in the Evaluation Framework shown above.

3. **Selection of recommended strategies, actions and pilot project:** Based on the results of the preliminary qualitative evaluation and screening of actions and strategies, both the Transportation TAG and the Land Use TAG selected a package of complimentary top tier, or high priority actions and strategies (presented in Section 4) to recommend for further impact analysis and inclusion in the Seattle Climate Action Plan.
4. **Combined impact analysis:** To assess the combined impact of the strategies, actions, and pilot projects recommended in Section 3, Nelson/Nygaard followed a two-step process, including (a) a refined analysis of the stand-alone impacts of each individual recommended action or strategy, and (b) a combined impacts analysis, accounting for potential overlap and synergies between strategies. The baseline assumptions and methods used to estimate GHG emissions impact for both the stand-alone and combined strategy analysis are provided in Appendix C.

For each strategy recommended by the Transportation and Land Use TAG's, the Nelson\Nygaard team developed a high-level, order of magnitude estimate of potential GHG emission reduction from a baseline, Business-as-Usual scenario (BAU). These estimates of the stand-alone and cumulative GHG emissions reduction that could likely be achieved with implementation of the recommended actions and strategies were drawn from local data sources, plans, studies including Carbon Neutral Seattle (Stockholm Environmental Institute, 2011), analysis conducted by SDOT, King County Metro, Puget Sound Regional Council (PSRC), Nelson\Nygaard's library of best practice case studies, and a broad literature review. Citations for source data and assumptions are provided either in the Action Evaluation Matrices (Appendices A and B), or in the associated GHG Emissions Reduction Analysis spreadsheets.

Business-As-Usual Scenario

All estimates of stand-alone GHG emissions reduction (from stand-alone strategies, and/or the cumulative impacts of any combination of actions and strategies) in this report are presented as compared to an estimated "Business-as-Usual," or "BAU" Scenario for 2020, 2030 and/or 2050, developed for the City of Seattle Office of Sustainability and Environment by Stockholm Environmental Institute as part of the Carbon Neutral Seattle project (2011). This BAU scenario:

- Assumes that "no further action" is taken by the City or other levels of governments beyond "expected development and existing federal and state policies." This means

[9] "Medium" impact strategies are those that would reduce GHG emissions by 5,000 to 20,000 metric tons per year. All strategies that would reduce GHG emissions by less than 5,000 metric tons per year by 2030 were considered to be "low impact" strategies. GHG emissions reduction strategies costing between $30 and $100 per metric ton reduced/eliminated per year, were identified as "Moderately cost-effective," while those that cost $100 or more per metric ton reduced/eliminated per year, were considered to be "cost ineffective."

currently planned and funded actions, such as extending Link Light Rail system to Lynnwood, Redmond, and Federal Way, are included in the BAU Scenario.

- Is based on current (as of 2008) PSRC projections for population, employment, incomes, housing, and
- Accounts for the US Energy Information Agency's projected changes in fuel and electricity use in response to changes in energy prices, and federal policies [currently, as of 2008] in place such as ... vehicle standards, and renewable fuel standards.

Rationale for Focusing on On-Road Passenger Transportation

GHG emissions are generated by multiple modes of transportation used for a variety of purposes, ranging from passenger transportation to freight/goods movement by road, rail, air, and water. For this analysis of the transportation sector, the Transportation TAG and the Land Use TAG focused in particular on actions and strategies for reducing emissions from *on-road passenger transportation,* in part because:

- On-Road Passenger Transportation is the largest source of GHG emissions in the transportation sector.
- Through its role in land use and transportation system management, the City has a greater ability to address on-road passenger trips than other types of travel (e.g. freight/goods movement, air travel, water transportation, and rail travel).
- Demand for freight/goods movement, and passenger air travel, water transportation, and rail travel are influenced to a much greater degree by private sector actions, and state and federal actions and regulations, meaning that the City has limited ability to reduce GHG emissions from these types of transportation by unilateral action. The TAGs have recommended that SDOT complete a Freight Master Plan (FMP) which should include strategies for reducing GHG emissions.
- Actions and strategies that reduce GHG emissions from on-road passenger transportation – especially those that do so by expanding transportation choices, and reducing VMT and congestion, offer a host of co-benefits that help the City achieve other social, economic and environmental goals and objectives, such as:
    - Improving accessibility and mobility
    - Improving safety for all road users
    - Reducing local air and water pollution
    - Improving local and regional economic vitality and competitiveness
    - Reducing total household expenditures for housing and transportation.
- Reducing VMT from passenger transportation and consequent road congestion can in turn improve travel speeds and lower GHG emissions from freight transportation/ goods movement.

4 RECOMMENDED STRATEGIES

This chapter provides a description of the specific actions and strategies for reducing GHG emissions from on-road passenger transportation recommended for inclusion in the Seattle Climate Action Plan by the Transportation TAG and the Land Use TAG. An estimate of the stand-alone impacts of each strategy (and many of the recommended implementation actions), is provided, along with the TAG's assessment of other key outcomes, potential co-benefits, synergies with other strategies, and strategy cost-effectiveness, where cost-information is readily available. Innovative pilot projects are also recommended for each strategy.

Assessments of the "stand-alone" impacts for selected strategies (highlighted in call-out boxes within each strategy/action profile) are intended to highlight the potential relative contribution of each strategy to meeting the City's adopted GHG emissions reduction targets. Just as importantly, the assessment highlights the value of these actions and strategies to achievement of other community goals and objectives.

TTAG RECOMMENDED TRANSPORTATION STRATEGIES

Pedestrian Facilities & Services

Increase Completeness and Quality of Pedestrian Network

~1-2 %
Estimated reduction in GHG from on-road passenger transportation by 2050 (Enables other transport and land use strategies)

Trips that shift from driving to walking due to pedestrian enhancements will be relatively short trips, so GHG emissions reduction is expected to be modest. Nevertheless, investments in pedestrian facilities are essential components of complete communities and enable transportation and land use strategies that reduce emissions (i.e., most transit trips start and end with a walk to the stop/station). Safe and functional pedestrian facilities and amenities can encourage people to use transit more or to park once to visit multiple destinations.

1. IMPLEMENT "SAFE ROUTES" PROJECTS
Implement priority Safe Routes to School (SR2S), and Safe Routes to Transit (SR2T) projects to improve pedestrian connections to schools, transit, and business districts; ensure improvements benefit vulnerable populations (i.e., enlist students and non-profits to conduct pedestrian safety audits)
2. ENHANCE SIDEWALKS, CROSSINGS AND PUBLIC SPACE IN URBAN CENTERS AND URBAN VILLAGES
Improve sidewalks and crossings in Urban Centers and Urban Villages (in conjunction with transit service and facility enhancements), in accordance with priorities in the Pedestrian Master Plan (PMP).

3. CONNECT URBAN CENTERS AND URBAN VILLAGES	
Widen sidewalks, and improve crossings of arterial streets to connect Urban Centers/Villages.	
PILOT PROJECT	**SAFE ROUTES TO TRANSIT (SR2T)** Initiate a SR2T program and implement pedestrian facility improvements based on audits of pedestrian safety risks accessing frequent transit stops.
PILOT PROJECT	**TRANSFORM STREETS TO PUBLIC SPACES** Reallocate excess portions of the public rights-of-way in selected areas from general traffic uses to public/pedestrian spaces such as public plazas, "parklets," and laneways (converting alleys to active pedestrian spaces with retail frontage) to support compact, complete communities in Urban Centers and Villages, especially outside of Downtown.

Investments in priority Safe Routes to School and Safe Routes to Transit projects**,** sidewalk and crossing enhancements**, along with critical** pedestrian connections for Urban Centers and Villages **will improve the safety and viability of walking.**

Cost Effectiveness

Moderate

Estimated cost per metric ton of GHG emissions eliminated is $7,700 per year (2030). Enhances cost-effectiveness of other strategies (e.g. transit, TDM, etc.)

KEY OUTCOMES

- Increase sustainable travel options, improving the walk mode share in the city
- Improves access for vulnerable populations
- Provides public space essential for complete transit oriented communities

CO-BENEFITS / SYNERGIES WITH OTHER STRATEGIES

- Promotes social equity by improving access to goods, services, employment, cultural and recreational opportunities for vulnerable populations
- Promotes change in the transportation culture
- Provides public space essential for complete transit oriented communities
- Improves public health by improving air quality, pedestrian safety, and facilitating active transportation.
- Improves vitality of local retail, restaurant, and business districts

OPPORTUNITIES AND BARRIERS

- Widening sidewalks in some locations may reduce the space available for natural drainage and trees
- Real and/or perceived traffic and parking impacts of dedicating limited right-of-way space that is currently used for general purpose travel or parking to new sidewalks, crossings and other pedestrian space presents challenges in some areas.
- Gaining community support to transition active street rights-of-way to public spaces/ plazas can be a challenge

Bicycle Facilities & Services

Increase the extent, completeness, quality and priority of citywide bicycle networks, parking and supportive services to provide safe and direct bicycle access and mobility for users of all ages and abilities.

~ 4%-6%

Est. potential reduction of GHG emissions from on-road passenger transportation (2050)

Currently, about 3.6% of commute trips made by City of Seattle residents are made by bicycle[10]. This strategy includes implementation of new on- and off-street bicycle facilities and services, designed to substantially increase bicycle mode share by accommodating users of all ages and abilities.

1.CYCLE TRACKS

Develop cycle tracks (bikeways within the street right-of-way that are physically separated from motor vehicle and pedestrian traffic) within the Center City, with connections to and through Urban Villages. The cycle track network should be integrated with the citywide network of on-and off-street bicycle facilities in the Seattle Bicycle Master Plan (BMP).

2. GREENWAYS

Develop a citywide network of neighborhood greenways on traffic calmed residential streets. Greenways should be connected with off-street trails to create a citywide network of routes for low-stress bicycle travel that is fully integrated with the network of on-street and off-street facilities in the BMP.

3. BIKE PARKING

Expand quality on-street bike racks (e.g. racks that have multiple points of contact), and facilitate provision of secure off-street bike parking, including several full-service bike stations (with attended parking) in the Center City, Urban Centers/Villages and transit stations/stops (Develop a complementary "Bike 'n Ride" outreach program).

4. INTERSECTION PRIORITY AND SAFETY IMPROVEMENTS

Implement signal timing, bike boxes, 'No Right Turn on Red' restrictions and other intersection safety and priority treatments for bicycles in primary bicycle corridors citywide.

[10] 2010 American Community Survey

PILOT PROJECTS

CENTER CITY CYCLE TRACKS

Implement a cycle track on at least one corridor through Center City

BIKE SHARING

Implement a bike sharing program with pods in the Center City and adjacent neighborhoods.

Citywide networks of **cycle tracks,** and **greenways,** with expanded **bike parking**, and with appropriate **intersection improvements** can make cycling a first-choice for more people and more types of trips.

Cost Effectiveness:

High

Estimated cost of $5,000-$15,000 per metric ton of GHG emissions reduced (enables other highly cost-effective projects/services)

KEY OUTCOMES

- Improves access and mobility
- Reduces barriers to cycling for trips to and within Center City and Urban Villages
- Provides safe and comfortable facilities for people of all ages and abilities, including the "willing but wary" who do not ride frequently

CO-BENEFITS / SYNERGIES WITH OTHER STRATEGIES

- Improves health by increasing active transportation, reducing pollution and improving safety for cyclists, drivers and pedestrians
- Reduces local air and water pollution
- Improves access to transit and the economic vitality of local retail districts
- Facilitates development of dense, transit oriented communities (TOC) by reducing demand for on-street and off-street parking
- Complements TDM and pricing strategies by providing a cost-effective, low-impact alternative to driving
- Development of bicycle facilities generates jobs at a higher rate per dollar of investment than highway/road construction projects.

OPPORTUNITIES AND BARRIERS

- There is significant latent demand for bicycle facilities on low-traffic residential streets, and growing community support for bicycling
- Bicycle facilities and services compete for funding with roads and transit, which dominate travel mode-shares in most parts of the state
- Bicycle facilities are highly cost-effective compared to other capital projects
- Greenway system enjoys significant community support and low barriers to system implementation
- Development of on-street bike facilities requires tradeoffs in the use of limited street rights-of-way for other purposes

Transit Facilities & Services

Invest in transit facilities and new service to improve frequency, reliability, and user experience

Investments in a comprehensive citywide network of frequent transit lines, including high capacity transit facilities, and capital improvements in priority bus corridors, can improve transit speed, frequency and reliability. In turn, these improvements reduce GHG emissions by attracting a higher share of trips to transit (particularly non-commute trips), and by enabling the development of compact communities, where transit is a first option and many common destinations are within walking distance.

~2-5%
Estimated direct reduction of GHG emissions from on-road passenger transportation by 2050 (Note: Enables substantial GHG emissions reduction from TDM and land use strategies)

1. HIGH CAPACITY TRANSIT
Implement four HCT Corridors in the Seattle Transit Master Plan (TMP) by 2030, including Ballard-Downtown, U-District-Downtown, Central Area-Downtown, and Westlake-International District. Build out HCT in all TMP priority corridors by 2050.
2. TRANSIT SERVICE AND INFORMATION
Add transit service to high demand routes and upgrade service on other routes to expand the Frequent Service Network (reduction estimate assumes 100% increase in service within the City of Seattle by 2030, and a 200% increase in service by 2050). Support development and operation of real-time transit information and wayfinding applications.
3. BUS PRIORITY CORRIDORS
Implement capital improvements to Priority Bus Corridors identified in the Seattle TMP (including dedicated bus lanes, bulb-outs, stop/shelter improvements, and intersection priority treatments) by 2030. Expand bus priority treatments to all frequent bus corridors by 2050.

PILOT PROJECT

MOBILE MULTIMODAL INFO / WAYFINDING APP

Support development and operation of mobile information application(s) for real-time multimodal access, mobility and wayfinding information. Consider open source competition to spur innovative applications.

Creating **high capacity transit corridors** and expanding the **Frequent Transit Network** in Seattle improves mobility and access; supports development of compact Transit Communities.

Cost Effectiveness

Moderate

Stand-alone capital improvements to the transit network are expensive, but combined with added service, support development of walkable Transit Communties

KEY OUTCOMES

- Improves transit frequency, capacity, speed, reliability, comfort, and convenience
- Expands transportation choices
- Improves person mobility within the City
- Allows transit to attract and accommodate more non-work trips

CO-BENEFITS / SYNERGIES WITH OTHER STRATEGIES

- Improves citywide mobility and access to neighborhood business districts
- Reduces household transportation costs
- Improves social equity by reducing costs and expanding travel choices for very low-income, transit-dependent households
- Transit improvements, particularly HCT and priority bus corridors are essential to accommodate growth in compact Transit Communities that reduce GHG emissions by encouraging walking, cycling and use of transit
- Fosters growth and economic vitality
- Improves public health by reducing local and regional air pollution (improving air quality) and encouraging active transportation (walk and bike access to transit)

OPPORTUNITIES AND BARRIERS

- Near-term funding opportunities include a potential renewal of the "Bridging the Gap" levy (funding would need to be prioritized for investments in pedestrian, bicycle and transit infrastructure and services).
- With legislative authorization, regional road pricing may be a sustainable long-term funding source for both transit capital and operations improvements.
- King County Metro and Sound Transit currently lack funding to maintain service levels. Sate legislation improving funding options for transit districts has the potential to allow service increases. The City can help shape how additional funding would be directed.
- Implementation of HCT and bus priority requires exclusive transit lanes in selected segments.

Transportation Demand Management, Marketing & Education

Use pricing, policies, outreach, and incentives to shift trips to walking, cycling, transit, and other shared transport modes

~10-15%

Est. reduction in GHG emissions from on-road passenger transportation, resulting from shifting trips to walking, cycling, and transit (2050)

Proposed Transportation Demand Management (TDM) actions will reach new markets and reinforce current efforts. Among the opportunities are expanding effective education and incentive programs, supporting innovation and the efficient use of existing resources, and implementing new financial incentives that have been demonstrated to reduce driving. TDM actions leverage the capital investments made in walking, bicycling, and transit to maximize the effectiveness of those investments.

1. EXPAND AND IMPLEMENT "SAFE ROUTES" EDUCATION PROGRAMS

Expand education and outreach elements of the Safe Routes to School (SR2S) Program, and implement a Safe Routes to Transit (SR2T) Program as recommended in the Seattle Transit Master Plan (TMP).

2. EXPAND THE ORCA PASSPORT PROGRAM; ADD NEIGHBORHOOD ORCA PASSPORT PROGRAM FOR RESIDENTS OF MULTI-UNIT BUILDINGS IN TRANSIT COMMUNITIES

Work with TMAs and community groups to develop, market, and negotiate bulk purchase of a universal transit pass (similar to an ORCA Business Passport; good for travel on all regional services) for all residents of new multi-unit residential buildings in each participating Transit Community.

3. ENCOURAGE SHARED TRANSPORT: VANPOOLS, RIDESHARE, CARSHARE, FLEETSHARE

Encourage and support vehicle sharing and ridesharing, including (1) an instant ridesharing pilot project, (2) implementing a fleet share pilot project (making City motor pool vehicles available for shared use), (3) expanding King County Metro Vanpooling, and (4) supporting implementation of peer-to-peer carsharing.

4. PARKING CASHOUT

Require provision of cash or other transportation benefits in lieu of parking subsidies (free or below market rate parking) for all establishments with 100 or more employees that offer such subsidies.

5. EXPAND CUSTOMIZED TRAVEL OPTIONS TOOLS AND OUTREACH PROGRAMS

Provide customized trip planning info directly to individuals and through employers, prop. managers, etc.

PILOT PROJECTS	**FLEET SHARING PILOT PROJECT** Support a major institutional/corporate fleet sharing pilot project (sharing fleet vehicles outside of business hours, or contracting with a carsharing service for business mobility)
	VOLUNTARY GHG REDUCTION PROGRAM Pilot a voluntary Transportation GHG Emissions Reduction Program for employers or neighborhood organizations.

KEY OUTCOMES

Cost Effectiveness

HIGH

Strategies leverage investments made in walking, bicycling and transit.

- Improved transportation choices.
- High impact (e.g., Parking cashout can reduce commute-related VMT and emissions at selected employment sites by 10-12%; ORCA passports may reduce VMT by up to 10-11%).
- Fleet sharing eliminates GHG emissions by reducing private vehicle ownership and VMT; and by replacement of older, higher-emitting vehicles with new, fuel efficient models.

CO-BENEFITS/SYNERGIES WITH OTHER STRATEGIES

- All initiatives improve public health by reducing air pollution and encouraging active transportation.
- All initiatives promote social equity by reducing subsidies for vehicle owners and increasing incentives for travelers using non-auto modes (including transit-dependent populations).
- Transportation Management Associations (TMAs) enable other high impact strategies (e.g. adoption of ORCA Passports and shared parking) and can catalyze local TDM planning and cultural change.
- Fleet sharing can reduce the space required for vehicle storage.

OPPORTUNITIES AND BARRIERS

- Leverages the investments made in pedestrian, bicycling and transit facilities and services.
- Need to increase facilities and services to accommodate increased modes to meet the increased demand.
- Contracting out for shared fleet vehicles may raise labor and contracting issues for some institutions/employers.
- A voluntary GHG emission reduction program would likely be widely supported; key to success is to inspire widespread adoption of GHG emissions reduction goals by individuals.
- Expanding the ORCA Passport Program requires collaboration with King County Metro and Sound Transit.

Parking Pricing and Management

Manage parking to maximize access and reduce unnecessary travel

~20-25%
Est. reduction in GHG emissions from on-road passenger transportation (2050), by shifting trips to walking, cycling, and transit

The most important use of on-street and public off-street parking in downtown and commercial districts is for short-term customer access to businesses and services. Poorly managed parking can incent employees and other long-term parkers to make auto trips and use parking that could be better used for short-term access to businesses. When parking is scarce, drivers burn more fuel searching for parking – up to 30% of traffic in some major downtowns is due to drivers searching for a parking stall. Strategies that use basic market pricing to manage parking can enhance access to neighborhoods and businesses, while reducing GHG emissions – a true win - win strategy.

1. EXPAND USE OF ON-STREET PARKING PRICING WHERE DEMAND IS HIGH

Price on-street parking (expanding meter and/or or permit zones) in areas where free on-street parking is typically congested to improve access and encourage use of non-auto modes. Adjust rates as necessary to maintain parking availability and dedicate revenue to access and streetscape improvements within newly established Parking Benefit Districts (see Pilot Project).

2. REFORM OFF-STREET PARKING REQUIREMENTS IN TRANSIT COMMUNITIES

Eliminate parking minimums and establish maximums in Transit Communities while protecting adjacent areas from spillover impacts.

3. DEVELOP A NON-RESIDENTIAL PARKING SPACE TAX

Advocate for authority to levy a per space tax on off-street parking which can be tiered to account for climate impacts based on factors such as the transit accessibility and density of the area.

4. REQUIRE OR INCENT PARKING "UNBUNDLING"

Adopt requirement or incentives for developers that parking be separated from commercial space and residential units in lease and sale agreements.

5. IMPROVE CUSTOMER PARKING INFORMATION

Expand the E-Park program in the Center City and enhance web and mobile/smart phone user interfaces. Develop parking signage regulations that require consistent communication of parking rate information.

PILOT PROJECT

DEVELOP A PARKING BENEFIT DISTRICT (PBD)

Implement a PBD in a Transit Community business district with demand for on-street parking pricing

KEY OUTCOMES

- Reduces driving to and within the Center City and Seattle's busiest neighborhoods
- Increases developable, productive space in Transit Communities
- Reduces demand for road space keeping transit moving and making room for cyclists
- Improves access to and economic vitality of local retail districts

COST EFFECTIVENESS

HIGH

Reduces GHG emissions while generating revenue to fund implementation of other GHG reduction actions/ strategies

CO-BENEFITS / SYNERGIES WITH OTHER STRATEGIES

- Decreases potential conflict between pedestrians, bicyclists and automobiles
- Provides opportunity for new citywide and local neighborhood revenue sources
- Facilitates development of dense, transit oriented communities (TOC) by reducing demand for valuable real estate that can be used for development
- Complements TDM and pricing strategies by providing a cost-effective, low-impact alternative to driving for trips under 5 miles

OPPORTUNITIES & BARRIERS

- Highly cost-effective compared to capital project strategies
- Increase turn-over of auto-oriented retail parking (parking space tax)
- Market benefits of performance-based management in terms of customer convenience and increased access to businesses to defray the perception that parking pricing is a revenue strategy
- Pricing strategies are politically controversial
- Perceived negative impacts to local retail businesses
- Need to frame parking regulatory and pricing changes in terms of community benefits
- In developing and implementing parking management plans in local business districts, maintain access and curb priority for load/unload zones and commercial deliveries.

Congestion Pricing and other Auto User Fees

Advocate for regional authority to implement variable congestion pricing and other road user fees with a portion of revenue dedicated to multimodal transportation

Variable pricing of all limited-access highways and major arterials in the region is the highest impact and most cost-effective strategy for reducing GHG emissions in the transportation sector. Tolling is in effect on SR-520, SR-167, and the Tacoma Narrows Bridge (and will apply to the SR-99 tunnel). Construction and maintenance of other roads is subsidized through other taxes and fees. Regionwide congestion pricing can reduce traffic (including diversion) and GHG emissions, and may generate substantial revenue to fund other strategies.

~15-30%
Est. reduction in GHG emissions from on-road passenger transportation (2050) by shifting trips to walking, cycling, and transit

$1.9 to 6.1 billion
Generated per year in regional funding for transportation

1.ADVOCATE FOR REGIONAL CONGESTION PRICING
Advocate for legislative authorization and regional implementation of variable congestion pricing on all limited access highways and potentially also on major arterials. Legislation should provide regional authority to set toll rates and objectives, and to dedicate revenues to multimodal transportation, including transit, bicycle, and pedestrian projects.
2. ADVOCATE FOR AND IMPLEMENT OTHER ROAD USER FEES
Further evaluate and advocate for legislative authorization of pricing mechanisms that also provide revenue to sustainable transportation options (impact fees, higher license fees for 2nd and 3rd vehicles, street utility fees, vehicle pollution taxes, etc).
3. EDUCATE ON THE BENEFITS OF PRICING
Host City- sponsored forums that address need for pricing strategies to meet city economic, social and environmental goals.

LEGISLATIVE ACTION

ADVOCATE FOR STATE LEGISLATIVE REFORM

Legislative changes are needed to enable tolling of existing general-purpose lanes on state and federal highways, to provide a regional entity with authority to set and adjust toll rates and establish tolling objectives, and to permit the expenditure of toll revenues on multimodal transportation improvements and TDM programs region-wide. To fund other GHG emissions reduction actions and strategies in this plan, revenues would need to be distributed to local jurisdictions.

KEY OUTCOMES

The *Seattle Variable Tolling Study*, commissioned by SDOT, upon the recommendation of the Green Ribbon Commission states the following City interests in tolling[11]:

- Reduce Greenhouse Gas Emissions
- Generate revenue to fund transit and other transportation choices (up to $6.1 billion region-wide)
- Improve the throughput of people and goods on roadway
- Provide reliable travel times, especially for transit and freight

COST EFFECTIVENESS

VERY HIGH

Reduces GHG emissions while generating revenue to fund implementation of other reduction actions/ strategies

CO-BENEFITS / SYNERGIES WITH OTHER STRATEGIES

- Reduces peak hour traffic congestion and associated delay in the movement of people and goods
- Reduces local air and water pollution
- Improves public health by improving air quality, encouraging a shift to active modes of transportation (cycling and walking)

OPPORTUNITIES AND BARRIERS

- Tolls will have disproportional cost impact on low-income travelers unless toll rates are adjusted by income, and/or revenues are dedicated to transit and non-motorized transportation projects and services
- Requires state level actions and legislative authorization
- Tolling of major arterial roadways (in addition to limited-access highways) may reduce diversionary impacts

[11] SDOT, Seattle Variable Tolling Study (2009), p. 3.

Planning and Road Management and Goods Movement

Consider GHG emissions in transportation planning, resource allocation and right-of-way management decisions

Enabling Strategies

City plans, including the Transportation Strategic Plan (TSP), the Comprehensive Plan, and Master Plans for each mode, clearly identify the City's goals of shifting travel demand from driving alone to walking, cycling, transit and other shared travel modes. A shift from a focus on vehicle capacity and delay, to prioritizing accessibility and mobility for people and goods is necessary to meet the needs of a growing population within a finite geographic area.

1. ADOPT A TRANSPORTATION DECISION HIERARCHY

Adopt a decision hierarchy prioritizing (1) walking, cycling, and transit, followed by (2) freight and goods movement, (3) high occupancy vehicles, and (4) single occupancy vehicles in planning, infrastructure investment, policy and program development and right-of-way management to reduce GHG emissions and improve safety while fostering mobility and accessibility.

2. DEVELOP A BUDGET PRIORITIZATION TOOL

Develop a budget prioritization tool to ensure consideration of "Triple Bottom Line" factors, including GHG emissions reduction analysis, updates to transportation and land use plans, evaluation of budget and policy/program alternatives, and prioritization of implementation actions and strategies.

3. PLAN MULTIMODAL CORRIDORS

Develop and complete plans for multimodal transportation improvements in broad travel corridors. Such plans should be well coordinated with land use plans and focused on improving accessibility, mobility and safety. Better align roadway and utility planning to maximize transportation outcomes.

4. DEVELOP FREIGHT MASTER PLAN (FMP); FOSTER USE OF SMALL DELIVERY TRUCKS

Develop a Freight Master Plan (FMP) with goals to improve the efficiency and reduce the GHG emissions impact of goods movement; when possible revise freight access requirements in zoning/building codes to support adoption of smaller, more efficient delivery vehicles.

PILOT PROJECT	**MOBILITY CORRIDOR PLAN** Identify and implement a complete land use and multimodal mobility corridor in a high priority transit / bicycle corridor for pilot project in mobility corridor planning

Integrated planning and prioritization of walking, cycling, transit and goods movement in resource and right-of-way management – especially at the corridor level – can be transformative, reducing GHG emissions while enhancing accessibility, mobility and other city goals.

KEY OUTCOMES

- City planning, investment, resource allocation, and project/program implementation aligned with adopted GHG goals
- Low-GHG emission modes of access and mobility are prioritized in mid- to long-term planning and investment decisions

CO-BENEFITS / SYNERGIES WITH OTHER STRATEGIES

- Improves public health by improving air quality, promoting active transportation and improving safety for all users (pedestrians, bicyclists and drivers)
- Improves mobility, accessibility and connectivity
- Increases affordability by reducing the combined costs of housing and transportation
- Promotes transportation investment and management decisions that favor sustainable transportation
- Enhances positive impact of other strategies (e.g. investment in transit capital improvements and operations)
- Increases person access to downtown and key business districts
- Freight Master Plan (FMP) supports city and regional economic development and job creation
- Reforms load zone requirements in Urban Centers and Villages to allow smaller delivery vehicles, supports more efficient goods movement and removes a barrier to development of Transit Communities

OPPORTUNITIES AND BARRIERS

- Shifting to a more performance-based process for resource allocation and project/program implementation requires consideration of the needs of all communities in planning, resource allocation and service delivery to address equity issues
- Prioritizing walking, cycling and transit, and adopting a Freight Mobility Plan require coordinated planning to maximize safety and balance the movement of people and goods in key corridors. Coordination and integration of planning (as recommended for the Mobility Corridor Planning Pilot Project) can reduce barriers to implementation of mode specific strategies.

Transitioning to clean and efficient vehicle fuels and technologies

Transition to Clean Vehicle Fuels and Technologies; Emissions-Free Electric Power

~50%
Estimated reduction in GHG emissions from on-road passenger transportation by 2030 (Notes: assumes next generation biofuels are market-ready by 2030)

Seattle can be a leader in technology and efficiency for public transit, the private vehicle fleet and goods movement. The Seattle Transit Master Plan (TMP) calls for taking advantage of the City's hydroelectric power by expanding the emissions-free Electric Trolley Bus network. Although the state and federal governments regulate vehicle fuels and fuel economy, the City may play an important role by advocating for appropriate standards that support climate protection, and by encouraging the efficient use of vehicles through fleet sharing/carsharing, and local adoption of more efficient fuels and vehicles, including Electric Vehicles (EV's) and hybrids.

1.CONVERT TRANSIT ROUTES TO ELECTRIC POWER
Take advantage of Seattle's emissions-free hydroelectric power by substantially increasing the number of bus route miles planned for conversion to Electric Trolley Bus (ETB) service by 2020 (converting all in-City routes to ETB, or other emissions-free power by 2050).
2. ADVOCATE FOR FUEL CARBON STANDARD
Advocate for a State Low-Carbon Fuel Standard (as an alternative to renewable fuel standards) that reduces carbon content of fuels over time, with a clear tie to GHG emissions reduction goals
3. SUPPPORT PLUG-IN-READY PROJECT
Provide necessary public support (infrastructure, policy, planning, etc.) for private electric vehicle adoption. GHG emission reduction estimate assumes 5% adoption by 2020, 20% adoption by 2030, and 80% adoption by 2050.
4. SUPPORT DEVELOPMENT AND ADOPTION OF NEXT GEN. BIOFUELS
Support development and local adoption of biofuels, including aggressive near-termadoption of the best first-generation biofuels (sugar ethanol and equivalents), and development of second-generation bio fuels such as cellulosic ethanol (which may have life-cycle GHG emissions that are 70% lower than petroleum).

LEGISLATIVE ACTION	Advocate for adoption of a State Low-Carbon Fuel Standard

Seattle and Washington as a whole will benefit from reduced carbon emissions with a **fuel carbon standard**, expansion of the **Electric Trolley Bus** network, and increased use of **electric vehicles** and **next-generation biofuels**

Cost Effectiveness

High

Conversion to electric trolley buses requires substantial up-front investment, but provides long-term returns; Support for adoption of electric vehicles (including transit), and low-carbon fuels may be low-cost – high-impact strategies.

KEY OUTCOMES

- GHG emissions reduced by conversion of diesel bus routes to Electric Trolley Buses (ETB)
- GHG emissions reduced in the mid- to long-term as a result of bio-fuel and EV adoption in accordance with low-carbon fuel standards

CO-BENEFITS / SYNERGIES WITH OTHER STRATEGIES

- All strategies benefit public health through improved air quality
- Electric trolley buses provide faster/more reliable service on hills and quiet operations in neighborhoods

OPPORTUNITIES AND BARRIERS

- Unlike many other strategies evaluated, shifting to alternative fuels would not have significant co-benefits in terms of reduced congestion, connectivity or improved transportation choices or social justice and shared prosperity outcomes
- The timing of the availability of market ready sustainable next generation biofuels is uncertain
- EV and bio-fuel marketing and development are best led by the private sector; limited role for the public sector may include City of Seattle support for research, development and implementation
- Increased electric vehicle use could reduce revenues from fuel taxes for roadway maintenance and investments in non-auto modes
- Significant investment in charging stations and other infrastructure and services is required to bring electric vehicles "to scale' in Seattle and the Central Puget Sound region.
- Increased utilization of electric vehicles will require investments in electric power conservation and generation, and may reduce fuel tax receipts
- Trolley bus conversion requires substantial up-front capital expenditure that may be difficult to fund without complementary capacity improvements and/or service enhancements

LUTAG RECOMMENDED LAND USE STRATEGIES

Land Use Planning & Policy

Deliver walkable neighborhoods & essential components of livability

Meeting the growing demand for conveniently located homes and businesses in walkable neighborhoods can significantly reduce the number of miles Seattleites drive, shrinking the city's carbon footprint while giving people more housing choices and access to essential components of livable communities (such as parks, plazas, sidewalks, etc.).

~20-25%
Estimated reduction in GHG emission from on-road passenger transportation by 2050 (Also enables other high-impact strategies)

In short, regardless of income, people drive less when provided with easy walk and bike access to transit, basic retail, and community services. Seattle is expected to grow by 100,000 people by 2030. Without land use policies, regulations, and development incentives that accommodate our growing population in compact, complete communities near transit, the most aggressive transportation strategies for reducing GHG emissions will fall short of meeting local targets.

1. POLICY AND PLANNING

Policies and legislation that guide land development have long-term impacts on how people travel. Transitioning from policies that assume auto-access and travel as the norm to those that promote diverse options for travel will require new laws, policies, and approaches for planning and prioritizing projects. A Transit Communities Policy and related updates to the Comprehensive Plan will align planning, zoning and public investments to support transit communities and inform neighborhood planning.

2. FLEXIBLE, PERFORMANCE BASED ZONING FOR TRANSIT COMMUNITIES

Zoning codes and development requirements often create obstacles for developers to build better developments in connected and complete communities. Creating more flexible zoning regulations that measure performance and form and providing incentives for low-trip generating development types are keys to meeting Climate Action Plan (CAP) goals.

3. INCENTIVES & OUTREACH TO ENCOURAGE CARBON-FRIENDLY BUSINESS DISTRICTS

There is opportunity to provide incentives and target outreach to encourage local businesses to support and leverage the benefits of pedestrian and bicycle access. In particular, city resources should be focused in transitional commercial districts to support retention of existing small and minority-owned businesses.

4. PARKING REFORM

Excess off-street parking (parking spaces built to code that are rarely used) reduces space for new development, increases the cost of housing and commercial space, and increases emissions from transportation. Developers should be provided with options to reduce or eliminate off-street parking for well-designed, transit-oriented development. Use of new and existing parking should be maximized at all times of day, and its physical impact on neighborhoods limited. Parking pricing can be used strategically to increase access and improve walkability in business districts.

KEY OUTCOMES

- Reduced per capita vehicle miles traveled and GHG emissions resulting from increasing the share of residents living in close proximity to retail and other essential services (and close to transit, enabling low-impact, long-distance travel within the region)
- Foundation of policies and regulations that support private investment in compact, walkable, mixed-use neighborhoods, particularly where there are high-quality transit and non-motorized transportation options
- Complete communities where most new housing units and jobs are within walking distance of transit and basic services, recreation, and cultural activities

CO-BENEFITS / SYNERGIES WITH OTHER STRATEGIES

- Improved human health due to more people using active transportation; reduced pollution and improved safety for cyclists, drivers and pedestrians
- Increased options for the type, size and location of housing for families and multi-generational households
- Improved access to and economic vitality of local retail districts; more customers within a short walk of local retailers
- Opportunities created for more compact, energy efficient buildings
- More incentives and opportunities provided for the integration of affordable housing and creation of accessible family wage jobs in complete, walkable, bicycle accessible, transit-oriented communities

OPPORTUNITIES & BARRIERS

- Educate the public about community character, vitality, and business benefits of infill development and moderate and high density urban development
- Foster compact, walkable neighborhood development, while restricting negative impacts of gentrification (displacement, housing cost increases, loss of cultural resources, etc.)
- Provide family-sized housing units and high-quality neighborhood public schools in transit communities, two key elements needed to attract a broad range of household types including families

- Protect and encourage local businesses by creating new opportunities for customer access as neighborhoods transition from auto-dependent to more transit and pedestrian oriented (e.g. target parking maximums, pricing strategies to areas already well-served by transit)
- Preserve affordable commercial space and protect industrials lands

Land Use: Policy Reform

Adopt policies to support climate-friendly communities

Policies and legislation that guide public and private land development have long-term impacts on how people travel. Historically, comprehensive planning and environmental review processes assume that single-occupant vehicle travel is the norm. Adjusting to the new norm, where people desire diverse options for travel, will require new laws, policies, and approaches for planning and prioritizing project spending.

Enabling Strategies

1.ADOPT AND IMPLEMENT A TRANSIT COMMUNITIES POLICY
Adopt a Transit Communities Policy to better align land use and investment strategies to maximize transit investments; update the Comprehensive Plan to align planning and zoning to support transit communities; use walksheds to define planning areas and inform neighborhood planning.
2. CREATE A DEVELOPMENT AUTHORITY
Create a city development authority that would partner with the private sector and use district-based funding mechanisms (i.e., tax increment finance, tax abatement, local improvement districts) to promote and shape transit communities.
3. REDUCE COST AND UNCERTAINTY OF PROJECT REVIEW IN TRANSIT COMMUNITIES
Provide categorical exemption from SEPA for projects that meet minimum criteria for density, mix of uses, and GHG reductions (advocate for authority to allow mitigation of project impacts by payment of a multimodal transportation impact fee based on estimated Vehicle Trip Generation); align planning and development review functions and reduce process time; continue to reform the design review process to ensure transit-oriented projects are provided with an expedited review timeline.

4. ESTABLISH NEIGHBORHOOD-BASED GREEN INFRASTRUCTURE GOALS	
Identify priorities for green space, shared use facilities, and green infrastructure needs on an individual neighborhood scale. Integrate these priorities into neighborhood plans and allow development of shared public spaces to meet Green Factor requirements through fee-in-lieu of options or similar.	
PILOT PROJECT	**TRANSIT COMMUNITIES POLICY** Adopt and apply to a set of neighborhoods or station areas.
LEGISLATIVE ACTION	**ADVOCATE FOR STATE LEGISLATIVE REFORM** Advocate for state legislative reforms to update the Growth Management Act to incorporate GHG reduction goals and allow tools that support Transit Community development such as inclusionary zoning, opportunities to influence housing unit size, and tax increment financing.

Land Use: Zoning Reform

Update zoning to foster complete, walkable Transit Communities

Residents of compact neighborhoods, with a mix of shops, services, and cultural, recreational and civic uses within walking distance of transit, drive less and generate less GHG emissions per capita than residents of lower-density, single-use districts. Accommodating more jobs and households in neighborhoods accessible to transit is essential for GHG emissions reduction. With an influx of nearly 100,000 new residents by 2030, investments in walking, cycling and transit infrastructure and services are needed.

Enabling Strategies

The City is developing a citywide Transit Communities Policy that will further enhance its successful Urban Village Strategy by better aligning land use and investment strategies to maximize new investments in Link light rail, RapidRide, streetcar and other modes of transit. Soon to be designated Transit Communities will allow zoning and development codes to create compact, vibrant, healthy communities with affordable housing choices that are accessible by transit and rich in the essential components of livability such as parks, open space, sidewalks, etc. Providing more flexibility in the zoning code – especially in areas with good transit access, and providing incentives for low-traffic development are keys to meeting climate protection goals.

1. INCREASE THE DIVERSITY OF HOUSING TYPES IN SINGLE-FAMILY ZONES WITHIN TRANSIT COMMUNITIES

Allow and facilitate permitting for a greater diversity of housing types (e.g. duplex, tri-plex, courtyard cottages etc.) in single family zones within Transit Community boundaries.

2. INCREASE THE DIVERSITY OF HOUSING TYPES IN MULTI-FAMILY ZONES WITHIN TRANSIT COMMUNITIES

Develop tools to foster family-sized housing and accommodations for multi-generational households in Transit Communities (e.g. provide FAR and height bonuses for three or more bedroom units etc.)

3. USE ZONING TO INCREASE AFFORDABLE HOUSING AND COMMERCIAL SPACE IN TRANSIT COMMUNITIES

Implement inclusionary zoning (requiring a share of units in a new multifamily project to be "affordable"), expanded density and height bonuses [incentive zoning], tax exemptions, and/or other tools to foster affordable housing and to preserve spaces for small businesses in commercial and/or mixed-use buildings.

4. INCREASE FLEXIBILITY IN NEIGHBORHOOD COMMERCIAL ZONES

Modify codes to foster diverse commercial activities and to preserve and promote business and job opportunities (e.g. provide height bonuses to allow leasable ground floor commercial spaces).

PILOT PROJECT

CLIMATE FRIENDLY VISUALIZATIONS

Expand the climate friendly visualization project into a neighborhood outreach program that uses visual preference testing to promote smart growth policies, zoning changes, etc.

Land Use: Incentives

Provide incentives and conduct outreach to encourage businesses to support and leverage the benefits of pedestrian and bicycle access

Enabling Strategies

Success in shifting more trips in Seattle to walking, biking, and transit will require not only quality services and facilities, but also collaborative programs that encourage changes in how neighborhoods are designed. Programs that improve the pedestrian accessibility of retail businesses and services encourage people to leave their car at home and households to operate with one less vehicle. Prioritizing underutilized rights-of-way for new pocket parks, bike parking, and/or pedestrian ways makes walking and biking more attractive and can bring more customers to local businesses.

1. PROVIDE GRANTS TO CONVERT PARKING AND OTHER AREAS TO ACTIVE USES AND BUSINESS ACCESS BY OTHER MODES

Provide small targeted investments for retailers to transition auto-oriented space to other purposes that support business access and uses (e.g. bicycle corrals, café seating etc).

2. PROMOTE THE BUSINESS BENEFITS OF PEDESTRIAN AND BICYCLE IMPROVEMENTS

Educate businesses on the increased patronage that could be achieved by improving access to local businesses by pedestrian and bicycle traffic (e.g. provide pedestrian and bicycle count data to increase awareness of the amount of non-motorized traffic passing by).

3. TARGET AND EXPAND GRANT PROGRAMS TO TRANSITIONAL COMMERCIAL CORRIDORS

Target and expand existing grant programs that support local business to commercial areas that are transitioning into complete Transit Communities.

PILOT PROJECT

CLIMATE-FRIENDLY BRAND

Create a brand and marketing program for climate friendly, transit-oriented communities.

Land Use: Parking Reform

Reform parking requirements and manage parking to maintain accessibility; encourage access by walking, cycling and public transit

Enabling Strategies

Walkable, bicycle-accessible, transit communities, with a mix-of land uses and services and well managed parking, can be accessible without over-committing valuable, limited land to parking. With measures to prevent parking congestion on streets in surrounding areas, and elimination of off-street parking requirements, parking can be developed, shared between uses, and managed efficiently to provide auto access, while encouraging travelers to arrive by walking, cycling, or transit, or to "park once" to visit multiple destinations. By reducing costs for the development of excess parking (off-street parking spaces that are built to code, but rarely used) these reforms may also reduce the cost of housing, commercial space and retail goods and services.

1. REFORM OFF-STREET PARKING REQUIREMENTS IN TRANSIT COMMUNITIES

Eliminate minimum parking space requirements and establish appropriate maximums for land uses in Transit Communities, while enacting policies to minimize spillover impacts in adjacent areas.

2. DEVELOP A NON-RESIDENTIAL PARKING SPACE TAX

Advocate for authority to levy a per space tax on off-street parking to be paid by property-owners. Pricing may be tiered to account for climate impacts based on factors such as the transit accessibility and density of the area.

3. DEVELOP PARKING BENEFIT AREAS

Consider creating parking benefit districts in areas with priced on-street parking to allow parking fees and taxes to be used for local improvements focused on enhancing access by walking, cycling and transit.

4. MINIMIZE THE IMPACT OF PARKING ON BUSINESS DISTRICT CHARACTER

Design parking to provide access to businesses without interrupting building frontage on walkable retail streets, and build shared parking structures that accommodate demand from multiple sites efficiently.

PILOT PROJECT

DEVELOP A PARKING BENEFIT DISTRICT (PBD)

Implement a PBD in a Transit Community business district with demand for on-street parking pricing

5 COMBINED IMPACTS

This section highlights a high-level assessment of combined Vehicle Miles Traveled (VMT) and Greenhouse Gas (GHG) emissions reduction impacts of coordinated implementation of the high priority strategies recommended by the Transportation and Land Use TAGs. Most of these recommended actions and strategies are related and interdependent, such that the benefits of one strategy (e.g. land use) depend in part on the implementation of others (e.g. expansion of bicycle, pedestrian, and transit facilities and services). Because of the interdependent and synergistic relationships between many of the recommended actions and strategies (quantified in Appendix C), the combined impact of full implementation of all TAG recommended actions and strategies is greater than the sum of the stand-alone impacts of each.

In most cases in this report, projections for the combined impacts of transportation and land use strategies are presented as they relate to the City's 2020, 2030, and 2050 targets for VMT reduction and GHG emissions reduction from on-road passenger transportation. It is important to note that these targets, adopted by the Seattle City Council by resolution (31312) on October 3rd, 2011, are "preliminary" targets, based on the findings of the Carbon Neutral Seattle study of the technical feasibility of reducing net GHG emissions in the City to zero by 2050. The Seattle City Council is expected to reconsider these targets based on the findings of this analysis, and the recommendations of each TAG and the City's Green Ribbon Commission (GRC) for the Seattle Climate Action Plan.

To illuminate the relative importance of key strategies—such as land use policy reform and promoting the development and adoption of low-carbon transportation fuels and energy sources— this section outlines the combined impacts of three alternative implementation scenarios:

- **Scenario A** illustrates the potential impact of implementation of all priority land use and transportation strategies.
- **Scenario B** assesses the potential impact of the strategies the City is best positioned to influence. This scenario illustrates implementation of all priority land use and transportation strategies more directly within the City's sphere of influence, while leaving out vehicle fuels and technology actions. Except transit electrification, development and deployment of new fuels and technologies at market scale depends largely on actions by the private sector and state and federal governments that are outside of the control of the City of Seattle or its regional partners.
- **Scenario C** illustrates the potential impact of foregoing implementation of the priority land use strategies by eliminating them from the analysis undertaken for Scenario B (otherwise, Scenario C is the same as Scenario B).

Figure 5-1 shows the projected total combined GHG emissions reduction impact of Scenario A—implementing all transportation and land use strategies recommended by the Transportation and Land Use TAGs (Note that the estimates of total emissions reduction for 2020, 2030, and 2050,

presented in Figure 5-1 and the following figures are based on an analysis of the combined impacts of all strategies). This figure also reveals the total metric tons and relative share of combined GHG emissions reduction each year that can be attributed to each primary strategy. Among other possibilities, this figure highlights:

- The potential long-term decline in GHG emissions from passenger transport with full implementation of TTAG and LUTAG recommendations (the gap between projected emissions and City targets declines over time)
- Carbon neutrality for on-road passenger transportation is within reach by 2050
- The relative importance of pricing strategies (both congestion and parking pricing and management) and improvements to vehicle fuels and technologies (especially the potential development and adoption of next generation biofuels and electric vehicles between 2030 and 2050)
- Near-term benefits of immediate implementation of aggressive TDM strategies, balanced by their declining share of total emissions reduction (Non-auto alternatives become more attractive and fuel/technology improvements limit the GHG emissions reduction impact of every vehicle trip avoided)

Figure 5-1 Estimated Change in GHG Emissions (Metric Tons) by Strategy, Assuming Combined Implementation of All Transportation & Land Use Strategies (Scenario A)

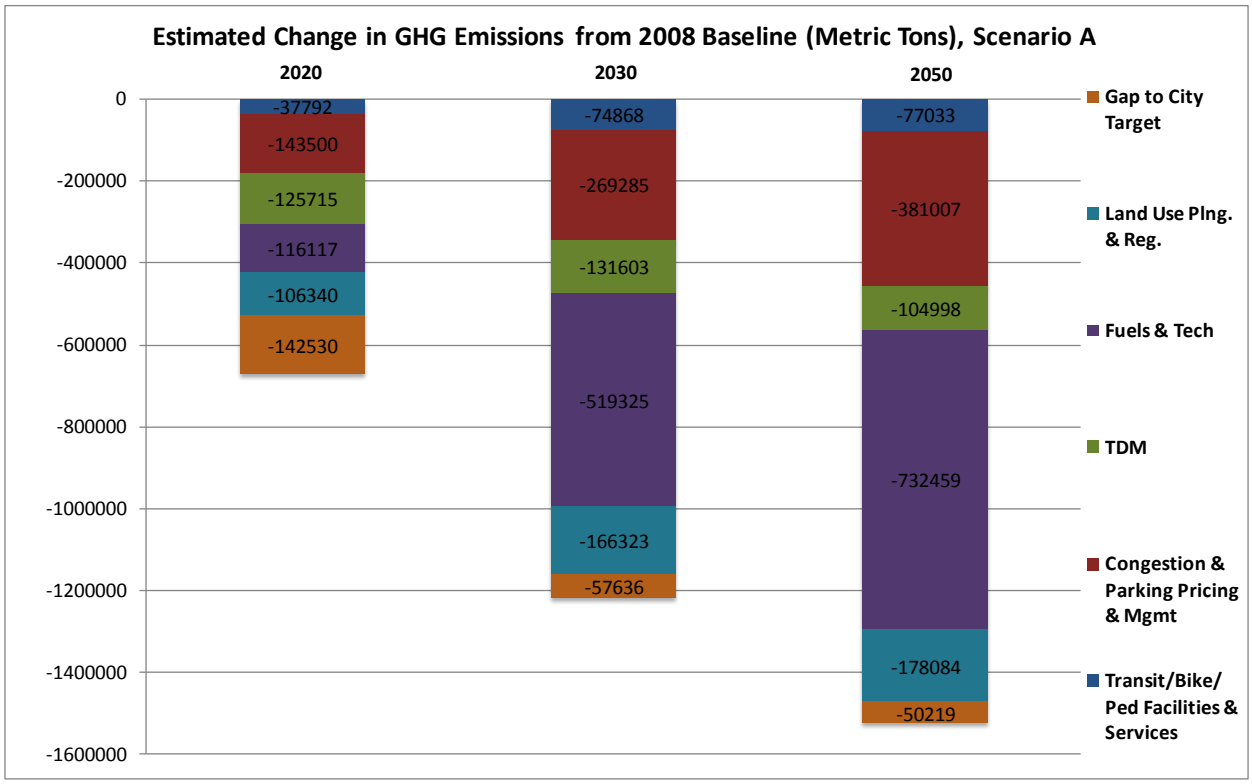


Figure 5-2 provides an overview of the differences between the three scenarios evaluated for GHG emissions reduction impact from 2020-2050[12].

Figure 5-2 Overview of Evaluation Scenarios Including Presentation of Differences in GHG Emissions from 2008 to 2050

	Scenario A	Scenario B	Scenario C
Profile	Full implementation of all recommended transportation strategies (Assumes achievement of goals estimated in Carbon Neutral Seattle report for biofuel and EV adoption). Full implementation of all recommended land use strategies	Partial implementation of all recommended transportation strategies (Includes transit electrification but assumes business-as-usual [BAU] rates of biofuel and EV adoption). Full implementation of all recommended land use strategies.	Partial implementation of all recommended transportation strategies (Includes transit electrification but assumes business-as-usual [BAU] rates of biofuel and EV adoption). No implementation of land use strategies (assumes BAU trends for land use and development through 2050).
GHGs (mt) cut from **2020 BAU**	**-36%**	**-29%**	**-23%**
GHGs (mt) cut from **2030 BAU**	**-75%**	**-50%**	**-41%**
GHGs (mt) cut from **2050 BAU**	**-96%**	**-65%**	**-56%**

As shown in Figure 5-3, implemented together, the full package of TAG recommended transportation and land use strategies would allow the City to make substantial progress towards its adopted targets, reducing total GHG emissions from on-road passenger transportation from the 2008 baseline by up to 35% by 2020, 76% by 2030 and up to 96% by 2050. Scenario A would

[12] It is important to note that the estimates provided in Figures 5-1 and 5-2, as well as all other projections of GHG emissions reduction in this report, are high-level estimates. Actual results for each individual strategy and the combinations of strategies presented in this section may vary substantially from these projections. Moreover, although the actions and strategies involving improvements to vehicle fuels and technologies (improving fuel/energy economy of the vehicle fleet and reducing the carbon intensity of vehicle fuels/energy) are projected to substantially reduce GHG emissions over time, they do not promise many of the co-benefits of the strategies that reduce VMT (e.g. pricing, parking management, TDM, and investment in transit, pedestrian and bicycle facilities and services).

reduce GHG emissions to 36% below projected business-as-usual (BAU) levels for 2020, 74% below projected BAU levels for 2030 and 96% below projected BAU levels for 2050[13].

Figure 5-3 Projected Changes in VMT and GHG Emissions from On-Road Passenger Transportation from 2008-Baseline, Scenario A vs. Preliminary City Targets

Targets and Outcomes	VMT and Emissions from On-Road Passenger Transportation	Change Relative to 2008 Baseline		
		2020	2030	2050
Preliminary City Targets	Greenhouse Gas (GHG) Emissions Per Mile	-35%	-75%	n/a
	Vehicle Miles Traveled (VMT)	-14%	-20%	n/a
Effective City Target	Total GHG Emissions from On-Road Passenger Transportation	-44%	-88%	-100%
Projected Outcome of Implementing All TAG Recommended Transportation & Land Use Strategies (Scenario A)	GHG Emissions Per Mile	-15%	-59%	-89%
	Vehicle Miles Traveled (VMT)	-24%	-43%	-71%
	Total GHG Emissions from On-Road Passenger Transportation	-35%	-76%	-97%

Combined VMT Impacts

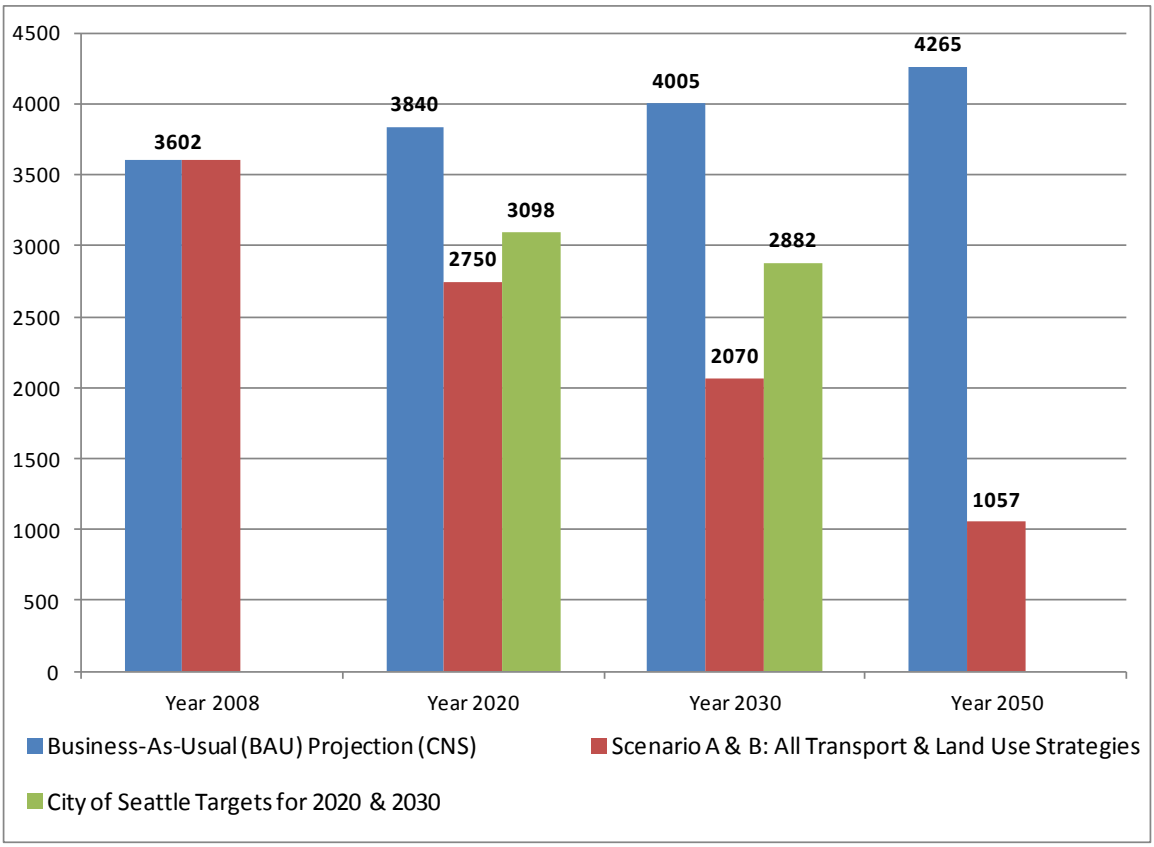
The combined implementation of transportation and land use strategies recommended in this report will result in reductions in total vehicle miles traveled (VMT) in the City that substantially exceed the preliminary targets set by the City Council in October of 2011. The City Council's preliminary targets are to reduce total VMT to 14% below 2008-levels by 2020 (3,098 million VMT), and to 20% below 2008-levels by 2030 (2,882). As shown in Figure 5-4, the implementation of all recommended transportation and land use strategies affecting VMT (Scenarios A and B both affect VMT to the same extent, only differing in the average fuel economy/energy efficiency of the vehicle fleet and the carbon intensity of vehicle fuel/energy) is projected to result in VMT reduction from 2008-levels by approximately 23% by 2020, 43% by 2030, and 71% by 2050.

The estimated percentage reduction of VMT below BAU levels is greater than the percentage reduction in GHG emissions in part because of expected baseline/BAU improvements in the fuel economy/energy efficiency of vehicles and reductions in the carbon intensity of vehicle fuels/energy. Even despite the substantial reductions in GHG per VMT projected for the BAU Scenario, the fuels and technologies strategies recommended by the TTAG represent a major share of the total potential GHG emissions reduction through 2050 (Vehicle fuel and technology

[13] Note that this is an estimate of the combined impact of recommended actions and strategies, rather than the sum of the stand-alone impacts identified in Chapter 4. For details on the methodology used for this combined impact analysis, see Chapter 3, and Appendix C.

strategies represent 22% of potential GHG emissions reduction through 2020, 45% through 2030, and 49% through 2050).

Figure 5-4 Vehicle Miles Traveled (Millions) for On-Road Passenger Transportation, Implementation of All Land Use and Transportation Strategies vs. BAU Scenario and Preliminary City Targets



Scope of Change Associated with Implementing Recommended Transportation and Land Use Strategies

Significant changes would be required to implement Scenario A and the other evaluation scenarios. For instance, Scenario A assumes that all of the projects, programs, and services recommended in the previous chapter are built, implemented, and/or delivered in a coordinated, timely, and sustained way. Successful implementation of Scenario A would require or result in the following:

- Every measure that requires significant legislative changes would be met by approval of the legislature.
- Rail lines, dedicated bus lanes and separated cycle tracks would crisscross the City by 2030 in many places, requiring the utilization of public rights of way that are currently open to general purpose traffic or parking.

- Drivers, whether from Seattle or outside the City, would pay a congestion fee to use I-5, SR-99, and other major travel corridors in the region.
- Neighborhoods surrounding every High Capacity Transit (HCT) Station and Bus Rapid Transit (BRT) corridor would be further transformed with a dense and diverse mix of commercial and housing development within walking distance.
- Significantly, it also assumes that new low-carbon fuel standards and support for the integration of electric vehicle charging stations into the fabric of the City, coordinated with aggressive national and international efforts (by both public and private sectors) to develop and bring to scale improved battery technologies. In addition, second and third generation biofuels would "pay off," as intended, resulting in substantially lower GHG emissions per mile traveled by all vehicles in the City.

These are substantial changes and are likely to be costly. Many of the key elements— such as multimodal infrastructure investments and ongoing investment in transit services and high impact TDM programs— will likely cost several orders of magnitude more than the public resources currently available for transportation by the City or its partners. As noted previously, these changes will only be possible with substantial new funding sources at the local and regional levels.[14]

These cost barriers highlight the importance of the Transportation and Land Use TAG recommended strategies, such as congestion pricing, VMT-fees, and non-residential parking taxes that offer dual benefits of generating new revenue for transportation, while directly or indirectly reducing VMT and GHG emissions.

Outcomes of Alternative Strategy Scenarios

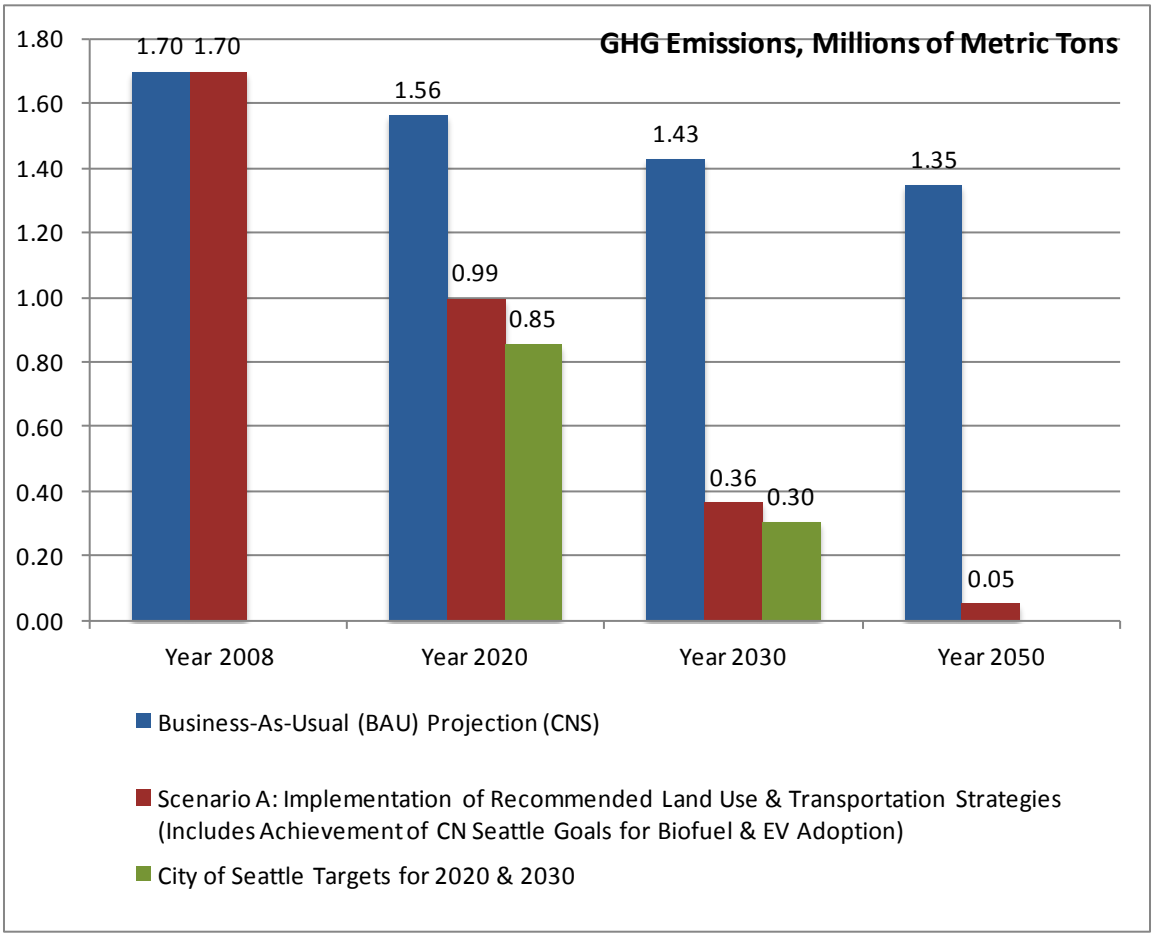
Scenario A - Full Implementation of Recommended Transportation & Land Use Strategies with Achievement of City Goals for Biofuel and EV Adoption

Figure 5-5 shows the size of the projected gap between projected GHG emissions from on-road passenger transportation for both the BAU case and Scenario A, relative to the preliminary City Council targets for 2020 and 2030. By 2030, as the major benefits of land use and fuel carbon content reductions begin to accrue, total emissions are projected to drop to 360,000 metric tons; approximately 95% of the reductions from BAU targeted for that year. By 2050, full implementation may result in total GHG emissions of only 50,000 metric tons. This amount of emissions is likely low enough for the City of Seattle to achieve its goal of net zero emissions from passenger transportation and carbon neutrality on the whole by purchasing a limited amount of GHG emissions "off-sets" or investing directly in GHG emissions reduction measures outside of the City.

These results will only be achievable through ambitious and concerted action by the City of Seattle and its partners in the public and private sector in the Central Puget Sound Region, with cooperation at the state and federal levels.

[14] Additional cost estimation was not within the scope of this project.

Figure 5-5 GHG Emissions from Passenger Transportation (On-Road), Scenario A vs. Preliminary City Council Targets and BAU Scenario



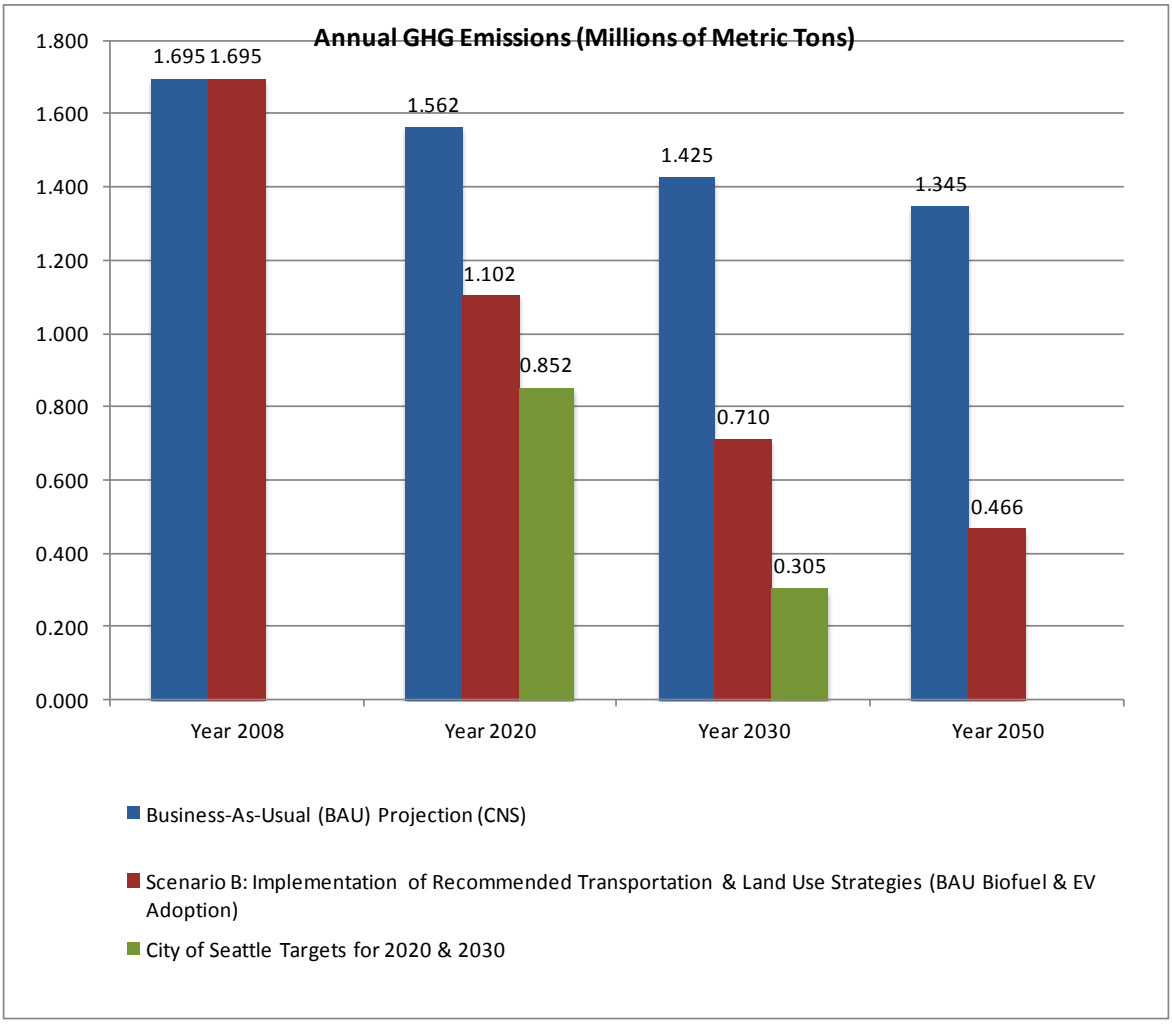
Outcomes for Partial Implementation

Scenario B - Full Implementation of Recommended Transportation and Land Use Strategies with BAU Adoption Rates for Biofuel and EV's

Scenario B assumes full implementation of all TAG recommended land use and transportation strategies (assuming BAU rates of adoption of biofuels and EV's). This scenario describes what can be achieved by the City of Seattle and regional partners, independent of national and international trends in the development and adoption of biofuels and EV's.

Figure 5-6 shows GHG emissions from passenger transportation resulting from Scenario B. For each of the three time horizons (2020, 2030, and 2050), successful implementation of the TTAG and LUTAG recommended land use and transportation actions and strategies would result in approximately two-thirds of the GHG emissions reductions from on-road passenger transportation necessary to meet the City's preliminary targets for total GHG emissions.

Figure 5-6 GHG Emissions from Passenger Transportation, Scenario B vs. City Preliminary Targets and BAU



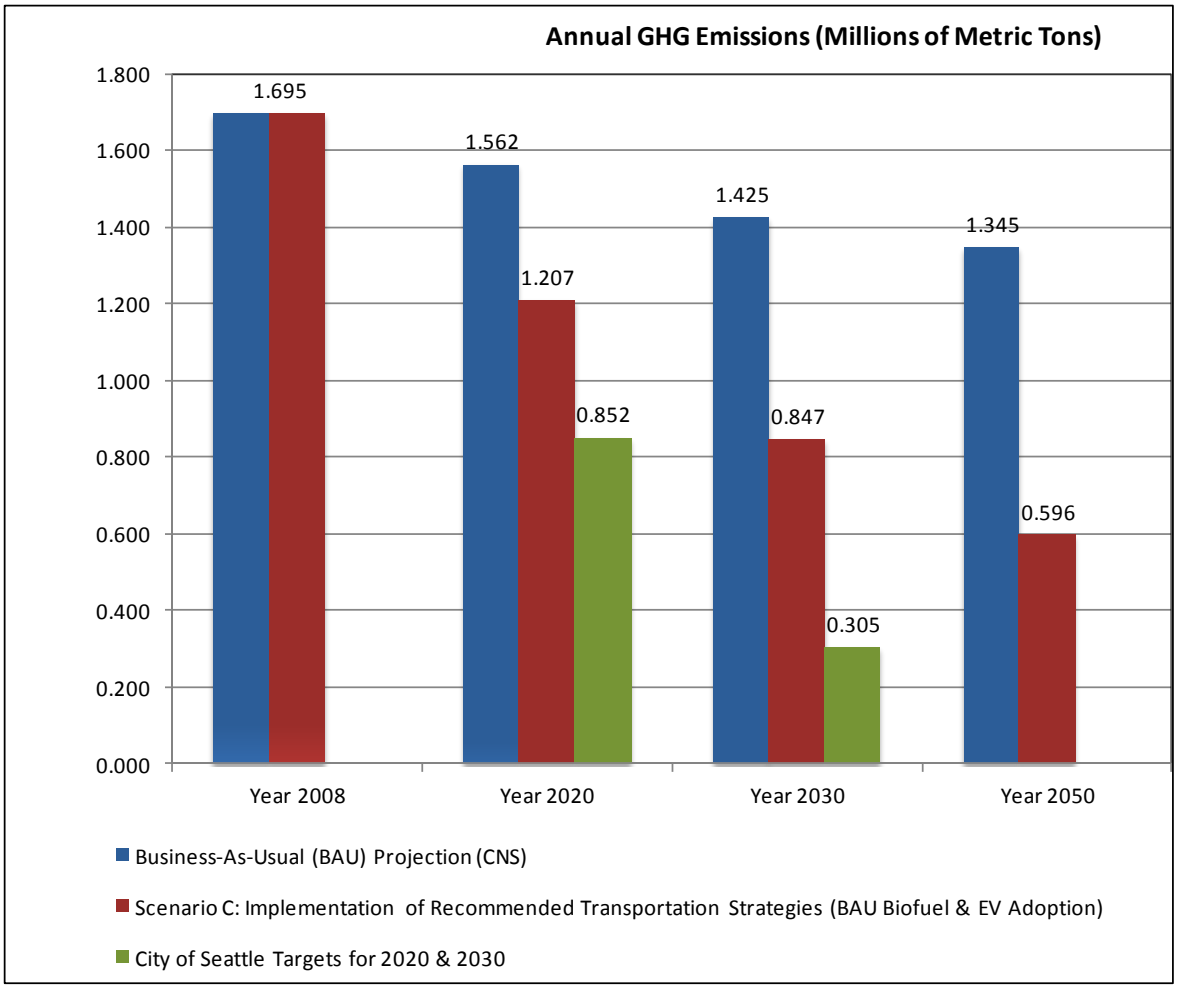
Scenario C – Recommended Transportation Strategies Only (No Implementation of Recommended Land Use Strategies) with BAU Rates of Adoption of Biofuels and Electric Vehicles

Scenario C was created to isolate the contribution of the recommended land use strategies towards GHG emissions reduction efforts by subtracting them out of this analysis of combined/cumulative impacts. A comparison with Scenario B reveals the projected impact of these recommended land use measures. The following assumptions were made in the development and analysis of Scenario C:

- Implementation of all recommendations of the Transportation TAG (with the exception of strategies related to biofuels and EV's)
- BAU rates of adoption for biofuels and EV's
- Electrification of selected King County Metro Transit bus lines in the City (a TAG recommended strategy that is not included in the BAU scenario)

Figure 5-7 shows the projected GHG emissions from passenger transportation under Scenario C, relative to adopted preliminary City targets and the BAU scenario. Implementing only selected transportation strategies, without any change from BAU assumptions for land uses, fuel/energy efficiency and carbon content, or EV adoption rates, would limit GHG emissions reductions to just over half of what is necessary to achieve City targets for 2020 and 2030.

Figure 5-7 GHG Emissions from Passenger Transportation, Scenario C (Transportation Strategies Only – No Implementation of Land Use Strategies) vs. Preliminary City Council Targets, and the BAU Scenario



6 IMPLEMENTATION OPTIONS

Potential reduction of GHG emissions from changes in the transportation sector is greatest when all strategies recommended in this report are implemented together and coordinated with supportive land use regulations. However, while the impact of some GHG reduction strategies will be higher if others are also in full effect, not all strategies can be implemented immediately given available resources or technologies. This section provides a recommended approach for phasing and implementation of the TAG recommended transportation and land use related strategies described in Section 4, as well as additional options and considerations to guide next steps. In particular, this section includes:

- guiding considerations for prioritization and implementation of recommended strategies;
- an overview and criteria for selection of pilot projects;
- a recommended phasing plan identifying priority actions for the near-, mid-, and long-term periods;
- an overview of funding and financing options; and
- a policy strategy, prioritizing key reforms for the City's legislative agenda and indentifying areas requiring collaboration with partners.

Guiding Considerations

To achieve the greatest cumulative GHG emissions reduction, the following principles for prioritization of funding for and implementation of recommended actions and strategies should be considered:

- **Emphasize the value of co-benefits:** Prioritize actions and strategies that create and provide access to walkable, diverse, and economically vital neighborhoods that reduce carbon emissions compared to conventional neighborhood form.
- **Proceed with low-cost, high-impact programs**: Invest limited resources in programs that can offer immediate/near-term emissions reduction while building support for new programs and significant reforms (e.g. expand funding for the City's successful TDM/Commute Trip Reduction programs to reach more commuters).
- **Focus on long-term cumulative impacts:** Although they may not contribute significantly to achieving year 2020 targets, early actions should be taken to develop the plans, policies and regulations that will result in long-term GHG emissions reduction. For example, the City could develop bold land use plans and regulations that support climate friendly communities, embedding GHG emissions reduction over decades.

While implementing more expensive or wide-reaching strategies such as investments in infrastructure or large-scale changes to urban development and land use patterns may not be the easiest or most cost-effective ways to reach short-range targets (2020 or 2030), new research suggests that committing to such structural reforms in the near-term is necessary to enable major

reductions in VMT and consequent GHG emissions in the long-term (e.g. 2030-2050), as necessary to reach cumulative GHG emissions reduction targets for 2050[15].

Pilot Projects

A key focus of the Transportation TAG and the Land Use TAG work was to identify, develop and prioritize a short list of pilot projects that can be implemented within a short timeframe.

Pilot projects were identified by the TTAG and LUTAG with a focus on projects that are:

- Immediately viable or viable in the short term (2012-2014)
- Have funding or a realistic opportunity for funding in the short-to mid-term
- Are politically viable
- Play a role in changing the culture around transportation and land use decision-making in the public sector and/or private marketplace
- Help to enable high-value (in terms of GHG reduction) strategies

[15] Vogt-Schilb, Adrien, and S. Hallegatte (2011). "When Starting with the Most Expensive Option Makes Sense: Use and Misuse of Marginal Abatement Cost Curves." The World Bank Sustainable Development Network, Office of the Chief Economist, *Policy Research Working Paper #5805*, September, 2011.

Figure 6-1 TAG Recommended Transportation and Land Use Pilot Projects by Strategy

Strategy	TAG Recommended Pilot Projects
Transit Facilities & Services	Support Development of Mobile Real-Time Info/ Wayfinding App(s)
Pedestrian Facilities & Services	Implement Safe Routes to Transit Program (SR2T)
Bicycle Facilities & Services	Initiate Center City Bike-Sharing Program Plan and Implement Center City Cycle Track
Parking Management & Pricing	Create Parking Benefit District(s)
Transportation Demand Management (TDM)	Develop Voluntary Neighborhood/Employer GHG Emissions Reduction Programs Support Institutional/Corporate Fleet Sharing Project
Planning & Roadway Management	Transform Public Streets into Public Spaces Initiate a Multimodal Mobility Corridor Planning Process
Land Use	Adopt a Transit Communities Policy with Comp Plan Update Expand Climate Friendly Visualization Project Create a Climate Friendly Branding and Marketing Program

Phased Priority Actions and Strategies

Consistent with the principles defined in the previous section (Guiding Considerations) and findings of the analysis presented in detail in Appendix C, the following table (Figure 6-2) presents an option developed by Nelson/Nygaard for phased implementation of selected transportation and land use strategies recommended by the Transportation TAG and the Land Use TAG.

Figure 6-2 Phasing of Selected TTAG and LUTAG Recommended Actions for Reducing GHG Emissions from On-Road Passenger Transportation

Phase	Implementation Actions
Phase I - Immediate Action (2012-2014)	Seek grant funding and dedicate a share of available resources to fund TTAG and LUTAG recommended pilot projects. **Congestion Pricing/ Parking Pricing & Management / Funding** ▪ Initiate study of local benefits (including funding potential) and impacts of implementing regional road congestion pricing. ▪ Complete Seattle Paid Parking Study and expand parking data collection to unmetered areas near Urban Villages / Transit Communities. **Pedestrian, Bicycle and Transit Facilities & Services** ▪ Complete the Bicycle Master Plan Update, incorporating detailed plans and viable funding mechanisms for TTAG recommended bicycle facilities & services. (Greenways, Cycle Tracks, Intersection/Signal Improvements, etc.). ▪ Complete implementation of one high priority Neighborhood Greenway corridor in each quadrant of the City. ▪ Safe Routes to Schools (SR2S): Expand funding for; scope of Safe Routes to Schools (prioritizing capital improvements for next available City funding [e.g. BTGII, STB VLF, etc.). ▪ ***Pilot Project:*** Initiate Safe Routes to Transit Program (SR2T) ▪ ***Pilot Project:*** Support development and operation of mobile information application(s) for real-time multimodal access, mobility and wayfinding information **Parking Management & Pricing** ▪ Complete the Seattle Paid Parking Study and begin implementing study recommendations, (e.g. expanding areas subject to paid on-street parking and increasing parking fees in selected locations based on demand). ▪ Reform off-street parking requirements by expanding areas exempt from minimum parking requirements and evaluating options for requiring separation of parking from commercial/residential lease and sale agreements (unbundling requirement). **Planning, Roadway Management & Goods Movement** ▪ Seek funding for and initiate a Freight Master Plan with guidance to achieve Council targets for VMT and GHG emissions reduction from freight transportation. **Funding** ▪ Seek voter approval of additional Vehicle License Fees, with revenue dedicated to local transportation system maintenance and operations, and specific TTAG recommended/ SDOT defined pedestrian, bicycle, and transit improvement projects. **Fuels & Technologies** ▪ Expand the activities of the City's Plug-in-Ready project, and aggressively promote the reforms and initiatives involved to other cities and regions to spur further innovation and adoption of EV's. **Land Use Planning & Regulation** ▪ Adopt high priority regulatory reform measures, including expanding the geographic areas and specific land use designations that are exempt from minimum off-street parking requirements. ▪ Initiate and complete a Seattle Comprehensive Plan update that defines the boundaries of "Urban Villages"/ "Transit Communities," and incorporates LUTAG recommended Land Use Strategies. ▪ ***Pilot Project:*** Adopt a Transit Communities Policy associated with the Seattle Comprehensive Plan Update and apply such policy to encourage land uses that are supportive of walking, cycling and transit in selected neighborhoods / transit station areas. ▪ ***Pilot Project:*** Expand the Climate Friendly Visualization Project into a neighborhood

Phase	Implementation Actions
	outreach program that uses visual preference testing to promote smart growth policies, zoning changes, etc. ▪ ***Pilot Project:*** Create a Climate Friendly Branding and marketing program to promote the climate protection benefits and co-benefits of climate friendly, transit-oriented communities in the City of Seattle. **Transportation Demand Management** ▪ Continue and expand implementation of TTAG recommended TDM and CTR strategies that the City and King County are currently sponsoring (e.g. expanding the reach of King County's successful vanpool program; King County In-Motion, and Seattle Way-to-Go), and support new initiatives of Commute Seattle. ▪ Collaborate with King County Metro and Sound Transit to conduct an evaluation of the market for expanding ORCA Passport sales to smaller employers and developing an ORCA Neighborhood Passport program ▪ ***Pilot Project:*** Voluntary GHG Emissions Reduction Program: Pilot a voluntary Transportation GHG Emissions Reduction Program for employers or neighborhood organizations. ▪ ***Pilot Project:*** Fleet Sharing: Support a major institutional/corporate fleet sharing pilot project (sharing fleet vehicles outside of business hours, or contracting with a carsharing service for business/organizational mobility services). Pilot with one major institution/organization. **Advocate legislation to:** ○ Adopt an appropriate low-carbon fuel standard for Washington State ○ Authorize congestion pricing with local revenue return and flexibility for expenditure on transportation projects and services (including non-road and non-motorized). ○ Authorize a local option non-residential parking space tax ○ Authorize a flexible, local option vehicle pollution tax (VMT fee, or VMT-based Vehicle License Fee (VLF)). ○ Authorize a ○ Seek funding for projects, programs and additional planning (e.g. for conducting a Freight Master Plan (FMP) and/or for HCT design).
Phase II – Near-term Actions (2015-2020)	**Land Use Planning & Regulation** ▪ Establish a Transit Communities Development Authority to support implementation of LUTAG recommended land use strategies (elements of the Seattle Comprehensive Plan Update). **Funding** ▪ Seek voter approval to renew the Bridging the Gap Levy (2015), with revenue prioritized to fund TTAG recommended/ SDOT defined pedestrian, bicycle and transit projects and services. ▪ Commission a Nexus Study for a Multimodal Transportation Impact Fee based on adjusted Vehicle Trip Generation Rates (permitting payment of a per trip fee as mitigation for impacts that might otherwise trigger SEPA review). **Pedestrian, Bicycle & Transit Facilities & Services** ▪ Finalize planning and design for and begin construction of initial HCT and Transit Priority Corridor enhancement projects specified in the TMP (Analysis assumes completion of one HCT corridor and six Transit Priority Corridors by 2020 [timeline requires local, regional, or state funding]). ▪ Develop City-wide network of Neighborhood Greenways integrated with the regional trail and on-street bicycle facility networks; plan, design and begin implementation of associated intersection/crossing improvements. ▪ Begin planning for network of Cycle Tracks and related improvements to arterial corridors and crossings. ▪ Work with Sound Transit to initiate planning for long-term local and regional High

Phase	Implementation Actions
	Capacity Transit (HCT), and transit priority improvements. ▪ Expand transit service by up to 50% from 2010 baseline. ▪ ***Pilot Project***: Initiate a full-scale bike share program in the Center City, and nearby Urban Centers/ Villages (building on previous pilot projects). ▪ ***Pilot Project:*** Plan and complete implementation of at least one Center City Cycle Track (in addition to Broadway Cycle Track under development with the First Hill Streetcar project). ▪ ***Pilot Project:*** Streets to public spaces project: Transform public right of way to pedestrianized spaces, parklets, and/or public plazas (pilot one project in each Urban Village citywide). **Parking Management & Pricing** ▪ Seek private sector partners and state / federal grant funding to substantially expand the City's e-Park program to provide mobile and on-site real-time information on off-street parking availability in more areas (in congested parts of the Center City and Urban Centers). ▪ With State authorization, implement tax on non-residential off-street parking tax ▪ ***Pilot Project:*** Adopt legislation to enable creation of Parking Benefit Districts in a Transit Community/ Urban Village business district with demand for on-street parking pricing. **Planning, Road Management and Goods Movement** ▪ ***Pilot Project:*** Mobility Corridor Planning: Develop and implement a complete land use and multimodal mobility corridor plan in a high priority transit / bicycle corridor (Consider one of the HCT corridors identified in the Seattle TMP). **Fuels & Technologies** ▪ Plan and implement the conversion of King County Metro Route 48 into a low-carbon emitting Electric Trolley Bus line. ▪ Create incentives for transition to next generation biofuels. **Congestion and Parking Pricing & Management** ▪ With state authorization, begin first phase of regional congestion pricing program implementation, with tolls on additional corridors, such as I-90, SR-99, and the I-5 express lanes. **Funding** ▪ With State authorization, assess a local option Motor Vehicle Excise Tax (MVET) to fund transportation projects and services ▪ With State legislative authorization, assess a local option VMT tax, or VMT-based Vehicle License Fee (VLF) to fund transportation projects and services.
Phase III – Mid-term Actions (2021-2030)	**Congestion and Parking Pricing & Management** ▪ Proceed with implementation of system and region-wide congestion pricing, with variable automatic tolls levied on all limited access highway segments in the Central Puget Sound Region. **Pedestrian, Bicycle & Transit Facilities & Services** ▪ Complete build out of bicycle and pedestrian facilities and services called for in the Bicycle Master Plan (BMP) Update (including Citywide Greenways and Cycle Tracks networks) and the Pedestrian Master Plan (PMP) (including Complete Pedestrian Network within ½ Mile of all Schools, HCT and BRT Stations, Urban Centers, Urban Villages, and Hub Urban Villages). ▪ Continue build out of the Citywide HCT network with completion of two to four of the HCT corridors identified in the Seattle TMP. ▪ Complete implementation of up to 12 Transit Priority Corridors identified in the Seattle TMP. ▪ Increase transit service in the City of Seattle by 150% from 2010 baseline. **Land Use Planning & Regulation**

Phase	Implementation Actions
	▪ Reduce the legal maximum number of off-street parking spaces that can be provided in Urban Centers/Villages and/or Transit Communities incrementally over time to reduce traffic in developing Centers and Business Districts. ▪ Evaluate development performance and market trends relative to the requirements and guidance of the Seattle Comprehensive Plan and the Zoning Code. Update both the Comp Plan and the Zoning Ordinance to ensure that Seattle continues to attract a large share of regional growth, development and opportunities, consistent with market preferences. ▪ Consider options for appropriate geographic expansion of Urban Villages, Urban Centers and Transit Communities in the City of Seattle to accommodate new growth and development in with a low-carbon footprint. **Fuels & Technologies** ▪ Convert at least 2/3 of all King County Metro arterial transit line miles within the City of Seattle electric trolley bus (ETB) service.
Phase IV – Long-term (2030-2050)	**Pedestrian, Bicycle and Transit Facilities & Services** ▪ Complete build out of the Citywide HCT network, converting all remaining bus based Priority Transit Corridors into HCT lines by 2050 (14-16 HCT lines in all), while extending Transit Bus Priority treatments to all remaining frequent service bus lines (est. 12 additional corridors). ▪ Increase transit service in the City of Seattle by 250% from 2010 baseline. ▪ Complete all missing gaps in the Citywide pedestrian facilities network with provision of sidewalks or sidepaths on all streets, except where infeasible for technical reasons (includes filling major gaps in the sidewalk network in the far north end and far south end (southeast and southwest) in areas not addressed in earlier efforts because they are not located within one half mile of HCT/BRT Stations, schools, Urban Villages, or other priority pedestrian investment areas. **Congestion & Parking Pricing & Management** ▪ Expand congestion pricing to cover major state highways and arterial roadways (e.g. SR-522 Lake City Way) in addition to all limited-access highways in the region (e.g. I-5, I-405, SR-520, etc). Adjust VMT fees and congestion pricing tolls; increasing per mile rates incrementally over time with the explicit purpose of meeting State VMT and GHG emissions reduction targets. **Fuels & Technologies** ▪ Convert all remaining King County Metro Transit arterial route line miles to electric trolley bus service (or other zero emissions fuel/energy source). ▪ Achieve 80% adoption of EV's for automobile passenger transportation by 2050; with 100% utilization of next generation biofuels by all remaining internal combustion vehicles.

Funding Strategy

Implementing the strategies recommended in this report over a period of time sufficient to achieve City GHG emissions targets will require a strategic approach to securing ongoing funding. In particular, this goal requires developing funding and financing measures that can withstand political oscillations over the extended implementation timeframe. A high-level overview and evaluation of Transportation TAG recommended funding options is provided in Figure 6-2.

Figure 6-1 Transportation TAG Recommended Funding Options

Funding Option	Estimated Annual Revenue Potential (Millions (M) $, 2012)	Direct VMT Reduction Potential	Requires Legislative Changes	Notes
Regional Congestion Pricing	$1,900 m - $6,100 m[16] *(regionwide)*	Very High	✓	To fund recommended City-led actions in this plan, funding should be returned to local jurisdictions and eligible for expenditure on walking, cycling, and transit facilities and services (including TDM). Consideration should be give to pricing levels set and adjusted to maximize GHG reductions.
Motor Vehicle Excise Tax	$20-$30 m[17]	Low	✓	Near-term funding option; Legislative approval would be required to vary MVET rate based on the estimated life-cycle GHG emissions of each vehicle.
Bridging the Gap Levy Renewal	$30-$40 m[18]	None		Funding from property taxes and other local sources. Current levy expires in 2015. Offers best revenue potential for high priority actions. For GHG reduction purposes, prioritize allocation of revenue to pedestrian, bicycle, and transit investments.
Transit Communities Development Authority	$150-$250 m[19]	None	*	City may establish an entity responsible for implementation of planned improvements in Urban Villages. Supports land use strategies. May be eligible for multiple funding sources. Legislative authorization required to use Tax Increment Financing (TIF).

[16] Tolling of all limited access highways in the Central Puget Sound Region projected to generate $1.9 billion/year. Comprehensive regional tolling of all limited access highways and major arterials projected to generate $6.1 billion/year, regionwide (PSRC).

[17] Assumes the MVET is levied citywide at the same rate and schedule collected by the Seattle Monorail Authority from 2002-2006, generating approximately $25 m/ year (Note: this revenue stream was approximately 30% less than projected by the Elevated Transportation Company, resulting in the dissolution of the SMA in January 2008).

[18] Current BTG levy was initially projected to raise $365 m over 9 years.

[19] For Reference, the Portland Development Commission had revenue of $188 m in 2010.

Funding Option	Estimated Annual Revenue Potential (Millions (M) $, 2012)	Direct VMT Reduction Potential	Requires Legislative Changes	Notes
Expanded Public Parking Pricing	$10-100 m[20]	Moderate		Includes expanding areas subject to on-street meter & permit parking pricing where demand warrants, as well as expanded pricing of publicly-owned off-street parking facilities.
Off-Street Parking Space Tax	$40-$265 m[21]	Moderate	✓	Legislative authority would be needed to levy a per-space tax on all public and private off-street parking (May substitute for commercial parking tax; may be limited to non-residential parking).
Vehicle License Fee	$25-$30 m[22]	Low	*	Seattle TBD authorized to levy an additional $80 per year VLF with voter approval. With legislative changes, fee may vary based on vehicle fuel efficiency; estimated life-cycle emissions. (*Legislative changes required to permit variable fee.)
Vehicle Miles Traveled (VMT) Fee	$180 m (at $0.05/mile) to $380 m (at $0.10/mile)	High	✓	Revenues should be eligible for expenditure on walking, cycling, and transit facilities and services (including TDM); though regularly monitoring/checking VMT is an implementation challenge.

[20] Top revenue generation estimate based on PSRC estimate of potential revenue generation from "Area parking pricing," as cited in: Final Seattle Tolling Study Report, Table 3-1, "Destination 2030 Tolling Concepts Modeling Summary Results."

[21] Low-end of revenue generation estimate based on Litman, T., and D. Carlson (2010), Evaluating Seattle Parking Tax Options, Victoria: Victoria Transportation Policy Institute (rate of approx. $47/stall per year). High-end estimate based on current rates in Sydney Australia, which levies an annual tax of $800 AU ($850 USD) per stall for non-residential parking in the Central Business District, and $400 AU ($425 USD) per stall for non-residential parking in neighborhood business districts. Applying the lower of the two rates to Litman's mid-point estimate of the total number of non-residential off-street stalls in Seattle, we estimate a high-end revenue generation potential of $265 m/year.

[22] The STBD has state authority to levy up to $80 VLF (which would generate approximately $27m/year). The City or STBD may seek additional authority to raise fees above $80/year.

Funding Option	Estimated Annual Revenue Potential (Millions (M) $, 2012)	Direct VMT Reduction Potential	Requires Legislative Changes	Notes
Vehicle Trip Generation (VTG) Fee	TBD based on nexus study	High	✓	Assess a multimodal transportation impact fee on new development based on estimated Vehicle Trip Generation (VTG), as an alternative to environmental review of infill development /TOD projects. (Fee revenue to be invested in multimodal transportation improvements that fully mitigate impacts).

One key to garnering community and political support for funding – especially for new revenue sources – is to develop and implement revenue mechanisms that include local benefit/control elements and display a clear nexus with user benefits. Funding measures that fall in this category of "user fees" include parking fees, a Vehicle Miles Traveled (VMT)/carbon pollution tax, and regional congestion pricing. Developing any new user fee or increasing tax increments to support proposed projects and initiatives will be challenging, so fees based primarily on the mitigation of clearly identified negative impacts of transportation and site access (e.g. Vehicle Trip Generation fees and fees and parking space taxes) may be more viable in the near-term because of their direct nexus to impacts.

Legislative Agenda

To increase the viability of implementation, both the Transportation TAG and the Land Use TAG focused on actions that the City of Seattle could implement directly with its existing authority. Nevertheless, many of the high-impact actions and strategies recommended by the two TAGs require state legislative changes and/or direct collaboration with partners in the private and public sectors, including transit agencies (King County Metro and Sound Transit) and other local, regional, and state agencies and governments. This section provides an overview of the key state legislative changes necessary for the City of Seattle and its local and regional partners to implement and realize the benefits of many of the actions and strategies recommended in this report. The following measures are not presented in order of priority:

- **Authorize a flexible, local option Motor Vehicle Excise Tax (MVET).** MVET revenues should be eligible for expenditure on walking, cycling and/or transit facilities and services (including TDM).
- **Adopt a Low-Carbon Fuel Standard:** Adopt an appropriate statewide low-carbon fuel standard consistent with City Council targets for emissions from passenger and freight transport in 2020 and 2030, and the achievement of net zero GHG emissions by 2050.
- **Authorize congestion pricing on existing state and federal highways with flexible use of revenues:** To fund recommended City-led actions in this plan, funding

should be returned to local jurisdictions and eligible for expenditure on walking, cycling, and transit facilities and services (including TDM). Toll rates should be set and adjusted as necessary to maximize GHG reductions (among other goals).

- **Amend the State Growth Management Act (GMA) to support development of low-carbon, transit accessible communities:** Incorporate GHG emissions reduction goals in GMA (Chapter 36.70A RCW), and authorize local government tools for transit community development, such as inclusionary zoning, and housing unit size requirements.
- **Authorize a regional or local-option Vehicle Miles Traveled (VMT) fee:** Revenues should be eligible for expenditure on walking, cycling, and transit facilities and services (including TDM); though regularly monitoring/checking VMT is an implementation challenge.
- **Authorize local governments to levy a non-residential parking space tax:** This tax may be authorized and/or levied in-lieu of the existing state authorized commercial parking tax. Ensure flexibility to spend revenues on walking, cycling and transit facilities and services (including TDM).
- **Authorize variable VLF:** Amend Transportation Benefit District authorizing legislation to permit local jurisdictions to vary Vehicle License Fee (VLF) based on VMT or estimated GHG emissions.
- **Authorize local governments to create Transit Communities Development Authorities (TCDA's) with TIF authority:** With authority to utilize Tax Increment Financing (TIF), local or regional Development Authorities can support implementation of selected Comprehensive Plan provisions, consistent with the State Growth Management Act (Chapter 36.70A RCW).

A local road to pricing

Developing a viable path to implementation is a particular challenge to achieving the VMT/GHG emissions reduction benefits of road congestion pricing (automatic tolling based on actual traffic conditions, with higher prices during periods of peak congestion). Legislative changes are necessary to authorize region-wide tolling and to expand the potential uses of tolling revenue.

One approach to potential political barriers to such reforms is to develop a local benefit plan, wherein a substantial portion of toll revenues will be allocated to local governments of jurisdictions through which toll roads pass. While a share of revenues would be retained by the state for facility operations maintenance, including long-term rehabilitation, the local toll revenue allocations could be directed by a range of different priorities specific to each jurisdiction. For example, the City of Seattle might opt to use its share of revenues to fund selected strategies in this plan.

As a first step toward this goal, the City and/or one of its partners could initiate or sponsor a study identifying specific local transportation projects and initiatives that would be supported by congestion pricing revenues. Providing a clear vision of local benefits would provide a model for other local jurisdictions and help build a regional coalition of support for congestion pricing and the legislative changes required to put it into motion.

Appendix A

Transportation Strategy Evaluation Matrix

DRAFT Evaluation of Strategic Initiatives to Facilitate Walking, Bicycling and Riding (WBR)

Seattle Transportation GHG Emissions Reduction Action Plan, City of Seattle Office of Sustainability & Environment (Feb 2012)

Strategy	Short-Term Actions (by 2020)	Pilot Project Viability (L/M/H)	2020 GHG Emissions Reduction Potential (L/M/H)	Mid-Term Actions (by 2030/2035)	2030 GHG Emissions Reduction Potential (L/M/H)	Long-Term Actions (by 2050)	2050 GHG Emissions Reduction Potential (L/M/H)	Outcomes *High Contribution to Outcome*	Guiding Considerations *High Positive Benefit*	Lead Agency	Cost-Effectiveness *(Based on Cost/ ton GHGE reduced (2030))*	Overall Priority (1,2,3)
Increase Complete-ness, Quality, and Comprehen siveness of Pedestrian Network	Expand Sidewalks/Paths: Priority Improvements for Safe-Routes-To Schools	L	L[23]	Complete Pedestrian Network within ½ Mile of all Schools (Sidewalks or Sidepaths on all City Streets and Arterial Roadways; Bulb-outs and countdown signals at all arterial intersections)	M[24]	Complete Citywide Pedestrian Facility Network (Sidewalks or Sidepaths, Curb ramps on all City Streets and Arterial Roadways)	M[25]	Safe Movement of People Consistent with TSP/ Transport Hierarchy Maximizes Access Enhances Connectivity	Enhances Positive Impacts of Other Strategies (Transit Oriented Communities, Transit Expansion, etc.) Fosters active lifestyles	COS	M[26]	2
	Expand Sidewalks/Paths: Priority Improvements for Access to Transit	L		Complete Pedestrian Network within ½ Mile of all HCT and BRT Stations; ¼ Mile of all Frequent Transit Stops (Sidewalks or Sidepaths on all City Streets and Arterial Roadways; Bulb-outs and countdown signals at all arterial intersections)								
	Expand Sidewalks/Paths: Priority Improvements for Access to/within Centers/ Neighborhood Business Districts	L		Complete Pedestrian Network within ½ Mile of all Urban Centers, Urban Villages, and Hub Urban Villages (Sidewalks or Sidepaths on all City Streets and Arterial Roadways; Bulb-outs and countdown signals at all arterial intersections)								
	Complete Streets + Traffic Calming for all New Developments / Street Upgrades	L		Complete Streets + Traffic Calming for all New Developments / Street Upgrades				Safe Movement of People Consistent with TSP/ Transport Hierarchy Maximizes Access Enhances Connectivity	Enhances Positive Impacts of Other Strategies (Transit Oriented Communities, Transit Expansion, etc.) Fosters active lifestyles	COS		3[27]

[23] Near-term (2020) GHGe Reduction Potential adjusted from estimate for 2030, published for the Strategy "Accelerate Implementation of Pedestrian Master Plan (PMP); Expand Pedestrian Facilities Beyond PMP" on page 29 of the Transportation TAG Draft White Paper #1, Transportation Strategy Assessment (Oct. 2011)
[24] For methods and results of GHG e Reduction Analysis, see: "Accelerate Implementation of Pedestrian Master Plan (PMP); Expand Pedestrian Facilities Beyond PMP" on page 29 of the Transportation TAG Draft White Paper #1, Transportation Strategy Assessment (Oct. 2011)
[25] An additional 1% mode shift to walking can be expected by 2050 based on this action, resulting in a GHGe reduction of an additional 2,850 metric tons of GHGe (Source: Carbon Neutral Seattle Report)
[26] Estimated annual cost of $7,700 per ton of GHGe removed (Based on estimated cost to implement 150% of Tier 1 projects identified in the Pedestrian Master Plan (e.g. constructing 50% more sidewalk segments and crossing improvements than called for in the Tier 1 elements of the adopted PMP), annualized over a 20-year implementation period (2011-2031).
[27] This strategy would qualify as a "1," or a top priority strategy, according to screens 1 and 2, but its GhGE reduction impact is not high enough to qualify as a stand-alone, top tier strategy.

Strategy	Short-Term Actions (by 2020)	Pilot Project Viability (L/M/H)	2020 GHG Emissions Reduction Potential (L/M/H)	Mid-Term Actions (by 2030/2035)	2030 GHG Emissions Reduction Potential (L/M/H)	Long-Term Actions (by 2050)	2050 GHG Emissions Reduction Potential (L/M/H)	Outcomes *High Contribution to Outcome*	Guiding Considerations *High Positive Benefit*	Lead Agency	Cost-Effectiveness *(Based on Cost/ ton GHGE reduced (2030))*	Overall Priority (1,2,3)
	Improve Condition of Existing Sidewalks and Crossings in Areas with High Pedestrian Traffic (Includes Implementing ADA Compliant Ramps)	L	L[28]	Complete installation of new ADA Compliant Curb Ramps in all Urban Centers, Urban Villages & Hub Urban Villages	M[29]			Promotes Social Justice Enhances Connectivity	Enhances Positive Impact of Other Strategies (Transit Oriented Communities, Transit Expansion, Etc.) Fosters active lifestyles	COS		3
	Widen Existing Sidewalks and Improve Crossings in Selected Areas with High Pedestrian Traffic (May Require removing some On-Street Parking and/or Travel Lanes)	M		Widen Existing Sidewalks in Selected Areas with High Pedestrian Traffic and/or Planned Pedestrian Priority Corridors (May Require removing some On-Street Parking and/or Travel Lanes)				Consistent with TSP/ Transport Hierarchy Maximizes Access	Enhances Positive Impact of Other Strategies (Transit Oriented Communities, Transit Expansion, Etc.) Fosters active lifestyles	COS		2
Increase Supply of Transit, Improve Transit Quality and Convenience	Implement High Capacity Transit in 2 Highest Priority Transit Corridors in TMP	L	L[30]	Implement HCT in remaining 3 corridors identified in the TMP	M[31]	Build Out TMP Long Range HCT Vision Plan	M	Safe movement of people Consistent with TSP and Transportation Hierarchy Enhances Access Fosters dense transit-oriented communities (TOC) Enhances Connectivity	Catalyst for High Long-Term Benefit Enhances Positive Impact of other Strategic Actions Reduces Barriers to Implementation of other Strategic Actions: Essential to Enable Long-Term GHGe Reduction Benefits of Land Use and Pricing Strategies. Improves personal mobility and access	COS, ST, KCM	L	2
	Develop Center City Transit Circulation System (Enhanced Transit on 1s Ave, Pike/Pine, Seneca/Spring, and Jackson/Yesler Corridors)	L		Upgrade Full Center City Transit System to Rail or Bus in Fully Dedicated Lanes (Increased Service Frequency); Add up to Four New Priority Enhanced Transit Routes to Center City Circulation System.	L[32]	Upgrade All Center City HCT and Circulation Corridors in the Center City and Adjacent Neighborhoods to HCT in Fully Segregated Rights of Way (e.g. Subway)	L[33]			COS, ST, KCM		

[28] Near-term (2020) GHGe Reduction Potential adjusted from estimate for 2030, published for the Strategy "Accelerate Implementation of Pedestrian Master Plan (PMP); Expand Pedestrian Facilities Beyond PMP" on page 29 of the Transportation TAG Draft White Paper #1, Transportation Strategy Assessment (Oct. 2011)
[29] For methods and results of GHG e Reduction Analysis, see: "Accelerate Implementation of Pedestrian Master Plan (PMP); Expand Pedestrian Facilities Beyond PMP" on page 29 of the Transportation TAG Draft White Paper #1, Transportation Strategy Assessment (Oct. 2011)
[30] Assumes annual reduction of 120 metric tons of GHG emissions through 2030, resulting from mode shift associated with approximately 560 net new daily transit trips on these priority Center City Circulation Corridors (Accounts for increased GHG emissions from transit)
[31] For methods and results of GHGe Reduction Analysis, see: "Implementation of HCT in 5 High Priority Corridors," on page 25 of the Transportation TAG Draft White Paper #1, Transportation Strategy Assessment (Oct. 2011)
[32] Assumes annual reduction of 120 metric tons of GHG emissions through 2030, resulting from mode shift associated with approximately 560 net new daily transit trips on these priority Center City Circulation Corridors (Accounts for increased GHG emissions from transit)
[33] Scale of change in transit ridership (from base of 500+ trips/day on selected Center City circulator routes) is not large enough to push GHG Emissions reduction above 5,000 Metric Tons per year (the threshold for consideration as a "Medium Impact" Strategy).

Strategy	Short-Term Actions (by 2020)	Pilot Project Viability (L/M/H)	2020 GHG Emissions Reduction Potential (L/M/H)	Mid-Term Actions (by 2030/2035)	2030 GHG Emissions Reduction Potential (L/M/H)	Long-Term Actions (by 2050)	2050 GHG Emissions Reduction Potential (L/M/H)	Outcomes *High Contribution to Outcome*	Guiding Considerations *High Positive Benefit*	Lead Agency	Cost-Effectiveness *(Based on Cost/ ton GHGE reduced (2030))*	Overall Priority (1,2,3)
	Implement Bus Priority Treatments in 6 Highest Priority Transit Corridors in TMP	L	L[34]	Implement bus priority treatments in 6-8 more priority transit corridors	M[35]	Entire City within ¼ Mile Walk of Frequent Transit Network Corridor	M		Enhances Positive Impact of other Strategic Actions Reduces Barriers to Implementation of other Strategic Actions Improve personal mobility and access	KCM, COS	L	2[36]
	Invest in Transit Facilities to Selected High Ridership Routes Outside of Priority Frequent Transit Network (e.g. Add Shelters, Bulb-outs, Real-Time Transit Information)	L	L	Provide advanced transit terminal facilities (Shelters, Stops, Real-Time Information, etc.) associated with all transit stops citywide		TBD	TBD		Enhances Positive Impact of Other Strategic Actions (Esp. TOC Development and Transit Expansion)	KCM, COS		3
	Develop, Implement and Fund Transit Station Access and Wayfinding Standards and Strategy (All Rail Stations)	H	Indirect	Implement at all Rail and Frequent Bus Stations	Indirect	Implement System Wide	Indirect	Enhances Connectivity	Enhances Positive Impact of Other Strategies (TOC Development, Transit Expansion) Reduces Barriers to Other Strategies	KCM, COS	N/A	3
	Add Transit Service to Existing High Demand Routes (50% increase in Service Hours over 2011 base on Selected Routes)	L	H[37]	Add Transit Service to Existing High Demand Routes (100% Increase in Service Hours)	H[38]			Maximizes Person Access Promotes Social Justice	Enhances Positive Impact of Other Strategies (TOC Development; Transit Capital Expansion, etc)	KCM, COS	L	1

[34] Estimated GHG emissions reduction of approximately 3,800 Metric Tons per year for implementation of priority treatments in 6 corridors (See "Implement Bus Priority Treatments in 12 Priority Corridors," on page 26 of the Transportation TAG Draft White Paper #1, Transportation Strategy Assessment (Oct. 2011)
[35] Full implementation of bus priority treatments in 12 TMP corridors by 2030 is estimated to result in annual GHGHE reduction of approximately 7,600 MT (for For methods and results of GHGe Reduction Analysis, see: "Implementation of Bus Priority Treatments in 12 High Priority Corridors," on page 26 of the Transportation TAG Draft White Paper #1, Transportation Strategy Assessment (Oct. 2011)
[36] According to the screening criteria, this action would be a level-3 priority, but it is elevated to a 'High' priority (level-2) status in this evaluation for qualitative reasons; notably the importance of improved local infrastructure to support transit priority and fast, frequent transit service in key corridors, as necessary to (a) build market share for future conversion to High Capacity Transit (HCT), and (b) to support zoning and land use regulatory changes needed in the near-term to provide long-range transportation-related GhGE reduction benefits from land use and built form strategies.
[37] Estimated GHG emissions reduction of approximately 2,000,000 Metric Tons Per year, based on estimated increase of 21 new riders for each additional service hour (with GHG emissions reduction of 0.15 lbs. per additional rider per service hour).
[38] Doubling the number of service hours on High Demand Routes may reduce up to approximately 4,000,000 Metric Tons of GHG emissions per year (see assumptions for note (11)).

Strategy	Short-Term Actions (by 2020)	Pilot Project Viability (L/M/H)	2020 GHG Emissions Reduction Potential (L/M/H)	Mid-Term Actions (by 2030/2035)	2030 GHG Emissions Reduction Potential (L/M/H)	Long-Term Actions (by 2050)	2050 GHG Emissions Reduction Potential (L/M/H)	Outcomes *High Contribution to Outcome*	Guiding Considerations *High Positive Benefit*	Lead Agency	Cost-Effectiveness *(Based on Cost/ ton GHGE reduced (2030))*	Overall Priority (1,2,3)
	Expand Transit Service to "Frequent" Service Levels on Selected Additional Routes (50% Increase in Service Hours over 2011 Base on Selected Routes))	L	H[40]	Expand Transit Service to "Frequent" Service Levels on Selected Additional Routes (100% Increase in Service Hours over 2011-base on Selected Routes)	H[41]	Further Service Expansion (TBD)	H[39]	Consistent with TSP & Transport Hierarchy	Removes Barriers to Implementation of Other High Impact Strategies (Essential to Enable Long Term GHG Emissions Reduction from Land Use and Pricing. Community & Political Support. Note: Expanding Frequent Service may be more cost-effective for GHGE reduction (by attracting "choice" riders), than adding service to high demand routes (which may enhance equity).		L	2
Increase Support for Vanpooling and Ridesharing Services	Work with King County Metro and WSDOT to Double Annual Investment in Vanpools Serving Seattle Residents and Commuters to Employment Sites in Seattle and those Serving Seattle	L	M[42]	Further increase Investment in Vanpooling – Particularly Targeting Commute Markets not well Served by Regional Frequent Transit Network	H	TBD	H	Enhances Access & Connectivity	Increases Access to Business Districts	COS/KCM	L[43]	2
	Expand Rideshare Support Facilities and Services (e.g Allocating Curb Space for Casual Carpool Pick-up/Drop off; Expanded Carpool Parking Provision/Requirements and/or Support for a Dynamic Ridesharing Pilot Project).	H	M[44]	Further Increase Support for Conventional and Dynamic Ridesharing	M	TBD	H	Enhances Access & Connectivity	Cost-Effective	COS/KCM	M[45]	1

[40] Estimated GHG emissions reduction of approximately 1,000,000 Metric Tons Per Year, based on est. increase of 11 riders for each additional revenue service hour (GHG emissions reduction of 0.15 lbs. per additional rider per service hour)
[41] Adding a 100% increase in service hours to bring additional routes up to established Frequent Service levels may reduce up to approximately 2,000,000 Metric Tons of GHG emissions per year (see assumptions/methodoogy for note (11)).
[39] Additional transit service expansion, such as a further doubling of service hours on selected High Demand Routes and bringing all other routes up to frequent service levels would easily exceed the 5,000 Metric Ton/Year Threshold for consideration as a "Medium Impact" GHG emissions reduction strategy.
[42] With a fleet of 1,031 Vans, King County Metro Estimates that its regional vanpool program eliminated approximately 5,400 vehicle trips, and more than 117,000 VMT from regional roadways on an average weekday (Source: King County Metro Regional Stakeholder Task Force Resource Notebook 2010). This VMT reduction resulted in a reduction in total vehicle emissions of GhGE's in the region of approximately 23,000 tons (approximately 21,000 metric tonnes) according to analysis prepared for King County Metro by Green Car Bellevue. Using the more conservative emissions factors used in the Seattle Transit Master Plan, this action may result in reduction of up to approximately 13,500 metric tonnes of GHG emissions per year. A doubling of investment in vanpooling services within King County could be reasonably expected to lead to a further reduction of approximately 10,000-20,000 metric tonnes of GHG emissions reduction per year (Note that a doubling of program funding may not result in a doubling of participation rates, VMT reduction or GHG emissions reduction, as it may be assumed that the individuals and businesses most likely to participate in and benefit from GHG emissions reduction will be those already captured by the current program).
[43] Estimated cost per metric tonnne of GHG emissions reduction of $250-$400 (based on estimated King County Metro 2010-2011 operating ($690,213) and capital ($4,690,500) budgets for vanpool services, as referenced in: http://metro.kingcounty.gov/am/reports/2010/KingCountyDOT_Budget.pdf)
[44] Estimated GHGe Reduction impact of ridesharing programs is approximately 7,000 mt per year, including (1) approximately 950 metric tonnes per year for a pilot project with twice the scale and projected first year impact of the WSDOT Go520 Flexible Carppoling Pilot Program (assumes 500 regular drivers and 1500 regular carpool passengers use the program), and (2) up to 6000+ metric tonnes per year for development of an informal (not pre-arranged, or electronically assisted) casual carpooling system with a weekday average of 9,000 participants carpooling to downtown Seattle, the University of Washington, Microsoft and/or other major regional employment centers. Estimate for GHG emissions reduction impact of casual carpooling is based on Minnett & Pearce (2011), who estimated annual fuel savings of 0.45 to 0.90 million gallons per year resulting from the 9,000 participants in casual carpooling in the San Francisco Bay Area (Minnett, Paul and John Pearce (2011), Estimating the Energy Consumption Impact of Casual Carpooling, Energies, 2011, (4), p. 126-139.
[45] Cost to facilitate casual carpooling may be minimal (installing signage on selected block faces and at selected park and ride lots; initial guerilla marketing may cost no more than $100,000, making this a highly cost-effective action ($16/mt reduced). Estimated cost per metric tonne of GHG emissions reduction is approximately $400 per tone/year (based on cost of $388,000 to initiate a program through the WSDOT Flexible Carpooling Grant Program. Note that the scale of impact envisioned in this action is 200% of the projected impact of the Go520 program, because the program may not be limited to a single corridor).

Strategy	Short-Term Actions (by 2020)	Pilot Project Viability (L/M/H)	2020 GHG Emissions Reduction Potential (L/M/H)	Mid-Term Actions (by 2030/2035)	2030 GHG Emissions Reduction Potential (L/M/H)	Long-Term Actions (by 2050)	2050 GHG Emissions Reduction Potential (L/M/H)	Outcomes *High Contribution to Outcome*	Guiding Considerations *High Positive Benefit*	Lead Agency	Cost-Effectiveness *(Based on Cost/ ton GHGE reduced (2030))*	Overall Priority (1,2,3)
Increase Lane Miles, Complete-ness, and Quality of Bicycle Network, (Including Protected Bike Lanes and N-Hood Greenways), and Expand Bike Parking	Increase Lane Miles of Standard Bike Lanes and Bike Trails, Connecting Missing Links to Complete Citywide Network (+400%, from 65 in 2007 to 260 in 2020)	L	H	Increase the Density of the Network of Standard On-Street Bike Lanes, Buffered Bike Lanes, Protected Bike Lanes ("Cycletracks"), and Neighborhood Greenways to 8-Miles for every Square Mile and Achieve a Goal that Protected/Buffered On-street lanes AND Separate Low-Stress Bike Routes (Greenways/ Trails) Connect all Urban Centers and Villages by 2030.	M-H	Infrastructure and programs developed to reach target of 30% of all trips under 5 miles made by bicycle	H	Enhances Connectivity Consistent with TSP/ Transport Hierarchy Enhances Access	Cost-effective Partial Funding Availability Challenge: Political Support Fosters Active Lifestyles	COS	L	3
	Increase Lane Miles of Buffered Bike Lanes on Arterials (6 North Seattle Routes and 6 South Seattle Routes), Developing a Citywide Network.	L								COS		3
	Develop a Citywide Network of Neighborhood Greenways on Traffic Calmed Streets (at least 6 North Seattle Route Segments and 6 South Seattle Route Segments), Connecting with Trails to Create a Citywide Network of Routes for Low-Stress Bicycle Travel.	M	H					Safety of Personal Mobility Enhances Connectivity Consitent with TSP/Transport Hierarchy	Increases Person Access Challenge: Political Support Fosters active lifestyles	COS, Non-Profits	L	1[46]
	Develop Protected Bike Lanes Downtown and Within Urban Centers (Cycletracks), Fully Integrated with Citywide Network of On-Street and Off-street Bicycle Facilities, Including Protected and Buffered Bike Lanes and Neighborhood Greenways.	H								COS	L	1

[46] Based exclusively on GHG emissions reduction impact and screening evaluation, implementation of both protected bike lanes and greenways would be 'High" or "level 2" priorities. However, the public health co-benefits of promoting these new types of cycle facilities, as well as the fact that they enable or are synergistic with other high impact strategies (such as land use reform, and pricing), makes these 'Top Tier,' or "level 1" priority actions in this evaluation.

Strategy	Short-Term Actions (by 2020)	Pilot Project Viability (L/M/H)	2020 GHG Emissions Reduction Potential (L/M/H)	Mid-Term Actions (by 2030/2035)	2030 GHG Emissions Reduction Potential (L/M/H)	Long-Term Actions (by 2050)	2050 GHG Emissions Reduction Potential (L/M/H)	Outcomes *High Contribution to Outcome*	Guiding Considerations *High Positive Benefit*	Lead Agency	Cost-Effectiveness *(Based on Cost/ ton GHGE reduced (2030))*	Overall Priority (1,2,3)
Increase Lane Miles, Complete-ness, and Quality of Bicycle Network, (Including Protected Bike Lanes and N-Hood Greenways), and Expand Bike Parking	Provide On-Street Bike Parking Facilities in High Volume Locations Downtown	H	H[47]	Provide On-Street Bike Parking Facilities in High Volume Destinations Citywide.	H	Infrastructure and programs developed to reach target of 30% of all trips under 5 miles made by bicycle	H	Enhances Access	Enhances Positive Impact of other Strategies (Expanding On-Street and Off-Street Bikeways) Fosters active lifestyles	COS, Private Sector	H[48]	2
	Provide On-Street Bike Parking Facilities in High Use Areas in other Urban Centers and Hub Urban Villages	M										2
	Bike-And-Ride Program: Develop Bike Stations at Key Transit Stations/Centers in each Urban Center	M		Expand Bike Stations to additional Transit Stations				Consistent with TSP and Transport Hierarchy Enhances Intermodal Connectivity	Enhances Positive Impact of Other Strategies (Expanding On-Street and Off-Street Bikeways; Expanding Transit Facilities & Service) Increases Person Access to Business Districts and Fosters Active Lifestyles	COS, Non-Profits		2
	Implement 'Green Wave' signal timing, signal priority for bikes, and 'No Right Turn on Red' restrictions in primary arterial bikeway corridors	H	M	Expand Bicycle Priority Treatments at Signalized Intersections to Bicycle Corridors Citywide.	M	TBD	M	Improve safety of access and mobility for all users	Improved safety and reduced speed differential between cycling and driving, increases bicycle mode share.	COS/ WS-DOT	H	2
Manage Street & Roadway Operations	Establish a "Transit First" Policy, prioritizing Transit over Autos in Planning & Operations of Streets and Roadways in the City Center and Priority Transit Corridors	L	H (when applied with whole package)[49]	Apply "Transit First" Policy Citywide	H	TBD	M	Enhances Access Consistent with TSP and Transport Hierarchy	Enhances Positive Impact of Other Strategies (Expanding Transit Facilities & Services) Increases Person Access to Business Districts	COS	H	1

[47] Bicycle parking expansion is part of the 2007 Seattle Bicycle Master Plan. The GHGe reduction impact of full implementation of the Seattle BMP is discussed in White Paper #1
[48] High-level estimate; assumes relatively low capital cost compared transit and road capital improvement projects.
[49] City and County of San Francisco, Strategies to Address GHG Emissions, 2010, pg IV-3.

Strategy	Short-Term Actions (by 2020)	Pilot Project Viability (L/M/H)	2020 GHG Emissions Reduction Potential (L/M/H)	Mid-Term Actions (by 2030/2035)	2030 GHG Emissions Reduction Potential (L/M/H)	Long-Term Actions (by 2050)	2050 GHG Emissions Reduction Potential (L/M/H)	Outcomes *High Contribution to Outcome*	Guiding Considerations *High Positive Benefit*	Lead Agency	Cost-Effectiveness *(Based on Cost/ ton GHGE reduced (2030))*	Overall Priority (1,2,3)
	Expand use of Traffic Calming Measures (in Addition to Neighborhood Greenways)	**M**	**Indirect**	Expand use of Traffic Calming Measures (in Addition to Neighborhood Greenways)	**Indirect**	TBD	**Indirect**	Safe Movement of People Net Positive Impact on Vulnerable Populations Consistent with TSP	Enhances positive impact of other strategies (Expanded bicycle facilities and services) Strong community support Fosters active lifestyles	COS	**N/A**	**3**
	Reallocate Portions of the Public Right-of-Way in Selected Areas from Automobility Uses to Public Space Functions and/or Enhanced/ Expanded Pedestrian Facilities in Urban Centers and Urban Villages (e.g.Create more public plazas and/or 'parklets,' to support urban living)	**H**	**Indirect**	Expand place-based/ public space functions of selected streets/roadways in Urban Centers and Urban Villages (Implement in Additional Areas through 2030).	**Indirect**	TBD	**Indirect**	Fosters dense Transit Oriented Communities (TOC)	Co-Benefits: Public spaces, including plazas and wider sidewalks can enhance retail and wider economic vitality of business districts citywide.	COS (SDOT/ DPD)	**N/A**	**3**
Manage Street & Roadway Operations	Mobility-Corridor: Identify and implement a complete multimodal mobility corridor (SDOT to select one of several highest priority transit / bicycle corridors in the City for pilot project in mobility corridor planning)	**H**	**Indirect**	Plan and implement multimodal corridors in each quadrant of the City (NE, SE, NW, and SW), as an integral component of Integrated Modal Plan Development and Integrated Multimodal Project Delivery.	**Indirect**	TBD	**Indirect**	Enhances Multimodal Access & Connectivity Integrated/ Coordinated Modal Plans will be Consistent with the TSP and the Associated Transport Hierarchy.	Enhances positive impact of other strategies (All Mode-Specific Strategies) Coordination and integration of planning can reduce barriers to implementation of mode specific strategies	COS, KCM, ST	**N/A**	**2**

Strategy	Short-Term Actions (by 2020)	Pilot Project Viability (L/M/H)	2020 GHG Emissions Reduction Potential (L/M/H)	Mid-Term Actions (by 2030/2035)	2030 GHG Emissions Reduction Potential (L/M/H)	Long-Term Actions (by 2050)	2050 GHG Emissions Reduction Potential (L/M/H)	Outcomes *High Contribution to Outcome*	Guiding Considerations *High Positive Benefit*	Lead Agency	Cost-Effectiveness *(Based on Cost/ ton GHGE reduced (2030))*	Overall Priority (1,2,3)
Update and Coordinate Modal Plans, Comprehensive Plan, and Transit Oriented Communities Policy Development	Update Modal Plans (Bicycle Master Plan in 2013, Transit Master Plan in 2017, Pedestrian Master Plan in 2015)	L	Indirect	Develop Integrated Modal Plan Updates	Indirect	Develop and Adopt Integrated and Prioritized Long-Range Plan for Sustainable Access, Mobility and Land Use, and Climate Mitigation & Adaptation.	Indirect	Safety of Movement of People Integrated/ Coordinated Modal Plans will be Consistent with the TSP and the Associated Transport Hierarchy. Improves Public Health (if objectives are explicit) Enhances Multimodal Access Enhances Intermodal Connectivity Improves Public Health (esp. PMP and BMP)	Enhances positive impact of other strategies (All Mode-Specific Strategies) Coordination and integration of planning can reduce barriers to implementation of mode specific strategies.	COS	N/A	2
	Include GHG Emissions Reduction Analysis in Updates to all Transportation Master Plans and Prioritization of Implementation Strategies; add a Climate Note (similar to a Fiscal Note) presenting high level evaluation of the GHG emissions impact of all plans, policies, and major projects	H		Include GHG Emissions Reduction Analysis and Resilience Planning in Updates to all Transportation Master Plans and Prioritization of Implementation Strategies.				Puts Focus on Primary Objective to Reduce GHG emissions in the Transport Sector	Enhances GHG emissions reduction impact of all other mode-specific strategies. Political Support: Enhanced information about GHG emissions reduction potential of each strategy/ action helpful to build case for implementation.	COS (SDOT/OSE)	N/A	1

Strategy	Short-Term Actions (by 2020)	Pilot Project Viability (L/M/H)	2020 GHG Emissions Reduction Potential (L/M/H)	Mid-Term Actions (by 2030/2035)	2030 GHG Emissions Reduction Potential (L/M/H)	Long-Term Actions (by 2050)	2050 GHG Emissions Reduction Potential (L/M/H)	Outcomes *High Contribution to Outcome*	Guiding Considerations *High Positive Benefit*	Lead Agency	Cost-Effectiveness *(Based on Cost/ ton GHGE reduced (2030))*	Overall Priority (1,2,3)
Update and Coordinate Modal Plans, Comprehensive Plan, and Transit Oriented Communities Policy Development	Integrate Planning for Prioritized Pedestrian, Bicycle and Transit Facilities & Services, and Land Use Criteria for Supporting Expansion of Pedestrian, Bicycle & Transit Improvements in next Seattle Comprehensive Plan Update	H	**Indirect**	Integrate Planning for Prioritized Pedestrian, Bicycle and Transit Facilities & Services, and Land Use Criteria for Supporting Expansion of Pedestrian, Bicycle & Transit Improvements in 2022 Seattle Comprehensive Plan Update.	**Indirect**	Develop and Adopt Integrated and Prioritized Long-Range Plan for Sustainable Access, Mobility and Land Use; Climate Mitigation & Adaptation.	**Indirect**	Supports Coordination and Integration of Land Use and Transportation Planning, Policy and Investment, Fostering Dense, TOC's, Enhancing Access, and Providing for Improved Public Health and Benefit to Vulnerable Populations	Enhances Positive Impact of Other Strategies (All Mode-Specific Transport Strategies and Actions). Co-Benefits: Improved Access, Mobility, Neighborhood Livability; Lower Total Cost of Housing & Transportation for Occupants of New TOC's. Catalyzes High Benefit, Long-Term Strategies	COS (DPD/SDOT)	**N/A**	**1**
Update and Coordinate Modal Plans, Comprehensive Plan, and Transit Oriented Communities Policy Development	Develop a Budget Prioritization Tool for Use Across All City Departments (DPD, SDOT, OSE, etc.) to Ensure Consideration of "Triple Bottom Line" Factors in Evaluating Budget and Policy/Program Alternatives.	H	**Indirect**	Refine Tool and Analytical Capabilities; Revisit "Bottom Line" Goals/Values	**Indirect**	Refine Tool and Analytical Capabilities; Revisit "Bottom Line" Goals/Values	**Indirect**	Facilitates Evaluation of Tradeoffs Between Capital and Service Intensive Options/Alternatives (e.g. Bus Purchases vs. TDM Programs); as well as Joint Funding for Capital and Operations Components of Plans/Programs (e.g. Bike Facility Investments, Accompanied by Bicycling Education and Encouragement Programs).	Enhances Positive Impacts of Other Strategies (All Mode Specific Transportation Strategies and Actions) Removes Barriers to Implementation of other Strategies Catalyzes High Benefit, Long-Term Strategies	COS (DBD, SDOT, OSE)	**N/A**	**1**
	Integrate SDOT Processes for Delivery of W/B/R Projects and Programs and Complementary TDM Programs and Policies (e.g. Development of Design Standards for Wayfinding, Transit Access, etc); Reflecting Complete Streets Approach and Aligning with GHGE Reduction Goals	H	**Indirect**	Fully Integrate Project Delivery Across Modes. Monitor and Update SDOT Planning and Project Delivery Systems to Ensure Alignment with City Walk/Bike/Ride and GHGE Reduction Goals	**Indirect**	Monitor and Update SDOT Planning and Project Delivery Systems to Align with WBR and GHGE Reduction Goals	**Indirect**	Consistent with TSP & Transport Hierarchy Enhances Multimodal Connectivity Enhances Multimodal Access Positive Impact on Vulnerable Populations	Enhances Positive Impacts of Other Strategies (All Mode Specific Transportation Strategies and Actions) Removes Barriers to Implementation of other Strategies Catalyzes High Benefit, Long-Term Strategies	COS	**N/A**	**1**

Strategy	Short-Term Actions (by 2020)	Pilot Project Viability (L/M/H)	2020 GHG Emissions Reduction Potential (L/M/H)	Mid-Term Actions (by 2030/2035)	2030 GHG Emissions Reduction Potential (L/M/H)	Long-Term Actions (by 2050)	2050 GHG Emissions Reduction Potential (L/M/H)	Outcomes *High Contribution to Outcome*	Guiding Considerations *High Positive Benefit*	Lead Agency	Cost-Effectiveness *(Based on Cost/ ton GHGE reduced (2030))*	Overall Priority (1,2,3)
	Develop Comprehensive Downtown Bicycle Access and Parking Plan in Coordination with Business Community	**H**	**L-M**	Check Progress and Update Bicycle Access and Parking Plan Develop Complementary Bicycle Access and Parking Plans for all Urban Centers and Urban Villages in Coordination with Local Businesses/ Transportation Management Associations	**M**	Check Progress and Update Downtown and Urban Center Bicycle Access and Parking Plans	**M**	Safe movement of people Consistent with TSP and Transport Hierarchy Enhances Access	Enhances Positive Impacts of Other Strategies (Expansion of On-Street and Off-Street Bikeways)	COS/ Dntn. Seattle Assoc (DSA)	**N/A**	**2**

Notes:

A: Methodology and data for all GHGe reduction estimates without a reference stating otherwise are detailed in Transportation TAG Draft White Paper #1, October 2011.

B: Emissions reduction potential is rated as 'High' for those strategies that could reduce GHG emissions more than an estimated 20,000 metric tons annually by 2030. Strategies rated as "Medium" could reduce emissions by an estimated 5,000 metrictons or more per year by 2030. Strategies with "Low" potential could reduce emissions by less than an estimated 5,000 tons per year by 2030.

C: Strategies are rated as having "High" cost effectiveness if they would cost the city less than $30 per ton of emissions reduction (including those that are expected to generate revenue). Strategies are rated "Medium" if they are estimated to cost less than $100 per metric ton of emissions reduction by 2030. Cost effectiveness is "Low" for strategies estimated to cost more than $100 per ton.

DRAFT Evaluation of Strategic Pricing, Parking Management, TDM and Efficiency Initiatives

Seattle Transportation GHG Emissions Reduction Action Plan, City of Seattle Office of Sustainability & Environment (Feb 2012)

	Short-Term Actions (by 2020)	Pilot Project Viability (L/M/H)	2020 GHG Emissions Reduction Potential (L/M/H)	Mid-Term Actions (by 2030/2035)	2030 GHG Emissions Reduction Potential (L/M/H)	Long-Term Actions (by 2050)	2050 GHG Emissions Reduction Potential (L/M/H)	Outcomes	Guiding Considerations	Lead Agency	Cost-Effectiveness *(Based on Cost/ ton GHGE reduced (2030))*	Overall Priority (1,2,3)
Variable Roadway Pricing (Tolls May Vary Based on Time of Day, Congestion Levels, Vehicle Fuel Efficiency, and/or Vehicle Occupancy)	**Cordon Pricing:** Charge a toll on all vehicles entering a cordon around a defined area or areas (e.g. the Center City and congested Urban Centers, such as the U-District).[50]	L	TBD	Adjust cordon boundaries and toll rates (and expand cordon tolling to additional urban centers) as necessary to manage congestion and reduce GHG emissions. Toll rates may be adjusted to account for the full external costs of auto mobility, but with cordon tolling as opposed to system-wide tolling, toll rates may need to be lower to prevent widespread diversion of traffic, and economic activity to areas outside of the cordon/ congestion charging zone.	TBD	Cordon pricing may be outmoded by more systemic tolling systems	TBD	Enhances multimodal access to areas inside the cordon by reducing congestion. Enhances access and mobility by providing funding for multimodal transportation projects and services.	Political/ legislative barriers to implementation. Cost Effective/ Enhances impact of other strategies (Generates revenue that may be used to fund Walk, Bike, Ride strategies and other GHG emissions reduction initiatives) Requires use of funds to significantly expand transit and non-motorized access and mobility to mitigate negative impacts to low-income travelers. May be implemented by the City of Seattle, with or without state or regional implementation (although independent action by the City may push some activities to other un-tolled centers within the region, with undefined net VMT and GHG emissions impacts).	COS/ PSRC/ WS-DOT	TBD[51]	2
	Limited Access Highway Pricing: Variable tolling of all limited access highways (assumes region-wide implementation)	L	H[52]	Implement system-wide road pricing, with toll rates adjusted to account for the full external costs of auto mobility (e.g. costs associated with congestion,	H	Continue to adjust toll rates and update technology as appropriate	H	With potential for up to a 10% reduction in per capita VMT and consequent GHG emissions, full system pricing is by far the most impactful strategy for	Political/ legislative barriers to implementation (Requires state action) Cost Effective / Enhances impact of other strategies (Generates revenue	PSRC/ WS-DOT	H[53]	1

[50] Cordon pricing may be implemented as part of a regional pricing strategy (e.g. with cordon tolls around all major metropolitan centers, including Seattle, Bellevue, Tacoma, Everett and Bremerton), or by the City of Seattle, acting alone (however, independent action by the City of Seattle may have undetermined impacts to aggregate regional VMT and consequent GHG emissions. PSRC has not modeled any scenarios with the City of Seattle taking independent action to price road use for any purpose, so no high-level evaluation of impacts of this alternative are available at this time.
[51] Generates revenue to fund other transportation-related GHG emissions reduction projects and programs. Cost-effectiveness is difficult to evaluate because no modeling of the regional transportation and GHG emissions reduction impacts of cordon tolling has yet been completed by PSRC.
[52] In analysis for Destination 2030, PSRC tested the impact of tolling "all existing limited access roadways located within the regional Urban Growth Area. Tolls are applied to all vehicles (except transit) using the freeway." In this PSRC scenario, the average estimated toll tested was $0.39 per mile; tolls were dynamically priced and collected 24 hours per day. This PSRC analysis found a 5.8% VMT reduction per capita by 2030 (with VMT dropping from 24.1 to 22.7 per capita). If applied only to the City of Seattle's baseline emissions forecast for that year, a 5.8% reduction in per capita VMT would amount to 82,650 metric tons of GHG emissions avoided.
[53] Highly cost-effective (Generates revenue)

	Short-Term Actions (by 2020)	Pilot Project Viability (L/M/H)	2020 GHG Emissions Reduction Potential (L/M/H)	Mid-Term Actions (by 2030/2035)	2030 GHG Emissions Reduction Potential (L/M/H)	Long-Term Actions (by 2050)	2050 GHG Emissions Reduction Potential (L/M/H)	Outcomes	Guiding Considerations	Lead Agency	Cost-Effectiveness *(Based on Cost/ ton GHGE reduced (2030))*	Overall Priority (1,2,3)
	System-Wide Pricing: Tolling of all limited-access highways and major arterial roadways (assumes region-wide implementation)	L	H[54]	collisions, economic and public health impacts of driving)				GHG emissions reduction (with attendant public health benefits from reduced local/ regional air pollution). Enhances regional multimodal access and mobility by reducing congestion-related delay (for movement of both people and goods). System-wide pricing significantly reduces VMT and consequent GHG emissions Enhances access and mobility by providing funding for multimodal transportation projects and services.	that may be used to fund Walk, Bike, Ride strategies and other GHG emissions reduction initiatives) Requires use of funds to significantly expand transit and non-motorized access and mobility to mitigate negative impacts to low-income travelers.	PSRC/ WS-DOT	H[55]	2

[54] Another approach analyzed by PSRC in Destination 2030 involved tolling all major roadways in the region including both limited access highways and major arterials. The average estimated toll for this analysis was $0.40 per mile, and tolls would be dynamically priced and collected 24 hours/ day, 7 days/week. This analysis projected 10% VMT reduction per capita resulting from this full system tolling scenario by 2030 (reduction from 24.1 to 21.7 VMT / day per capita). A 10% reduction in the City of Seattle's baseline emissions forecast for that year would amount to 142,500 metric tons of GHG emissions avoided.
[55] Highly cost-effective (Generates revenue)

	Short-Term Actions (by 2020)	Pilot Project Viability (L/M/H)	2020 GHG Emissions Reduction Potential (L/M/H)	Mid-Term Actions (by 2030/2035)	2030 GHG Emissions Reduction Potential (L/M/H)	Long-Term Actions (by 2050)	2050 GHG Emissions Reduction Potential (L/M/H)	Outcomes	Guiding Considerations	Lead Agency	Cost-Effectiveness *(Based on Cost/ ton GHGE reduced (2030))*	Overall Priority (1,2,3)
Parking Pricing and Management	**Dynamic On-Street Parking Pricing:** Expand and refine performance-based, variable on-street parking pricing and management program (adjusting metered areas and permit parking zones, hours of operation, and rates as necessary to achieve policy goals)	**M**	**M**[56]	Adjust on-street parking pricing and management practices as necessary to achieve availability and emissions reduction goals	**M**[57]	Adjust on-street parking pricing and management practices as necessary to achieve availability and emissions reduction goals	**H**[58]	Enhances multimodal access and mobility and public health by reducing parking search related traffic congestion, VMT and emissions. Generates revenue to fund bicycle, pedestrian and transit facilities and services and TDM programs. Funding must be dedicated to transit and non-motorized travel options to mitigate impacts to low-income and other vulnerable populations.	By generating revenue, expanded parking pricing can enable other high-impact GHG emissions reduction strategies. By increasing parking turnover and availability, parking pricing can improve person access to business districts and support economic development.	COS	**H**[59]	**2**
	Eliminate Parking Minimums: Eliminate minimum off-street parking requirements where they exist (coupled with on-street parking management policies and practices to prevent spillover parking impacts)	**L**	**Indirect**	Reduce Supply of Off-Street Parking: Having eliminated minimum parking requirements, and imposed site specific maximums, the City may – through its zoning ordinance -- opt to develop a cap on the number of off-	**Indirect**	Further reduce supply of off-street parking; incentivize development of surface parking lots and adaptive reuse of existing parking structures.	**Indirect**	Enables other high impact strategies. Reduces cost to develop infill and transit-oriented development (commercial and residential).	Eliminating minimum off-street parking requirements is a necessary condition for several other parking-related policies and actions that can significantly reduce vehicle trips, VMT and GHG emissions (e.g. enabling parking cashout, and unbundling of parking from commercial and residential leases by facilitating the	COS	**TBD**	**1**

[56] Based on the Carbon Neutral Seattle Analysis, which assumed an overall increase in average meter rates of 25% (above 2011 rates) by 2020, resulting in a 1.5% reduction (from 2020 baseline) in VMT, when considered in concert with other parking management strategies, such as an off-street parking tax (similar to the varialble off-street parking tax referred to in this plan), which translates into a reduction of 21,375 metric tons of GHG emissions. Without the off-street parking tax, or City Sticker programs evaluated along with on-street parking management in the CNS Analysis, we assume that this strategy will generate significantly less than 20,000, but more than 5,000 metric tons of GHG emissions reduction in 2020 and 2030.
[57] Based on the Carbon Neutral Seattle Analysis, which assumed an overall increase in average meter rates of 50% (above 2011 rates) by 2030, resulting in a 3.5% reduction (from 2030 baseline) in VMT, which translates into a reduction of 49,875 metric tons of GHG emissions. Without the off-street parking tax, or City Sticker programs evaluated along with on-street parking management in the CNS Analysis, we assume that this strategy will generate significantly less than 20,000, but more than 5,000 metric tons of GHG emissions reduction in 2020 and 2030.
[58] Based on 2020 and 2030 estimates from the Carbon Neutral Seattle Analysis, this analysis assumes that the GHG emissions reduction impact of on-street parking pricing through 2050 will significantly exceed the 20,000 metric tons per year threshold for consideration as a "High" impact strategy/action.
[59] Highly cost-effective (Generates revenue)

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	Parking Maximums: Reduce existing maximum off-street parking requirements and establish parking maximums in new areas where appropriate (e.g. Urban Villages and Transit Communities)	**M**	**Indirect**	street parking spaces permitted in each urban center and urban village (with property owners empowered to trade 'rights to parking' under the cap.				Reduces a hidden subsidy for driving that may be expected in turn to reduce VMT and consequent GHG emissions (free or low-cost off-street parking provided as required by code)[60]	legal lease, sale, and/or shared use of off-street parking spaces that were built to code, but are no longer necessary). Elimination of minimums must be implemented in concert with adoption of policies that preserve on-street parking availability, and prevent spillover parking impacts in surrounding neighborhoods (e.g. performance-based on-street parking pricing and residential permit parking zones). Maximum parking requirements are most appropriate for areas well served by transit and/or other non-auto modes.	COS	**TBD**	
Parking Pricing and Management	**Adopt Unbundling Requirement:** Require separation of parking from commercial and residential lease agreements.	**H**	**Indirect[61]**	Extend unbundling requirement to all commercial and residential sale agreements recorded in the City.	**Indirect[62]**	TBD	**Indirect 63**	Likely reduces vehicle ownership, VMT and consequent GHG emissions[64] Enables other high impact strategies. Reduces the cost of housing for all users (with greatest benefit to low-income residents).	Unbundled parking is a necessary condition for several other parking-related policies and actions that can significantly reduce vehicle trips, VMT and GHG emissions (e.g. enabling parking cashout, and unbundling of parking by facilitating the legal lease, sale, and/or shared use of off-street parking spaces that were built to code, but are no longer necessary).	COS	**TBD**	**2**

[60] Although the elimination of minimum parking requirements has a theoretical impact on VMT and GHG emissions, this impact is indirect. In The High Cost of Free Parking (2005), Donald Shoup notes that off-street parking requirements "spread activities further apart, making cars more necessary, "increasing mobility by car, but…reducing mobility by walking, cycling and public transit" (p. 93). Shoup cites Forinash, Millard-Ball, and Tumlin (Nelson\Nygaard) et. al (2004), who found that parking lots [built to satisfy off-street parking standards] "reduce the attractiveness of walking and biking by increasing the distances between activities and by creating unattractive routes," and " reduces the potential for public transit by attracting travelers to cars and reducing the density of development."
[61] Shoup (2005) estimates that for owners of median-aged cars, unbundling of parking spaces valued at $50 per month, or $600 per year will increase the fixed cost of vehicle ownership and operations by 60%. Based on an estimate of long-run elasticity of annual VMT with respect to the fixed costs of vehicle ownership and operation (estimated at -0.48 to -0.68), Shoup estimates in turn that unbundling parking will reduce VMT for such a median-aged vehicle by up to 30%. For the purpose of this high-level analysis, we have assumed a 5% annual reduction in VMT from unbundled parking.
[62] See (12)
[63] See (12)
[64] See (12)

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	Levy Off-Street Parking Tax: Advocate for local authority to levy a graduated, non-residential off-street parking tax (replacing existing commercial parking tax levy). Fee may be graduated based on the share of full parking costs charged to end users.	**L**	**Indirect**	Expand application of off-street parking tax to new areas and new uses, and adjust rates as necessary to meet revenue targets and incentivize property-owners/managers to (a) price parking, and/or (b) to convert parking to more active uses.	**Indirect**	TBD	**Indirect**	If implemented in concert with elimination of minimum parking requires; enables property owners to reduce costs by leasing, selling, or converting underutilized parking spaces to other uses. Provides revenue to fund mobility and access programs and services[65]. Provides incentive for property owners to price and unbundle parking; both of which may reduce VMT and GHG emissions.	Requires legislative authorization. May replace the existing commercial parking tax (which may discourage some property-owners from pricing parking). A graduated, non-residential parking tax can encourage use of parking management techniques that can reduce parking and travel demand (as well as congestion). Equity considerations: Impact of fee may be off-set for low-income commuters if employers are required to offer-parking cash-out (a TDM strategy).	COS	**H[66]**	**2**
Transport-ation Demand Management	**Parking Cashout:** Adopt a local ordinance requiring existing employers (with 100 or more employees) to offer cash in-lieu of subsidized parking	**L**	**H[67]**	TBD	**H**	TBD	**H**	Consistent with TSP and transportation hierarchy Promotes equity/ social justice in distribution of employee benefits Reduces vehicle trips, VMT, and consequent GHG emissions; improves public health.	Short-term and long-term GHG emissions reduction return on minimal investment. Synergistic impacts on other strategies; Enables other high return strategies		**M**	**1**

[65] Revenues from a non-residential off-street parking tax (replacing the existing commercial parking tax) are estimated to be $40 to $265 m per year.
[66] Revenue generation potential makes this a highly cost-effective strategy for GHG emissions reduction.
[67] Estimated GHG emissions reduction impact is approximately 27,000 metric tons per year in 2030 (based on assumptions that the regulation would apply only to employers with 100 or more employees (which represent 64.6% of all employees (Small Business Administration, 2007) that cashout would result in a 12% commute VMT reduction at selected employment sites implementing cashout (based on evidence from Shoup, D (1997), and the assumption that work/commute trips (the subject of this TDM measure) represent no more than one-quarter of all trips (as assumed in the Carbon Neutral Scenario Analysis (Technical Appendix, p. 23, referencing Cambridge Systematics, *Moving Cooler* (2009)..

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Transport-ation Demand Management	**PAYD Insurance:** Support and Promote Transition to Pay-As-You-Drive Auto Insurance (optional for Washington State drivers)	L[68]	H[69]	Full transition to PAYD for all auto insurance policies issued in the state of Washington	H[70]	TBD	H	By making insurance a marginal, rather than fixed-cost, provides an incentive for reduced driving. Full transition to PAYD Insurance may result in up to 5.6% reduction in VMT and consequent GHG emissions. Benefits low-income drivers by permitting economization on insurance by reduced driving.	Requires state authorization (This strategy would require changes in insurance regulation s, then a transition period (approx. 5 years) for insurance companies and consumers to adjust. This strategy is cost-effective both for consumers and for insurance companies.[71]	State Insur-ance Comm.	H	2
	ORCA TMA Employee Passports: Work with TMA's to develop, negotiate bulk purchase and market a Universal Transit Pass (good for travel on all regional transit services) for all employees of TMA member businesses.	L	H[72]	Potential implementation of employee passports for employees at all Seattle business establishments.	H[73]	TBD	H	Reduces vehicle trips by passport holders by approximately 11% Benefits lower-income employees.	May be implemented at no cost or minimal cost to the City, TMA's or transit service providers (ST, KCM) Requires partnership/ collaboration with King County Metro, and Sound Transit and other transit/ mobility service providers.	COS, KCM, ST	H	1

[68] King County Metro, WSDOT, and partner agencies are currently conducting a statewide pilot of PAYD Insurance.
[69] The Carbon Neutral Seattle Analysis estimated that PAYD insurance would result in average VMT reduction per participant of 5.6% (assuming an average cost of insurance of 6.6 cents per mile, and a price elasticity of VMT of -0.45 (from *Moving Cooler*, Cambridge Systematics, 2009). If PAYD Insurance were permitted by the state, but not required, we assume that approximately 25% of drivers in Seattle would opt to participate in the program, resulting in a net reduction of 1.4% of VMT, or 22,000 metric tons of GHG emissions per year.
[70] The Carbon Neutral Seattle Analysis estimated that PAYD insurance would result in average VMT reduction per participant of 5.6% (assuming an average cost of insurance of 6.6 cents per mile, and a price elasticity of VMT of -0.45 (from *Moving Cooler*, Cambridge Systematics, 2009). This would result in a decrease of 87,000 metric tons of GHG emissions.
[71] Simplest and least costly approach to monitoring and enforcement of mileage-based insurance charges would be for the state department of licensing to check VMT during annual vehicle inspections.
[72] GHG emissions reduction potential for this strategy was only calculated for the 2030 planning time horizon.
[73] Assumes that implementation of this strategy may result in reduction of up to 42,500 metric tons of CHG emissions per year (based on evidence that approximately 30% of jobs in Seattle are located in Urban Centers and Urban Villages, PSRC estimated regional average VMT per capita for 2030 (24.1 milles per day), and evidence of the impact of universal transit passes from the (Pasadena Traffic Reduction Study (Nelson\Nygaard, 2008).

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	ORCA Neighborhood Passports: Work with TMA's, Neighborhood Associations, and/or HOA's to develop, negotiate bulk purchase and market a Universal Transit Pass (similar to the ORCA Business Passport) for all residents of new multi-unit residential buildings/projects in each Urban Center and Urban Village (Participation required for owners of new multi-unit buildings; optional for owners of existing buildings).	**M**	**M**[74]	Potential implementation of neighborhood passports for residents of multiunit housing citywide.	**M**[75]	TBD	**H**	Reduces vehicle trips by passport holders by approximately 11%[76] Benefits vulnerable populations living in multi-unit housing in Urban Village neighborhoods that are part of the ORCA Neighborhood Passport program.	May be implemented at no cost or minimal cost to the City, or TMA's. If implemented in concert with elimination of minimum off-street parking requirements, may represent a minimal cost to property owners/managers.	COS, KCM, ST	**H**	
	Multimodal Trip Planner / App: Collaborate with KC Metro, Sound Transit, and WSDOT to produce, or facilitate private development of a fully functional web and mobile, multimodal trip planner application (capable of utilizing real-time information and GPS data from agencies)	**H**	**TBD**	Support continual updates to app/s to take advantage of new information and communication technologies and new data availability	**TBD**	TBD	**TBD**	Enhances transportation choices, access, connectivity and convenience of non-SOV travel options	Requires publication of open source transit route, schedule, GPS/real-time arrival data/information. Enhances impact of other actions and strategies (all modes)	Private Sector, COS, KCM ST, WS-DOT	**TBD**	**2**

[74] Estimated reduction of approximately 7,000 metric tons of GHG emissions per year, based on assumed 11% reduction in vehicle trips and VMT per year for program participants (based on evidence cited in *the Pasadena Traffic Reduction Study* (Nelson\Nygaard, 2008), including all residents of new multi-unit buildings constructed between 2010 and 2030, located within established Urban Center Villages, Hub Urban Villages, and Residential Urban Villages in the City of Seattle (as of 2000, these urban villages were home to approximately 32.7% of the population of the City of Seattle). Note that this action assumes that all new housing units in multi-unit structures, built from 2010-2020 would be required to participate in this neighborhood based transportation options program.

[75] Estimated reduction of approximately 15,600 metric tons of GHG emissions per year, based on assumed 11% reduction in vehicle trips and VMT per year for program participants (based on evidence cited in *the Pasadena Traffic Reduction Study* (Nelson\Nygaard, 2008), including all residents of multi-unit buildings located within established Urban Center Villages, Hub Urban Villages, and Residential Urban Villages in the City of Seattle (as of 2000, these urban villages were home to approximately 32.7% of the population of the City of Seattle).

[76] Assumes potential reduction of up to approximately 10,200 metric tons of GHG emissions per year if the WayToGo program, including the One-Less-Car Challenge program and incentives are expanded to serve ten percent of households in the City of Seattle (25,800 hh in 2010), with savings of up to 0.39 metric tons of GHG emissions per household per year (Based on evidence cited in the *Pasadena Traffic Reduction Study* (2008), see Appendix B, Strategy Sheets, "Universal Transit Passes".

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Transport-ation Demand Management	**Vehicle Trip Cap & Fee:** Adopt a cap for vehicle trips generated within each Urban Center and Urban Village, or citywide (e.g. Santa Monica, California's "No Net New Trips" Policy). To enforce and provide flexibility with implementation of trip cap, adopt a Vehicle Trip Generation (VTG) fee based on the estimated vehicle trip generation of new development projects, with allowance for project developers to (a) incorporate project elements that would reduce VTG, and/or (b) pay a mitigation fee to fund VTG and GHG emissions reduction projects/programs off-site	**L**	**Indirect**	TBD	**Indirect**	TBD	**Indirect**	Adoption of the fee may help to reduce vehicle trips, parking demand and VMT for travel to subject properties and developments over time (developers will likely adjust project profile to reduce fee owed [e.g. reducing parking, pricing parking, and/or siting in a transit accessible area]) Provides revenue to fund other high impact actions and strategies (including Walk, Bike, Ride strategies)	If a VTG-based fee is adopted as part of a cap on vehicle trips (citywide, or specific to each Urban Center/Village), and if fee revenue is dedicated to a set of projects and programs that are explicitly designed to reduce vehicle trips to meet the policy target ('mitigation') this tool offers the potential to significantly reduce GHG emissions. Enables (by providing funding to) other high impact actions and strategies. Implementation challenges include political barriers to establishing citywide or neighborhood specific trip caps (and debate over the appropriate cap level) and to adopting a VTG-related fee. Requires conducting a comprehensive nexus study to develop a program of specific projects and services that can be implemented to achieve cap targets	COS	**H**[77]	**3**
	Commute Trip Reduction for Small Employers: Provide additional commute trip reduction and general TDM program support to small employers with fewer than 100 employees per establishment	**L**	**M**	Expand GTEC programs and incentives to provide trip reduction and TDM services to small employers citywide.	**M**[78]	TBD	**M**	Enhances access and mobility for individual employees of Seattle business establishments.	Requires collaboration with state and regional partners. Cost-effective: supports other TDM strategies, enabling other high impact strategies to increase walking, bicycling, and transit use	COS, KCM WS-DOT	**H**	**2**

[77] Revenue generation potential for the VTG-fee makes this a highly cost-effective GHG emissions reduction strategy.
[78] Based on Carbon Neutral Seattle Analysis, which concluded that aggressive support for implementation of CTR programs at establishments with less than 100 employees would result in a reduction (relative to business as usual scenarios) of drive alone mode share of 3.5%, an increase in transit ridership of 4.9% (at affected employment sites), and an ultimate total VMT reduction of 0.9%. The CNS Analysis assumes that this rate of VMT reduction would be constant for 2020, 2030 and 2050 (see CNS Technical Appendix, Table, 19)

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	Affordable Housing for Climate Protection: Expand affordable housing opportunities in transit communities by adopting policies such as inclusionary zoning (requiring a share of all new multi-unit buildings to be affordable to Low and Very-Low Income households) to allow Seattle employees to live near work, reducing commute distance and cost.	**L**	**M**[79]	Increase incentive bonus for affordable housing provision and minimum percentage of affordable units required for new multi-unit development in Urban Villages, Centers and Transit Corridors.	**M**[80]	TBD	**M**[81]	Improves access to employment and services for low income residents If implemented as part of the City's incentive zoning program, fosters density necessary to support transit, local services and amenities Directly benefits low-income populations	Synergistic impacts on other strategies (Note: Low-income households are more likely to own fewer vehicles, utilize transit and non-motorized transport modes, making this an effective strategy to support investments in bicycle, pedestrian and transit infrastructure and services in Urban Centers and Villages). Co-benefits include improved housing affordability in the City. Permissible with recent leg. changes.	COS	**TBD**	**3**
	Peer-to-Peer Carsharing: Support the development and implementation of peer-to-peer carsharing (including advocacy for state legislation to clarify insurance coverage for participants).	**H**	**TBD**	TBD	**TBD**	TBD	**TBD**	Improves transportation choices, access, connectivity, and convenience of non-SOV travel options	Requires legislative changes to clarify insurance protections for participants. Requires re-evaluation of management and regulation of public and private on-street and off-street parking.	Private Sector, w/ COS Support	**TBD**	**2**
Transport-ation Demand Management	**Proximate Commuting and Employee Housing**: Support and promote innovative employer commute trip reduction programs such as proximate commuting (re-assigning employees to work-sites closer to their residence) and employee housing programs (e.g. the recently announced UW/ Children's Hospital housing project in the U-District).	**M**	**TBD**	Continued support for proximate commuting, and development of employee housing programs	**TBD**	TBD	**TBD**	Enhances access and mobility for employees. Provides for enhanced safety for participating employees by reducing vehicle trip lengths. Benefits low-income and vulnerable populations by reducing commute time and cost.	Works for some but not all employees of major businesses (working only at the 'local branch,' may limit promotion opportunities). Both proximate commuting and employee housing options are politically attractive, but challenging to implement for individual businesses. Presents opportunity for economic development by increasing attractiveness of employment with employers that address quality of life issues by reducing minimizing commute time and cost.	Private Sector, and Unions,with support of COS	**TBD**	**2**

[79] Estimated annual reduction of approximately 4,400 metric tons of GHG emissions per year by 2020, based on assumed application of an estimated 35% average VMT reduction (midpoint of VMT reduction for location efficient developments cited in a study by Litman at **CCAP** (2003), State and Local Leadership On Transportation And Climate Change, Center for Clean Air Policy (www.ccap.org)), to an estimated increase of approximately 14,300 new housing units built in multi-unit buildings in urban villages, urban centers, and transit corridors between 2010 and 2020 which may be subject to the policy (resulting in approximately 2,150 new affordable units if a 15% inclusionary requirement is enacted).
[80] Estimated annual reduction of approximately 10,000 metric tons of GHG emissions per year by 2030, based on assumed application of an estimated 35% average VMT reduction (midpoint of VMT reduction for location efficient developments cited in a study by Litman at **CCAP** (2003), State and Local Leadership On Transportation And Climate Change, Center for Clean Air Policy (www.ccap.org)), to an estimated increase of approximately 32,200 new housing units built in multi-unit buildings in urban villages, urban centers, and transit corridors between 2010 and 2030 which may be subject to the policy (resulting in approximately 4,800 new affordable and location efficient units constructed by 2030, if a 15% inclusionary requirement is enacted).
[81] Estimated annual reduction of approximately 16,000 metric tons of GHG emissions per year by 2050 (No forecast of population or households in the City of Seattle is available for the 2050 time horizon. This estimate is based on an assumed straight line growth rate of 10.2% per decade for the period 2040-2050 (as forecast by PSRC for the period 2030-2040). For the other assumptions and data used to generate this estimate, see notes (29) and (30).

	Short-Term Actions (by 2020)	Pilot Project Viability (L/M/H)	2020 GHG Emissions Reduction Potential (L/M/H)	Mid-Term Actions (by 2030/2035)	2030 GHG Emissions Reduction Potential (L/M/H)	Long-Term Actions (by 2050)	2050 GHG Emissions Reduction Potential (L/M/H)	Outcomes	Guiding Considerations	Lead Agency	Cost-Effectiveness *(Based on Cost/ ton GHGE reduced (2030))*	Overall Priority (1,2,3)
Incentives, Marketing, and Education	**Eco-Points:** As an alternative to conventional pricing, shift to charging for all or a share of the cost of tolls, parking and/or transit fares with a single currency of "Eco-Points" (as referred to in Hong Kong), which users can consume or save based on individual travel behavior. The cost of access and mobility services may vary by person, mode, route, and time of day based on vehicle GHG emissions per person per mile, among other factors.	**L**	**TBD**	Adjust price of transit fares, tolls, and other transportation costs billable using Eco-Points, to reflect updated information on the external costs (e.g. environmental impacts, climate impacts, congestion impacts on other users) of trips (Prices continue to vary based on time of day, route, distance, location, etc.).	**TBD**	TBD	**TBD**	Reduces VMT and consequent GHG emissions by aligning the prices of transportation options more closely with their true environmental and social impacts. Encourages innovation in vehicle trip, VMT, and GHG emissions reduction by fostering a market for exchange of Eco-Points (e.g. Private vanpool drivers might offer to provide shared rides at low-cost, with significant environmental benefit). Enables other high impact strategies	New medium of exchange may confuse some new users; require adjustments and comprehensive public education about how to use the system, including ways to save time and money using the lowest-impact (often also the lowest cost) travel alternative. May be perceived as a prescriptive intrusion of government into personal/ business travel decision-making (e.g. 'Big Brother,') Acts as a catalyst to build support/ change culture.	COS, PSRC, with KCM, ST, and WS-DOT	**TBD**	**3**
	Incentives: Expand the Way-To-Go travel options education and incentives program to reach a wider audience.	**M**	**M**[82]	Merge transportation education and marketing programs into a single, personalized/customized transportation options and outreach marketing program targeting residents/ employees in Seattle, with a mode shift goal for all trip purposes (not just commute trips) and for all trip times/destinations.	**H**[83]	TBD	**TBD**	Cycling outreach and education programs facilitate the safe movement of people and goods. Enhances access for city residents and employees by expanding knowledge of transportation choices. Improves public health by encouraging shift to active modes of transportation and reducing pollution associated with driving.	Marketing, incentives and outreach programs are relatively low-cost (as compared to capital investments), but challenging to obtain funding for. Association with specific transportation projects and programs provides the best funding opportunity. Relatively low-cost strategies for reducing VMT and consequent GHG emissions. Synergistic with/ enhances impact of other high impact strategies such as investment in bicycle, pedestrian and transit facilities and services. Catalyst for cultural change	COS	**M**	**1**
	Bike Ed: Support the development of comprehensive Citywide bicycling education and encouragement program(s) (including 'bike ed' safety training classes in schools).	**M**	**TBD**									
	Personalized Transport Options Marketing: Expand personalized marketing of and education about transportation options (e.g. King County Metro In-Motion Program) to reach residents and employees in urban centers and villages citywide.	**M**	**H**[84]									

[82] Based on evidence of the impact of the Way-to-Go One Less Car Challenge on 86 households, surveyed in 2002 (Hoffman, Jemae [2003]. Way to Go, Seattle: One Less Car Demonstration Study, Final Report, Revised Sep 2, 2003 (City of Seattle Department of Transportation).
[83] For 2030 and 2050 this analysis assumes that incentive programs (such as the 'One Less Car Challenge' sponsored by SDOT's Way to Go program) and mode specific outreach and education programs would be folded into a citywide personalized/customized marketing and outreach program with the same level of VMT and GHG emissions reduction benefit as the Travel Choice program (e.g. approximately 13% vehicle trip and VMT reduction for participating households).
[84] A 'post implementation' survey of participants in the Travel Choice program in the San Francisco Bay Area in 2006 confirmed that a similar, customized/personalized travel options marketing program in that region led to a reduction of 14% in auto mode for all trips. If such results were to be achievable on a larger scale here in Seattle, the City could expect to see a reduction of approximately 156,750 metric tons of GHG emissions per year (far exceeding the threshold needed for consideration as an all start)

	Short-Term Actions (by 2020)	Pilot Project Viability (L/M/H)	2020 GHG Emissions Reduction Potential (L/M/H)	Mid-Term Actions (by 2030/2035)	2030 GHG Emissions Reduction Potential (L/M/H)	Long-Term Actions (by 2050)	2050 GHG Emissions Reduction Potential (L/M/H)	Outcomes	Guiding Considerations	Lead Agency	Cost-Effectiveness *(Based on Cost/ ton GHGE reduced (2030))*	Overall Priority (1,2,3)
Incentives, Marketing, and Education	**Safe Routes to Schools & Transit/ School Trip Reduction:** Expand City support for Safe Routes to Transit (SR2T) and Safe Routes to Schools (SR2S) programs and develop and implement staff and student vehicle trip reduction program for all schools (public and private).	M	L	Expand Safe Routes to Schools and Transit Programs upgrade pedestrian, and bicycle facilities, wayfinding information, and services within ½ miles of all FTN lines/stops and all schools.	M	Expand school vehicle trip reduction programs to meet hard targets.	TBD	Enables and enhances GHG emissions reduction impact of other high impact strategies and actions (e.g. transit capital facilities and service expansion). SR2T and SR2S promote active lifestyles and enhance public health. Benefits vulnerable users.	SR2S and School Vehicle Trip Reduction programs require close collaboration with the Seattle Public School District and private school administrators throughout the City. SR2T requires close coordination with King County Metro and Sound Transit. SR2S and School Vehicle Trip Reduction programs are catalysts for cultural change in transportation behavior.	COS, KCM, ST Seattle Public Schools Private Schools	TBD	2
Transition to Clean and Efficient Vehicle Technologies and Fuels	**Transit Electrification:** Expand electrification of in-City trolley bus routes in the City of Seattle (This action includes doubling the number of route miles proposed for conversion from diesel to electric trolley service in the TMP by 2020)	L	M[85]	Convert two-thirds of all King County Metro transit diesel bus route miles in the City of Seattle to electric trolley service by 2030.	H[86]	Convert all King County Metro routes in the City of Seattle to electric trolley service	H[87]	Provides significant reduction in GHG emissions and local pollution associated with transit service in the City of Seattle. Provides faster, more reliable service on Seattle's steep hills.	Co-benefits include reduced noise and local air pollution in Seattle neighborhoods.	KCM, COS	L[88]	3

[85] The Seattle Transit Master Plan (TMP) calls for electrification of selected King County Metro Diesel Transit Bus Routes in the City of Seattle (e.g. Route 48). An aggressive trolley bus route expansion program doubling the number of diesel bus route miles proposed for conversion to electric trolley bus routes in the TMP, would result in an annual reduction of approximately 5,400 metric tons of GHG emissions by 2020.
[86] Estimated annual GHG emissions reduction of approximately 40,000 metric tons per year by 2030, based on TMP estimate of the potential for reduction of up to 62,000 metric tons of GHG emissions with full conversion of all diesel bus routes in the City to electric trolley bus routes.
[87] Estimated annual GHG emissions reduction of approximately 62,000 metric tons of GHG emissions (Note: this estimate was generated for evaluation of the emissions reduction impact of immediate conversion of KCM transit routes to Electric Trolley Bus routes. The emissions profile of the KCM fleet and the private vehicle fleet in the City of Seattle in 2050 may significantly alter the picture for estimation of the GHG emission reduction impact of this strategy beyond 2020.
[88] Estimated cost is approximately $10 million per route mile (Seattle TMP), meaning that the cost of GHG emissions reduction from electrification is approximately $6,750 per metric ton.

	Short-Term Actions (by 2020)	Pilot Project Viability (L/M/H)	2020 GHG Emissions Reduction Potential (L/M/H)	Mid-Term Actions (by 2030/2035)	2030 GHG Emissions Reduction Potential (L/M/H)	Long-Term Actions (by 2050)	2050 GHG Emissions Reduction Potential (L/M/H)	Outcomes	Guiding Considerations	Lead Agency	Cost-Effectiveness *(Based on Cost/ ton GHGE reduced (2030))*	Overall Priority (1,2,3)
	Plug-in-Ready Project: Provide necessary public support (infrastructure, policy, planning, etc.) for private vehicle electrification (goal of scaling up to 5% adoption of electric vehicles by 2020)	**H**	**H**[89]	Public support as necessary to achieve target of 10%-20% adoption of electric vehicles by 2030	**H**[90]	Target 80% adoption rate for electric vehicles by 2050	**H**	Significantly reduces GHG emissions and local/regional air pollution. Benefits public health through reduced air pollution.	Unlike many other strategies evaluated, shifting to EV's would not have significant co-benefits in terms of reduced congestion or improved transportation choices. Requires significant investment in charging stations and other infrastructure and services to bring electric vehicles "to scale' within Seattle and the Central Puget Sound region. Increased utilization of electric vehicles will require investments in electric power conservation and generation. May reduce fuel tax receipts.	COS, WS-DOT, Private Sector	**TBD**	**2**
	Bio-fuels: Support development and local adoption of bio fuels, including aggressive near term-adoption of the best first-generation biofuels (sugar ethanol and equivalents), and research and refinement of second-generation bio fuels such as cellulosic ethanol (which may have life-cycle GHG emissions that are 70% lower than petroleum).	**L**	**M**[91]	Provide public support as necessary to achieve break-throughs in bio-fuels research, development and implementation.	**H**[92]	Target 100% adoption (among vehicles with internal combustion engines) of second-generation bio-fuels by 2050	**H**[93]	Significantly reduces GHG emissions and local/regional air pollution. Benefits public health through reduced air pollution	Public sector investment in research could support development of these fuels, but such investments may be best made at the state and/or federal levels. The City of Seattle could consider providing incentives for biofuels businesses and research centers to locate in the City and provide support for initial dispersion of fueling stations. Does not offer co-benefts such as reduced congestion, expanded access or improved transportation choices.	COS, State DOE, WS-DOT Fed. Gov't.	**TBD**	**2**

Notes:

A: Methodology and data for all GHGe reduction estimates without a reference stating otherwise are detailed in Seattle Transportation TAG Draft White Paper #1, October 2011.

B: Emissions reduction potential is rated as 'High' for those strategies that could reduce GHG emissions more than an estimated 20,000 metric tons annually by 2030. Strategies rated as "Medium" could reduce emissions by an estimated 5,000 metrictons or more per year by 2030. Strategies with "Low" potential could reduce emissions by less than an estimated 5,000 tons per year by 2030.

C: Strategies are rated as having "High" cost effectiveness if they would cost the city less than $30 per ton of emissions reduction (including those that are expected to generate revenue). Strategies are rated "Medium" if they are estimated to cost less than $100 per metric ton of emissions reduction by 2030. Cost effectiveness is "Low" for strategies estimated to cost more than $100 per ton.

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[89] City estimates that if 5% of Seattle passenger vehicles were converted to plug-in electric vehicles, it would result in a reduction of 72,000 metric tons of GHG emissions per year (see City of Seattle Transportation Strategy Assessment, Transportation TAG, Draft White Paper #1, October 2011 (p. 47).

[90] City estimates that if 10% of Seattle passenger vehicles were converted to plug-in electric vehicles, it would result in a reduction of 144,000 metric tons of GHG emissions per year (see City of Seattle Transportation Strategy Assessment, Transportation TAG, Draft White Paper #1, October 2011 (P. 47).

[91] No detailed estimate for 2020 is provided, but the CNS is careful to note that second generation fuels may not be widely available by then, so this analysis conservatively puts the GHG emissions reduction potential through 2020 in the "Medium" category (although it is not unlikely that bio-fuel adoption may be more rapid than expected (By one high-level estimate based on the CNS analysis, 10% adoption of the best first-generation bio-fuels (sugarcane ethanol), which produce 60% less emissions than petroleum, would result in a net reduction of 6% of GHG emission from auto passenger transport, equivalent to approximately 85,000 metric tons per year by 2020.

92 Based on projections from the Carbon Neutral Seattle Analysis, which, assuming 100% adoption (for non-electric vehicles) of second-generation bio-fuels by 2050, may be expected to reduce GHG emissions, relative to a 'business as usual' scenario by approximately 940,000 metric tons per year by 2050. The high-level estimate for 2030 (568,000 metric tons per year) was prepared using a simple pro-ratio of the CNS estimate for 2050.

[93] Seattle Transportation TAG Draft White Paper #1, Transportation Strategy Assessment cites the Carbon Neutral Seattle Analysis, which estimated that a 100% adoption of second generation bio-fuels for all non-electric, non-fuel cell vehicles by 2050 would result in a net reduction o up to 940,000 metric tons of GHG emissions per year.

APPENDIX B

Funding Strategy Evaluation Matrix

Strategies	Short-Term Actions (by 2020)	Req. Leg. Change (Y/N)	Allows Funding for… Ped. & Bike Facil. (Y/N)	Transit Capital Facil. (Y/N)	Transit Oper. (Y/N)	Potential Annual Funding Authority (millions $)	Pilot Project Viability (L/M/H)	Lead Agency	Outcomes	Notes/ Guiding Considerations	Value for Enabling GHG Emission Reduction (L/M/H)	Overall Priority (L/M/H)
Funding and Legislation												
Reprioritization of Transportation Spending for Sustainable Transportation Projects	Prioritize transportation funding in City budget (including operations, maintenance and capital funding) for transit served streets and streets with bicycle facilities while protecting needs of freight and goods movement.	N	Y	Y	N	N/A	M	COS	Additional revenue for investment in walk, bike and ride strategies. Reduces GHG emissions. Enhances access and connectivity.	Optimizing transportation funding to reduce GHG emissions. Enables other high impact GHG emissions reduction strategies (All mode-specific strategies and high impact pricing strategies [provides low-cost alternatives], and land use strategies [necessary to support dense transit-oriented communities]).	M	H
	Advocate for increased state and federal funding for walking, bicycling and transit facilities & services	Y	Y	Y	Y	N/A	L	COS (State/ Fed)				
Pricing: Develop Strategy and Evaluate Legislative Authorization for Variable Pricing of Roadways in Central Puget Sound Region (Note: The Direct VMT reduction impacts several pricing strategies were analyzed in the associated evaluation of Pricing, TDM and Vehicle Fuel/Technology Strategies).	Work with regional partners at PSRC to develop and evaluate a detailed strategy for implementation of region-wide variable road pricing (including planning and analysis for options, including (a) no additional tolling (except for SR-520 and SR-99 AWV), (b) tolling of all limited access highways in King, Pierce, and Snohomish Counties, and (c) tolling of all limited access highways and major arterial roadways in the region Advocate, with regional partners for state legislation to: (1) provide tolling authority to PSRC or a new Regional Tolling Authority, (2) permit tolling of all limited access highways and major state or county-owned/ operated arterial, (3) permit the regional tolling authority to set and vary toll rates by day, time of day, or in real-time based on actual road conditions to achieve congestion reduction and/or GHG emissions reduction targets, and (4) permit toll revenues to be spent on transit operations and capital improvements, and on other non-road transportation facilities and services (including TDM, bike and ped programs,/ facilties), including projects and programs serving areas outside of the immediate tolled corridor.	Y	Y	Y	Y	Regional tolling may generate up to $6.1 billion/yr for full system-wide tolling of all arterials and limited access highways, o r $95 m/yr for tolling of "Selected Facilities," [94]	L	WSDOT/ PSRC/ New Regional Tolling Authority	Reduce VMT and GHG emissions (among most effective strategies). Improves transit and freight speed and reliability. Generates revenue to fund transit, walking and cycling infrastructure and services. Enhances access and mobility.	To achieve greatest GHG emission reduction and to avoid diversionary impacts, tolling must be implemented on a systemwide basis or across parallel network links. To be equitable, tolling must be implemented with "reasonable alternatives," to toll payment, such as improved transit frequency and reliability, and potentially discounts for low-income or otherwise disadvantaged users. Tolls may vary based on vehicle fuel efficiency to encourage shift to low GHG emission vehicles As alt. city may consider program similar to Eco-Points used in Hong-Kong. [95]	H	H

[94] Final Seattle Tolling Study Report, Table 3-1.
[95] The Final Seattle Tolling Study Report describes the Eco-Points Program as, "alternative payment program developed in Hong Kong, is based on the concept of carbon trading. Under the EcoPoint program, users accrue or trade emissions credits to meet travel needs into and out of a tolled area. Fares are set by environmental impact and trips are charged in eco-points that users consume or save based on individual travel behavior."

Strategies	Short-Term Actions (by 2020)	Req. Leg. Change (Y/N)	Allows Funding for…			Potential Annual Funding Authority (millions $)	Pilot Project Viability (L/M/H)	Lead Agency	Outcomes	Notes/ Guiding Considerations	Value for Enabling GHG Emission Reduction (L/M/H)	Overall Priority (L/M/H)
			Ped. & Bike Facil. (Y/N)	Transit Capital Facil. (Y/N)	Transit Oper. (Y/N)							
Funding and Legislation												
Parking Pricing: On-street and public off-street parking pricing (Note: The travel demand management impacts of this strategy will be part of the evaluation of Pricing and Regulatory Strategies).	Explore the revenue generation potential and potential annual funding for bicycle, pedestrian and transit projects and services from a variety of parking pricing alternatives (such as increasing on-street and off-street parking rates; expanding on-street parking pricing to new areas; increasing on-street parking permit rates and expanding on-street parking permit zones to new areas; monitoring the utilization of permit parking zones and offering to sell available capacity at market rates).	N	Y	Y	Y	As an alternative to area tolling, area parking pricing has potential to generate approximately $100 m/ year[96]	L		The availability and price of parking are major determinants of destination and mode choice. If effective alternatives are not available, can have adverse impacts on businesses. Elimination of standard free off-street parking as a subsidy for auto access and mobility reduces VMT and GHG emissions. With variable rates, parking pricing can enhance turnover of spaces, improving access to and enhancing the vitality and profits of retail districts.	To be equitable and just, expanded parking pricing must be implemented with "reasonable alternatives," to access by driving and parking, such as improved transit frequency and reliability, and potentially discounts for low-income or otherwise disadvantaged users.	H	H
Establish a Transit Communities Development Authority (Note: This Is Also Included as a Land Use Strategy).	Establish a Transit Communities Development Authority	N	Y	Y	Y	For reference, the Portland Development Commission's annual budget is $150-$250 m[97] (funding comes from grants, real estate income, Tax Increment Financing (TIF), City general funds, and private donations).	H	COS to Establish new TCDA	Facilitates development of transit oriented development (TOD) and transit-oriented communities (TOC) enabling long term GHG emissions reduction from land use strategies May dedicate funding to development supportive walk, bike and ride projects, and services within TOD/TOC's. (Supports infrastructure development that contributes to long-term travel behavior change).	Enables other high impact GHG emissions reduction strategies (Facilitates development of transit-oriented communities (TOC)). Likely strong political support. Facilitates valuable public and private partnerships. Strong mechanism for improving coordination of land use and transportation.	TBD	H

[96] Final Seattle Tolling Study Report, Table 3-1, "Destination 2030 Tolling Concepts Modeling Summary Results."
[97] For Reference, the Portland Development Commission, which is active in supporting Transit Oriented Development projects and the provision of so-called "urban living amenities," that help make completed Transit Oriented Communities had revenue of $188 m in 2010. The proposed budget for 2012-2013 is $186 m (after a decline to $159 m in 2011-2012)

Strategies	Short-Term Actions (by 2020)	Req. Leg. Change (Y/N)	Allows Funding for…			Potential Annual Funding Authority (millions $)	Pilot Project Viability (L/M/H)	Lead Agency	Outcomes	Notes/ Guiding Considerations	Value for Enabling GHG Emission Reduction (L/M/H)	Overall Priority (L/M/H)
			Ped. & Bike Facil. (Y/N)	Transit Capital Facil. (Y/N)	Transit Oper. (Y/N)							
Funding and Legislation												
Development Impact Fees	Enact a Transport/Climate Impact Fee for new development based on estimated Vehicle Trip Generation (VTG)	Y	Y	Y	Y	TBD	L	COS	Generates revenue to fund facilities and services to support walking, bicycling and transit, as well as TDM programs and services that are specifically tailored to reduce vehicle trips. Reduces VMT and associated GHG emissions. Provides incentive for developers to build projects in locations where access to transit reduces vehicle trip generation rates and to design projects in ways that reduce vehicle trips.	Note that amendments to the State Growth Management Act (GMA) and/or the State Environmental Policy Act (SEPA) are necessary to authorize cities to legislate impact fees with revenue dedicated to any non-roadway improvements (e.g. transit, bicycle, or pedestrian facilities/services) City may opt to use an innovative approach to transportation impact mitigation proposed by the San Francisco County Transportation Authority (SFCTA) – levying one-time fee based on a location adjusted estimate of project Vehicle Trip Generation (VTG). The fee would be set at a fixed, per trip rate, established by calculating the cost of a package of citywide vehicle trip reduction projects and programs that can reduce, mitigate or accommodate (on sustainable modes) all net new vehicle trips projected from allowable citywide development.	H	H
Off-Street Parking Tax	Advocate for and pursue legislation to set a flat per space fee on all off-street parking spaces in the City (Note: This fee may be designed to be levied in lieu of or in addition to the City's existing commercial parking tax; and may be limited exclusively to non-residential spaces.	Y	Y	Y	Y	$40m - $265 m[98]	L	COS	Provides revenue to fund mobility and access programs and services Provides incentive for property owners to price and unbundle parking; both of which may reduce VMT and GHG emissions.	May replace the existing commercial parking tax (current tax structure may discourage property-owners from pricing parking). A graduated, non-residential parking tax can encourage use of parking management techniques that can reduce parking and travel demand (as well as congestion). Equity considerations: Impact of fee may be off-set for low-income commuters if employers are required to offer-parking cash-out (a TDM strategy).	H	H

[98] This is the estimated mid-point of revenue generation potential for a Non-Residential Parking Tax proposal evaluated by Litman, T., and D. Carlson (2010), Evaluating Seattle Parking Tax Options. To replace projected revenue from elimination of the duplicative commercial parking tax, Litman and Carlson assumes a rate of approximately $47 /yr per stall for a high-end estimate of the number of stalls subject to the tax (citywide) and $110/yr per stall for a low end estimate of total stalls subject to the tax. These estimates were developed to address the question of what rate would be necessary to replace commercial parking tax revenues at current 2011 rates. The high end of this estimate is based on current rates charged in Sydney Australia, which levies an annual tax of $800 AU ($850 USD) per stall for non-residential parking in the Central Business District, and $400 AU ($425 USD) per stall for non-residential parking in neighborhood business districts. Applying the lower of the two rates to Litman's mid-point estimate of the total number of non-residential off-street stalls in the Seattle, we estimate a high-end revenue generation potential of $265 m/year.

Strategies	Short-Term Actions (by 2020)	Req. Leg. Change (Y/N)	Allows Funding for…			Potential Annual Funding Authority (millions $)	Pilot Project Viability (L/M/H)	Lead Agency	Outcomes	Notes/ Guiding Considerations	Value for Enabling GHG Emission Reduction (L/M/H)	Overall Priority (L/M/H)
			Ped. & Bike Facil. (Y/N)	Transit Capital Facil. (Y/N)	Transit Oper. (Y/N)							
Motor Vehicle Excise Tax	Advocate legislation to secure local or transit agency authority to levy a GHG emissions intensity-based MVET	Y	Y	Y	Y	$20-$30 m[99]	L	COS/ Seattle TBD	Most socially just among lump-sum vehicle fees and taxes (progressive tax, based on vehicle MSRP).	Political hurdles remain to reauthorize MVET for use by local governments and/or transit agencies (State MVET was eliminated by voter initiative in 1999).	L	M
Funding and Legislation												
Vehicle License Fees	Advocate legislation to secure local authority to assess an additional local vehicle registration fee based on the GHG emissions intensity of vehicle operations.	N[100]	Y	Y	Y	$25-$30 m[101]	L	COS/ Seattle TBD	Increases the fixed costs of vehicle ownership and operation. Some stakeholders have argued that the VLF is a 'regressive' form of funding, although it places no burden on transit-dependent Very Low Income households.	Seattle TBD currently levies a $20/year VLF; has state authority to levy up to an additional $80/year VLF. A November 2011 ballot measure to authorize a $60/year VLF within the City of Seattle was rejected. As with other license, registration and excise taxes, represents a one time, fixed-cost of auto mobility that does not currently discourage driving once paid. With state authorization, VLF may be restructured to vary based on annual VMT (see VMT-fee for details).	M	H
Local and Regional Sales Taxes	Advocate legislation to seek additional authority for the City, or regional agencies (e.g. Sound Transit, or King County Metro) to seek voter approval to levy an additional 0.5% to 1.0% sales tax to fund additional walking, bicycling, transit and/or TDM facilities, and services.	Y	Y	Y	Y	[102]$60-$90 m	L	COS/ Seattle TBD/ KCM	Not as effective as other revenue sources at fostering social equity (Regressive tax; not associated with transportation system utilization).	State may be seeking additional sales taxes for general fund purposes; making it difficult to garner authority to levy additional local option sales taxes for any purpose.	L	L

[99] Assumes the MVET is levied citywide at the same rate and schedule collected by the Seattle Monorail Authority from 2002-2006, generating approximately $25 m/ year (Note: this revenue stream was approximately 30% less than projected by the Elevated Transportation Company, resulting in the disollution of the SMA in January 2008.
[100] The Seattle Transportation Benefit District has authority to levy up to $80/year in additional Vehicle License Fees on vehicles owned by Seattle residents. To generate more revenue, the City would need to seek legislative changes for increased local or regional fee authority.
[101] In Nov. 2011, City of Seattle voters rejected a proposal by the Seattle Transportation Benefit District to levy an additional $60/year VLF, which was expected to raise $20.4 m/year for transportation projects and services through 2021. The STBD has state authority to levy up to $80 VLF (which would generate approximately $27m/year). The City or STBD may seek additional authority to raise fees above $80/year.
[102] Based on estimates of potential revenue from a 0.5% Sales Tax increase for the period 2006-2025, prepared for Sound Transit as part of development of the ST2 Funding Package (Revenue estimate for North King Sub-Area was adjusted to City of Seattle based on the ratio of City of Seattle Population to the population of the North King Sub-Area (including the City of Shoreline) per 2010 US Census Data. Note that sales tax revenue is down significantly below projections during the recessionary period from 2008-2012, so the estimate of $90 m/year in funding capacity from each 0.5% in sales tax in Seattle is taken here as the top-end of the range provide ($60m-$90m / year).

Strategies	Short-Term Actions (by 2020)	Req. Leg. Change (Y/N)	Allows Funding for…			Potential Annual Funding Authority (millions $)	Pilot Project Viability (L/M/H)	Lead Agency	Outcomes	Notes/ Guiding Considerations	Value for Enabling GHG Emission Reduction (L/M/H)	Overall Priority (L/M/H)
			Ped. & Bike Facil. (Y/N)	Transit Capital Facil. (Y/N)	Transit Oper. (Y/N)							
Local Sales Tax on Gas	Advocate legislation to secure local authority to apply local sales tax rates to gasoline, with some or all revenue dedicated to investments in walking, bicycling and public transit infrastructure and services.	Y	Y	Y	Y	$30-$40 m[103]	L	COS/ KCM / WSDOT	Revenue generation (Given the limited revenue generation potential of this funding option, it is likely best considered as a complement to other options for funding major transit capital expansion). Directly reduces VMT and GHG emissions.	Removes a tax exemption, rather than establishing a new tax. Revenues subject to volatility of gas prices.	M	M
Carbon Tax	Advocate legislation to secure local and/or regional authority to assess Climate Impact and Public Health Mitigation tax based on the carbon content of fossil fuels (effectively taxing carbon emissions), with some funding dedicated to pedestrian, bicycle, transit and TDM programs, facilities, and services that have a demonstrated vehicle trip reduction impact.	Y	Y	Y	Y	TBD	M	WSDOT, PSRC, or COS	Tax on the carbon content (and consequent GHG emissions impact) of transportation fuels is a direct way to incentivize both (a) cleaner, lower-carbon intensity fuels, (b) improved fuel efficiency in the public and private motor vehicle fleet, and (c) reduced consumption through vehicle trip and VMT reduction.	Difficult to define and assess. Carbon taxes are often discussed as part of "tax shift" strategies, wherein an economy-wide carbon tax levy is off-set by a reduction in income or sales taxes so as to be revenue neutral. Levying a carbon tax a walk/bike/ride funding strategy may require a new political strategy.	H	M
Vehicle Miles Traveled (VMT) Fee	Advocate legislation to secure local and/or regional authority to assess a VMT-based Climate Impact and Public Health Mitigation fee on vehicle travel (Funding dedicated to pedestrian, bicycle, transit, and TDM program facilities and services that have a demonstrated vehicle trip reduction impact).	Y	Y	Y	Y	$180 m ($0.05/mile) to $380 m ($0.10/mile)	H	COS/ Seattle TBD/ WSDOT	Generates significant revenue for walking, bicycling, and transit infrastructure and services. May significantly reduce VMT and consequent GHG emissions by providing cost incentive to reduce driving.	As a user-fee, this funding source is expected to have a direct VMT reduction effect. However, the rate of expected VMT reduction for each incremental increase in cost of travel per mile is unknown and may differ from that of tolls and/or gas taxes, because the charge is proposed to be levied on an annual rather than a periodic, or per trip basis[104].	H	H
Vehicle Weight Fees	Advocate for local or regional authority to levy an annual vehicle fee on light and heavy duty vehicles based on gross vehicle weight.[105]	Y	Y	Y	Y	Revenue generation potential depends on authorized fee rate and schedule.	L	COS/ Seattle TBD/ WSDOT	Because vehicle fuel efficiency, and GHG emissions per mile vary closely with vehicle weight, this fee would have similar effect to a carbon tax or gas tax (however, it would not capture the GHG emissions reduction benefit of vehicles designed to use cleaner burning, lower-carbon fuels).	Local vehicle weight fees may be assessed by WSDOT, which already assesses for a state fee. Likely to face strong political opposition. If applied to all vehicles, a universal (cost per lb.) weight fee would have a significant impact on freight mobility costs. Weight fees may also be structured to apply only to qualifying "light trucks" and passenger cars	L	M

[103] Based on data indicating that Washington residents used 7.4 gallons of transport fuel per week per capita in 2009. Assumes Seattle residents utilize no more than 4 gallons of fuel per week (given higher densities, greater availability of transportation choices and shorter trip distances), a $3.50/gallon average fuel price, and application of 9.5% local + state sales tax to all motor vehicle fuel sales transactions.
[104] The elasticity of VMT with respect to per mile charges assessed on an annual basis likely differs slightly from per mile charges assessed as tolls, or gas taxes paid periodically.
[105] The State of Washington currently assesses weight-based motor vehicle fees.

Strategies	Short-Term Actions (by 2020)	Req. Leg. Change (Y/N)	Allows Funding for…			Potential Annual Funding Authority (millions $)	Pilot Project Viability (L/M/H)	Lead Agency	Outcomes	Notes/ Guiding Considerations	Value for Enabling GHG Emission Reduction (L/M/H)	Overall Priority (L/M/H)
			Ped. & Bike Facil. (Y/N)	Transit Capital Facil. (Y/N)	Transit Oper. (Y/N)							
Public-Private Partnerships	Seek private partners for funding and implementing walking, bicycling, and/or transit facilities & services (e.g. P\privately operated bike-sharing; private subsidy for extra transit service to a major employment site).	N	Y	Y	Y	No Limit	H	COS, Downtown Seattle Assoc., Chambers of Commerce; Individual Institutions & Organizations	Improved collaboration with private sector on development design and process, improving access, connectivity, and consistency with the TSP. Agreements may include affordable housing and transit subsidy (for residents and/or workers) provisions to promote equity. Private contributions such as Seattle Childrens' Hospital's contribution to Greenway development and additional public transit service or potential health care sector contributions to bike share or cycling programs have explicit public health objectives.	Meaningful partnerships can be large or small. As an example, in 2006, Seattle Childrens' Hospital entered into an agreement with King County Metro to secure additional transit service to its NE Seattle Campus. Seattle Childrens' pays $300,000 per year, or 1/3 of the cost to provide additional service on local routes serving the hospital and has employed aggressive parking pricing and TDM programs to fill those buses increasing transit service efficiency.	M	M
Bikeway Sponsorship Programs (Similar programs can be structured to support transit facilities, bike parking [see Vancouver BC, or other capital facilities])	Solicit health care providers or other private businesses to sponsor bike and pedestrian facilities in exchange for limited advertising rights (London Model).	N	Y	N	N	$5-10 m /yr	H	COS, DSA and Private Sector	Private sponsorship can help innovative programs, such as bike sharing and car sharing "get to scale" quickly, using advertising revenue to cover costs of up to $10 m/ year. Greater investment of business partners in cycling and other sustainable modes of transport increases their likely support for planning and public investment in climate-friendly transport and land use initiatives.	An exemplary model program is the Barclay's Cycle Hire scheme in London, where the bank has contributed £25 m /$39.6 m over 5 years to fund a citywide bike sharing program.	M	M

Strategies	Short-Term Actions (by 2020)	Req. Leg. Change (Y/N)	Allows Funding for…			Potential Annual Funding Authority (millions $)	Pilot Project Viability (L/M/H)	Lead Agency	Outcomes	Notes/ Guiding Considerations	Value for Enabling GHG Emission Reduction (L/M/H)	Overall Priority (L/M/H)
			Ped. & Bike Facil. (Y/N)	Transit Capital Facil. (Y/N)	Transit Oper. (Y/N)							
Other Funding Options for Consideration												
Local Improvement Districts/ Road Improvement District	With approval of local property owners, the City or the Seattle TBD may establish Local Improvement Districts (LID) or Roadway Improvement District (RID) in specific areas that are likely to benefit from bicycle, pedestrian and/or transit improvements in order to fund such improvements.											
Make Bike and Pedestrian Facility Projects Eligible for Green Stormwater Infrastructure (GSI) Funding	Include sidewalk and bike facility improvements as integral components of GSI projects (Coordinate GSI development with Seattle Bicycle Master Plan Update, esp. Greenways Development Plan)											
Grant Funding	Work medical/health institutions and industry groups to secure grant funding for walking, bicycling, transit and TDM programs and services that support active transportation and public health											
	Lead or participate in an outreach and education campaign to train key development industry leaders in the benefits of walking, cycling and transit access to sites and network connectivity, and other Urban Living Infrastructure.											
Innovative Neighborhood Funding	Explore options such as CrowdFunding of public facilities (ie., bike lanes) that support GHG emissions reduction targets (Note: Crowd funding (also referred to as crowd financing, or crowd sourced capital) is the collective cooperation, attention and trust by people who network and pool their money together -- usually via the Internet -- to support efforts initiated by other people or organizations[106].											
Develop Competitive Matching Grant Program for Bike/Ped Projects	Create program that allows neighborhood or district level matching to better leverage limited public funds											

[106] Definition of "CrowdFunding" sourced from http://en.wikipedia.org/wiki/Crowd_funding

APPENDIX C

Methods of Analysis

This section provides an overview of the process, sources of data, methodology and assumptions used to estimate the stand-alone and combined Vehicle Miles Traveled (VMT) and Greenhouse Gas (GHG) emissions impacts of the strategies considered and recommended by the Transportation TAG and the Land Use TAG for reducing GHG emissions from transportation.

Methods of Analysis of VMT and GHG Emissions Reduction

The GHG emissions reduction estimates presented in this report for individual actions and strategies in the transportation and land use sectors are high-level, order-of-magnitude estimates based primarily on data and projections published in other relevant plans, studies and models. These include local data sources, plans, and studies, including:

- the *Carbon Neutral Seattle* analysis, prepared for the Seattle Office of Sustainability and Environment by the Stockholm Environmental Institute (SEI) in 2011,
- analysis conducted by and for the Seattle Department of Transportation including the *Seattle Transit Master Plan* (2011), the *Seattle Bicycle Master Pla*n (XYZ), and the *Seattle Pedestrian Master Plan* (XYZ), and
- Puget Sound Regional Council plans and studies, including *Transportation 2040,* the regional transportation plan, and *Vision 2040*, the regional growth management strategy.

Data and assumptions estimates were also derived from Nelson\Nygaard's library of national best practice case studies, and a broad literature review. Wherever possible, the estimates were based on quantitative data (empirically derived or modeled). When appropriate, professional judgment was used to refine impact estimates for specific policy, project and program options, based on prior experience with the development, implementation and analysis of similar vehicle trip reduction strategies.

The relationships between land use development patterns and regulations and transportation system design and programming are complex and highly interdependent. Detailed travel-demand modeling of the combined impacts of strategies was not part of this project[107]. Rather, technical analysis was conducted as necessary to inform Technical Advisory Group (TAG) decision-making.

The sources referenced, and methods and assumptions used to provide planning level estimates of GHG emissions reduction in the transportation and land use sectors are purposefully conservative, to avoid the risk of overstating GHG emissions reduction potential and other benefits. This conservative methodology was maintained both for (a) estimates of the stand-alone impacts of individual actions and strategies, and (b) the cumulative impacts of a combination of complementary actions and strategies from across the land use and transportation sectors.

Methodology for evaluation of stand-alone impacts

The following provides a stepwise overview of the analytical methodology used to evaluate the *stand-alone* VMT reduction and GHG emissions reduction impacts of all transportation and land

[107] An interactive regional modeling process that that considers travel demand and land development patterns using an activity-based, interactive methodology, would be needed to generate more precise estimates of the timing and scale of GHG emissions reduction from stand-alone actions/strategies, and combinations or packages of actions/strategies (as might be necessary for financial modeling, or to verify emissions reduction potential as part of emissions tax or trading regime). Such a process would be time and resource intensive and was not included in the scope of work for this project.

use policies, programs and projects considered. The Transportation TAG used these estimates, along with other identified evaluation criteria (detailed in Section 3) to prioritize and select short- and long-term actions and initiatives for recommendation.

1. **Determination of primary means of GHG emissions reduction.** GHG emissions from passenger transportation are a function of one or more of the following factors:
    - distance traveled (Vehicle Miles Traveled, or VMT)
    - number of passengers per vehicle (Vehicle occupancy)
    - fuel/energy efficiency of vehicles (Miles per gallon of fuel, and/or per kilowatt/hour for electric vehicles). Note: For many vehicles, this variable is affected by speed of travel, which may be considered a fifth GHG emissions variable.
    - the carbon intensity of fuel used directly or indirectly (e.g. by electric vehicles) for propulsion.

    Because the City of Seattle has the greatest influence over strategies that impact the first two factors – distance traveled, as measured by VMT, and vehicle occupancy -- most of the recommendations in this report address one or both of these factors. Changes to the fuel/energy efficiency of vehicles and/or the carbon intensity of fuels are among the most effective stand-alone strategies for reducing GHG emissions in the transportation sector, but it is important to note that these require concerted private and/or public sector initiative and collaboration at the state and national levels.

2. **VMT Reduction analysis.** Although different sources are cited for estimates of VMT reduction for different actions and strategies, this report has employed a standard methodology for estimating changes in GHG emissions, based on evidence or estimates of changes in VMT. Based on the best available research tailored to conditions in Seattle, planning-level, order of magnitude estimates of anticipated VMT reduction were calculated for specific initiatives or for a suite of policies and programs. These estimates were based on several key assumptions, including:
    - Continuation and/or expansion of existing policies and programs (Some existing policies and programs were evaluated based on either status quo implementation or expanded implementation).
    - Implementation of new policies and programs that research has shown to have a proven effect on mode choice and travel behavior. For some new policies or programs, both moderate and robust implementation frameworks were considered.

3. **Disaggregation of impacts.** VMT and GHG emissions reduction estimates were disaggregated for individual strategies where it was logical to do so and the available research and case studies allowed derivation of a reasonable estimate. In some instances, estimates of changes in VMT and/or GHG emissions for individual policies and programs were disaggregated as follows:
    a. **New trips versus existing trips.** In the evaluation of several recommended actions and strategies that only apply to new development, new residents, and/or new employees in the City, estimates of VMT and/or GHG emissions reduction impacts were only generated for travel generated by these new (rather than existing) residents, employees and businesses. For example, to determine the effects of offering or requiring the purchase of bulk-discounted transit passes by employers

and/or property owners (e.g. ORCA Passports for employees and/or neighborhoods), new commute trips were separated from existing peak-hour commute trips for analysis. The provision of partially or fully subsidized transit passes would only be required in new commercial and residential developments in urban villages and/or City-defined Transit Communities, thus no additional trips from existing commercial and residential developments would be expected.

b. **Commute versus non-work trips:** Where possible, this analysis evaluates the impacts of recommended actions and strategies on commute and non-commute trips separately. Many current City, regional and state transportation and TDM programs are focused on promoting and encouraging use of non-auto modes of transportation for commute trips. At the same time, much of the literature on the vehicle trip, VMT, and GHG emissions impacts of non-auto transportation infrastructure and services, including TDM programs, focuses on their impact on vehicle trips, VMT, and/or pollutant emissions resulting from work commute trips during peak periods. Nevertheless, due to expected demographic shifts over time (especially the aging of Baby Boomers) and growth in the incidence of flexible work schedules, telecommuting, and self-employment, non-commuter trips comprise an increasingly large proportion of all trips, including peak-hour trips.

   This report includes a number of actions and strategies that were recommended specifically to reduce vehicle trips, VMT and consequent GHG emissions from the majority of vehicle trips that are made for non-commute purposes (e.g. the recommended development of an ORCA Neighborhood Passport program, expansion of the Safe Routes to School (SR2S) program, as well as investment in Neighborhood Greenways and other bicycle and pedestrian facilities that expand youth and Senior mobility and transportation choices).

Impacts of some strategies were not quantifiable

The estimated reduction in VMT and consequent GHG emissions can be quantified with greater certainty for some policies and programs due to available data, while others do not lend themselves to easy quantification due to lack of data or other unknown variables. Lack of an estimate for a particular action or strategy does not mean that it has no impact on VMT or GHG emissions. Instead, these designations mean that:

- The impact on VMT and/or GHGE is not significant enough to model (e.g., the impact could fall within the margin of error); or
- There is no solid basis (e.g., empirical research or published case studies) for documenting the precise VMT and/or GHG emissions reduction impacts of a specific action or strategy.

For example, no estimate of GHG emissions impacts is provided for selected individual actions that comprise the strategy of expanding bicycling facilities and services, such as developing a citywide network of greenways and cycle tracks, or expansion of bike parking facilities in urban villages because there is insufficient evidence to estimate the stand-alone impact of such interventions). Instead, this report provides an estimate of the combined impact of these complementary actions, based on the share of trips made by bicycle in regions that have such extensive networks of on-street and off-street bicycle facilities.

Geographic assumptions

Where possible, estimates are based on data and projections for the City of Seattle. In some cases, estimates of the impact of specific policies and programs in the City of Seattle were generated from data and projections of the impact of policies and programs at the regional level. In limited

cases, evidence of impacts at a state or national level were used to estimate impact in Seattle and the Central Puget Sound Region.

Where data inputs or estimates of VMT or GHG emissions impact were available only at a regional-level (e.g. for the Central Puget Sound Counties of King, Kitsap, Pierce and Snohomish), the share of regional impact attributable to the businesses, employees and residents of Seattle was estimated using regional per capita rates, or by multiplying the regional total by the share of regional population and jobs located in the City of Seattle.

EVALUATION OF COMBINED IMPACTS

Section 5 provides a high-level analysis of the combined impacts of a recommended package of transportation and land use actions and strategies intended to reduce GHG emissions in the transportation sector. To the extent feasible with available information on the inputs and assumptions for the GHG reduction estimates referenced for each individual action and strategy area, this report identifies and accounts for areas of overlapping or synergistic influence between individual transportation and land use related actions and strategies. The following provides an overview of the method used to estimate the cumulative trip reduction impacts of the land use and transportation policies and programs under consideration.

It is important to note, given the fact that the underlying estimates of the GHG emissions reduction potential of each individual action and strategy are planning-level estimates (based on data from a variety of different sources), that the resulting estimates of the combined impact of implementing recommended strategies by 2020, 2030 and 2050 are similarly planning-level, order of magnitude estimates. These combined impact estimates are intended to provide a general estimate of the emissions reduction potential of recommended transportation and land use actions and strategies over time and relative to the potential reductions in other sectors (e.g. Building Energy, Waste Reduction, etc).

This GHG emissions reduction analysis and its component elements (e.g. VMT emissions reduction estimates) may inform, but should not be used directly for project-level planning, budgeting, financial analysis, or analysis of GHG emissions reduction impact.

Non-additive GHG emissions reduction

A cumulative estimate of GHG emissions reduction potential for the TTAG/LUTAG recommended package of transportation and land use actions and strategies was developed using a non-additive methodology. This was done for several reasons, including:

- **Synergies increase the effectiveness of complementary actions/strategies:** Because many of the recommended actions and strategies in this plan are complementary and synergistic, joint implementation can leverage greater emissions reduction than stand-alone implementation. For example, reforming parking requirements and land use regulations can support development of walkable, bicycle and transit accessible, mixed-use communities. Doing this in concert with the provision or improvement of high frequency transit service can increase transit ridership, walking and cycling, and optimize GHG emissions reduction.
- **The emissions impacts of selected actions/strategies are mutually exclusive:** Conversely, the benefits of some transportation and land use strategies are mutually exclusive. For example, this analysis assumes that some TDM strategies, such as telecommuting are mutually exclusive of the benefits of other selected transportation strategies (since telecommuters cannot by definition commute by transit, carpooling, bicycling, etc.). These impacts were therefore "netted out" of the cumulative estimates for certain policy alternatives.

Overlap/Synergy Analysis

To evaluate cumulative GHG emissions reduction potential in the transportation and land use sectors, an analysis of overlap and synergies between the various recommended actions and strategies was conducted. The first step in the analysis was to identify a set of complementary actions within each recommended strategy (specifying which, if any actions have mutually exclusive GHG emissions reduction benefits, and which have synergies that increase their respective effectiveness in reducing emissions).

This section identifies the methodology used to produce an overarching estimate of the GHG emissions reduction impact of each of the recommended transportation and land use strategies. Figure D-2 highlights assumptions used in the evaluation of overlap and synergy between individual actions and strategies recommended for inclusion in the Seattle Climate Action Plan. It is important to note that this step of the analysis only addresses the question of whether or not a substantial additional VMT or GHG emissions reduction impact can be expected from the combined implementation of two or more complementary actions or strategies. This analysis assumes that the estimated GHG emissions and/or VMT reduction impact associated with individual strategies and actions evaluated in the 'stand-alone' analysis do not significantly overlap, because most of the stand-alone estimates were generated or derived from studies that attempted to isolate the impact of individual strategies, holding all other factors constant (including the presence or lack of other policies, projects and programs that may aim to reduce on-road passenger travel related VMT and/or emissions generated by the same travelers and/or the same vehicle trips).

Where a combination of two strategies is expected to have an additional impact, above and beyond the sum of the stand-alone impacts for each strategy identified in Appendices A, B and C, a "Synergy Factor," ranging from +1.5% to + 15% is noted in Figure D-1 and accounted for in the evaluation of the combined impacts presented in Section 4[108]. In many cases, where the impact of one strategy on another is assumed to be largely accounted for in the stand-alone estimates of the VMT and GHG emissions reduction impacts of each strategy, this was noted in Figure D-1, and no synergy factor was applied.

[108] First, all synergy factors affecting each strategy were added. Then the total stand alone impacts of the recommended actions under each strategy were multiplied by one plus the total of all synergy factors affecting that strategy to generate an estimate of the total impact of the given strategy as a part of a larger package of complementary actions and strategies

Figure C-1 Strategy Synergy Analysis

How Does THIS v Strategy (*below*) Affect THIS Strategy > (*at right*)	Fuels/Tech	Land Use	Ped Facilities/ Services	Bike Facilities/ Services	Transit Facilities/ Services	Congestion Pricing	Parking Management & Pricing	TDM Programs	Planning & Roadway Mgmt/ Goods Movement
Clean Fuels & Technologies (CFT)	n/a	CFT may minimally increase dispersion of development by reducing cost/mile VMT[109].	n/a	n/a	Transit electrification reduces GHG (Accounted for in CFT)	n/a	n/	n/a	Substantially reduces GHG from freight mobility (Accounted for in GHG est. for all trans. [CFT])
Land Use Development and Regulation (LU)	n/a	n/a	Substantially increases GHG reduction potential of PFS by putting more trip origins and destinations in walking distances (Accounted for in LU)	Substantially increases GHG reduction potential of BFS by putting more trip origins and destinations in biking distance (Accounted for in LU)	Substantially increases GHG reduction potential of TFS by concentrating growth in jobs and housing near transit **(Synergy: +15% impact of TFS)**		Increases the effectiveness of parking pricing & management by putting more jobs and housing in areas where shared parking is feasible **(Synergy: +5% impact of PMP)**	Substantially increases effectiveness of TDM programs by making more trip origins and destinations transit, bike, and pedestrian accessible **(Synergy: +5% impact of TDM).**	Reduces freight GHG by concentrating urban activities within metro area; reducing VMT for distribution (accounted for in LU)
Pedestrian Facilities & Services (PFS)	n/a	Investment in Ped F/S make dense, mixed-use development more attractive to prospective developers/occupants (accounted for in LU)	n/a	PFS increase GHG reduction potential of BFS by calming traffic/ enhancing safety for all users (**Synergy: +5% impact of BFS)**	Increases GHG reduction potential by improving pedestrian access to transit **(Synergy: + 10% impact of TFS)**	n/a	Increases parking choices by increasing area within walking distance of destinations **(Synergy: +5% impact of PMP)**	Increases effectiveness of TDM by expanding travel choices **(Synergy: +5% impact of TDM)**	n/a
Bicycle Facilities & Services (BFS)	n/a	Investment in Bike F/S make dense, mixed-use development more attractive to prospective developers/occupants (accounted for in LU)	BFS increase GHG reduction potential of PFS by calming traffic/ enhancing safety for all users **(Synergy: +10% PFS)**	n/a	Increases GHG reduction potential by improving bicycle access to transit **(Synergy: +5% impact of TFS)**	Increases GHG reduction potential of pricing by providing a low-carbon travel alternative in some corridors (accounted for in CP impact on BFS)	n/a	Increases effectiveness of TDM programs by providing access alternatives **(Synergy: +5% impact of TDM)**	n/a
Transit Facilities & Services (TFS)	n/a	Expanded HCT and frequent transit service enables significantly higher density of development **(+15% impact of LU)**			n/a	Increases GHG reduction potential of pricing by providing a low-carbon travel alternative in some corridors (accounted for in CP impact on TFS)	n/a	Increases effectiveness of TDM programs by providing access alternatives **(Synergy: +10% impact of TDM)**	n/a
Congestion Pricing (CP)	n/a	Improved off-sets effect of increased cost of driving on land use. VMT fee increases impact of land use strategies **(+10% impact of LU)**	Every 10% increase in the cost of driving leads to a 1.5% increase in walking **(+1.5%)**	Every 10% increase in the cost of driving leads to a 1.5% increase in cycling **(+1.5%)**	Every 10% increase in the cost of driving leads to a 1.5% increase in walking **(+1.5%)**	n/a	n/a	Increases GHG reduction potential of TDM by adding price incentive to seek non-SOV alternatives **(Synergy: +5% impact of TDM)**	Increases potential GHG reductions from reduced delay for freight (accounted for in evaluation of CP effect on all transport GHG)

[109] There is not sufficient evidence to account for the effect of reduced marginal costs of automobility on land use patterns and in turn on VMT and consequent GHG emissions. Evaluating impacts of this factor on net GHG emissions would require development and application of an integrated travel demand an d land development model capable of accounting for local and regional barriers to and incentives for growth and development.

How Does THIS v Strategy (below) Affect THIS Strategy > (at right)	Fuels/Tech	Land Use	Ped Facilities/ Services	Bike Facilities/ Services	Transit Facilities/ Services	Congestion Pricing	Parking Management & Pricing	TDM Programs	Planning & Roadway Mgmt/ Goods Movement
Parking Management & Pricing	n/a	Increases GHG reduction potential of LU by lowering cost of/ improving access to urban mixed-use dev. **(+5% impact of LU)**	Every 10% increase in the cost of driving leads to a 1.5% increase in walking **(+1.5%)**	Every 10% increase in the cost of driving leads to a 1.5% increase in walking **(+1.5%)**	Every 10% increase in the cost of driving leads to a 1.5% increase in walking **(+1.5%)**	n/a	n/a	Impacts of parking cashout (TDM strategy) and selected parking management and pricing strategies overlap. Impact of cashout is eliminated where these overlap.	n/a
Transportation Demand Management (TDM)	n/a	Increases GHG reduction potential of land use strategy by enabling dense mixed-use development (accounted for in LU and impacts of LU on TDM).	n/a	n/a	n/a	n/a	Impacts of parking cashout (TDM strategy) and selected parking management and pricing strategies overlap. Impact of cashout is eliminated where these overlap.	n/a	n/a
Planning & Roadway Management (PRM)	n/a	n/a	Prioritization of pedestrian access/ connectivity in street planning/operations increases effectiveness **(+10% impact in PFS)**	Prioritization of bicycle access/mobility in street planning /operations increases effectiveness **(+10% impact in PFS)**	Prioritization of transit in street planning/ operations increases effectiveness **(+10% impact in PFS)**	n/a	n/a	n/a	n/a

After accounting for the mutually exclusive and synergistic impacts of actions with adjustments to the stand-alone impacts, a multiplicative approach was used to determine the combined impacts of the suite of actions and strategies recommended by the Transportation TAG and the Land Use TAG. Using a multiplicative approach rather than an additive approach avoids overstating the impact of individual strategies by ensuring, for example, that the estimated emissions level resulting from combined implementation of two complementary strategies that are each estimated to reduce GHG emissions from passenger transportation by 10% in 2030, is equal to:

> *(1.0 – 0.10) x (1.0 – 0.10) = 0.81, or 81% of the estimated BAU level of emissions for 2030*

This means, essentially, that the VMT and emissions reduction potential for Strategy 2 is applied to the total volume of VMT estimated only *after* accounting for GHG emissions reduction resulting from strategy 1 (Note: using an additive approach, these two strategies would be assumed to reduce GHG emissions by a combined 20%, resulting in emissions levels equal to 80% of the estimated BAU-level for 2030).