Chapter 7
Transportation and Land Use Mitigation

Sector Vision for a Low-Carbon Future

The Transportation and Land Use (TLU) Technical Work Group—comprised of stakeholders from government agencies, industry, academia, and nonprofit organizations—developed a vision statement for the transportation and land use sector. Under that vision, New York's transportation system will have the following characteristics:

Vehicle types and fuels: Trips that are not made using mass transportation will be made in vehicles fueled by electricity, hydrogen and/or sustainably derived biofuels.[1] Aviation, the goods movement system, and the construction industry will be powered by a similar mix of low-carbon fuels. Vehicles across the entire fleet population will approach carbon neutrality.

Mass transportation and vehicle miles of travel (VMT): Extensive mass transit systems will be powered by very low- and/or zero-carbon fuels. Because so many attractive mass transportation options will be available, per-capita personal vehicle miles of travel will be low.

Freight transportation: Goods will be moved over a variety of low-carbon modes—an emphasis on non-highway systems will reduce overall VMT. The share of goods transported by each mode (ship, rail, barge, truck, aviation) will be optimized to minimize greenhouse gas (GHG) emissions while accommodating a growing and thriving economy. Maintaining the public and freight transportation system in a state of good repair will be an important baseline GHG reduction strategy.

Land use planning: New York communities will be compact, mixed-use and interconnected, keeping per capita VMT low. Residents, employees and visitors will rely primarily on public transit, walking, biking, telecommuting, and limited, short distance car trips to reach central locations with concentrations of commercial, residential, cultural, recreational, social, civic, and educational activities. Neighborhoods will be designed to encourage non-motorized travel including walking and biking. Centers for goods distribution and consolidation will be located near consumer centers to minimize "last mile" transit; these centers will use advanced technology to minimize emissions, light pollution, and noise pollution.

Adaptation: Transportation infrastructure decisions will take into account and adjust for the effects and impacts of climate change. In particular, transportation infrastructure location, elevation, and constituent materials will be appropriate for existing and projected climate

[1] All three fuels of the future (electricity, hydrogen, and biofuels) can be produced using carbon intensive fuels such as coal. For this reason, reliance on these fuels must only occur when they are produced in low-carbon ways, as measured in terms of the total fuel cycle.

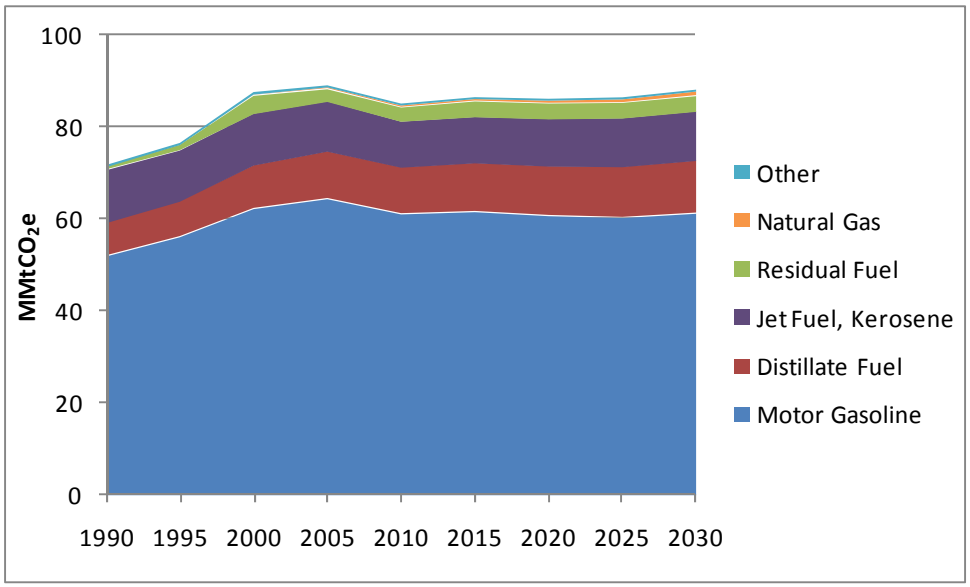
conditions: transportation infrastructure will be located above and inland from rising water levels, and will employ heat resistant materials for optimal functioning in warmer temperatures.

Investment: Investment in mass transit will be serious and sustained, in and between cities and towns, and in most regions of the state. Public incentives will favor smart growth planning, transit-oriented development and revitalization of downtowns, main streets, and other central business districts. Public investments in transit and alternative vehicles and fuels will increase significantly. Investments will avoid subsidizing sprawl development. Existing infrastructure will be maintained in a state-of-good-repair.

Overview of GHG Emissions

The transportation sector accounts for 34% of New York's gross GHG emissions in 2008. Total transportation sector emissions are forecasted to increase to 99 million metric tons of carbon dioxide equivalent ($MMtCO_2e$) in 2030 under the reference scenario, compared to 86 $MMtCO_2e$ in 2008. The increase in transportation sector emissions from 2008 to 2030 can be attributed in part to the increase in VMT, which is partly offset by the increased fuel economy values for on-road vehicles over this same period.

Figure 7-1. Transportation Gross GHG Emissions by Fuel, 1990–2030



GHG = greenhouse gas; MMtCO2e = million metric tons of carbon dioxide equivalent.

As shown in Table 7-1 and Figure 7-1, emissions from this sector rose at an average annual growth rate of 1.4% from 1990 to 2005. Emissions from the transportation sector are forecasted to increase slightly in the forecast years, with an average annual growth rate of 0.12% from 2015 to 2030. The mix of transportation fuels responsible for GHG emissions is expected to remain relatively similar

between 2005 and 2030, with motor gasoline, jet fuel, and diesel fuel forecasted to account for 64%, 21%, and 12% of gross 2030 transportation emissions, respectively.

Table 7-1. Historic and Forecasted New York State Gross GHG Emissions from Transportation, 1990–2030 ($MMtCO_2e$)

Fuel Types	1990	1995	2000	2005	2015	2020	2025	2030
Motor Gasoline	52.0	56.2	62.3	64.5	61.6	60.8	60.3	61.3
Distillate Fuel	7.20	7.66	9.32	10.2	10.5	10.6	10.9	11.3
Jet Fuel, Kerosene	11.4	11.0	11.2\	10.9	10.0	10.2	10.5	10.7
Residual Fuel	0.67	1.15	4.02	2.81	3.52	3.49	3.46	3.46
Natural Gas	<0.01	0.02	0.05	0.15	0.31	0.44	0.59	0.75
Other	0.49	0.47	0.55	0.44	0.43	0.43	0.43	0.43
Totals	**71.8**	**76.5**	**87.4**	**88.9**	**86.4**	**86.0**	**86.3**	**88.0**

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent.

Overview of Policy Options and Estimated Impacts

An effective suite of transportation GHG reduction policies must address three determinants of transportation emissions: vehicle efficiency, fuels emissions intensity, travel activity/system efficiency. New York will not achieve its 2050 vision and goals simply by attaining only a low-GHG fleet, or only low carbon fuels, or only less driving in single occupancy vehicles. The range of policy options presented herein recognizes this imperative that all dimensions be addressed. Further, these GHG reduction strategies recognize that the existence of a safe, efficient, balanced and environmentally-sound transportation infrastructure is critical.

The policy options identified by the Technical Work Group seek to:

- Influence the future mix of technologies in New York's fleet of vehicles (low-carbon vehicles, or vehicle efficiency);
- Influence the fuels used (low-carbon fuels or fuel emissions intensity);
- Influence travel activity by reducing the need for individual trips, increasing public transit options, reducing total VMT, and increasing overall transportation efficiency.

Some of the policy options address more than one of these dimensions. Figure 7-2 portrays graphically how the transportation and land use policy options can be expected to interact with one another across these different dimensions.

Policy options TLU-1, TLU-2, and TLU-3 seek to influence the future mix of technologies in New York's fleet of vehicles, while TLU-4 addresses fuels. These policies aim to shift the vehicle market away from conventional internal combustion engine, petroleum fuel-dependent vehicles towards a mix of alternative fuel vehicles including plug-in electric, hydrogen fuel cell, and biofuel

powered vehicles and toward more fuel-efficient vehicles in general. The more this shift occurs, the more GHG emissions reductions will be realized. While the success of these technology-focused options depends on technology development and commercialization, there is an important role for the public policy that can provide certainty to the private sector and help technology evolve.

TLU-6 and TLU-7 attempt to reduce VMT by increasing the efficiency of the transportation system and reducing the share of trips that occur in single occupancy vehicles. Investment in transit—both for maintenance and expansion—and investment in high speed rail are central to this goal. These policies recognize the need to give most New Yorkers access to low-carbon mass transit, and to create high speed rail corridors to serve the Empire State, the Northeast Corridor, and the nearby provinces of Canada. Improved mass transit will provide efficient ways to travel between cities and, if well connected, allow for complementary transit options within those cities.

TLU-8 is a group of strategies to reduce emissions from freight transportation, which can occur by shifting freight from trucks to rail or water transport and by having more efficient and alternatively-fueled trucks.

TLU-9, TLU-10, and TLU-11 are designed to influence future land use patterns in order to minimize VMT and to offer New York residents more choice in places to live and work using three policies: priority growth centers, transit-oriented development and location efficient land use. These policies integrate much greater access to transit and shared modes with planning and land use decision-making aimed at minimizing the need for motorized transportation by increasing mixed use, density, and efficient design. Because both population and VMT are projected to rise in New York, these smart growth measures are key strategies to reduce emissions over the long term.

Many of the recommended policy options could be applied at the state level or in partnership with other states. There are certain options that are especially appropriate for coordinated, multi-state and regional cooperative actions. These have been grouped and described under TLU-12 as ‘intergovernmental/regional proposals.”

The TLU policy options have important co-benefits in terms of public health, quality of life, clean air, reduction of demand for imported petroleum-based fuels, and conservation of open space. Many of these TLU policies will also spur economic development. For example, investment in transit and rail could revitalize construction and manufacturing in the state. Economic benefits could accrue from using high speed rail to link cities that enjoy robust economies with cities working to develop stronger economies. Investment in rail will also increase freight capacity, increasing efficiency and reliability in freight movement. Finally, by reducing dependence on petroleum and minimizing the need for single occupancy vehicle travel, New York could reduce the vehicle costs and fuel expenditures for residents and businesses. This would keep more energy-related spending within the state economy.

While many of these recommendations are expected to have low associated costs or net savings to the State of New York, there are notable exceptions:

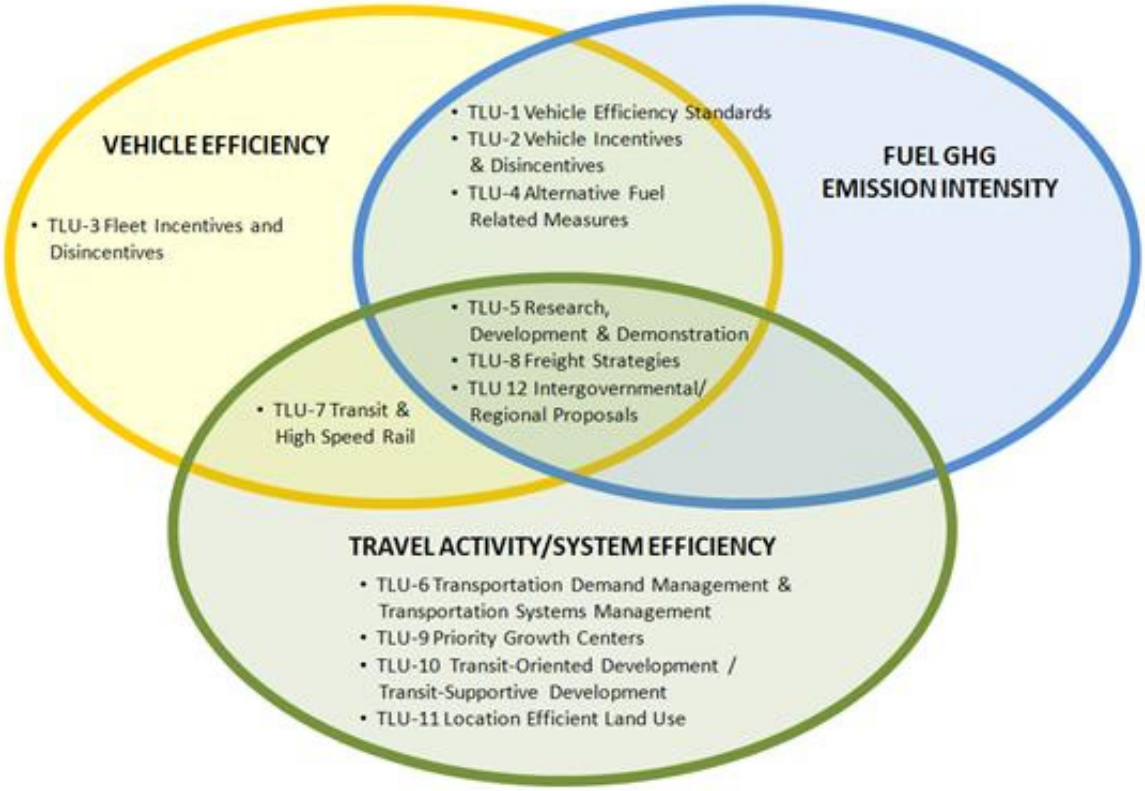
- Maintaining, expanding, and improving public transportation systems;
- Creating high speed rail for key corridors within New York State and the Northeast Corridor;

- Enhancing New York's rail infrastructure, especially eliminating freight rail bottlenecks;
- Investing in the research, development, and deployment necessary to grow the next generation of vehicle technologies and fuels.

Even programs that have a low State cost or result in net savings—like a revenue-neutral fee and rebate system of vehicle purchasing incentives ("feebate") or a new public low-interest loan program for vehicle replacements—still require seed funding and program administrative support to be successful. Further, revenue from current fuel-based taxes that currently fund the transportation system will decrease if programs that encourage drivers to switch to more fuel-efficient vehicles and reduce the number of miles they drive are successful. As a result, New York will need policies that generate State revenue to support some of the GHG reduction policy options, and to continue to support the state's existing transportation system. New York will also need policies specifically designed to leverage investment by the private sector and draw on capital held by regional or national infrastructure banks.

For the transportation sector, the same pricing policies that are needed to generate revenue can also be policies to directly reduce emissions. Financial incentives to reduce transportation emissions can both influence choices and generate revenue that can be dedicated to programs to reduce emissions. Examples include: VMT fees, fuel fees, emission-based road tolls, emission-based vehicle registration fees, sales tax surcharges for high GHG vehicles, congestion pricing, or fees on vehicle related expenses. Other important pricing mechanisms, such as pay-as-you-drive (PAYD) insurance or a feebate system, are planned to be revenue-neutral but will reduce significant amounts of emissions. Both the amount of emissions reductions and the amount of revenue that will result from these types of policies will depend on the size and scope of the pricing mechanism and the elasticity of demand for the type of vehicle, fuel, or travel mode.

Figure 7-2. Transportation and Land Use Policy Options



Policy Scenario Summary Table Estimates

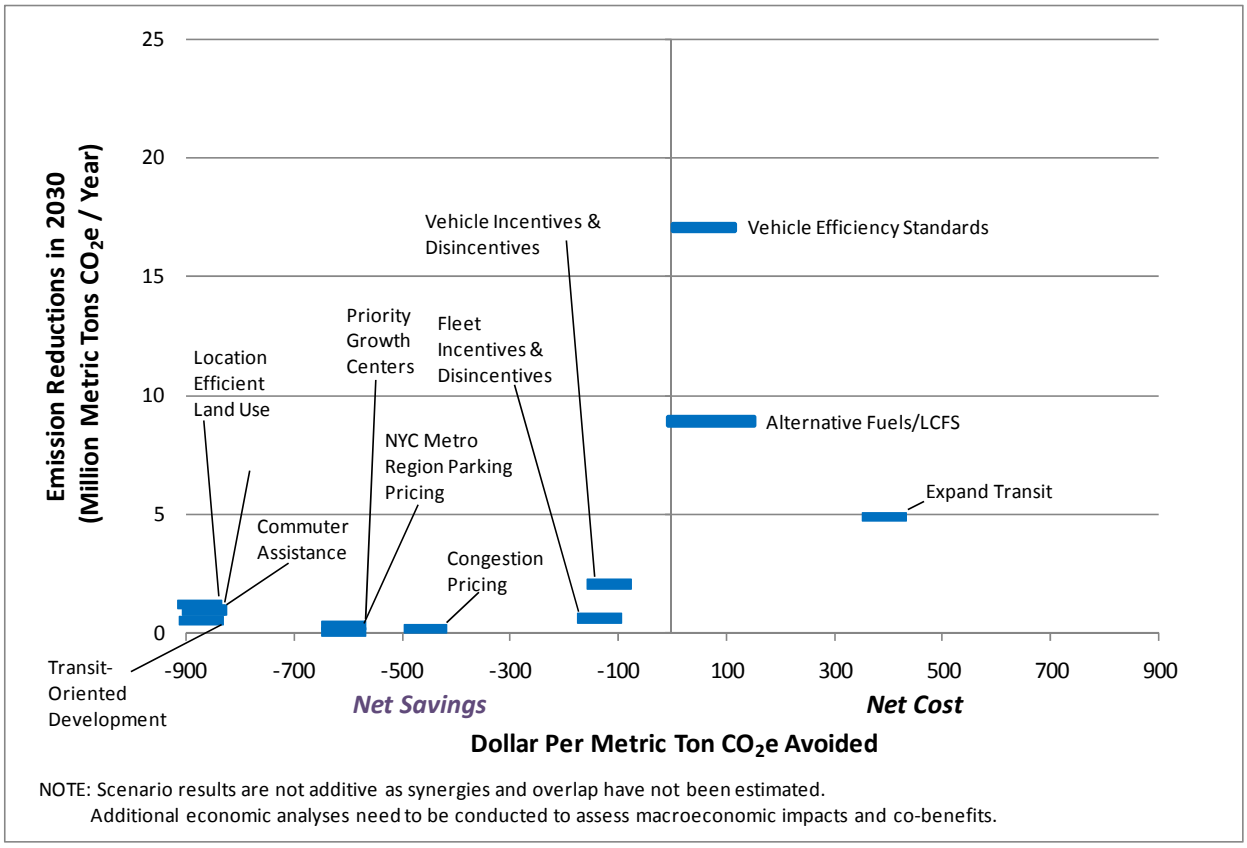
Policy No.	Policy Option	GHG Reductions ($MMtCO_2e$)			Net Present Value: Cost/Savings (Million $2005 (2011–2030)	Net Cost/Savings per Avoided Emissions ($/tCO2e) (2011–2030)	Energy Savings (million gallons fuel saved in 2030)
		2020	2030	Total (2011–2030)			
TLU-1	Vehicle Efficiency Standards	5.3	17	130	$7,900	$62	3,600
TLU-2	Vehicle Incentives and Disincentives	0.9	2.0	20	-$2,300	-$120	220
TLU-3	Fleet Incentives and Disincentives	0.2	0.6	5.6	-$750	-$130	69
TLU-4	Alternative Fuel Related Measures and Infrastructure—Low Carbon Fuel Standard (LCFS)	3.9	8.5	84	$6,700	$79	2,000
TLU-6	Commuter & Traveler Assistance	1.0	1.0	18	-$15,000	–$870	120
	Parking Pricing—						
	Upstate	0.3	0.3	0.5	$720	$1,400	3
	NYC Metro Region	0.4	0.4	0.8	-$480	-$610	5
	Telecommuting	1.0	1.0	18	-$15,000	-$870	120
	Congestion Pricing	0.2	0.2	2.4	-$1,100	-$460	18
TLU-7	Expand Transit	3.7	4.9	64	$25,000	$390	910
TLU-9	Priority Growth Centers	0.1	0.3	2.6	-$1,600	-$610	36
TLU-10	Transit-Oriented Development / Transit Supportive Development	0.3	0.5	5.7	-$5,000	-$870	100
TLU-11	Location Efficient Land Use	0.6	1.2	13	-$11,000	-$870	230

$/tCO2e = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; TDM = transportation demand management; TSM = transportation system management.

Negative values represent savings.

The numbering used to denote the above policy recommendations is for reference purposes only; it does not reflect prioritization among these important policy recommendations. The policy numbers that appear in this table are not consecutive because they reflect only those policies for which quantitative analysis has been completed and not all policies are amenable to quantification.

Figure 7-3. Estimates of Cost and GHG Emissions Reduction for TLU Policy Options



Note that for the Vehicle Efficiency Standards and Alternative Fuel Related Measures and Infrastructure—LCFS policies, the elongated data points represent the range of potential costs of carbon based on differing petroleum price forecasts.

VEHICLE EFFICIENCY STANDARDS (TLU-1)

Policy Summary

New York State could advocate for a stronger federal or California carbon dioxide emission program[2] for light-duty vehicles (LDVs). Under current federal law (the Clean Air Act), New York State cannot adopt its own CO_2 emission standards for LDVs independently. If stricter standards are adopted in California, New York has the option of adopting California's program through a rulemaking process. In the past, New York has always exercised this option and adopted California's clean car standards. New standards would be technology-neutral but could be expected to significantly increase market penetration of zero-GHG vehicles as well as increase fleet-wide fuel economy.

[2] Current standards apply to vehicles up to model year 2016.

This policy could also include the implementation of an Eco-Driving Program to raise drivers' awareness via an outreach and education component and an enforcement component (e.g., for speeding).

Quantitative Analysis

To approach the 80 by 2050 vision and goal for the whole transportation sector, 100 percent of new LDVs sold in 2035 would have to be near-zero-GHG. There would need to be a mix of plug-in electric vehicles (PEVs), hydrogen fuel-cell vehicles, and bio-fueled vehicles. Toward this vision, the GHG emission standards for LDV would strengthen over time, with a 50 percent reduction in LDV GHG emissions by 2025 (for new fleet, from 2016 levels = 125 grams per mile [g/mi]); and 90 percent reduction in LDV GHG emissions by 2035 (for new fleet, from 2016 levels =25 g/mi). The TLU vision requires a near 100 percent reduction of GHG emissions for LDV, assuming that other transportation types (aviation, heavy-duty trucks, marine, railroads) will not be able to achieve as aggressive reductions.

The estimated GHG reduction potential, total cost or savings (as measured by net present value), and cost effectiveness (as measured by dollars per metric ton of carbon dioxide equivalent [$/tCO$_2$e] reduced) for the policy scenario analyzed by the Technical Work Group are presented below. The scenario assumed that New York will successfully advocate for a fleet wide LDV standard of 75 g/mile by 2030.

GHG Reductions (MMtCO$_2$e)		Net Present Value Cost ($Million)	Net Cost per Avoided Emissions ($/tCO$_2$e)
2030	Total 2011–2030		
17	130	$7,900	$62

$/tCO$_2$e = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; MMtCO$_2$e = million metric tons of carbon dioxide equivalent.

A price sensitivity analysis was performed to show how different fossil fuel price forecasts affect estimated net present value and cost per metric ton. Using fuel price forecasts from the most recent *U.S. Department of Energy Annual Energy Outlook* (AEO 2009), the net present value and net cost per avoided emissions were respectively reduced to $770 million and 6 $/tCO2e. The use of higher price forecasts transforms this policy scenario from a net-cost to approximately cost-neutral, showing the sensitivity of this analysis to price forecasts. .

For purposes of illustration, the following vehicle mix would approximately achieve this standard:

- 69 percent of all new LDVs sold in 2030 are PEVs, and the remainder is conventional vehicles.
- Of the new PEV fleet, about half (49 percent) are all battery electric vehicles, 17 percent are plug-in hybrid electric vehicles (PHEVs) with a 10-mile range (PHEV-10), and 34 percent are plug-in electric with a 40-mile range.
- Also in this scenario, cellulosic ethanol comprises 21 percent of fuel used in conventional and plug-in hybrid vehicles.

Special Considerations

- In contrast to most other policy options, implementation of this policy is not fully within the discretion of New York State and instead depends on federal or California action.[3]
- As defined here, this policy option results in the largest GHG reduction estimates, as a result of the fact that the emission standards goals identified by the technical work group were extremely aggressive. This represents a result-oriented, top-down approach, which starts with the 80 by 50 vision and identifies an emission standard that would nearly achieve that goal. In contrast, TLU-4 is a more constrained scenario that also results in substantially lower-carbon mix of vehicles, but not to the same level as TLU-1.
- The most significant co-benefit is a reduction in the emissions of other air pollutants, including particulates, toxics, and oxides of nitrogen, which contribute to ozone formation (smog). These pollution reductions would be noticeable and significant in terms of attaining federal health-based air quality standards and improving public health and quality of life, especially in urban areas and areas of high traffic volume.
- While the indirect emissions from electric vehicles are not counted in the vehicle standards, these emissions are taken into account in the Quantitative Analysis of GHG reductions presented above.

VEHICLE INCENTIVES AND DISINCENTIVES (TLU-2)

Policy Summary

The State of New York could create financial incentives for the purchase of low-GHG vehicles. These incentives can take the form of feebates, tax credits, sales tax exemptions, registration fees (or fee waiver), emission based tolls, or other mechanisms as appropriate.

To influence vehicle purchasing decisions, New York State could implement a revenue-neutral feebate system for all new LDVs starting in 2015. There are a variety of ways to design a feebate program. Under one approach, the program would establish a baseline GHG emission level for two to four classes of vehicles based on their passenger capacity. Consumers who purchase vehicles that emit fewer GHG emissions per mile than the baseline for their class could receive a proportional rebate. Those that purchase vehicles that emit more GHGs per mile than the baseline could pay a similarly proportional fee. The program could be designed to simply favor vehicles with a higher fuel economy to affect purchasing decisions across the market, or to target the fees or rebates only at the highest and lowest GHG-emitting vehicles on the market to influence purchasing just at these margins.

New York State could also implement emissions-based registration fees and tolling based on a vehicle's GHG emissions per mile, providing further incentives to buy and operate low GHG vehicles and potentially raising revenue for other transportation GHG reduction programs.

[3] New York's current State Energy Plan also directs New York to advocate for a stricter federal standard.

Quantitative Analysis

The estimated GHG reduction potential, total cost or savings (as measured by net present value), and cost effectiveness (as measured by $/tCO$_2$e reduced) for the policy scenario analyzed by the Technical Work Group are presented below. The scenario assumed that New York implemented a feebate program that successfully reduced average GHG emissions from newly purchased vehicles on average by 5% beyond the existing standards.

GHG Reductions (MMtCO$_2$e)		Net Present Value Savings ($Million)	Net Savings per Avoided Emissions ($/tCO$_2$e)
2030	Total 2011–2030		
0.9	20	-$2,300	-$120

$/tCO$_2$e = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; MMtCO$_2$e = million metric tons of carbon dioxide equivalent.

Negative values represent savings.

Special Considerations

- In contrast to emission standards (TLU-1), incentive programs are fully in the control of New York State.
- The level of program success would depend on the level of fee or rebate put into place. Because economic modeling of feebate programs at the national level suggests that most of the GHG reductions would result from vehicle manufacturers reducing the GHG emissions of their cars, a feebate program's effectiveness increases if implemented over a larger market, such as the northeastern states region or at a national level, similar to the options described in TLU-12. However, it could also be effective if implemented exclusively in New York State.
- By designing a revenue-neutral feebate system, where the total amount offered as incentives is equal to the total amount charged as disincentives, New York could implement a program without any General Fund expense. The rebates disbursed could be slightly smaller than the fees collected, with a small amount of fees reserved each year to cover administrative costs and in case of an unexpectedly large need to pay for rebates in future years. But a vehicle purchase incentive program could also be designed to be revenue generating (e.g., gas-guzzler sales tax surcharge), or to be revenue-negative (e.g., tax credit for purchase of electric cars or a cash for clunkers program).
- This policy option was developed independent of New York's ability to achieve TLU-1. Even if TLU-1 standards were put in place, an incentive program would still be necessary to achieve the 2030 vision for LDVs.
- Co-benefits for this policy would be in the form of 1) reduced gasoline expenditures by New Yorkers as the fleet becomes more fuel efficient, and 2) reduced vehicle pollution and the accompanying improvement in air quality.
- Low-income communities tend to have a much higher percentage of older vehicles, which has implications for air quality. Programs that facilitate the retirement of such vehicles help to address this problem.

HEAVY-DUTY FLEET INCENTIVES AND DISINCENTIVES (TLU-3)

Policy Summary

This policy could establish a State revolving loan fund for replacing fleet vehicles with lower GHG-emitting vehicles, or other financial incentives for both public and private fleet replacement. The 2050 vision for the transportation sector includes a zero emission light-duty fleet and a heavy-duty vehicle (HDV) fleet with GHG emissions as low as possible using available technology and low-carbon biofuels. New soon-to-be-released federal standards mandating greater HDV efficiency mean that normal vehicle turnover will reduce GHG emissions. However, accelerating this HDV turnover will be necessary to achieve the 2050 vision. A low-interest revolving loan program could be used to provide the necessary incentive to achieve fleet turnover in the required timeframe. New York State could offer below market interest rates and extended loan terms based on the useful life of the vehicle, reducing annual loan or lease payments. The state could also enhance the financing incentive by offering lower interest rates to incentivize fleets to purchase alternative vehicles; i.e. hydrogen fuel-cell or electric.

Quantitative Analysis

The estimated GHG reduction potential, total cost or savings (as measured by net present value), and cost-effectiveness (as measured by $/tCO$_2$e reduced) for the policy scenario analyzed by the Technical Work Group are presented below. The scenario assumed that New York put in place a State revolving loan program that is successful in replacing 3% of the HDV fleet per year. (Although LDVs could also be included in a loan program, the quantitative analysis focused on HDVs.)

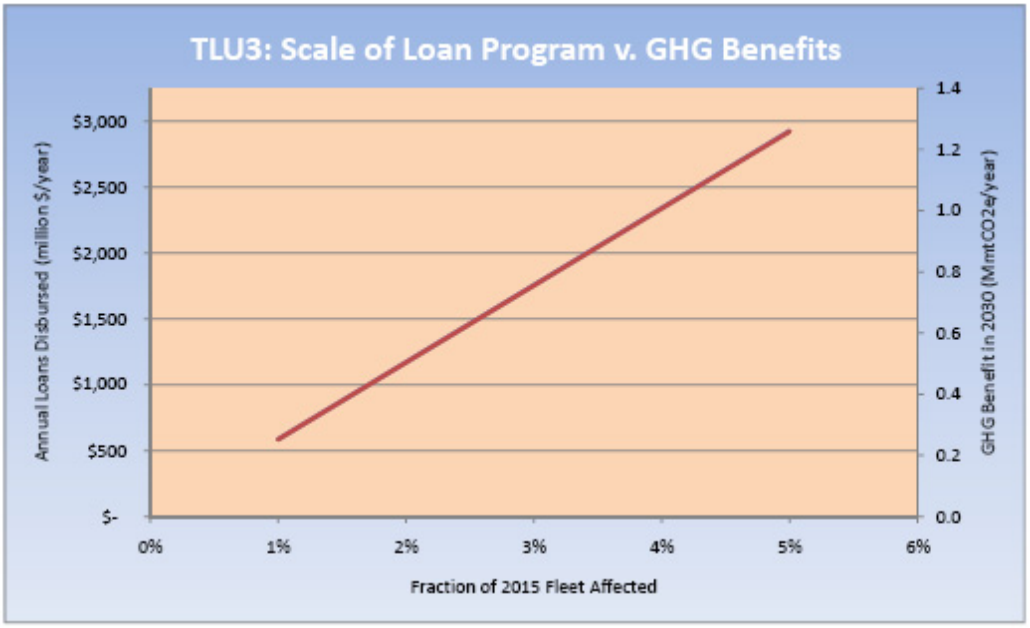
GHG Reductions (MMtCO$_2$e)		Net Present Value Savings ($Million)	Net Savings per Avoided Emissions ($/tCO$_2$e)
2030	Total 2011–2030		
0.6	5.6	-$750	-$130

$/tCO$_2$e = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; MMtCO$_2$e = million metric tons of carbon dioxide equivalent.

Negative values represent savings.

Figure 7-4 provides an indication of the level of capitalization required to accelerate HDV turnover and emission benefits achieved depending on the fraction of the fleet to be turned over:

Figure 7-4. Level of Capitalization Required to Accelerate HDV Turnover



Special Considerations

- Due to its experience implementing loan programs with lower-than-market interest rates, the New York State Environmental Facilities Corporation would be well positioned to take on the role of administering this type of program. New statutory authority would need to be provided by the Legislature.
- Accelerated turnover in the HDV fleet would bring significant co-benefits in terms of air quality, because diesel vehicles are a major source of particle pollution, toxics, black carbon, and oxides of nitrogen. Although on-road diesel HDVs are considerably cleaner since 2007 due to new federal standards, the longevity of vehicles slows fleet-wide emissions improvements. Diesel emissions contribute to New York State's non-attainment of air quality standards, and urban environmental justice (EJ) neighborhoods often bear a disproportionate burden from truck traffic due to their proximity to industrial areas, freight routes, or transit depots. A cleaner HDV fleet will help New York State attain air quality standards and improve health and quality of life in EJ neighborhoods.
- Another important co-benefit is the provision of access to credit for small and large businesses, non-profit organizations (e.g., paratransit agencies), and local governments that could use this loan fund to replace and upgrade their fleet vehicles.
- The environmental impacts associated with truck traffic, including emissions, noise, dust, and congestion often represent one of the primary concerns of EJ communities, particularly those burdened with solid waste management facilities. By incorporating an explicit focus on overburdened communities and encouraging a shift to newer vehicles with lower emissions, this policy could provide significant EJ benefits, while helping to meet New York State's GHG reduction goals.

ALTERNATIVE FUEL RELATED MEASURES AND INFRASTRUCTURE (TLU-4)

Policy Summary

In December 2009, the governors of New York and 10 other states in the Northeast and Mid-Atlantic region signed a Memorandum of Understanding (MOU), affirming each state's commitment to developing a low-carbon fuel standard (LCFS) program framework by 2011. This policy supports this LCFS program: a market-based program to decrease the carbon intensity (the amount of average GHGs released per unit of energy produced or g CO2e/megajoule) of all on-road transportation fuels sold in New York by some amount from current levels by 2020. The LCFS would provide an incentive to commercialize new fuel technologies and encourage the development of infrastructure to produce and distribute low-carbon fuels including biodiesel (B20 and B100), cellulosic ethanol (E10 and E85), and electricity.4

In addition, to help develop and expand alternative, low-carbon fuels New York State could establish financial incentives for low-carbon fueling investment: sales tax exemption for low carbon fuels, investment tax credits for retail fueling infrastructure, and production tax credits. As part of the 11-state Transportation and Climate Initiative, New York State has proposed a planning process to develop guidelines and a master plan for implementing a regional electric vehicle (EV) network of charging stations that enable local and regional EV travel. New York State could potentially invest in and construct charging/battery-exchange stations in the context of this regional framework.

To support near-zero carbon vehicle deployment, New York could invest in research and modeling to assess the in-state infrastructure needs for fueling for electrification and hydrogen, including the standardization of electrical connections and voltages necessary for electric charging infrastructure. New York could also develop policies and regulations that support the development of business models that allow the sale of electricity by non-utilities (through both direct charging and battery swapping), aggregation of loads for business transactions, private and public investment in publicly accessible vehicle charging, and the development and deployment of standardized quick charge technology. (See paper by the electric vehicle sub-group in Appendix G.)

For this group of policy options, an important consideration will be the sequencing of implementing a LCFS and investing in fueling infrastructure, so as to achieve the standard's carbon intensity reductions and to prevent stranding of significant investment.

[4] B20 is a fuel blend of 20 percent biodiesel and 80 percent gasoline, and B100 is 100percent biodiesel fuel. E10 is a fuel blend of 10 percent ethanol and 90 percent gasoline, and E85 is a fuel blend of 85 percent ethanol and 15 percent gasoline.

Quantitative Analysis

The estimated GHG reduction potential, total cost or savings (as measured by net present value), and cost effectiveness (as measured by $/tCO$_2$e reduced) for the policy scenario analyzed by the Technical Work Group are presented below. The scenario assumed implementation of a LCFS that achieves a 10 percent decrease in average carbon intensity by 2020 and a 12 percent improvement by 2030.

GHG Reductions ($MMtCO_2e$)		Net Present Value Cost ($Million)	Net Cost per Avoided Emissions ($/tCO$_2$e)
2030	Total 2011–2030		
8.5	84	$6,700	$79

$/tCO$_2$e = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent.

A price sensitivity analysis was performed to show how different fossil fuel price forecasts affect estimated net present value and cost per metric ton. Using fuel price forecasts from the most recent *U.S. Department of Energy Annual Energy Outlook* (AEO 2009), the net present value and net cost per avoided emissions were respectively reduced to -$180 million and -1 $/tCO2e. The use of higher price forecasts transforms this policy scenario from a net-cost to approximately cost-neutral, showing the sensitivity of this analysis to price forecasts.

An LCFS program would be fuel technology-neutral—in other words, it would set a performance standard but would not prescribe how fuel providers meet the standard. The LCFS would be expected to lead to an increased market penetration of alternatively fueled vehicles. For purposes of illustration, one mix of vehicles that would achieve this LCFS (10 percent improvement in carbon intensity by 2020 and 12 percent by 2030) is: 50 percent of all new LDVs sold in 2030 are PEVs, and the remainder of the LDV fleet uses a combination of conventional fuels, conventional biomass, and advanced biomass.

Although the quantitative analysis did not propose specific goals for the complementary policies (financial incentives, infrastructure installation) these policies are an important part of a comprehensive fuel strategy, and would facilitate achieving an LCFS.

Special Considerations

- Additional analyses will be conducted in the next phase of the Climate Action Plan process to separately quantify the potential benefits and costs of utilization of biomass for application in the TLU sector.
- Assuming that the policy promotes the use of zero-emission electric or hydrogen vehicles, a significant co-benefit is a reduction of pollutants, including particulates, toxics, and oxides of nitrogen, which contribute to ozone formation (smog). These pollution reductions would be noticeable and significant in terms of attaining federal health-based air quality standards and improving public health, quality of life, especially in urban areas and areas of high traffic volume.

- Only a portion of the sustainable level of biofuels production, as described in New York's Biofuels Roadmap, would be available to the transportation sector, and this Quantitative Analysis takes this into consideration. The GHG emissions reductions presented above did not take into account indirect land use changes.
- For PEVs, quick charging technology is not currently commercially available and battery swapping systems must be standardized to be widely used. If multiple technologies and business models continue to develop, EV charging and long-range travel will become more convenient for consumers.
- Note that the scenario quantified for this policy option does not achieve the fleet-wide emissions standards put forward in TLU-1, which was 75 grams of CO_2/mile by 2030.

RESEARCH, DEVELOPMENT AND DEMONSTRATION NEEDS FOR THE TRANSPORTATION AND LAND USE SECTOR (TLU-5)

See Chapter 10 for a complete presentation of Research, Development and Demonstration needs for this sector.

TRAVEL DEMAND MANAGEMENT AND TRANSPORTATION SYSTEM MANAGEMENT (TLU-6)

Policy Summary

An essential strategy in reducing GHG emissions from transportation sources is improving the energy efficiency of the road and highway network. This may include reducing the growth rate in VMT, providing alternatives to single-occupant vehicle travel, and reducing delay and eliminating bottlenecks on the highway system. Providing these elements may reduce GHG emissions by reducing the number of trips on the highway system and VMT per person, and by generating a significant mode shift to carbon-efficient and zero carbon modes of travel.

An important aspect of this is transportation system management (TSM). Effective TSM (such as high-occupancy vehicle lanes, improved traffic flow) utilizes a variety of strategies including advanced technologies, policies, and design standards. TSM strategies attempt to make travel more efficient by shortening trip lengths, reducing vehicle delay, increasing the reliability of the transportation network, and reducing idling and other transportation actions. System design complements technology actions, and includes access management and intersection improvements. An efficient system minimizes GHG emissions.

Another important component is the integrated implementation and delivery of travel demand management (TDM) strategies and services (such as carpooling, van pooling, telecommuting) in New York's urban, suburban, and rural locations, built on market-based incentives and education and outreach programs to reduce, eliminate, or shorten vehicle trips. When these strategies are applied in concert, substantial gains can be achieved.

Quantitative Analysis

The estimated GHG reduction potential, total cost or savings (as measured by net present value), and cost effectiveness (as measured by $/tCO$_2$e reduced) for the policy scenario analyzed by the Technical Work Group are presented below.[5] The implementation in New York State of the following programs was quantified:

- Implement a Commuter and Traveler Assistance Program in upstate New York starting in 2011. This program aims to change commuter and traveler behavior by providing easily accessible information that prompts the choice to use other commute modes or carpooling, and includes other actions to maximize commuter and traveler mobility.
- Implement parking pricing practices in New York urban areas using smart parking meters in central business districts starting in 2011.
- Implement a New York State Telecommuting Project, primarily in the New York metropolitan area and secondarily on a statewide level.
- Implement congestion pricing in the New York City metro area as previously proposed by New York City starting in 2015. Implementing a congestion pricing program in the New York metro area could reduce VMT and provide revenue for TSM and TDM activities by requiring a fee for vehicles to enter designated parts of the New York metropolitan area. Legislation would be needed to permit this strategy but is estimated to reduce VMT within the cordon area in New York City by approximately 6%, with additional VMT reduction in the greater metropolitan area due to reduction in trips to and from the City.

Commuter & Traveler Assistance

GHG Reductions (MMtCO$_2$e)		Net Present Value Savings ($Million)	Net Savings per Avoided Emissions ($/tCO$_2$e)
2030	Total 2011–2030		
1.0	18	-$15,000	-$870

$/tCO$_2$e = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; MMtCO$_2$e = million metric tons of carbon dioxide equivalent.

Negative values represent savings.

[5] Note that quantitative analysis was not undertaken for the TSM measures.

Parking Pricing: New York City Metropolitan Region

GHG Reductions ($MMtCO_2e$)		Net Present Value Savings ($Million)	Net Savings per Avoided Emissions ($/tCO_2e$)
2030	Total 2011–2030		
0.4	0.8	-$480	-$610

$/tCO$_2$e = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; MMtCO$_2$e = million metric tons of carbon dioxide equivalent.

Negative values represent savings.

Telecommuting

GHG Reductions ($MMtCO_2e$)		Net Present Value Savings ($Million)	Net Savings per Avoided Emissions ($/tCO_2e$)
2030	Total 2011–2030		
1.0	18	-$15,000	-$870

$/tCO$_2$e = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; MMtCO$_2$e = million metric tons of carbon dioxide equivalent.

Negative values represent savings.

Congestion Pricing

GHG Reductions ($MMtCO_2e$)		Net Present Value Savings ($Million)	Net Savings per Avoided Emissions ($/tCO_2e$)
2030	Total 2011–2030		
0.2	2.4	-$1,100	-$460

$/tCO$_2$e = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; MMtCO$_2$e = million metric tons of carbon dioxide equivalent.

Negative values represent savings.

Special Considerations

- State legislation would be needed to allow a congestion-pricing program to be developed and implemented in New York City.
- TDM measures should be designed to reduce single-occupant vehicle commuting and overall VMT; i.e., addressing both commute and non-commute trips. TDM measures should be integrated with other related strategies that promote transit options.
- Successful programs must use innovative, and non-traditional measures that consider and reflect best practices; a customer-needs focus in delivery; enhanced marketing, communications, outreach, and public relations including leveraging existing resources such as 511-NY and Clean Air NY; advanced, state-of-the-art information and communication; and

education, training, and development activities. Further, successful programs should monitor for performance and effectiveness that track commuter and traveler behavior, response, and change. There needs to be multi-agency coordination and collaboration to maximize effectiveness.

- Availability of information through the Internet must be maximized to provide travelers with a full range of real-time travel options through on-line trip brokerages, travel planners, and service databases. As trip brokerages and travel planners mature, new forms of demand-responsive taxi, transit, and paratransit services can be developed to operate more efficiently and effectively in lower density areas as well as higher density, urbanized settings.
- In developing parking pricing programs, particular care should be given to implement the program so that it is not counter-productive to the State's smart growth efforts; i.e., that it does not discourage use and enjoyment of downtown areas. For existing employer-provided parking, the State could implement a parking cash-out program with a tax credit for employers as an incentive for their participation; and for new parking in developing areas, the true cost of parking should be reflected in municipal development policies and zoning ordinances.
- Co-benefits include improved travel mobility, flexibility, and choice, as well as a reduction in congestion and travel time, and a reduction in other air pollutants from transportation.

TRANSIT and HIGH-SPEED RAIL (TLU-7)

Policy Summary

New York State could reduce GHG emissions from the transportation sector by encouraging a major shift in mode share from predominantly single-occupant vehicle travel to public transportation. This would occur through investment in the improvement and expansion of transit systems to existing communities and the development of high speed rail with competitive trip times along the Empire and Adirondack Corridors. In cooperation with other Northeast states, New York State could also promote the development of high speed rail in the Northeast Corridor. Sustained financial investment in public transportation, particularly transit infrastructure, could provide affordable, convenient, and comprehensive travel options that would connect communities, jobs, and long-distance travel centers. Construction of expanded subway, light rail, bus rapid transit, and high speed rail networks would promote job growth and economic development in the state in two ways. The expansion of transit systems in New York State could spur a growth in the transit- and rail-related manufacturing sectors. High speed rail that offers competitive trip times could boost economic output and prosperity by linking metro areas with robust economies to metro areas trying to create strong economies, a strategy that would expand the options of job seekers and employers. Dedicated high speed rail tracks would also free up existing rail tracks for improved freight deliveries and efficiencies by reducing congestion and competition for track availability. The strategies, investments, and high speed rail trip times suggested in this policy are aggressive, but are suggestive of what would be needed to reach the 80 percent GHG reduction goals established for 2050. Achieving these goals would require funding well above what is available today. It would require increased federal resources, including a dedicated ongoing funding source for rail investments at the federal level, as well as ongoing

operating subsidies to support continued service and operations. Achieving these transit goals would require a sustained long-term commitment to system planning and funding. Accomplishing these high speed rail goals would require right-of-way acquisition, legislation to allow new corridor construction in the Adirondack State Park, and interstate and international agreements.

The state could also promote the use of shared modes of transportation, such as transit, carpooling, and ride sharing, by expanding available information about these services through improved communications technology. The appropriate mix of technology and real-time information could provide the kind of comparative data on costs or saving that would enable workers, residents, and visitors to make more informed choices when they select a particular mode or combinations of modes for work trips and discretionary trips. Expanded use of wireless technology could enable new demand-responsive transit services to be developed that can operate more efficiently and effectively both in lower-density areas and in higher-density and urbanized settings. Improvements and expansions to inter-city train travel could also reduce GHG emissions by developing additional shared modes of transportation in cities once a traveler reaches their destination city.

One short-term discrete action for New York is to invest in a multi-state high speed rail feasibility and planning study that also examines the multitude of economic and environmental benefits.

Quantitative Analysis

Investment in transit and high speed rail would be pursued to bring about a major expansion of mobility options for New Yorkers, such that the annual rate of VMT growth would decrease to 0.4 percent until 2020, stabilize at 0 percent by 2030 and reduce VMT 10 percent below 2030 levels by 2050. (The current rate of VMT growth is greater than 1 percent per year.)

The estimated GHG reduction potential, total cost or savings (as measured by net present value), and cost effectiveness (as measured by $/tCO2e reduced) for the policy scenario analyzed by the Technical Work Group are presented below. The scenario assumed that the percentage of trips made in single occupancy vehicles would decrease from the current 50 percent downstate and 80 percent upstate to 35 percent by 2030 downstate and 65 percent by 2030 upstate.

GHG Reductions ($MMtCO_2e$)		Net Present Value Cost ($Million)	Net Cost per Avoided Emissions ($/tCO2e)
2030	Total 2011–2030		
4.9	64	$25,000	$390

$/tCO2e = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent.

Although not included in the quantitative analysis, another key goal of these policy measures is to make high speed rail more competitive with aviation in the Empire State and Northeast corridors, which would decrease emissions from the aviation sector and well as shift travelers from automobiles to trains. Please see TLU-12 for additional information.

Special Considerations

- This policy option is closely linked with TLU-6, which consists of TSM and TDM policies, including those that encourage using shared modes. It is also linked to TLU-9, TLU-10, and TLU-11, which consists of policies to promote the land use patterns that are particularly supportive of increased use of public transportation and high speed rail. The Regional recommendations are also linked to TLU-12.
- Increased use of public transportation, with its accompanying reduction in VMT, would greatly improve air quality, especially in the state's urban centers, because public transportation and shared modes of transportation generally emit less pollution per passenger mile traveled than single occupancy vehicles. These measures could also drastically improve mobility and reduce congestion in these same areas by taking vehicles off the road as drivers migrate toward shared modes. Other important co-benefits include the expansion of travel mobility, flexibility, and choice, which can be especially important to middle- and lower-income New Yorkers. Integration of an expanded transit network with high speed rail on Empire Corridor lines and the Northeast Corridor could have several other broad macroeconomic benefits, including freeing up airport capacity and airspace, freeing up rail capacity for rail freight movements, and better linking cities throughout the State.
- VMT reductions in more rural areas could be very difficult to achieve, as these trips may not lend themselves easily to shared mode travel.
- Recognizing the significant climate benefits and co-benefits, expanding public transportation options across the state to the extent described above would be very expensive. High speed rail, subways, and even light rail or bus rapid transit systems require significant infrastructure expenditures. Achieving large increases in transit ridership across the state will require major expansions of transit infrastructure, which is largely absent in many communities. New rail lines may require New York State to exercise its power of eminent domain, possibly over large areas. The GHG impact of induced demand from development opportunities created by high speed rail access should also be considered, as this would likely lead to both economic activity and population increases in New York compared to business as usual.
- Development of high speed rail would require ongoing, sustained funding and support to plan and develop the corridors. A separate and sustained source of federal funding for rail would be required.
- To attain the reliability and higher speeds suggested along the Adirondack Corridor, significant cross-border negotiations to reduce or eliminate border inspection delays (e.g., moving passenger inspections to Montreal) would be required. Further, development of high speed rail along the Adirondack Corridor would require a constitutional amendment to pursue new alignments.
- Moreover, providing transit services in diffuse communities, especially upstate, would likely require significant operating support to keep fares at publicly acceptable levels. If the land use policies in TLU-9, TLU-10, and TLU-11 are successful, a larger portion of the New York State population will live in areas that are easier to service with transit options.

FREIGHT STRATEGIES THAT PROMOTE GHG REDUCTIONS (TLU-8)

Policy Summary

New York State, in conjunction with a broad-based stakeholder group including State agencies and municipalities, adjoining states, the goods movement industry, and local community groups, could establish a comprehensive Goods Movement GHG Policy, with the dual goals of increasing freight efficiency while reducing GHG emissions.

The comprehensive policy should identify and prioritize key freight projects such as consolidation and distribution centers (including important highway and non-highway modal connections), new intermodal yards, rail system improvements, the development and expansion of non-highway system capacity, and the operational enhancement of existing highway systems to support local, regional, and transcontinental freight service into and out of New York State. Such projects would provide alternative off-road clean transport systems to improve goods movement, reduce congestion, and reduce emissions.

Once identified, key freight projects could also be subject to an efficient permit process that considers the needs of the local community. The policy could establish state requirements for system-wide GHG analyses and green technology advancement through the State Environmental Quality Review (SEQR) and other permitting requirements; set specific performance standards to incentivize low to zero emissions truck, rail, ship, and support equipment technology; and establish freight fees dedicated to transportation system and infrastructure upgrades. The policy could draw on existing efforts and partnerships, such as the New York State Rail Plan, the Port Authority of New York and New Jersey Comprehensive Long-Term Regional Goods Movement Plan, and the Regional Greenhouse Gas Initiative, while acknowledging New York State specific issues.

Further, the plan should identify key freight corridors and connectors and establish land-use guidelines for local and regional municipalities in those corridors that are specific to freight. It should also consider rail clearance and track improvements to allow heavier loads, thereby supporting a more viable rail system and should look for other investments and incentives to support low GHG options. The Technical Work Group explored several policy options that warrant further consideration:

- Develop comprehensive Goods Movement GHG Policy, prioritizing increasing efficiency and reducing GHG and congestion as main design metrics;
- Increase non-highway mode shift;
- Establish a network of freight villages/consolidation centers/urban distribution centers serving the upstate and downstate regions;
- Provide incentives to establish progressive performance standards and develop low-GHG rail and truck technology, terminal equipment, and ships/tugs/barges acknowledging full life-cycle emissions.

Quantitative Analysis

The estimated GHG reduction potential for the policy scenario analyzed by the Technical Work Group was not fully analyzed in quantitative terms, since it was difficult to estimate reliable costs of implementation for the multi-faceted program developed and described during the Technical Work Group process.

Special Considerations

- A Goods Movement Policy would first have to involve a baseline assessment of bottlenecks and network capacity issues, to act as a benchmark. Following this baseline assessment, and building from existing work, key freight corridors, connectors, and eventual projects throughout the state and northeast region could be identified. An efficient permitting process could be available to these resulting freight projects, with local and regional agencies able to apply for direct federal and state funding.
- Coordination both within and outside of New York State would be needed to ensure that freight moves by the most efficient combination of modes and the most efficient route, and utilizes a combination of VMT/unit of freight and total GHG per transit mode as metrics. Such coordination will prioritize consistency in policies and permitting requirements to alleviate administrative congestion such as differences in oversize/overweight rules between cities, counties, states, and Canada. Coordination must also recognize that freight decisions are largely under private sector control and that decisions are interstate, national, international, and global in nature. Freight decisions in New York must be made in ways that do not disadvantage the state's economy.
- Freight fees or congestion pricing could be established to promote efficient movement and reduce both VMT and total GHG emissions. Ideally developed in partnership with the freight industry, fees could be based on elasticity studies and consider existing tolls and taxes. Fees could be collected by and administered through a regional partnership entity and go into a fund dedicated solely to freight infrastructure improvements. Note: If a non-gas tax results from federal transportation law in 2011, this fee may supplement freight fee efforts. Decisions must be balanced in consideration of impacts on the state's economy.
- Progressive performance standards for trucks, rail, terminal equipment, ocean-going vessels, and harbor craft will need to be developed. The U.S. Environmental Protection Agency could be lobbied to adopt national standards modeled after California. Standards for freight consolidation/distribution centers will be needed to ensure minimal community impacts.
- The 2009 New York State Rail Plan cites a study conducted by the American Association of Railroads that reports that significant investment in the existing railroad freight infrastructure will be required to account for the projected growth in rail freight through 2035. This investment will be needed to maintain the current rail freight capacity. To allow for mode shift of freight to rail, additional investment will be required.

PRIORITY GROWTH CENTERS (TLU-9)

Policy Summary

The State of New York could assist and incentivize municipalities in designating, planning, zoning, and developing/re-developing priority growth centers. This could happen through a combination of State assistance and State incentives, such as shifting State resource allocations towards identified priority growth centers, which could be in urban, suburban, or rural areas. The priority growth centers would be encouraged to have compact, mixed-use, walkable/bikeable development in existing centers of activity, whether urban centers or hamlets and village centers. New York State could accomplish this through incentive programs such as:

- Assisting localities and regions in designating priority growth centers;
- Accelerating and prioritizing permit and SEQRA review for smart growth projects, without compromising outreach to, and input from, underserved populations or EJ areas;
- Ensuring affordable housing options within priority growth centers;
- Providing priority infrastructure funding (transportation, water, economic development, schools, housing) for Smart Growth;
- Incorporating principles of strategic land conservation and green infrastructure into open space preservation funding, plans, and documents;
- Providing public accessibility to parks and green spaces, both within and outside priority growth centers;
- Assisting with alternative local funding mechanisms, such as Tax Increment Financing;
- Further rewarding such smart growth development as described above if it comports with a regional land use and/or transportation plan; and
- Using regional transportation and land use planning to encourage development patterns that achieve prescribed transport-based GHG emission reductions.

Quantitative Analysis

The estimated GHG reduction potential, total cost or savings (as measured by net present value), and cost effectiveness (as measured by $/t$CO_2$e reduced) for the policy scenario analyzed by the Technical Work Group are presented below. The scenario assumed that the actions described above, if aggressively pursued at the State level, would result in 50 percent of new construction taking place in identified priority growth centers by 2030.

GHG Reductions ($MMtCO_2e$)		Net Present Value Savings ($Million)	Net Savings per Avoided Emissions ($/tCO_2e$)
2030	Total 2011–2030		
0.3	2.6	-$1,600	-$610

$/tCO_2e$ = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent.

Negative values represent savings.

Implementation costs were estimated by applying assumptions similar to those used for the *Moving Cooler*[6] study's Land Use and Smart Growth Strategies under the Maximum Deployment scenario. These include costs for policy, planning, and visioning. Since these planning costs are assumed to include all measures in TLU-9, TLU-10, and TLU-11, the cost was distributed between the three policy options, weighted by the emissions reduction.

Special Considerations

- Current and projected shifts in demographics and home/community preferences will in many ways support the policy recommendations and GHG reduction goals in this policy option. Population projections see an increase in more than 1 million residents in the urban areas downstate by 2030, but a decrease of almost 300,000 residents upstate, which should contribute to increasing access to smart growth land uses. Based on market and real estate trends and projections, the increase in the over-65 population (projected to be over 20% by 2030) will concomitantly increase the demand for smaller dwelling units (including more attached housing) in walkable/bikeable, transit-friendly, mixed-use communities, particularly in municipal centers. The rise in the number of childless households, single parent households and young, single professionals is projected to increase the market for compact, vibrant, diverse, mixed-use, walkable/bikeable, transit-friendly communities, particularly in urban areas. Furthermore, a larger nationwide trend toward urbanization could manifest itself in supportive, climate-friendly real estate and home-buying trends in New York.
- Implementation of this policy is especially relevant in those areas of the state that expect population growth between now and 2030, and could be targeted to those areas in the short term.
- Considering the limitations of State incentives and assistance (vs. mandates for example, which this policy doesn't include), the scenario of having 50 percent of all new construction occur in priority growth areas is very aggressive, but potentially feasible, given the long timeframe. Achieving these results would require a sustained long-term State commitment to promoting priority growth centers with assistance and incentives.
- TLU-9 is closely linked with TLU-10 and TLU-11, which consist of related land use policies, and TLU-6 and TLU-7, which consist of policies supporting transit and transportation demand management that enable and thrive in partnership with compact, mixed land use.

[6] "Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions," http://www.movingcooler.info/.

- Compact, mixed use developments, which could be encouraged through Priority Growth Centers, offer significant co-benefits from improved public health and air quality; better mobility through access to additional travel options such as public transportation, walking, or biking; and reduction in building energy use (compact land use is generally associated with lower building energy use per square foot).
- Without significant changes in land use and development patterns in New York State, the level of VMT reductions and mode share changes contemplated in the entire suite of TLU policies will be difficult to achieve. However, land use changes are particularly difficult to prescribe in New York State. New York State can offer incentives to municipalities and regional planning organizations to incorporate priority growth centers, but the State ultimately does not have the authority to create them itself, due to home rule. Incentives will have to be designed carefully to attract local authorities to update and alter their land use plans. Land use patterns are difficult to change once established, and changing incentives and local regulations could lead to significant property value shifts, raising values in denser areas and reducing values in sprawling neighborhoods. This could have significant economic and equity impacts.

TRANSIT- ORIENTED DEVELOPMENT (TOD)/ TRANSIT-SUPPORTIVE DEVELOPMENT (TSD) (TLU-10)

Policy Summary

This policy is a suite of measures to encourage and incentivize transit-oriented development (TOD). The State could provide favorable tax incentives, priority infrastructure funding, and technical assistance/planning grants for the planning, zoning, and development/re-development of: transit villages in close proximity (one-half mile, as a general rule) to transit stations (rail, bus, ferry); targeted compact, mixed-use development within walking, biking and short-car-ride distance of a transit station; and pedestrian-/bicycle-friendly access to transit. New York State could also develop parking policies and alternative funding mechanisms for parking that support TOD/transit-supportive development (TSD). New York State could offer:

- Continued development and expansion of existing technical assistance and public education around TOD;
- Sales tax exemptions and/or income tax credits for retail within one-half mile of a transit hub in an area appropriately planned and zoned for TOD;
- Priority state and local assistance for projects within a TOD;
- Additional location efficiency incentives if TODs reduce transportation and/or parking costs due to location efficiency;
- Assistance and incentives for Transfer of Development Rights initiatives that transfer development away from open space that serves maximum carbon sink and sequestration benefits and toward TOD;

- Agreements established by the state housing agencies to maintain the long-term affordability of affordable housing within TOD/TSD as a condition of receiving state affordable housing assistance;
- Rewards/incentives for communities with adequate TOD/TSD ordinances.

Quantitative Analysis

The estimated GHG reduction potential, total cost or savings (as measured by net present value), and cost effectiveness (as measured by $/tCO$_2$e reduced) for the policy scenario analyzed by the Technical Work Group are presented below. The scenario assumed that the suite of programs outlined above were successful in having 65 percent of all new development in the MTA service area within close proximity and accessible to transit; and in establishing bus rapid transit lines throughout all major metropolitan areas of the state, with TOD located on each route.

GHG Reductions ($MMtCO_2e$)		Net Present Value Savings ($Million)	Net Savings per Avoided Emissions ($/tCO$_2$e)
2030	Total 2011–2030		
0.5	5.7	-$5,000	-$870

$/tCO$_2$e = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; MMtCO$_2$e = million metric tons of carbon dioxide equivalent.

Negative values represent savings.

Implementation costs were estimated by applying assumptions similar to those used for the *Moving Cooler*[7] study's Land Use and Smart Growth Strategies under the Maximum Deployment scenario. These include costs for policy, planning, and visioning. Since these planning costs are assumed to include all measures in TLU-9, TLU-10, and TLU-11, the cost was distributed between the three policy options, weighted by the emissions reduction.

Special Considerations

- Population levels in New York are expected to increase and development and building is expected to occur. This policy option aims to steer that development to locations accessible by transit. This policy suite is closely linked with TLU-9 and TLU-11, which consist of related land use policies, and TLU-6 and TLU-7, which consist of policies supporting transit and transportation demand management that enable and thrive in partnership with compact, mixed land use. It is also linked to TLU-12 through policies to promote these policies at a Regional level
- The scenario of 65 percent of development in Metropolitan Transportation Authority (MTA) area occurring near transit is taken from the report of the Blue Ribbon Commission on Sustainability and the MTA.
- Compact, mixed use developments, which could be encouraged through TOD/TSD, offer significant co-benefits from improved air quality and public health; better mobility through

[7] "Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions," http://www.movingcooler.info/.

access to additional travel options such as public transportation, walking, or biking; reduction in building energy use (compact land use is generally associated with lower building energy use per square foot); and enhanced quality of life.

- Without significant changes in land use patterns in New York State, the level of TOD and TSD in this policy option and those related to transit, HSR, and freight will be difficult to achieve. As mentioned in TLU-9, land use changes are difficult to prescribe in New York State.
- Traffic congestion and heavy traffic areas are significant environmental burdens on EJ communities across the state. Efforts to increase efficiencies and strategically promote the use of mass transit can help to ameliorate these impacts.
- As described in more detail in TLU-9, demographic changes will support the recommendations and goals in this TLU. Population projections for New York foresee an increase in urban areas downstate by 2030, but a decrease of almost 300,000 residents upstate. The increase in the over-65 population will increase the demand for smaller dwelling units in walkable/bikeable, transit-friendly, mixed-use communities. Demographic trends support projections of a strong market for compact, vibrant, diverse, mixed-use, walkable/bikeable, transit-friendly communities.

LOCATION-EFFICIENT LAND USE (TLU-11)

Policy Summary

The State of New York could incentivize and promote local planning, zoning and development/re-development that minimizes the distance between locations of daily destinations through targeted density and mixed land uses; infill development/adaptive reuse (commercial, retail, residential); retrofitting sprawl development to achieve greater density, mix of land uses, inter-connectivity and walkability; affordable housing opportunities; close proximity between jobs and transit; and close proximity between affordable housing and low-/moderate-income jobs. As distinguished from TLU 9—Priority Growth Centers, this policy could occur by taking a micro-planning approach by creating specific, people-friendly/oriented network/land use connections. New York State could accomplish this through programs such as:

- Recognizing and incentivizing projects that comport with location efficiency with state economic development assistance;
- Developing a Location-Efficient Mortgage program, modeled on the Housing Finance Agency/State of New York Mortgage Agency Mortgage Insurance Fund agreement with the MTA to provide additional incentive for affordable housing near transit;
- Requiring that to the extent practicable and within the context of the setting, road and network design would adhere to the Complete Streets approach, offering equal access and use to all users including automobiles, transit vehicles, pedestrians, bicyclers, seniors, and children regardless of age or ability;
- Catalyzing university and college resources to create greater town land use synergies with surrounding neighborhoods and municipal centers;

- Developing policies that promote local food production and distribution;
- Building location efficiency into state housing program eligibility and policies to mitigate any negative aspects of gentrification and increased housing prices resulting from revitalization and redevelopment; and
- Investing State funds in brownfields cleanup and redevelopment, including improving the existing brownfields tax credit program for privately owned brownfields, and re-establishing the grants and technical assistance to localities for municipally-owned brownfields.

Quantitative Analysis

The estimated GHG reduction potential, total cost or savings (as measured by net present value), and cost effectiveness (as measured by $/tCO$_2$e reduced) for the policy scenario analyzed by the Technical Work Group are presented below. The scenario assumed that the measures above would measurably reduce the distance/VMT required to access work and other daily destinations, as well as the household costs devoted to transportation.

GHG Reductions (MMtCO$_2$e)		Net Present Value Savings ($Million)	Net Savings per Avoided Emissions ($/tCO$_2$e)
2030	Total 2011–2030		
1.2	13	-$11,000	-$870

$/tCO$_2$e = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; MMtCO$_2$e = million metric tons of carbon dioxide equivalent.

Negative values represent savings.

Implementation costs were estimated by applying assumptions similar to those used for the *Moving Cooler*[8] study's Land Use and Smart Growth Strategies under the Maximum Deployment scenario. These include costs for policy, planning, and visioning. Since these planning costs are assumed to include all measures in TLU-9, TLU-10, and TLU-11, the cost was distributed between the three policy options, weighted by the emissions reduction.

Special Considerations

- TLU-11 is closely linked with TLU-9 and TLU-10, which consist of related land use policies, and TLU-6 and TLU-7, which consist of policies supporting transit and transportation demand management that enable and thrive in partnership with compact, mixed land use. It is also linked to the TLU-12 related to RGGI for land use.
- Compact, mixed use developments, which could be encouraged through Location-Efficient Land Use, offer significant co-benefits from improved air quality, better mobility through access to additional travel options such as public transportation, walking, or biking, reduction in building energy use (compact land use is generally associated with lower building energy use per square foot), and enhanced quality of life.

[8] *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions*, http://www.movingcooler.info/.

- The significant changes in land use patterns in New York State required by this policy will be complicated to achieve because land use changes are particularly difficult to prescribe in New York State. There is, for example, no guarantee that the list of State-level incentives enumerated above would result in a significant shift in land use patterns.
- As described in more detail in TLU-9, demographic changes will support the recommendations and goals in this TLU. Population projections for New York foresee an increase in urban areas downstate by 2030, but a decrease of almost 300,000 residents upstate. The increase in the over-65 population will increase the demand for smaller dwelling units in walkable/bikeable, transit-friendly, mixed-use communities. Demographic trends support projections of a strong market for compact, vibrant, diverse, mixed-use, walkable/bikeable, transit-friendly communities.

INTERGOVERNMENTAL/REGIONAL PROPOSALS (TLU-12)

Policy Summary

New York could pursue a range of regional (i.e., multi-state) strategies to reduce GHG emissions from the transportation sector. This policy description is separated into four parts, although they are clearly interdependent: (1) a regional initiative for land use and GHG emissions, (2) a regional initiative for transportation and GHG emissions, (3) a regional initiative for high speed rail lines inside New York State (Empire Corridors) and on the Northeast Corridor, and (4) a federal advocacy program. The regional transportation initiative would include a carbon pricing mechanism that would generate revenue, and the regional land use initiative would reinvest that revenue in economic development projects that lead to reduced per capita GHG emissions from transportation.

Certain regional transportation initiatives have already begun. For example, on June 15, 2010, a Northeast and Mid-Atlantic Regional Transportation and Climate Initiative summit brought together transportation, energy, and environmental agency heads from 11 states plus Washington, DC to work collaboratively to reduce GHG emissions from the transportation sector. In another example, in December 2009 the governors of New York and 10 other states signed an MOU affirming each state's commitment to developing a low carbon fuel standard framework. The programs described here also suggest policies that could be developed with existing entities, such as the Coalition of Northeastern Governors, the Northeast Association of State Transportation Officials, or the I-95 Corridor Coalition.

Regional initiative for Land Use and GHG Emissions

This program could encourage states to prioritize the provision of their own state funds to those municipalities that take specific actions to encourage low GHG land use. Municipalities that commit to certain land use planning actions (e.g. sustainable planning, zoning, transit-oriented development) could get priority for a range of state and federal funding. Funds (potentially from a GHG auction resulting from a regional initiative for transportation and GHG emissions, described below) would be reinvested in smart growth economic development projects in communities, and communities would be eligible for funding based on their commitments to climate change

mitigation and adaptation actions. In the short term, states could work together to identify and publicize best practices; offer joint municipal training/information sessions; or share results.

Regional Initiative for Transportation and GHG Emissions

Under this policy, a price for carbon emissions from the transport sector would be established via an auction of credits. Entities that provide fossil fuel for transportation would be required to hold credits to cover their sales. Revenue from the auction would be reinvested in: (1) shared modes, including high speed rail and intra-city transit; (2) smart growth land use actions that would reduce VMT, e.g. transit oriented development; and (3) transportation system efficiency. Providers of transportation fuels could, instead of purchasing credits, invest in projects to offset their emissions. Instead of the cap-and-invest framework, states could implement other pricing strategies, including VMT fees, PAYD auto insurance, and an increased fuel tax, which each should be further studied.

Also in this policy, the Technical Work Group suggests a range of potential joint research and development (R&D) projects. Examples include developing a methodology for quantifying transit projects for offsets, piloting a pay-as-you-go insurance project, piloting emission-based tolls in interstate transportation corridors, and developing an electric-vehicle corridor through joint planning and investment in electric fueling infrastructure.

The freight sector offers another opportunity for collaboration on GHG reduction strategies from the transportation sector. A multi-regional approach to freight transportation creates the potential for far greater GHG emission reductions than a New York-only approach. Regional cooperation could include incentives to municipalities that commit to freight planning actions (e.g., intermodal rail yards, distribution centers, freight villages, and consolidation centers). A price for freight carbon emissions could also be established via credit auctions. Shippers, freight forwarders, and retailers would be required to hold credits to cover shipping, based on total freight VMT. Auction revenues would be reinvested in low-carbon freight system infrastructure and smart growth land use actions reducing freight VMT. States could pursue R&D projects, for example, to develop low and zero-emission short and long-haul freight rail systems or use advanced technology such as linear induction or emission-based truck tolls in interstate transportation corridors.

Regional High-Speed Rail for the Empire Corridors and the Northeast Corridor

New York should continue to engage and collaborate with Northeast states to undertake a major investment study on high speed rail in the Northeast Corridor and within New York State (Empire Corridor lines) and the nearby provinces of Canada. By far America's busiest rail corridor, the Northeast Corridor moves more than 259 million passengers annually. Amtrak's share of these riders in 2009 was 13 million. Preliminary estimates are that intercity passenger rail ridership along the Northeast Corridor is forecast to increase by 59 percent to a total of 412 million by 2030, with 23 million of these riders using Amtrak.[9]

Development of a high speed rail system that offers competitive trip times could shift travel demand from single-occupant vehicles and air travel to rail. Short-haul air travel would not be eliminated, as the need for connecting flights will likely persist but it could be dramatically

[9] The NEC Master Plan Working Group. Northeast Corridor Infrastructure Master Plan. May 2010.

reduced, freeing up congested airspace in the region. World class high speed rail in the Northeast could also create economic synergies between cities on the Eastern Seaboard. Linking cities that enjoy strong economies with cities trying to develop stronger economies will transform the economic geography and output of the Northeast. New York State should continue all efforts to develop high speed rail along the Empire Corridor. Dedicated high speed rail tracks would also reduce congestion on existing rail lines, leading to improved and more efficient freight movement.

The Northeast Mega-region is projected to grow from a population of 49.5 million in 2000 to 58 million by 2025 and 70 million by 2050.[10] The ability of the Northeast Mega-region to capture and sustain this population growth will depend largely on the quality of its transportation infrastructure. To continue its economic growth, the Northeast Mega-region will need to provide expanded capacity for intercity travel. Highways and airports cannot provide this capacity in a manner that meets the goals of the New York State Climate Action Plan. Dramatically increasing intercity rail capacity in the Northeast Mega-region, and reducing trip times in the process, could achieve increased mobility, economic growth, energy security, and GHG emissions reductions.

Preliminary data and analysis conducted by the Regional Plan Association suggests that a "California-style high speed rail" in the Northeast and Empire Corridors could shift 24 percent and 17 percent of passengers from air travel to rail, respectively.

New York State should continue to aggressively work with other Northeast States to undertake a major investment study of the impact of high speed rail on the Northeast and Empire Corridors. This study would forecast the economic development benefits of high speed rail on city pairs within the Northeast, changes in regional air space, GHG benefits, and mode shift toward rail.

A Federal Advocacy Program

Many actions to reduce emissions would best occur at the federal level. New York State advocacy for these changes will be most effective in concert with other states. New York State should advocate for a stronger federal program for LDV standards to significantly increase market penetration of zero-GHG vehicles (*see* TLU-1). As enumerated in the 2009 New York State Energy Plan, a new federal funding formula is needed within the next surface transportation funding bill to provide the correct incentives to states. There also needs to be significant federal investment in new low-GHG transportation modes, and an increase in federal funds for transit, rail and other modes that reduce GHG emissions. New York State should advocate for a diversification of the portfolio of revenue supporting the federal surface transportation program for a healthy transition to a low-carbon system. A federal advocacy partnership with other states could also address the need for streamlining the process to secure federal approval to expand transit systems, and linking the award of federal funds for major transportation system expansion to land use plans that support GHG emissions reduction.

Quantitative Analysis

Quantitative analysis of this suite of policy options was not undertaken.

[10] Ibid, page 8.

Special Considerations

- These are policies believed to be best designed and implemented on a multi-state basis. In some cases, the interconnected nature of the regional system (e.g., highways, trucking, and fuel markets) is the main impetus for a regional approach. For other policies, implementation on a regional basis could minimize any competitive disadvantages for New York. A regional approach may be necessary to reduce leakage. Also, a policy may need more research and analysis of likely outcomes, and this research would be most informative if it occurs for several states.
- Successful implementation of the policies described here would bring a range of co-benefits including reduction of other pollutant emissions, the provision of additional transportation choices, the reduction of traffic congestion, and more sustainable land use patterns.
- The policy options presented here are linked to many of the other options presented, especially TLU-7 (transit), TLU-8 (freight), and TLU-4 (fueling infrastructure).