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Transportation and Land Use Technical Work Group
Summary List of Mitigation Options

	Mitigation Option	GHG Reductions ($MMtCO_2e$)			Net Present Value 2008–2020 (Million $)	Cost-Effectiveness ($/tCO_2e$)	Status of Option
		2012	2020	Total 2008-2020			
TLU-1a	Land Development Planning	2.6	8.0	50.3	Net savings		Pending
TLU-1b	Multi-modal Transportation & Promotion	2.8	3.0	31.3	Net savings		Pending
TLU-3a	Feebates to raise revenue	1.2	2.2	15.9	Net savings		Pending
TLU-3a	Feebates to change fleet mix	0	< 0.5	2.0	Not quantified	-$40 to +$10	Pending
TLU-4	Truck-stop Electrification	Included in TLU-8			Net savings		Pending
TLU-5	Tailpipe GHG Standards	0	8.09	44.5	TBD	-$100	Pending
TLU-6	Biofuels Bundle	1.14	3.25	25.8	In progress	In progress	Pending
TLU-7	Procure Efficient Fleets	Included in TLU-6					Pending
TLU-8	Anti-idling	0.1	0.2	1.9	-$32	-$22	Pending
TLU-9	Diesel Retrofits	Not quantified					Pending
TLU-10a	Fuel tax (50 cents/gallon)	6.4	13.9	95.2	Net savings		Pending
TLU-10a	Fuel tax (10 cents/gallon)	1.3	2.8	19.0	Net savings		Pending
TLU-11	Pay As You Drive Insurance	2.3	5.3	35.8	Expected net savings		Pending
TLU-12	Incentives for Advanced Tech Vehicles	Not quantified					Pending
TLU-13	Buses – Clean Fuels	Included in TLU-6					Pending

	Mitigation Option	GHG Reductions ($MMtCO_2e$)			Net Present Value 2008–2020 (Million $)	Cost-Effectiveness ($/tCO_2e$)	Status of Option
		2012	2020	Total 2008-2020			
	SECTOR TOTAL AFTER ADJUSTING FOR OVERLAPS	15.4	42.84	277.8	TBD	TBD	Pending
	SECTOR TOTAL PLUS RECENT POLICY ACTIONS	TBD	TBD	TBD	TBD	TBD	Pending

TLU 1a Land Development Planning

Mitigation Option Description

Promote land planning and development that supports conservation of high quality natural and cultural resources and supports more compact development, and as a result reduces growth in driving and emissions.

Mitigation Option Design

Goals:

- Support and promote private and public planning and development practices, including infrastructure provision, that reduce the number, length, or travel mode of trips made in North Carolina.
- Reduce projected increase in VMT by 10% statewide by 2020.

Timing: Have policies in place to achieve that VMT goal by 2010.

Parties involved:

- Private developers/contractors
- Local government planning/elected boards
- Planning staffs for towns and counties

Implementation Mechanisms

Meeting the goal will require diverse implementation tools. Providing many options, statutory changes, and program assistance for smaller communities will be essential.

Land use and development legislation to require adoption of a growth plan:

- *Each municipality and county shall develop a land use and development plan.* The plan should designate planned growth areas and natural resource areas within that jurisdiction and any extraterritorial jurisdiction for a planning horizon of at least 25 years. The land use and development plan should include standards and criteria for conservation area and/or urban service area designations to accommodate a minimum 20-year growth forecast agreed upon by the each county and municipality, establish development and conservation goals, recognize important natural and human resources, and express appropriate policies, practices and strategies to implement these goals. Local planning programs should include appropriate public involvement processes to achieve consensus on the development and conservation vision for the community.

- *Require and support integration of transportation with land use plans.*

  Maryland, Minnesota, and Denver, CO, as well as the non-profit Triangle Land Conservancy have developed "greenprints" of areas that have old-growth forests, productive agricultural lands, water supply watersheds, historic sites or other critical and irreplaceable resources. Adding this as a required element of all transportation plans would be a simple and meaningful step that would greatly enhance the effect and benefits of NCGS 136-66.2 without requiring new zoning or regulatory powers. The November, 2004 passage of tax increment financing legislation demonstrates that North Carolina can and does make room for new ideas that help achieve economic development goals in concert with infill development objectives. The N.C. Small Town Economic Development (NCSTEP) initiative created grant funds that are being applied to 33 communities to better develop their areas.

- *Regulatory incentives* such as withholding transportation funds for non-compliance have worked in Tennessee and should be considered in North Carolina as well.

Remove barriers to Smart Growth

Many states have successfully implemented a variety of tools that are unavailable to North Carolina municipalities and counties due to prohibitions imposed by North Carolina statutes or constitution. Modify statutes to permit adequate public facilities ordinances, transfer of development rights programs, and development impact fees to improve the ability of local governments to control their own destinies.

Related Policies/Programs in Place

Development of a coordinated transportation system and provisions for streets and highways in and around municipalities.[1]

- The Department of Transportation may participate in the development and adoption of a transportation plan or updated transportation plan when all local governments within the area covered by the transportation plan have adopted land development plans within the previous five years.
- The Department of Transportation may participate in the development of a transportation plan if all the municipalities and counties within the area covered by the transportation plan are in the process of developing a land development plan.
- The Department of Transportation may not adopt or update a transportation plan until a local land development plan has been adopted. A qualifying land development plan may be a comprehensive plan, land use plan, master plan, strategic plan, or any type of plan or policy document that expresses a jurisdiction's goals and objectives for the development of land within that jurisdiction.
- At the request of the local jurisdiction, the Department may review and provide comments on the plan but shall not provide approval of the land development plan.

[1] See in § 136-66.2.

Coastal Area Management Act[2], Cooperative State-local program.[3]

This Article establishes a cooperative program of coastal area management between local and State governments.

- Local government shall have the initiative for planning.
- State government shall establish areas of environmental concern.
- With regard to planning, State government shall act primarily in a supportive standard-setting and review capacity, except where local governments do not elect to exercise their initiative. Enforcement shall be a concurrent State-local responsibility.
- A wide variety of other state, regional, and local level planning and design programs, requirements, and efforts.

Types(s) of GHG Reductions

Mainly CO_2, small amounts of others.

Estimated GHG Reductions and Costs (or Cost Savings)

- **GHG reduction potential in 2010, 2020 ($MMtCO_2e$):** 2.6, 8.0.
- **Cost Effectiveness:** Expected net savings.

Data Sources:

- *VMT impacts*: A wide variety of literature finds that integrated transportation and land use planning can substantially reduce VMT.[4] The appropriate percentage reduction depends on the scale at which policies are applied.[5] Given the methodology used here, a 30% reduction in VMT at the level of an individual development / neighborhood is an appropriate value. This is conservatively below the reductions of 50% and higher that have been empirically observed in neighborhoods planned to allow multi-modal access and compact, mixed-use development.[6]
- *Costs*: A wide variety of literature finds that integrated transportation and land use planning produces net savings on total costs of buildings + land + infrastructure + transportation. Some portions of that total cost of may be higher. Preponderance of literature suggests net savings overall.[7] A National Academy of Sciences / Transportation

[2] See § 113A-100.
[3] See § 113A-101.
[4] US EPA, *Our Built and Natural Environments: A Technical Review of the Interactions Between Land Use, Transportation, and Environmental Quality*, 2001. http://www.epa.gov/dced/built.htm
[5] US EPA, *Guidance: Improving Air Quality Through Land Use Activities* (EPA 420-R-01-001; January 2001), and US EPA, *Comparing Methodologies to Assess Transportation and Air Quality Impacts of Brownfields and Infill Development* (EPA-231-R-01-001 August 2001).
[6] Cambridge Systematics, Inc., *Transportation Impacts of Smart Growth and Comprehensive Planning Initiatives: Final Report*, prepared for National Cooperative Highway Research Program, May 2004.
[7] Literature reviews include US EPA, *Our Built and Natural Environments: A Technical Review of the Interactions Between Land Use, Transportation, and Environmental Quality*, 2001; and Burchell *et al.* in footnote 8.

Research Board review found substantial regional and state-level infrastructure cost savings from more compact development.[8] For example:

Burchell Findings of Savings of Compact Growth versus Current or Trend Development

Area of Impact	*Lexington, KY and Delaware Estuary*	*Michigan*	*South Carolina*	*New Jersey*
I. Public-Private Capital and Operating Costs				
1. Infrastructure Roads (local)	14.8-19.7%	12.4%	12%	26%
2. Utilities (water/sewer)	6.7-8.2%	13.7%	13%	8%
3. Housing Costs	2.5-8.4%	6.8%	7%	6%
4. Cost-Revenue Impacts	6.9%	3.5%	5%	2%
II. Land/Natural Habitat Preservation				
1. Developable Land	20.5-24.2%	15.5%	15%	6%
2. Agricultural Land	18-29%	17.4%	18%	39%
3. Frail Land	20-27%	20.9%	22%	17%

We have not attempted to apply these kinds of cost reduction percentages to North Carolina's total infrastructure costs, but even at the low end of the above figures, the total savings would be in the billions.

Quantification Methods:

Apply reductions to LDV VMT only:

- 15% of total VMT affected by these policies by 2012; 40% by 2020. So:
  - 2012 reduction = Statewide LDV * 15% * 30% = **4%** of total statewide HDV + LDV[9]
  - 2020 reduction = Statewide LDV * 40% * 30% = **10%** of total statewide HDV + LDV
- Convert to CO_2

Key Assumptions:

The given VMT and emissions reductions assume that the planning described in "Implementation Methods" will produce the changes growth patterns necessary to produce the stated goal.

Key Uncertainties

Achieving the given VMT goal depends on a vigorous implementation of the policy initiatives at all levels of government. It is possible that required planning could be done in a way that does

[8] Robert Burchell, *et al*., *The Costs of Sprawl—Revisited (TCRP Report 39)*, Transportation Research Board/National Research Council/National Academy Press, Washington, D.C. 1998.

[9] We express the final result in terms of percentage reduction in LDV + HDV to provide for a common basis of comparison in terms of VMT. Since the ultimate output of interest is CO2 / GHGs, it may be argued that this intermediate step is unnecessary, but many people find VMT percentage reductions a useful yardstick.

not change development patterns, and thus does not reduce emissions. That is, the policy language does not require these outcomes.

Additional Benefits and Costs

Benefits include reduced infrastructure costs noted above, avoided health care costs from reduced air pollution and increased walking/biking, and other quality-of-life aspects.

Costs: There will be front-end costs of program development and implementation, and a successful program requires dedicated resources.

Feasibility Issues

None Cited.

Status of Group Approval

Pending.

Level of Group Support

TBD

Barriers to Consensus

TBD

TLU – 1b Multimodal Transportation and Promotion

Mitigation Option Description

Shift passenger transportation mode choice to lower emitting choices. Ensure that transportation is integrated with and appropriately serves land-use development plans (developed under TLU-1a). State invests 5% of all state transportation dollars in transit by 2010, and 12% by 2030.

Mitigation Option Design

Goals:

Implement policies that increase use of public transportation, producing a shift to lower emitting mode choices, by the following policies:

- Improve Transit Service (frequency, convenience, quality).
- Expand Transit Infrastructure (rail, bus, BRT).
- Focus new development on transit-served corridors (Transit-Oriented Development).
- Expand Transit Marketing and Promotion (including tax-free and employer-paid Commuter Benefits, and Parking Cash Out).
- Expand Transportation System Management and Design, which speeds both transit and other traffic.
- Improve bike and pedestrian infrastructure both as feeders and as stand-alone modes.

Timing:

- Many programs are in place and are therefore immediately expandable/implementable. Enhancement and continuation can begin short-term.
- Infrastructure improvements will take 1-5 years at a minimum.

Parties involved:

- NC DOT.
- Regional Transportation Districts.
- Metropolitan Planning Organizations.
- Regional Planning Organizations.
- Municipalities.
- Counties.

Other: None Cited.

Implementation Mechanisms

- Aggressively support and aid the creation of Regional Transportation Districts (RTDs). RTDs can sell bonds for capital projects, and member governments can levy taxes for operation and maintenance subject to voter approval.
- Make planning and funding rules more flexible to allow transit operators to provide service to places outside of their municipal jurisdictions.
- Abolish or reduce minimum parking requirements in zoning codes, and allow localities to establish parking maximums.
- Create a best practice guide and recognize developers who adhere to best practice when designing and locating new private and public development.
- Require planning to extend beyond 5 years (20 years recommended) for all systems.
- Create incentives or require the purchase of biodiesel fuel (minimum: B20) as a part of all public bus replacement programs. Conover has already done so with great results.
- Location of State Facilities – Locate state facilities near transit facilities. Where and when appropriate all state government offices should be located downtown when possible.[10]
- State Targeting of Infrastructure Investments – Legislatively appropriated capital outlay funds, state public revolving loan fund, and other state-funded infrastructure initiatives should be used for projects that encourage walkable and traditional communities, and are supportive of transit.
- Make maintenance of infrastructure a priority – Fix it First. Revise any state infrastructure programs; transportation, water, sewer, that fund new systems but not maintenance or upgrades for existing systems.
- Replace "average cost pricing" for utilities services with rate structures that charge full marginal costs for both new infrastructure and for water, sewer, electricity, and telephone service delivery.
- Fund the transportation-related programs in this mitigation option with monies generated by other mitigation options such as feebates and/or gas tax.

Related Policies/Programs in Place

Overall, the NC State Transportation Plan[11] recommends spending 5.8% of total state transportation funding on transit over the next 25 years.

Statewide Transportation Demand Management Program (TDM)

- NCDOT-PTD supports the formation and ongoing activities of local TDM programs across the state by funding up to 50% of the cost of administering and marketing the services of the local TDM programs.

[10] This is an Executive Order from NC Governor James Holshouser.
[11] September, 2004.

- Provide training for the TDM Coordinators operating the TDM programs. Currently, there are programs in the Charlotte, Asheville, Triad, Triangle and Wilmington areas of the state.
- In support of the TDM programs, the state funded, with local areas support, a ridematching program that is available statewide which individuals can access through the internet to find or form carpools or vanpools for their daily commuter trips.
- The State is looking into adding a module to the program that allows individuals to enter trip needs that vary by day of the week, instead of the usual Monday through Friday work trip. The new module would allow part time workers, workers with variable work schedules and college students to find rides even though their trips are not regular throughout the week.

Intermodal Transportation Centers

- NCDOT-PTD works with municipalities in the states larger cities to develop intermodal transportation centers that allow for seamless movement between intercity passenger rail, intercity bus and city bus services. Currently Greensboro has an intermodal center in operation which spurred double digit increases in ridership on the city's bus system and the intercity bus operator after it opened. Rocky Mount has a successful intermodal center in operation. Additional projects are being developed in the following areas: Charlotte, Durham, Fayetteville, Greenville, Raleigh, Wilmington and Winston-Salem.
- The state assists the municipalities in getting Federal Transit Administration funding, provides a 10% match to the 80% FTA funding and participates in the planning, land acquisition and design processes leading to construction of the centers.

Technology on Transit Vehicles and Facilities

- NCDOT-PTD supports the installation of new technologies on transit buses and in transit facilities that make transit services more safe and efficient and that provide a higher level of information on the services for riders and potential riders. The state funds 90% of the cost of the technologies. Examples of such technologies include installation of cameras on buses (safety), real time transit service information signage at transit facilities (more information), compatible electronic fareboxes for systems in one region (ease of transit systems use) and installation of AVL/GPS systems on buses (more efficient operation and more information to passengers).

Types(s) of GHG Reductions

Mainly CO_2, small amounts of others.

Estimated GHG Savings and Costs per $MTCO_2e$

- **GHG reduction potential in 2010, 2020 ($MMtCO_2e$):** 2.8, 4.1.
- **Cost Effectiveness:** Expected net savings

Data Sources:

Reductions from transit improvements: Transit economics literature.[12]

Reductions from TDM and transit promotion: TDM literature.[13]

Costs: Both the above, and transit cost/benefit analysis guidance.[14]

Quantification Methods:

- **VMT reductions**

Apply reductions to urban LDV VMT only.

- Reductions from transit improvements:

50%	Percent of travel (by VMT) that is divertible to transit service (e.g., parallels transit service)
2%	Current passenger miles traveled share for transit trips
25%	Percentage decrease in transit fares
40%	Percentage increase in service
0.4	Elasticity of transit demand wrt price
0.8	Elasticity of transit demand wrt service
2.20%	Calculate expected percent reduction in VMT (based on fare decrease)
2.64%	Calculate expected percent reduction in VMT (based on service increase)

- 2012 reduction = **2.46%** of total statewide HDV + LDV

- 2020 reduction = **2.44%** of total statewide HDV + LDV

[12] See McCollom, Brian E. and Richard Pratt. 2004. "Transit Pricing and Fares." TCRP Report 95. Washington, D.C.: Transportation Review Board; and Cervero, Robert. 1990. "Transit Pricing Research." Transportation 17, 2: 117-140; and Victoria Transport Policy Institute, "Public Transit Improvements" in *TDM Encyclopedia*, 2005.

[13] Including ICF Consulting, *Strategies for Increasing the Effectiveness of Commuter Benefits Programs: Transit Cooperative Research Program Report 87*, Transportation Research Board, Washington, D.C., 2003; ICF Consulting, *Analyzing the Effectiveness of Commuter Benefits Programs: Transit Cooperative Research Program Report 107*, Transportation Research Board, Washington, D.C., 2005; and ICF Consulting, "Commuter Connections Strategic Review", report to the Maryland Department of Transportation Office of Planning and Capital Programming, November 7, 2004.

[14] ECONorthwest, *Estimating the Benefits and Costs of Public Transit Projects: A Guidebook for Practitioners, Transit Cooperative Research Program Report 78*, Transportation Research Board / National Research Council / National Academy Press, Washington, D.C., 2002.

- Reductions from TDM and transit promotion:

30%	Multiply urban LDV VMT by the percent of travel that is associated with commuting
12%	Effectiveness of TDM measures for reducing daily commute VMT (through 2012)
20%	Effectiveness of TDM measures for reducing daily commute VMT (through 2020)
4%	Calculate expected percent reduction in urban VMT through 2012
6%	Calculate expected percent reduction in urban VMT through 2020

- 2012 reduction = **1.8%** of total statewide HDV + LDV

- 2020 reduction = **2.44%** of total statewide HDV + LDV

- Add reductions from multi-modal investments + reductions from TDM and transit promotion.
- Convert to CO_2

- **Cost-effectiveness**

The cost-effectiveness of investments in transit and transit promotion will vary depending on how those investments are made, and the Option language gives the state and its constituents wide flexibility in making those investments. A given investment in transit and/or transit promotion may or not produce net benefits, so while this process needs to make general policy recommendations, it will remain the responsibility of the state and its constituents to maximize the cost-effectiveness of investments made.

For the purposes of this analysis, we ask whether those types of investments are *likely* to produce net costs or net savings. A wide variety of empirical experience suggests that the policies and investments listed in the Option Design and Implementation Mechanisms sections are likely to produce substantial net savings, as in the following three examples.

1. *Transit investments generally:* Nationally, transit produces net economic returns on investment: "For every $10 million invested, over $15 million is saved in transportation costs to both highway and transit users. These costs include operating costs, fuel costs, and congestion costs." These are in addition to the ancillary benefits summarized below.[15]
2. *Transit fare initiatives:* Unlimited Access transit at the University of California-Los Angeles costs $810,000 a year, and has total benefits of $3,250,000 a year.[16] Similar programs at other universities show similar results.[17] Universities are in some senses unique institutions, but the general types of challenges (esp. demand for, and cost

[15] Cambridge Systematics, Inc., *Public Transportation and the Nation's Economy: A Quantitative Analysis of Public Transportation's Economic Impact*, 1999. (available at http://www.camsys.com/publi01.htm)
[16] Jeffrey Brown, Daniel Hess, and Donald Shoup, "Fare-Free Public Transit at Universities: An Evaluation," *Journal of Planning Education and Research* (23:69-82), 2003.
[17] Jeffrey Brown, Daniel Hess & Donald Shoup, "Unlimited Access," *Transportation* 28:233–267, Kluwer, 2001.

providing, parking), and the types of benefits enjoyed in response to commute benefits programs, are equally available to businesses:

> "Eco Passes also offer significant advantages for employers who offer free parking to all commuters, because those who shift from driving to transit will reduce the demand for employer-paid parking spaces. A survey of Silicon Valley commuters whose employers offer Eco Passes found that the solo-driver share fell from 76 percent before the passes were offered to 60 percent afterward. The transit mode share for commuting increased from 11 percent to 27 percent. These mode shifts reduced commuter parking demand by approximately 19 percent.
>
> "Given the high cost of constructing parking spaces in the Silicon Valley, each $1 per year spent to buy Eco Passes can save between $23 and $333 on the capital cost of required parking spaces."[18]

3. *Transit and non-SOV options information and promotion:* Per public dollar, a Transportation Management Organization (TMO) can accommodate seven times as many commuters as new highway investment.[19]

Key Assumptions: Portions of TLU-1b support TLU-1a. The quantifications for TLU-1b focus on the role of transit, transit promotion and related initiatives. TLU-1a and -1b are labeled as (a) and (b) to emphasize their interdependent nature. We assume that they are implemented in concert to maximize effectiveness. Nonetheless, not all benefits are dependent on joint implementation. To use the Eco Pass example just above: Silicon Valley has little land use planning of the type called for in TLU-1a, but Eco Passes still have substantial emissions reductions and other benefits. See "Feasibility Issues" for additional discussion.

Key Uncertainties

None Cited.

Additional Benefits and Costs

There is a broad literature on the role of transit as a part of a modern economy and as a key contributor to creating and maintaining certain aspects of quality of life. Overarching reviews of that literature are done only periodically; one the most comprehensive being Cambridge Systematics (CS), Inc., *Public Transportation and the Nation's Economy: A Quantitative Analysis of Public Transportation's Economic Impact*, 1999. It lists the following additional types of benefits from transit investments. We give this list, and cite CS's bottom line estimate of transportation benefits above, not to suggest that North Carolina would necessarily see the same multipliers, but to support a finding that non-CO_2 benefits would, at a minimum, exceed costs:

- "Transit capital investment is a significant source of job creation. This analysis indicates that in the year following the investment 314 jobs are created for each $10 million invested in transit capital funding.
- "Transit operations spending provides a direct infusion to the local economy. Over 570 jobs are created for each $10 million invested in the short run.

[18] *Id*., p. 260.
[19] Minnesota Department of Transportation, Modal Options Identify Project, "Measurement and Evaluation", 2006

- "Businesses would realize a gain in sales 3 times the public sector investment in transit capital; a $10 million investment results in a $30 million gain in sales.
- "Businesses benefit as well from transit operations spending, with a $32 million increase in business sales for each $10 million in transit operations spending. [….]
- "Business output and personal income are positively impacted by transit investment, growing rapidly over time. These transportation user impacts create savings to business operations, and increase the overall efficiency of the economy, positively affecting business sales and household incomes. A sustained program of transit capital investment will generate an increase of $2 million in business output and $0.8 million in personal income for each $10 million in the short run (during year one). In the long term (during year 20), these benefits increase to $31 million and $18 million for business output and personal income respectively.
- "Transit capital and operating investment generates personal income and business profits that produce positive fiscal impacts. On average, a typical state/local government could realize a 4 to 16 percent gain in revenues due to the increases in income and employment generated by investments in transit.
- "Additional economic benefits which would improve the assessment of transit's economic impact are difficult to quantify and require a different analytical methodology from that employed in this report. They include "quality of life" benefits, changes in land use, social welfare benefits and reductions in the cost of other public sector functions.
- "The findings of this report compliment studies of local economic impacts, which carry a positive message that builds upon the body of evidence that shows transit is a sound public investment. [L]ocal studies have shown benefit/cost ratios as high as 9 to 1."

Feasibility Issues

Like any class of investment, the fact that empirically and on average it produces net returns does not guarantee that a given investment will do so. Transit investment and operation, and transit promotion, need to be tailored to the communities that they serve, and be well-planned, well-implemented, and well-run to produce the maximum return on investment (ROI). Emphasizing one aspect of TLU-1a or TLU-1b at the expense of another will reduce potential ROI and available emissions reductions.

Status of Group Approval

Pending.

Level of Group Support

TBD

Barriers to Consensus

TBD

TLU – 3a Feebates to raise revenue

Mitigation Option Description

Motor vehicle registration fees that vary with vehicle emissions and fuel economy as rated by U.S Environmental Protection Agency can be designed to be a 'feebate' by providing a small refund instead of surcharge for vehicles that achieve low scores.

Mitigation Option Design

Goals:

- To raise funds for State of North Carolina to provide funds for transportation-related projects that reduce GHG.
- To raise funds through a mechanism that is directly tied to a significant source of GHG emissions from cars and trucks.

Timing: Should be implemented as soon as possible.

Parties involved:

- DMV.
- Agencies that distribute and spend the revenue.

Other: None Cited.

Implementation Mechanisms

Legislation directed 'feebates.'

- In light duty vehicles, the appropriate emissions/efficiency factor is identified from the table below. This can be done by a DMV computer. This factor is based on the vehicle's Green Vehicle Guide rating, as published by EPA.[20] By incorporating the vehicle's Green Vehicle Guide rating, both fuel economy and emissions are accounted for.

[20] See http//www.epa.gov/greenvehicles.

Combined Score from EPA Green Vehicle Guide	Emissions/Efficiency Factor
19-20	10,000
17-18	9,000
15-16	8,000
13-14	7,000
11-12	6,000
9-10	5,000
7-8	4,000
5-6	3,000
3-4	2,000
<3	1,000

- Then to calculate the surcharge, vehicle miles traveled (VMT) is divided by the emissions/efficiency factor, as shown in the example below.

Vehicle	Vehicle Miles Traveled	Combined Score from EPA Green Vehicle Guide	Factor from Table Above	Fee (VMT/Factor)
Toyota Prius	15,000	20	10,000	$ 1.50
Volkswagen Jetta Diesel, Manual	21,000	13	7,000	$ 3.00
Chevy Cavalier	49,000	14	7,000	$ 7.00
Toyota Land Cruiser	15,000	2	1,000	$15.00

- Generally, the feebate design needs to be simple, minimize the number of pivot points, be well-documented, be designed to maximize not minimize consumer attention.
- During the past 2 legislative sessions, variations of a motor vehicle surcharge have been introduced; these could be drawn on for more detailed policy language.

  Mobile Source Emission Reduction Program
  Establishes variable motor vehicle registration fees based on vehicle's pollution and fuel economy score to generate funds for public and private sector use of alternative fuel and advanced transportation technologies. Funds would be distributed through the State Energy Office for transportation projects that support clean air renewable energy objectives. The committee proposed a substitute to set vehicle surcharge from $2-$14 annually.

Related Policies/Programs in Place

None.

Types(s) of GHG Reductions

CO_2

Estimated GHG Reductions and Costs (or Cost Savings)

GHG reductions

- 1.7 million NC LDV registrations per year @ $10 per vehicle = $37 million per year for programs to reduce emissions from travel.
- Regional commuter programs can reduce VMT at 2 cents/mile.
- $37 million per year times $0.02 per mile equals 1,850,000,000 VMT = 2% of total statewide VMT; 3% of total urban LDV VMT.
- This is essentially the same amount of reductions produced by the "transit promotion and TDM" portion of TLU-1b: 1.2 MMtCO2e in 2012; 2.2 MMtCO2e in 2020.

This mitigation option is envisioned as likely to fund the types of transit promotion activities described in TLU-1b. As such, there are two quantification options:

1. TLU-1b actions are envisioned to be funded out of the increased portion of the total state transportation budget that would go to TLU-1b. If increases of the recommended amount are not available from the current transportation budget, then this funding mechanism would be used. In this case, TLU-3a GHG reductions would not be reported separately.
2. If TLU-1b options are funded at the recommended level, then the reductions from this funding source would be essentially additive and reported separately.

Costs/cost savings: If, as in the above example, revenue is used to fund multi-modal options promotion, which has "Expected net savings" then this option will have expected net savings.

Data Sources: VMT reductions/$ from:

> ICF, *Commuter Connections Strategic Review: Final Report*, for Maryland Department of Transportation, Office of Planning and Capital Programming, November 7, 2004.

Quantification Methods: Above.

Key Assumptions: $2-$14 surcharge has no direct effect on behavior. All reductions come from supporting other programs.

Key Uncertainties

None Cited.

Additional Benefits and Costs

None Cited.

Feasibility Issues

None Cited.

Status of Group Approval

Pending

Level of Group Support

TBD

Barriers to Consensus

TBD

TLU – 3b Feebates to change fleet mix

Mitigation Option Description

Feebates (fee / rebates) charge or rebate a sliding scale of fees and rebates for new cars based on their emissions of greenhouse gases, fuel consumption, and/or other measures of a vehicle's environmental impacts. This provides an incentive for manufacturers to sell cost-effective efficiency technologies, and for consumers to buy lower-emitting vehicles.

Mitigation Option Design

Goals: To reduce overall GHG emissions from new automobiles purchased in the state.

- By having price signals reflect emissions levels and thus have emissions level more directly enter buying decisions.
- By sending a signal to manufacturers to produce increasingly low-emitting vehicles for the market.
- By creating a dedicated revenue stream for promotion of low emitting or no emitting GHG transportation alternatives e.g., hybrid tax credits, transit infrastructure.

Timing: Should be implemented as soon as possible.

Parties involved: All new vehicles registered in North Carolina.

Other: None Cited.

Implementation Mechanisms

Legislation directed 'feebates.'

- The simplest is to set the fee or the rebate in proportion to the amount of fuel consumed by the vehicle per mile driven. Specify the rate (in dollars per mile) and the "pivot point" between fees and rebates. The location of this pivot point will determine the net revenue flow.
- Emissions could be considered relative to other vehicles within each class or across classes based on their design variations.
- The feebate could be set as a multiplier for an excise tax so that the fee or rebate is determined not only by the emissions rate of the vehicle but by its price as well.
- Generally the feebate design needs to be simple, minimize the number of pivot points, be well-documented, be designed to maximize consumer attention.

Related Policies/Programs in Place

Feebates have been proposed in many forms over the last fifteen years but have not yet been implemented in the United States. Feebate programs would work on two levels. First, the feebates would directly affect consumer choices for vehicle purchases as a result of the financial incentives. Second, the feebates could indirectly affect the types of vehicles and technologies that manufacturers offer. While feebate proposals have been described in academic studies, there has been no implementation of a full feebate program to date in the United States. While there is a 'gas guzzler tax' and tax incentives for hybrid vehicle purchases, there is not yet any history of an on-the-ground example of an implemented feebate program.

Existing analysis shows that 90% of the benefits of feebate programs are likely to arise from the manufacturing response, as manufacturers change the technology mix in the fleet, rather than the consumer response, in which consumers change the mix of purchasing decisions within the current for-sale fleet. And manufacturers are unlikely to substantially change their technology mix in response to a single state feebate program. These studies have spurred an interest in multi-state feebate programs as a way to increase the increase the size of the affected market, and thus the incentive for manufacturers to shift technology mix. This policy option assumes only a NC-level policy.

Types(s) of GHG Reductions

Mainly CO_2

Estimated GHG Reductions and Costs (or Cost Savings)

Data Sources:

- CCS quantifications for feebates option for AZ
- Marbek Resource Consultants in association with Resources for the Future and DesRosiers Automotive Consultants, *Development of Options For a Vehicle Feebate In Canada*, Final Report, October 13, 2005

Quantification Methods:

- **Impacts**

Attempts have recently been made to estimate the GHG emissions reduction potential from individual state feebate programs, including programs proposed for the states of Arizona and California. A rough extrapolation to NC suggests that a stand-alone feebate program is unlikely to produce reductions of more than 0.5 $MMtCO_2e$ in 2020.

These recent estimates of the potential impacts of individual state programs are contingent upon assumptions and analytical methods that have not undergone thorough peer review. Therefore, the results of these analyses are preliminary and should be interpreted with caution. Further analysis and study of the potential benefits and costs of individual state and multi-state feebate programs would greatly increase confidence in projected results.

- **Costs**

A wide variety of economics literature finds that vehicle buyers do not buy all the efficiency technology that is cost-effective, taking into account the net present value of both the fuel savings and the additional technology cost. Feebate analyses, the most recent of which is cited above, find that the fuel savings that result from a feebate program would pay for additional costs, producing net cost savings:

> "The reduction in consumer surplus is more than compensated for by unvalued fuel savings that are realized. The benefits are positive for all rates up to $1000 but marginal costs begin to outweigh benefits between $500 and $1000. Adopting two or more classes reduces the benefits significantly while creating a relative subsidy for larger vehicles."
>
> As a result: Net benefits range from $40 per ton for a low feebate, to $10 per ton for a high feebate.
>
> "If it is assumed that consumers already fully value fuel savings, then there are no unvalued fuel savings and the costs are in the range of $10 per ton."

Key Assumptions: That the NC program is stand-alone.

Key Uncertainties

Until the US has more experience with feebates, responses on both the consumer and producer side are uncertain. In a single-state program, most of the response would come from the consumer side, as the production mix is unlikely to change substantially in response to demand changes a single state market.

Additional Benefits and Costs

None Cited.

Feasibility Issues

None cited.

Status of Group Approval

Pending

Level of Group Support

TBD

Barriers to Consensus

TBD

TLU 4 – Truck Stop – and Places Where Trucks Stop – Electrification

Mitigation Option Description

Reduce idling-induced emissions from heavy-duty diesel trucks by providing electrical hook-ups to power heating, cooling, and other needs while stopped.

Mitigation Option Design

Goals:

- To reduce the engine emissions from diesel trucks (typically, tractor trailers) by allowing truck drivers to "plug in" engine heaters, HVAC, and other electrical devices
- To use Truck Stop Electrification to support Idle Reduction/Elimination (IR/E) policies.

Timing: Conduct pilot projects at major truck stops on Interstate highways (principally, I-40 and I-85) and other places where trucks stop. Then, progress to include all major truck stops statewide with at least one electrified stop in each of the 17 urban areas in North Carolina.

Parties involved:

- All long-haul truck drivers of tractor/semi-trailers.
- All combination trailers.

  USDOT requires all truck drivers to rest for at least 10 continuous hours after an 11-hour driving stint within every (24) hour day and 34 continuous hours once per week.

Other: Note that Truck Stop Electrification may entail all off-board (shore power system) or some on-board/some off-board systems. The all off-board option may be owned by the proprietor of the truck stop. On-board equipment is owned by the driver/owner or trucking company.

Implementation Mechanisms

Third-party vendors, truck stop owners, and trucking companies will play key roles in the advancement and absorption rate of this option. A state-shared responsibility for funding and promotion, coupled with a strong, phased-in Idle Reduction/Elimination policy, is one possible approach. Acquiring feedback during the initial projects (some of which are already in place in N.C.[21]) and modifying the program accordingly will be critical as well.

[21] See map on following page.

Related Policies/Programs in Place

While programs are in discussion there are no policies or laws to enforce participation. TSE is typically discussed during anti-idling legislation. Pennsylvania, Oregon, and Washington[22] appear to have existing programs, as do certain cities, counties or other such, jurisdictions.

Types(s) of GHG Reductions

CO_2, carbon black.

Estimated GHG Reductions and Costs (or Cost Savings)

This mitigation option calls for a pilot program, but does not set penetration or adoption goals. As a result, we quantify cost effectiveness, but assume that reductions are part of reductions achieved under TLU-8.

Data Sources:

Thomas L. Perrot, "Truck Stop Electrification As A Long-Haul Tractor Idling Alternative", ANTARES Group Inc., presented at the Transportation Research Board Annual Meeting, 2004.

Quantification Methods:

Perrot summarizes the results of a New York Interstate 90 TSE Demonstration study:

> "$1.70 (fuel) + $0.92 (maintenance) - $1.50 (Cost for TSE service) = $1.12 (Net savings per hour of use [to the trucker])"
>
> The key variable in that equation is the full cost of the TSE service. Perrot concludes:
>
> > "A TSE shorepower facility installation can be engineered and installed at a cost that will provide a simple payback to the investor/owner in three years or less based solely on electrical supply. Revenue from other value-added services, such as cable TV, telephone and Internet service, will reduce the simple payback period."

Numerous other pilot studies are underway,[23] but based on the experience summarized here, we feel comfortable with a "net savings" forecast of costs.

Key Assumptions: See TLU-8.

Also, "Net savings" and "a 3-year payback" do not necessarily mean substantial market penetration without public-private partnership. For example, US EPA has a loan program for truckers to acquire fuel efficiency technologies; the technologies pay for themselves over time, plus reduce emissions, but due to a lack of market offerings, a public-private loan approach is being taken. Thus the mitigation option calls for additional pilots projects to test appropriate approaches for North Carolina.

Key Uncertainties

None Cited.

[22] See http://www.treehugger.com/files/2005/10/truck_stop_elec.php.
[23] http://www.epa.gov/smartway/idle-demo.htm

Additional Benefits and Costs

Reduced noise and other emissions in truck parking areas.

Feasibility Issues

None Cited.

Status of Group Approval

Pending.

Level of Group Support

Pending

Barriers to Consensus

Pending

TLU-5 Tailpipe GHG Standards

Mitigation Option Description

Adopt the State Clean Car Program to reduce emissions of GHGs from vehicle operation.[24]

Mitigation Option Design

Goals: Use California GHG emissions standards for cars and light trucks to reduce GHG emissions. California standards require reductions of GHG emissions of about 30 % from new vehicles, phased in from 2009 to 2016, through a variety of means.[25] Other Clean Car Program elements include standards requiring reductions in smog- and soot-forming pollutants, and promoting introduction of very low-emitting technologies into new vehicles.

Timing: The General Assembly could enact legislation in 2007 so that NC can implement the California standards.[26]

Parties involved:

- MY 2011 new cars.
- Light trucks.
- Automobile manufacturers.
- Car dealers.
- Consumers.

Implementation Mechanisms

Institute a regulatory program beginning with vehicle model year 2011.

Types(s) of GHG Benefit(s):

Principally CO_2, with some reduction also in N_2O, CH_4, and refrigerant losses.[27]

Related Policies/Programs in place:

Federal regulation of tailpipe emissions.

Estimated GHG Savings and Costs Per Ton:

- **GHG reduction potential in 2010, 2020 ($MMtCO_2e$):** 0, 8.09.
- **Cost Effectiveness:** Net savings of $100/ton.

[24] Also known as the Pavley standards or "California GHG emission standards"
[25] For detailed information see: http://www.arb.ca.gov/cc/ccms/ccms.htm.
[26] The California standards currently are being litigated, and timing may be affected as a result.
[27] See http://www.arb.ca.gov/cc/factsheets/cc_isor.pdf

- **Data Sources:** CCS, Draft North Carolina Greenhouse Gas Inventory and Reference Case Projections, 2006.

Quantification Methods:

- Impacts:

  CCS compared results from New England states, California, and a National PIRG model that were obtained using comparable modeling methods. CCS found that while all three modeling efforts were valid, reasonable, and comparable, some of the PIRG model assumptions and methods were relatively conservative, while the California and New England modeling results were relatively optimistic. CCS further refined the PIRG model results consistent with a middle range scenario that produced results less conservative than the PIRG results and less optimistic than the California and New England results. While PIRG projected a 13.7% reduction in light duty vehicle emissions with this policy for Arizona, a CCS refinement estimated a 15.5% reduction in emissions for Arizona. CCS applied this same refined percentage reduction in emissions to the CAPAG reference case for North Carolina.

- Costs:

  This estimate is based upon a review of past $/ton estimates prepared for the Pavley-type regulation for CARB, NESCAUM, and CCS.

Key Assumptions:

- The three modeling efforts have established a valid and reasonable method of projecting GHG emissions reductions from this policy.
- The CCS comparison of the three modeling methods provides some independent professional validation of the models and their results.
- The key assumption of the emissions reduction projected by CCS is that the most likely scenario for emissions reductions is one that would fall between the more conservative scenario projected by the PIRG model and the more optimistic scenario projected by the California and the New England models.

Key Uncertainties:

Fleet turnover rates for light duty vehicles and future patterns of consumer purchase choices between passenger cars and light duty trucks e.g., SUVs.

Additional Benefits and Costs

None Cited.

Feasibility Issues

None Cited.

Status of Group Approval

Pending

Level of Group Support

TBD

Barriers to Consensus

TBD

TLU-6 Biofuels Bundle

Policy Description

This policy option seeks to increase market penetration of biofuels in North Carolina by a mixture of policies (voluntary and/or mandatory) to achieve feasible goals. Offset fossil fuel use (gasoline) with production and use of starch-based and cellulosic ethanol.

Replacing gasoline with ethanol can reduce GHGs to the extent that the ethanol is produced with lower GHG content. Biodiesel has a lower GHG content than fossil diesel, so using biodiesel instead of fossil diesel reduces GHG emissions.

This option is linked with policy options AFW-2: Biodiesel Production and AFW-6: Policies to Promote Ethanol Production. This option seeks to develop the demand for biofuels, whether produced locally or out-of-state, while Options AFW-2 and AFW-6 pursue the GHG benefits that would be achieved beyond the TLU-7 option by promoting in-state production of ethanol and biodiesel using feedstocks and production methods with greater GHG benefits than the likely business as usual national market production methods (e.g., conventional starch-based ethanol).

Policy Design

The goals for this policy should be phased in to utilize biofuels to replace the specified percentages of gasoline and diesel consumed for transportation throughout North Carolina by the specified years, as shown under Goal Levels, below. The goals of this policy can be achieved through a combination of a renewable fuels standards, financial incentives, outreach, and market-based mechanisms.

Goal Levels and Timing:

- The goal levels and timing for biofuels implementation are shown in the table below.
- The Governor and the Legislature would have the authority to change these targets (up or down) based on technical and/or economic feasibility.
- The Governor and Legislature could also set intermediate targets.

Phase	Year	Percentage of Gasoline to be Replaced by Biofuels	Percentage of Diesel to be Replaced by Biofuels
1	2010	10% (E10 equivalent)	5% (B5 equivalent)
2	2015	15% (E15 equivalent)	10% (B10 equivalent)
3	2020	20% (E20 equivalent)	15% (B15 equivalent)
4	2025	25% (E25 equivalent)	20% (B20 equivalent)

Parties involved:

- State of North Carolina.
- Fuel retailers.
- Fuel wholesalers.
- Business owners.
- Car dealers.
- Biofuels producers.
- Alternative vehicle advocates.
- Private vehicle owners.

Implementation Mechanisms

Information and education:

Use information and education outreach to focus on voluntary methods of biofuels expansion. Provide the public with information on the use of and effects of using ethanol in their existing vehicles. Target information and outreach about biodiesel use and effects to trucking and shipping companies, as well as smaller owner/operators in the State. Information should also be provided on where these vehicles can be purchased and their environmental and fuel-saving benefits.

Technical assistance:

Provide technical assistance through vehicle dealers, consumer technical support groups and public demonstrations.

Funding mechanisms, market-based mechanisms, and incentives:

Pursue DOE and State funding for more alternative fuel pumps throughout the State and for introducing appropriate infrastructure throughout the State. Some federal tax incentives currently exist for the purchase of alternative fuel vehicles. When the federal incentives expire, examine the feasibility/need to continue such incentives for alternative fuel vehicles.

- Reduce or eliminate the motor fuels tax on biodiesel and ethanol (E85). Develop a system to provide for monthly credit for biodiesel and E85 blended fuel that would be equivalent to the state motor fuels tax owed on the biofuels portion of the fuel blend.

  Monthly tax credit would be claimed on same form (Biodiesel and Fuel Alcohol Providers Form) as marketers currently file with NC DOR Motor Fuel Tax Division to pay fuel tax. This would reduce pump price of Biofuels as marketers would pass bulk of credit on to consumer in order to be competitive. Credit could be paid for out of General State Revenues, DOT highway funds. Credit would be revenue neutral as it would be equal to the tax that would have been paid by marketers for biofuel portion of blend.

- Develop a $0.25/gallon credit for biodiesel and ethanol use in North Carolina vehicles.

Monthly tax credit would be claimed on same form (Biodiesel and Fuel Alcohol Providers Form) as marketers currently file with NC DOR Motor Fuel Tax Division to pay fuel tax. This would reduce price of Biofuels as marketers would pass bulk of credit on to consumer in order to be competitive. Credit could be paid for out of General State Revenues, DOT highway funds. Credit would not be revenue neutral as the state would be providing incentive for fuel sold to non-taxable entities (local and state government) as well as sales to taxable entities. However, only the biofuel portion of blended fuel would be eligible for .25 cent credit. For example a B20 blend would get a .05 cent credit.

- Create a tax credit for biodiesel producers

  A provision was included in the 2006 NC budget.[28] It is unclear, how this will be implemented but it appears to be an income tax credit that's related to the amount the taxpayer paid during the previous year in motor fuels taxes on the biodiesel.

  GENERAL ASSEMBLY OF NORTH CAROLINA
  SESSION 2005
  SESSION LAW 2006-66
  SENATE BILL 1741 (Budget Bill) signed by Gov Easley 7-10-06
  http://www.ncleg.net/Sessions/2005/Bills/Senate/PDF/S1741v8.pdf
  TAX CREDIT FOR BIODIESEL PRODUCER
  SECTION 24.8.(a) Article 3B of Chapter 105 of the General Statutes is amended by adding a new section to read:
  "§ 105-129.16F. Credit for biodiesel producers.
  (a) Credit. – A biodiesel provider that produces at least 100,000 gallons of biodiesel during the taxable year is allowed a credit equal to the per gallon excise tax the producer paid under Article 36C of this Chapter on the biodiesel. For the purposes of this section, 'biodiesel' is liquid fuel derived in whole from agricultural products, animal fats, or wastes from agricultural products or animal fats. The credit does not apply to tax paid on diesel fuel included in a biodiesel blend. The credit may not exceed five hundred thousand dollars ($500,000) and is subject to the limitations of G.S. 105-129.17.
  (b) Sunset. – This section is repealed for taxable years beginning on or after
  TLU TWG Mitigation Options Description, CCS, 9/08/06 15 January 1, 2010."
  SECTION 24.8.(b) This section is effective for taxable years beginning on or after January 1, 2008.

Codes and standards:

This measure should include a mandated Renewable Fuel Standard (RFS), corresponding to the penetration rates listed above. The RFS should include a cost trigger, so that if the cost of alternative fuels exceeds conventional fuels by more than a specified amount, the RFS would be temporarily removed. The cost trigger should be based on costs over a period of time, and not spot prices. Additionally, production issues should be included in the trigger, such as water use in growing corn (or other crops) for the biofuels, such that the production of the biofuels does not increase GHG emissions or cause other resource problems.

[28] See budget text in following section.

Voluntary and or negotiated agreements:

- Provide financial incentives for alternative fuels distributors.
- Provide state funds and/or loan guarantees for construction of alternative fuels distribution facilities.
- Provide grow receipts tax exemptions, production tax credits and reduction in excise taxes on alt fuel sales.

Pilots and demos:

Show example of existing multi-fuel pumps in North Carolina which provides a model for dispensing three alternative fuels: B20 biodiesel, E85 ethanol and E10. The State's experience with these vehicles should be publicized.

Research and development:

- Pursue in-state biofuels production from a variety of sources.
- The State should push for significant federal funds for research and development needed to commercialize cellulosic ethanol technology and processes as this will be required for the ethanol targets for 2020 and beyond to be met.
- Analyze and quantify range of cost benefits that accrue to alt fuels vehicle owners.
- Research on production of renewable electricity and hydrogen will be required in order to implement a cost effective process.

Related Policies/Programs in Place

The Energy Policy Act of 2005 includes provisions requiring an increasing volume of renewable fuel to be included in the gasoline sold in the United States starting in 2006 with 4 billion gallons, increasing to 7.5 billion gallons by 2012. In this Act, renewable fuel includes motor vehicle fuel produced from grain, starch, vegetable, animal, or other biomass material, cellulosic biomass ethanol, waste derived ethanol, and biodiesel.

Types(s) of GHG Reductions

CO_2 emissions are reduced by offsetting the use of petroleum-derived gasoline and diesel. In order to assess the CO_2 benefit of using ethanol, the energy requirements of producing ethanol from starch needs to be compared to the energy requirements of producing gasoline. Current research indicates that starch-based ethanol production provides up to 18-29% reduction in CO_2 from starch-based ethanol production compared to gasoline. To assess the benefits of using biodiesel, the overall energy required to produce biodiesel (e.g., life-cycle costs and benefits) must be compared to the energy requirements of producing fossil fuel diesel. Hill et al (2006) report that the energy available from biodiesel produced from soybeans is 93% greater than the fossil energy consumed in producing it.[29] This biodiesel reduces lifecycle GHG emissions by as much as 41% compared with petroleum diesel.

[29] See Data Sources below.

Estimated GHG Savings and Costs per Ton CO_2e

- **Impacts**

The table below shows the total CO_2e reductions associated with implementing the program described above in the Program Design section. Note that some of these reductions would be attributable to the use of biofuels as a result of the national Renewable Fuel Standard (RFS) in the Energy Policy Act of 2005. The total emission reductions attributable to the RFS versus the incremental reductions attributable to TLU -7 are broken out in the table below.

	Mitigation Option	GHG Reductions ($MMtCO_2e$)			Net Present Value 2008–2020 (Million $)	Cost-Effectiveness ($/tCO_2e$)	Level of Support
		2012	2020	Total 2008-2020			
TLU-6	**Biofuels bundle** - *Ethanol* - *Biodiesel* Total	**0.83** **0.31** **1.14**	**1.88** **1.37** **3.25**	25.8	In progress	In progress	Pending

Data Sources:

- *Environmental, Economic, and Energetic Costs and Benefits of Biodiesel and Ethanol Biofuels*, Jason Hill, et. al., University of Minnesota, published in Proceedings of the National Academy of Sciences of the United States of America, volume 103, no. 30, July 25, 2006.
- *Well-to-Wheels Analysis of Advanced Fuel/Vehicle Systems – A North American Study of Energy Use, Greenhouse Gas Emissions, and Criteria Pollutant Emissions*, General Motors, Argonne National Lab, and Air Improvement Resource, Inc., May 2005.
- "Documentation of Inputs to Macroeconomic Assessment of the Climate Action Team Report to the Governor and Legislature," California Climate Action Team, January 2006.
- "State and Federal Standards for Mobile-Source Emissions," National Research Council of the National Academies, Washington, DC, 2006.

Quantification Methods: Well-to-wheels CO_2 equivalent emission factors from a recent Argonne National Laboratory Study were used to estimate the benefits of offsetting conventional gasoline with starch-based ethanol in the amounts specified by the ethanol goals. Well-to-wheels emission factors take into account the energy required to produce, process, and transport each fuel type (i.e., starting with the oil well for gasoline and the crop for starch-based ethanol).

Based on this source of information, the use of starch-based ethanol to replace gasoline is assumed to reduce CO_2e by 18.3%. The quantity of diesel fuel projected to be replaced in North

Carolina with biodiesel was estimated based on the penetration rates of the above goals. A reduction in CO_2 emissions of 41% was applied to the quantity of diesel fuel replaced by biodiesel. (Hill et al, July 2006).

- **Costs**

In progress.

Key Assumptions: This policy option assumes that the ethanol and biodiesel demand will be met with fuels available from a national market. Therefore, it is expected that the ethanol production would be starch-based and the emission factors used here reflect that.

Key Uncertainties

Some uncertainty remains regarding the ethanol production life-cycle emission factors as well as the availability of ethanol and biodiesel at the levels needed by this policy.

Contributing Issues

EPA has reported that the use of B20 biodiesel can lead to a 21% reduction in HC, 11% reduction in CO, and a 10% reduction in PM. Toxic emission reductions can also be significant. However, some brands of biodiesel can lead to increased exhaust emissions of NOx and some air toxics, depending on feedstock and blend level. EPA reports a 2% increase in NOx emissions for B20 blends. In contrast, certain brands of biodiesel, such as Blue Sun Biodiesel B20, can reduce NOx emissions by 4% to 5%, according to a recent analysis performed by the National Renewable Energy Laboratory. Effects on newer diesel vehicles are likely to be different. An increased penetration of biofuels reduces our foreign fossil fuel dependency.

Feasibility Issues

Members of the CCAG have expressed concern over the land and water resources needed to produce the amount of biofuels required by this policy option.

Status of Group Approval

Pending

Level of Group Support

TBD

Barriers to Consensus

TBD

TLU 7 – Procure Efficient Fleets

Mitigation Option Description

Reduce GHGs by increasing the efficiency of government fleets and increase fleet use of alternative fuels and of more efficient engines.

Mitigation Option Design

Goals: Increase government fleet use of low-GHG fuels and more efficient vehicles to reduce greenhouse gas emissions from fleets, principally carbon dioxide (CO_2), but also including other emissions affecting ozone, sulfur, and carbon monoxide loadings.

Timing: Statewide GHG reduction targets for fleets phased in over period of roughly 8-10 years to allow fleet turnover to absorb most of the costs of replacing existing fleets. Other measures regarding more frequent maintenance and part specifications could be phased in much faster.

Parties involved:

- All government fleet vehicles
- Possibly private fleet operators
- On-road passenger cars
- Light-duty trucks
- Bus fleets
- Heavy-duty trucks

Other:

Some places in North Carolina are already implementing green vehicle fleets in whole or part.

Implementation Mechanisms

Statewide policy specifying target adoption rates can come with an incentive or enforcement package.

Although hybrid cars and higher-fuel efficiency cars comprise the biggest part of the potential market for creating greener state vehicle fleets, better purchasing decisions on tires and maintenance schedules can also contribute significantly to higher fuel efficiencies and lower emissions.

Alternative fuel use credits can be implemented to assure the use of cleaner fuels and more efficient vehicles.

Credit can be accrued through the use of biodiesel, ethanol, CNG, propane, hydrogen, electricity and the purchase of advanced technology vehicles such as hybrid electric vehicles. Such legislation was introduced during the 2005 session (SB1148). Text from bill:

> The State fleet shall accrue a total of 2,000,000 alternative fuel use credits during each calendar year 2006 and 2007. The State fleet shall accrue a total of 5,000,000 alternative fuel use credits during each calendar year 2008 and 2009. The State fleet shall accrue a total of 10,000,000 alternative fuel use credits during the calendar year 2010 and each calendar year thereafter.
>
> (e) Formulas for Calculating Credits. – Alternative fuel use credits are calculated as follows:
>
> (1) Subject to subdivision (2) of this subsection, one alternative fuel credit accrues for each one gallon of one hundred percent (100%) alternative fuel utilized by a State fleet vehicle. When alternative fuel is blended with petroleum-based fuel, the alternative fuel credit accrues for each one gallon of alternative fuel utilized by a State vehicle at a rate that is based on the percentage of alternative fuel that is utilized by a State fleet vehicle. (For example, one alternative fuel use credit accrues for every five gallons of B20 that is utilized by a State fleet vehicle.)

Thus, in 2012, the goal of that language is to move 10,000,000 gallons of fuel from fossil to bio.

Related Policies/Programs in Place

Many cities, including Raleigh, Durham, Greensboro, Hickory, Conover, Charlotte and others have converted part or all of their fleets to cleaner-burning fuels such as B20, compressed natural gas (CNG), ethanol, and electric hybrids. North Carolina has vigorously acquired flexible fuel vehicles (FFVs) and uses E85, E10, and biodiesel on more than 3,000 vehicles.[30]

Budget provision 19.5 of the 2005 NC budget requires the displacement of 20% petroleum from state fleet vehicles by 2010. These mandated goals affecting state fleets greater than 10 vehicles will result in more expanded use of Biodiesel (B20) and ethanol (E85). For example NC DOT has already announced expansion of B20 refueling to over 100 state refueling facilities in NC.

Types(s) of GHG Reductions

Mainly CO_2 .

Estimated GHG Reductions and Costs (or Cost Savings)

Because most of the GHG reductions and costs for this option come from alternative fuel use, they are incorporated into costs and benefits reported under TLU-6, Biofuels Bundle.

Data Sources: See TLU-6

Quantification Methods: See TLU-6

[30] See http://www.eere.energy.gov/afdc/pdfs/37133.pdf#search=%22green%20vehicle%20fleet%2C%20NC%22.

Key Assumptions: See TLU-6

State procurement of efficient fleets will help the state lead by example, and spur the alternative fuels market (both provision and infrastructure). CCS analysis suggests that this option will not add meaningful additional CO_2 emissions reductions to the reductions that would be gained through TLU-6 and through existing actions.

Key Uncertainties

None Cited.

Additional Benefits and Costs

None Cited.

Feasibility Issues

None Cited.

Status of Group Approval

Pending

Level of Group Support

TBD

Barriers to Consensus

TBD

TLU 8 – Idle Reduction/Elimination Policies

Mitigation Option Description

Implement state and local policies to reduce hours of operation and thus emissions from idling trucks and buses (principally), perhaps off-road engines as well.

Mitigation Option Design

Goals:

- To reduce greenhouse gas emissions from heavy vehicles.
- Reinforce Truck Stop Electrification (TSE) support.

Timing: Phased in; at full strength within five years of initiation.

Parties involved:

- All heavy truck.
- Public bus fleets.
- Private bus fleets.

Other: Exemptions for emergency vehicles, maintenance tasks, and similar cases. Note that "idling" here does not cover idling while stopped in traffic.

Implementation Mechanisms

This would require working with trucking groups, truck stops, and places where trucks stop as well as with government to formulate an agreeable policy approach, phasing schedule, and legislative content.

Related Policies/Programs in Place

About 15 states and a number of local governments have adopted anti-reduction legislation.[31] More are sure to follow or are already being discussed at some level. Toronto has had a law in place since 1996. Many North Carolina counties and the State Board of Education (Policy No. EEO-M-003) have adopted school bus idling policies already.[32] The Clean School Bus USA program (USEPA) should also be consulted.[33]

Types(s) of GHG Reductions

Mainly CO_2, some black carbon.

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[31] See http://atri-online.org/research/idling/Cab%20Card%20July%202006.pdf.
[32] See http://www.ncbussafety.org/idling.html.
[33] See http://www.epa.gov/cleanschoolbus/.

Estimated GHG Reductions and Costs (or Cost Savings)

- **Anti-Idling GHG reduction potential in 2010, 2020 ($MMtCO_2e$):** 0.1, 0.2.
- **Anti-Idling Cost Effectiveness:** -$22/ton.

Data Sources:

Reductions

Idle-reduction technologies and policies could reduce per-vehicle fuel use by 3% to 9% annually:

J. Ang-Olson and W Schroeer, "Energy Efficiency Strategies for Freight Trucking: Potential Impact on Fuel Use and Greenhouse Gas Emissions", *Transportation Research Record*.

Reductions and costs

American Transportation Research Institute, "Idle Reduction Technology: Fleet Preferences Survey," February 2006 for technology costs.

EPA SmartWay Transportation Partnership (www.epa.gov/otaq/smartway/idlingtechnologies.htm#truck-mobile) for technology costs.

"Analysis of Technology Options to Reduce the Fuel Consumption of Idling Trucks," ANL/ESD-43, Argonne National Laboratory, Transportation Technology R&D Center, June 2000 for information on technology impacts.

Quantification Methods / Key Assumptions:

- **Impacts**

10%	Percent of heavy duty travel (by VMT) by public sector.
50%	Percent of public sector heavy duty VMT observing anti-idling through 2012
40%	Percent of private sector heavy duty VMT observing anti-idling through 2012
80%	Percent of public sector heavy duty VMT observing anti-idling through 2020
70%	Percent of private sector heavy duty VMT observing anti-idling through 2020
95%	VMT-equivalency conversion factor of idling to non-idling vehicles in 2012.
95%	VMT-equivalency conversion factor of idling to non-idling vehicles in 2020.
2.05%	Calculate expected percent reduction in VMT-equivalency of conventional vehicles for 2010.
3.55%	Calculate expected percent reduction in VMT-equivalency of conventional vehicles for 2040.

- **Costs**

The cost analysis assumes a 5-year lifetime for idling technology equipment, applied to 80% of Class 8 vehicles starting in 2008 and 100% of Class 8 vehicles starting in 2015, at a cost of $6,000 per vehicle and a $2.40 per gallon diesel cost savings.

Program administration costs, enforcement costs, fines, and reduced vehicle maintenance costs have not been factored into the cost analysis.

Key Uncertainties

The use of truck stop electrification would increase emissions from electricity generation. Equipment cost and lifetime will vary by technology employed. The cost value selected was based on cost data summarized by American Transportation Research Institute, representing the capital costs of a variety of idle reduction technology. The cost of $6,000 per vehicle represents a mix of higher and lower technology costs. The cost analysis does not take into account the number of vehicles that have already installed idle reduction technologies. The fuel cost assumed here is based on long-term projected fuel costs. Increases in this assumed fuel cost will lead to greater cost savings for this measure.

Additional Benefits and Costs

None Cited.

Feasibility Issues

None Cited.

Status of Group Approval

Pending.

Level of Group Support

TBD

Barriers to Consensus

TBD

TLU-9 Diesel Retrofits / Retirement

Mitigation Option Description

Reduce diesel emissions from older diesel engine/emission systems through retrofit and/or retirement. Create incentives and encourage retrofits through a combination of funding and education/promotion.

Mitigation Option Design

Goals:

- Retrofit NC school buses with DOC pollution control devices. Reduce children's exposure to diesel emissions by retrofitting school buses in North Carolina with diesel oxidation catalyst (DOC) pollution control devices, and diesel particulate filters, which show auxiliary benefit of reducing some GHGs and carbon black.
- Speed retirement and/or retrofit of all older diesels through information and incentives.

Parties involved:

- NC school buses.
- NC diesel truck owners

Other: None Cited.

Implementation Mechanisms

- **Utilize various funding mechanisms** to purchase DOC pollution control devices for school buses that are not equipped with pollution control devices.
- **Information and education**: An information and education component is needed to provide truck and bus owners, school districts, and municipal organizations with information regarding the significant emission reductions that could be achieved by retrofitting or retiring certain truck or bus engines with high annual emissions and replacing them with vehicles meeting the new emission standards. Provide information on potential funding partners, grants, or loans available from a number of organizations for this purpose.
- **Funding mechanisms or incentives:** Develop a loan or grant program allow truck owners to accelerate new vehicle purchases or to apply retrofit technologies to their fleets.

Related Policies/Programs in Place

Currently in North Carolina, there is an ongoing effort to retrofit school buses across the State with diesel pollution control devices. An estimated 15% of the school buses in the State are

already equipped with some type of pollution control device. Sources of funding include Federal and State grants, local funding and gifts from private industry. The primary purpose of these diesel pollution control devices is to reduce particulate matter.

At the federal level, the US EPA's Voluntary Diesel Retrofit Program, part of the national Clean Diesel Campaign (http://www.epa.gov/cleandiesel/).

Types(s) of GHG Reductions

DOCs and particulate filters remove varying amounts of pollutants depending on design and manufacturer. EPA has verified a range of substantial (20% to 90%) reductions in PM, CO, NOx, HC,[34] of which NOx is a GHG, and PM contains carbon black.

Estimated GHG Reductions and Costs (or Cost Savings)

- **Impacts**

"With regard to fuel economy, studies conducted over the years generally have reported that either DOCs have no impact on fuel economy or in those cases in which a slight decrease was measured, it was not statistically significant."

This mitigation option sets no adoption or penetration goals, and GHG reductions are secondary. Further, given the variability in NOx reductions, it is impossible to estimate GHG reductions without knowing the types of DOCs likely to be used. As a result, GHG reductions are not quantified.

- **Costs**

"In 2000, CARB estimated the expected cost of DOC technology by horsepower rating as shown in Table 2-1 below.

Table 2-1, CARB-Estimated Costs of DOC Technology

Engine Horsepower	Hardware Cost
40	$400 - $600
100	$680 - $1,356
275	$2,100 - $3,700
400	$2,800 - $3,700
1,400	$10,000 - $20,000

"More recent estimates, suggest the costs for DOCs in retrofit applications are decreasing slightly and range from less than $500 to $1,250 for engines in the 100-200 horsepower category, and from less than $1,000 to $1,750 for engines in the 200-500 horsepower category. [….]DOC installation typically takes one to two hours and if provided by the technology supplier or its agent, the cost is in the range of less than $100 to about $200. Since, DOC installation is relatively straightforward, fleet technicians, sometimes after receiving training from the DOC supplier, install the DOCs themselves, thereby avoiding external installation costs. Finally, since DOCs are virtually maintenance free except for periodic checks of the DOC and exhaust system for mechanical integrity, typically no maintenance costs are incurred."

[34] http://www.epa.gov/otaq/retrofit/retroverifiedlist.htm.

Data Sources: Western Regional Air Partnership, *Offroad Diesel Retrofit Guidance Document*, Volume 2 – Section II.[35]

Quantification Methods: NA

Key Assumptions: None cited.

Key Uncertainties

None Cited.

Additional Benefits and Costs

Substantial reductions in other components of diesel exhaust, many of which are priorities for NC and NC communities.

Feasibility Issues

None Cited.

Status of Group Approval

Pending

Level of Group Support

TBD

Barriers to Consensus

TBD

[35] Available at http://www.wrapair.org/forums/msf/projects/offroad_diesel_retrofit/V2-S2_Final_11-18-05.pdf

TLU-10 Fuel Tax / Fee

Mitigation Option Description

A per-gallon fee or tax charged per gallon of liquid fuel sold at the pump.

Amount to be determined.[36]

- Small amounts (~5-10 cents) can have some demand impact, but can be more appropriately seen as a way to fund transportation-related policies than to reduce consumption and emissions directly.
- Larger amounts can have a more meaningful direct impact on consumption and emissions. Revenue can still be used to fund transportation-related policies, but can also be used to reduce other taxes and fees.

Mitigation Option Design

Goals:

- Reflect some of the health and environmental (especially GHG) costs of carbon combustion in the fuel being sold.
- Fund options other than single-occupant vehicle driving.
- By reflecting the costs of combustion, reduce the growth in combustion.

Timing: Phase in over 4 years.

Parties involved: All fuels. Can be adjusted by carbon content.

Other: None Cited.

Implementation Mechanisms

Use existing gas tax collection mechanisms. Revenue may flow to same or different end use than current gas tax. For analysis, impacts can be assumed to vary directly with fee levels; that is, a 10 cent/gallon fee has one-fifth the GHG impact of a 50 cent/gallon fee.

Related Policies/Programs in Place

None cited.

Types(s) of GHG Reductions

Primarily CO2.

[36] For this draft, using 50 cents / gallon.

Estimated GHG Reductions and Costs (or Cost Savings)

- **Fuel Tax (50¢/gallon) GHG reduction potential in 2010, 2020 ($MMtCO_2e$):** 6.4, 13.9.
- **Fuel Tax (10¢/gallon) GHG reduction potential in 2010, 2020 ($MMtCO_2e$):** 1.3, 2.8.
- **Cost Effectiveness:**

Fuel tax cost effectiveness depends on the use of revenues.

1. Current TWG discussion focuses on using the revenue to fund transit and other non-SOV travel choices. Cost-effectiveness in that case is the same as TLU-1b: net savings.
2. Depending on the chosen level of tax/fee, more revenue may be raised than will be used to fund travel choices. At that point, revenue can be used to reduce other, more economically distortionary taxes. Two typical examples are personal income taxes, and employer payroll taxes.[37] In one example of revenue-neutral "revenue recycling":

> "This paper considers the distributional effects of imposing additional excise duties [taxes] on energy products according to carbon content. The assumed duties escalate from 1999 to 2010 and achieve levels reducing CO2 emissions by 10 per cent below baseline by 2010 for 11 EU member states. By 2010, real personal disposable incomes are 1.6 per cent above baseline and employment is 1.2 per cent above, assuming that the change is tax-revenue-neutral."[38]

Data Sources: Economics literature, cited above.

Quantification Methods:

[37] For example, Richard D. Morgenstern, "Towards a Comprehensive Approach to Global Climate Change Mitigation", *The American Economic Review*, Vol. 81, No. 2, (May, 1991), pp. 140-145.

[38] Terry Barker, Jonathan Köhler (1998) "Equity and Ecotax Reform in the EU: Achieving a 10 per cent Reduction in CO2 Emissions Using Excise Duties", *Fiscal Studies* 19 (4), 375–402.

	LDVs
$2.00	Baseline fuel price
20	Average LDV fuel economy
$0.10	Average cost/mile for fuel, baseline
$0.50	Fuel tax
0.125	Average cost/mile for fuel, with tax
0.4	Elasticity of fuel consumption wrt price (through 2012)
0.75	Elasticity of fuel consumption wrt price (through 2020)
25%	Increase, %
10%	Calculate expected percent reduction in fuel consumption, 2012
19%	Calculate expected percent reduction in fuel consumption, 2020

	HDVs
$2.00	Baseline fuel price
2.5	Average HDV fuel economy
$0.80	Average cost/mile for fuel, baseline
$0.50	Fuel tax
1.00	Average cost/mile for fuel, with tax
0.4	Elasticity of fuel consumption wrt price (through 2012)
0.75	Elasticity of fuel consumption wrt price (through 2020)
25%	Increase, %
10%	Calculate expected percent reduction in fuel consumption, 2012
19%	Calculate expected percent reduction in fuel consumption, 2020

Key Assumptions: Above.

Key Uncertainties

None Cited.

Additional Benefits and Costs

None Cited.

Feasibility Issues

None Cited.

Status of Group Approval

Pending

Level of Group Support

TBD

Barriers to Consensus

TBD

TLU-11 Pay-as-you-drive Insurance

Mitigation Option Description

Pay-As-You-Drive (PAYD) pricing converts a portion of insurance to a variable cost with respect to vehicle travel, so premiums are directly related to mileage. PAYD makes insurance more actuarially accurate and allows motorists to save money when they reduce their mileage. The less you drive the more you save.

Mitigation Option Design

Goals: To reduce GHG emissions from automobiles by influencing individual drivers to reduce their annual VMT.

Timing: Proposal would require insurance companies to offer PAYD as part of their menu of insurance choices in NC. A pilot project could be implemented first on a smaller scale as soon as possible. Option design is to have full NC light duty fleet PAYD coverage by 2020.

Parties involved:

- Insurance companies
- All motorists insured in NC

Implementation Mechanisms

Require insurance companies to offer PAYD as part of their menu of insurance choices in NC.

Implementation technologies to be determined through rule-making, taking into account available and other required technology.

- Insurance companies could charge motorists in lump sum e.g. 10,000-12,000 first and charge for additional payments as needed with the total premium calculated at the end of the term based on recorded mileage (motorists credited or charged for extra mileage).
- Insurance companies could bill motorists based on their monthly vehicle mileage similar to other utilities.
- Variations in the policy design can address geographic and/or equity concerns.

Related Policies/Programs in Place

GMAC and On-Star Offers Low-Mileage Discount Rates[39]

Since mid-2004 the General Motors Acceptance Corporation (GMAC) Insurance has offered mileage-based discounts to OnStar subscribers located in certain states. The system automatically reports vehicle odometer reading at the beginning and end of the policy term to

[39] See http://www.onstar.com/us_english/jsp/low_mileage_discount.jsp.

verify vehicle mileage. Motorist who drive less than specified annual mileage receive insurance premium discounts of up to 40%:

1-2,500 miles: 40% discount

2,501-5,000 miles: 33% discount

5,001- 7,500: 28% discount

7,501-10,000: 20% discount

10,001-12,500: 11% discount

12,501-15,000: 5% discount

15,001-99,999: 0% discount

Value Pricing Program PAYD Pilot projects [40]

This Federal Highway Administration's Value Pricing Pilot Program is now providing funding for PAYD insurance simulation projects in GA and MA.

Distance Based Program

Progressive Insurance [41]offers distance-based insurance in Oregon, Michigan, and Minnesota. The program uses GPS to track vehicle location and use.

TripSense(SM)

"Safer drivers and people who drive less than average should pay less for auto insurance. That's why we created the revolutionary TripSense(SM) discount program, which measures your actual driving habits and allows you to earn discounts on your insurance by showing us how much, how fast and what times of day you drive. TripSense gives you more control over what you pay for insurance, as your driving habits determine your discount." [42]

Types(s) of GHG Reductions

CO_2

Estimated GHG Reductions and Costs (or Cost Savings)

3. **GHG reduction potential in 2010, 2020 ($MMtCO_2e$):** 2.3, 5.3.
4. **Cost Effectiveness:** Expected net savings.

Data Sources:

- The Arizona Public Research Interest Group (PIRG) Education Fund analyzed the potential GHG savings from a Pay-As-You-Drive (PAYD) automobile insurance policy. The strategy for a PAYD policy analyzed assumes that insurers are required to offer mileage-based insurance for certain elements of vehicle insurance, including collision and liability. The PIRG Education Fund assumes the PAYD policy is required, phased in

[40] See http://www.fhwa.dot.gov/policy/13-hmpg.htm.
[41] See http://www.progressive.com.
[42] See http://tripsense.progressive.com/about.aspx.

over time, and that all drivers in Arizona are eventually covered.

To calculate GHG savings, the Arizona Public Research Interest Group Education Fund converted Arizona state automobile collision and liability insurance expenditures to an insurance cost per mile (6.4 cents per mile). If insurance consumers pay 80 % of their collision and liability insurance on a per-mile basis, then drivers would be assessed about a 5.1-cent charge per mile. This per-mile insurance charge would reduce vehicle-miles traveled by about 8 %.[43] (To put this charge in context, at 20 mpg, 5.1 cents/mile = ~$1/gallon of gasoline.)

CCS compared the PIRG Education Fund results for estimated reductions in vehicle miles of travel with other studies of PAYD policies, including those produced by the Economic Policy Institute and Resources for the Future (RFF). CCS found that the AZ PIRG estimates were comparable with other estimates, which ranged from 8 % to 20 %. The 8 % reductions estimates CCS used for estimated reductions in vehicle miles of travel and greenhouse gas emissions reductions fell within the lower range of the comparable estimates.

Quantification Methods:

- Impacts:

  Pilot studies and empirical experience with other marginal costs of use find that PAYD can reduce VMT by between 8% and 20%. If phase in / ramp up, then:

  Apply reductions to LDV VMT only:

  - 2012 reduction = Statewide LDV * 4% reduction = **3.6%** of total statewide HDV + LDV
  - 2020 reduction = Statewide LDV * 8% reduction = **7.2%** of total statewide HDV + LDV

  - Convert to CO_2

- **Net present value / cost effectiveness:**

  The success of the Progressive Insurance pilot in Texas, suggests that there is an unmet demand for more choice in auto insurance. If PAYD a) improves and increases consumer choice, and b) allows insurance providers to more efficiently align risks and premiums, economic efficiency will increase.

Key Assumptions:

- State regulation of the North Carolina automobile insurance industry requires insurance companies to offer PAYD insurance
- Eventual application of PAYD insurance to the whole NC light duty fleet.

[43] Elizabeth Ridlington and Diane E. Brown, *A Blueprint for Action: Policy Options to Reduce Arizona's Contribution to Global Warming*, Arizona Public Research Interest Group Education Fund, April 2006, pp. 25-26. http://www.arizonapirg.org/AZ.asp?id2=23683. See also: http://www.serconline.org/payd/links.html, which links to a wide variety of PAYD studies and materials.

Key Uncertainties

The specifics of the PAYD insurance programs are to be determined, and the actual effects of PAYD insurance on driver behavior are subject to some significant uncertainty.

Additional Benefits and Costs

Equity Impacts

"Current vehicle insurance pricing significantly overcharges motorists who drive their vehicles less than average each year, and undercharges those who drive more than average within each price class" (Edlin, 1999; Litman, 2001). Since lower-income motorists drive their vehicles significantly less on average than higher-income motorists, this is regressive. Distance-based insurance is fairer than current pricing because prices more accurately reflect insurance costs.

"Distance-based pricing benefits lower-income drivers who otherwise might be unable to afford vehicle insurance, and who place a high value on the opportunity to save money by reducing vehicle mileage. It benefits lower income communities that currently have unaffordably high insurance rates…."[44]

Other equity issues may be addressed through policy design.

Feasibility Issues

None Cited.

Status of Group Approval

Pending

Level of Group Support

TBD

Barriers to Consensus

TBD

[44] Todd Litman, "Pay-As-You-Drive Vehicle Insurance: Converting Vehicle Insurance Premiums Into Use-Based Charges", *TDM Encyclopedia*, Victoria Transport Policy Institute, December 2005. http://www.vtpi.org/tdm/tdm79.htm

TLU-12 Advanced Technology Incentives

Mitigation Option Description

Technology will play a vital role in dramatically reducing carbon emissions from the cars of the future. Fuel cells, plug-in hybrid, low weight carbon-fiber bodies, and other technologies will require research, development, and commercialization. Because of its strong research university and both its high-tech and auto parts manufacturing, there may be an opportunity for North Carolina (esp. through the Department of Commerce) to encourage advanced automobile technology research and recruit the new generation of manufacturers.

The study can evaluate if there is an economic opportunity around the development and commercialization of advanced technology vehicles and suggest possible models for the Department of Commerce to take advantage of such opportunities.

Mitigation Option Design

Goals:

- To enable North Carolina's economy to establish itself in the research, development, and commercialization of advanced automotive technologies.
- To grow North Carolina's capacity to recruit sustainable industry.

Timing: long range, for example 10 year, investment plan.

Parties involved:

- NC Department of Commerce.
- NC Economic Development Board.

Other: None Cited.

Implementation Mechanisms

- Tax incentives.
- Education of industrial recruiters.
- Possible formation of a NC Advanced Technology Institute.

Related Policies/Programs in Place

Currently there are existing sustainable business recruiting efforts by the Department of Commerce.

Types(s) of GHG Reductions

CO_2

Estimated GHG Reductions and Costs (or Cost Savings)

By their nature, R&D initiatives cannot be predicted to produce certain kinds of technologies, and hence cannot be predicted to produce certain amounts of emissions reductions. This policy option potentially has substantial emissions benefit upside, but CCS is unable to estimate impacts for this level of policy intent.

Data Sources: NA.

Quantification Methods: NA.

Key Assumptions: NA.

Key Uncertainties

None Cited.

Additional Benefits and Costs

None Cited.

Feasibility Issues

None Cited.

Status of Group Approval

Pending

Level of Group Support

TBD

Barriers to Consensus

TBD

TLU-13 Buses – Clean Fuels

Mitigation Option Description

Expand TLU-7 to include transit bus fleets.

Mitigation Option Design

Goals: Included with TLU-6

Timing: Same.

Parties involved: Transit bus fleets.

Other: None cited.

Implementation Mechanisms

None Cited.

Related Policies/Programs in Place

None cited.

Types(s) of GHG Reductions

CO_2.

Estimated GHG Reductions and Costs (or Cost Savings)

Included in TLU-6.

Data Sources: Same.

Quantification Methods: Same.

Key Assumptions: None cited.

Key Uncertainties

None Cited.

Additional Benefits and Costs

None Cited.

Feasibility Issues

None Cited.

Status of Group Approval

Pending

Level of Group Support

TBD

Barriers to Consensus

TBD