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Transportation and Land Use Technical Work Group

Summary List of Pending Priority Policy Options for Analysis

	Policy Option	GHG Reductions* ($MMtCO_2e$)			Net Present Value 2008–2025 (Million $)	Cost-Effectiveness ($/tCO_2e$)	Level of Support
		2015	2025	Total 2008–2025			
TLU Area 1: Reduce VMT							
	To 1990 Light-Duty aggregate	2.72	8.12	66.4			
	To 1990 Light-Duty per capita	0.75	4.39	44.0			
TLU-1	Improved Land Use Planning and Development Strategies	0.7	2.2	16.1	Net savings	Net savings	Pending
TLU-2	Expand Transit, Bicycle, and Pedestrian Infrastructure	0.1	0.3	3.0	$0	$0	Pending
TLU-5	Climate-Friendly Transportation Pricing / Pay as You Drive	1.2	2.7	25.8	–$1	–$1	Pending
TLU-7	"Fix-it-First" Transportation Investment Policy and Practice	Not quantified					Pending
TLU-9	Workplace Tools to Encourage Carpooling, Bicycling, and Transit Ridership	0.3	0.4	5.3	Large net savings	Large net savings	Pending
TLU-14	Freight Mode Shifts: Intermodal and Rail	TBD					Pending
TLU Area 2: Reduce Carbon per Unit of Fuel							
TLU-3	Low GHG Fuel Standard (Overlap With AFW-7)	3.18	4.4	24.3	$3,090	$119	Pending
TLU Area 3: Reduce Carbon per Mile and/or per Hour							
TLU-4	Infrastructure Management	0.04	0.1	0.9	Not quantified		Pending
TLU-6	Adopt California Clean Car Standards	Being revised in response to new CAFÉ					Pending
TLU-11	Heavy-Duty Idle Reduction	Not quantified				$4 at $2.40/gal –$66 at $3.40/gal	Pending
TLU-12	Mobile Source Emissions Reduction	TBD					Pending
TLU-13	Reduce Maximum Speed Limits	TBD				$50 at $2.40/gal –$19 at $3.40/gal	Pending
	Sector Total After Adjusting for Overlaps						
	Reductions From Recent Actions						
	Sector Total Plus Recent Actions						

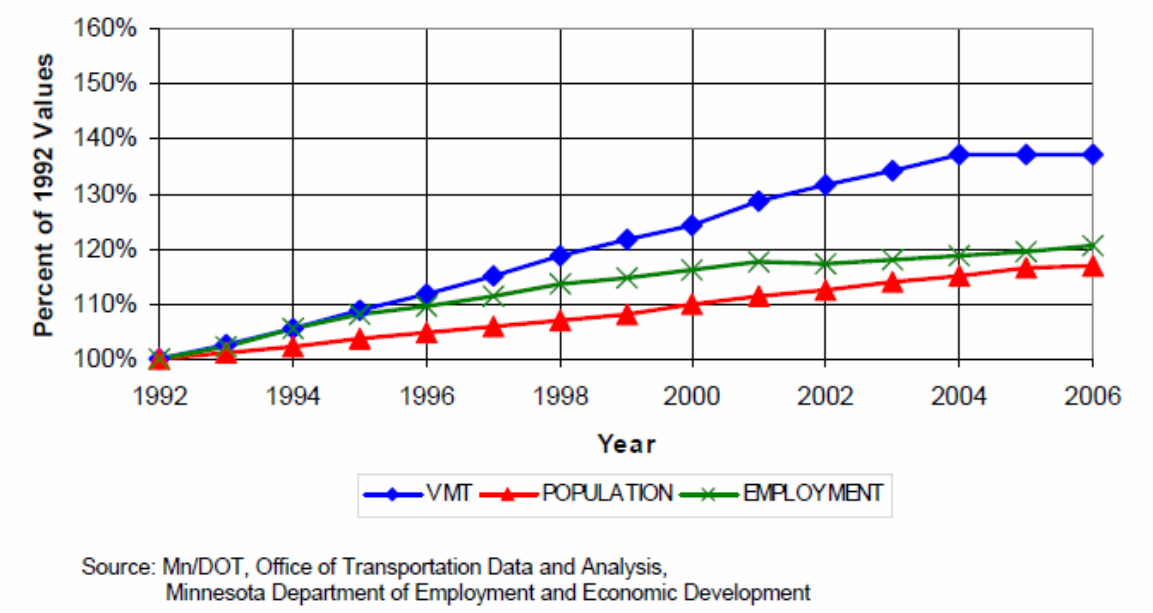
* All reductions numbers will change if the MCCAG approves the use of the new VMT baseline.

Recommended Change in Inventory and Forecast for MCCAG Consideration: Revised VMT Projections

The week of December 21, 2007, Metropolitan Council and Minnesota DOT traffic modelers agreed on new projections for statewide vehicle miles traveled (VMT). These new projections are substantially lower than the projections that CCS and the MCCAG have been using throughout the process. Using the new projections in the MCCAG process would substantially change both the baseline we have been using, and the calculated emissions reductions of Policy Options off of that baseline. We need MCCAG approval before making any changes to the Inventory and Forecast. The Transportation and Land Use Technical Work Group recommends to the MCCAG that the MCCAG approve this change to the Forecast. This memo briefly describes the rationale. Most data are drawn from Minnesota DOT Office of Transportation Data and Analysis, "Draft VMT Trends in Minnesota: 1992–2006."

Figure 1 show changes in VMT, population, and employment in Minnesota between 1992 and 2006. During most of the 14-year period growth in VMT has outpaced population and employment. VMT increased by a total of 37.3%, while population increased 17.0%, and employment increased 20.6%, although it can be seen that VMT growth has slowed in recent years.

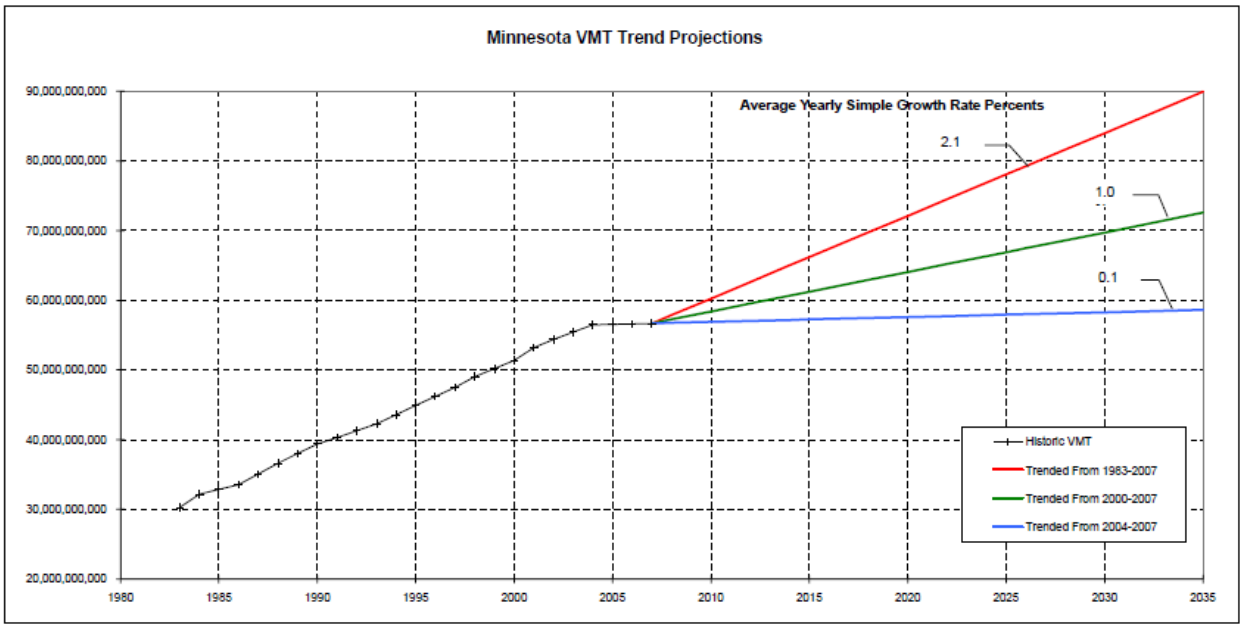
Figure 1. Statewide annual growth trends, 1992–2006



Source: Mn/DOT, Office of Transportation Data and Analysis,
Minnesota Department of Employment and Economic Development

After years of essentially unbroken growth that outpaced both population and employment growth, VMT was essentially flat VMT 2004–2006. How one interprets and treats that break in the historic trend has large effects on one's forecast.

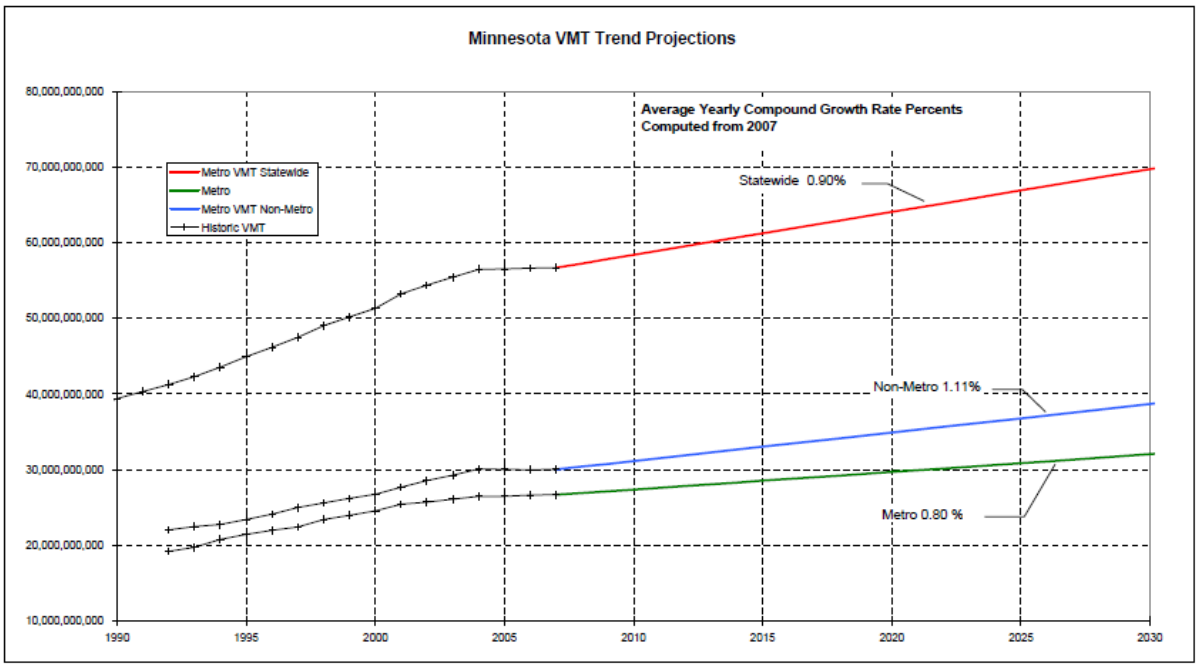
Figure 2. Minnesota VMT trend projections



- If 2004–2006 was essentially an anomaly, then growth resumes at its previous pace: the top, red line; mathematically, the average 1983 to 2007 trend, extended).
- If 2004–2006 is essentially the end of growth in VMT and the beginning of a new trend, then the forecast is the bottom, blue line; mathematically, the average 2004 to 2007 trend, extended.
- If 2004–2006 represents the beginning of a new era (including higher gas prices, as well as perhaps other demographic and transportation shifts), but not a complete break from the forces that produced the past growth, then the forecast is the middle, green line; mathematically, the average 2000–2007 trend, extended.

The Metropolitan Council and Minnesota DOT traffic modelers agreed the middle trend is the most likely, and adopted a forecast of statewide VMT growth of 0.9% annually. They further broke this forecast down as follows:

Figure 3. Minnesota VMT trend projections



Change from current CCS / MCCAG forecast:

Table 1. Current CCS/MCCAG forecast

2010–2015	2015–2020	2020–2025	2025–2030
1.85%	1.69%	1.56%	1.45%

The new forecast would reduce VMT growth by between ~0.9%/year and ~0.5%/year, fairly substantial amounts. Minnesota DOT and the Metropolitan Council, having agreed on these growth rates, will now turn to developing more formal VMT forecasts. At the moment we do not have projected VMT totals for the analysis years of 2015 and 2025. Roughly eyeballing from the provided graph, the change would give the new VMT forecasts shown in Table 2.

Table 2.

	2015	2025
Current (old) baseline forecast	70,093,415,733	82,363,435,036
New baseline forecast	~62,000,000,000	~67,000,000,000
Change	**–11%**	**–18%**

The good news is that this will reduce Minnesota's overall forecast GHG emissions, and those from the transportation and land use sector. The bad news, perhaps, from the perspective of this process is that

- Because many of the TLU Policy Options have goals in terms of percentage reductions, a lower forecast also reduces probable total benefits.

- Because Transportation is such a large percentage of total Minnesota GHG emissions, the lower forecast means that the entire state baseline, and all results off of it, not just TLU results, will need to be recalculated.

CCS will not do any of that recalculation until given the go-ahead by the MCCAG. Thus, all of the following figures use the CCS/MCCAG baseline that has been used so far.

Overall TLU Analysis Framework

- Transportation carbon emissions = **Miles driven** × carbon per mile.
- Carbon per mile = **vehicle emissions per unit × carbon per unit of fuel.**

So, to reduce green house gas emissions requires:

TLU Area 1: Reduce the number of miles driven
TLU Area 2: Reduce carbon per unit of fuel [Cleaner Fuels]
TLU Area 3. Reduce per vehicle energy consumption [Improved Vehicle Efficiency]

This "Overall TLU Analysis Framework" section summarizes for the MCCAG the most important policy option changes since the last MCCAG meeting, organized by TLU Area.

TLU Area 1: Reduce the number of **miles driven**

The following policies will all contribute to reducing miles driven:

- TLU-1 Land Use Planning & Development Strategies
- TLU-2 Expand Transit, Bike & Pedestrian Infrastructure
- TLU-5 Climate-Friendly Transportation Pricing [in part]
- TLU-7 Fix-It-First
- TLU-9 Commuter Choice
- TLU-14 Freight Mode Shifts: Intermodal and Rail **[NEW]**

An overview of options for statewide VMT goals:

At the last MCCAG, the TLU TWG reported on two possible statewide VMT goals:

1. Returning total state VMT to 1990 levels by 2025, and
2. Returning per capita VMT to 1990 levels by 2025.

These options, together with the baseline and with an arbitrary 15% reduction, are shown here for reference.

Figure 1. Minnesota VMT reduction proposals

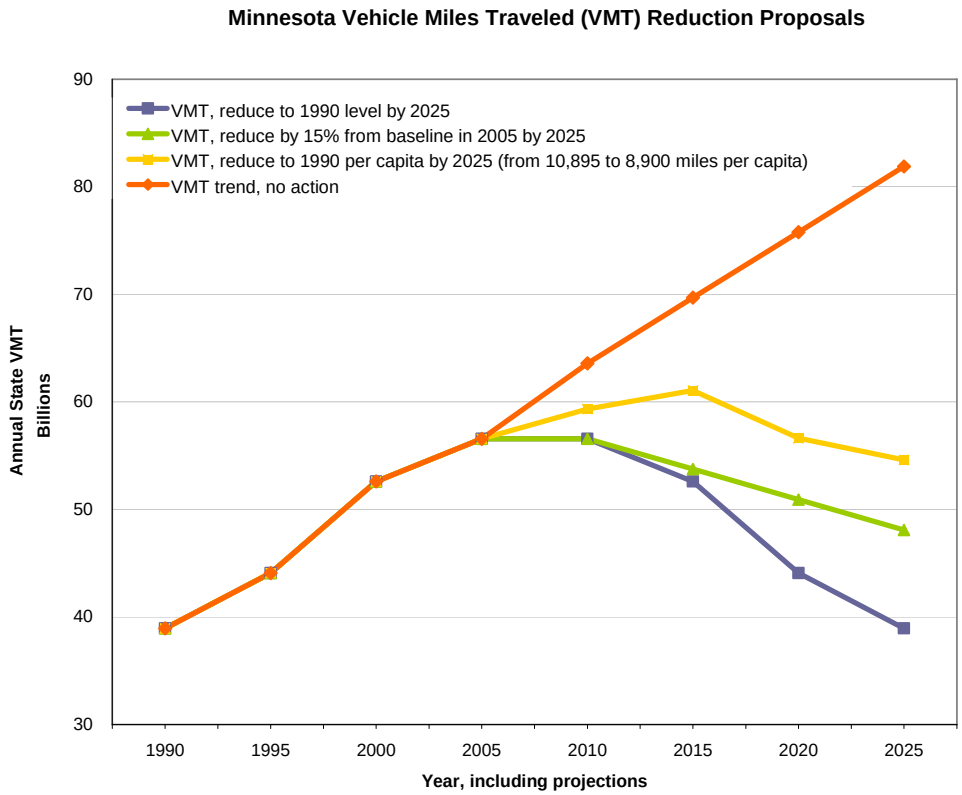


Table 1. Vehicle Miles Traveled in Minnesota—Goal Comparison Summary Chart

	1990	1995	2000	2005	2010	2015	2020	2025	% change 1990–2025	% change 2005–2025
Population	4,375,099	4,626,500	4,919,479	5,192,122	5,446,530	5,709,700	5,943,240	6,135,060	40%	18%
VMT trend, no action	38,940,000,000	44,072,000,000	52,601,000,000	56,570,000,000	63,582,000,000	69,681,000,000	75,780,000,000	**81,880,000,000**	110%	**45%**
Annual VMT Per Capita	8,900	9,526	10,692	10,895	11,674	12,204	12,751	13,346	50%	22%
VMT, reduce to 1990 level by 2025	38,940,000,000	44,072,000,000	52,601,000,000	56,570,000,000	56,570,000,000	52,601,000,000	44,072,000,000	**38,940,000,000**	0%	**–31%**
Annual VMT Per Capita	8,900	9,526	10,692	10,895	10,386	9,213	7,415	6,347	–29%	–42%
VMT, reduce by 15% from baseline (2005) by 2025	38,940,000,000	44,072,000,000	52,601,000,000	56,570,000,000	56,570,000,000	53,741,500,000	50,913,000,000	**48,084,500,000**	23%	**–15%**
Annual VMT Per Capita	8,900	9,526	10,692	10,895	10,386	9,412	8,567	7,838	–12%	–28%
VMT, reduce to 1990 *per capita* by 2025 (from 10,895 to 8,900 miles per capita)	38,940,000,000	44,072,000,000	52,601,000,000	56,570,000,000	59,341,864,868	61,048,112,400	56,615,304,240	**54,602,034,000**	40%	**–3%**
Annual VMT Per Capita	8,900	9,526	10,692	10,895	10,895	10,692	9,526	8,900	0%	–18%

Population sources: 2000 U.S. Census Bureau, 2005 estimates from U.S. Census Bureau. Modified by Minnesota Housing Finance Agency.

VMT sources: Federal Highway Administration.

Two issues: metro & outstate, and passenger & freight

The last MCCAG raised some questions about the feasibility of these goals. In response, the TWG took a closer look at VMT trends, and decided to break VMT goals out as follows:

- A policy option of reducing *Passenger VMT* only to either 1990 total or 1990 per capita
- A new *Freight-specific* policy option to address growing freight VMT. This is now TLU-14, for the MCCAG's consideration. TLU-14 does not yet set specific goals for freight VMT.

Further, the TWG observed that outstate requires policy attention, as VMT there is growing faster than in the Metro area:

Table 2. Metro and non-metro existing trend data, per capita index

State*	1990	1995	2000	2005	2025
Population	4,375,099	4,626,500	4,919,479	5,197,200	6,135,060
VMT trend, no action	38,940,000,000	44,072,000,000	52,601,000,000	56,570,000,000	81,880,000,000
Annual VMT per capita	8,900	9,526	10,692	10,885	13,346
Seven-County Metro Area†	**1990**	**2005**	**2025**	**% change 1992–2005**	**% change 2005–2025**
Population	2,288,721	2,810,179	3,579,750	22.78%	27.39%
% of state population	52%	54%	58%		
VMT trend, no action	17,710,006,902	22,598,182,950	29,233,300,775	27.60%	29.36%
% of state total VMT	45%	40%	36%		
Annual VMT per capita	7,738	8,042	8,166	3.92%	1.55%
Non-Metro Area	**1990**	**2005**	**2025†**	**% change 1992–2005**	**% change 2005–2025**
Population	2,086,378	2,387,021	2,555,310	14.41%	7.05%
	48%	46%	42%		
VMT trend, no action	21,229,993,098	33,971,817,050	52,646,699,225	60.02%	54.97%
% of state total	55%	60%	64%		
Annual VMT per capita	10,176	14,232	20,603	39.86%	44.77%

VMT = vehicle miles traveled.

* Population sources: 2000 U.S. Census Bureau, 2005 estimates from U.S. Census Bureau, modified by Minnesota Housing Finance Agency; VMT source: Federal Highway Administration.

† Population sources: 2000 U.S. Census Bureau, Metropolitan Council; VMT source: Federal Highway Administration, http://www.fhwa.dot.gov/ohim/hs92/roads.pdf, Metropolitan Council Transportation Planning; Source: Minnesota Department of Administration, Office of Geographic & Demographic Analysis, Minnesota Population Projections: 2000–2030, http://www.demography.state.mn.us/resource.html?Id=19332

Level per capita metro-area VMT is already a Metropolitan Council goal, and is currently being met, at 25.9 VMT per capita per day (http://www.metrocouncil.org/planning/framework/benchmarks.pdf). With increasing fuel prices, level Metro-area VMT per capita is probably not an aggressive goal.

Implications:

1. The TWG is further developing the Options to add, where possible, a focus on outstate passenger VMT.

2. Outstate in particular, decreases in VMT may need to come especially from mode shifts, not just shorter trip distances.

TLU Area 2: Reduce **carbon per unit of fuel** [Cleaner Fuels]

- TLU-3 Low Greenhouse Gas Fuel Standard

The last MCCAG meeting raised significant questions about the feasibility of the TWG-proposed 50% reduction in carbon content by 2025. As a result, the TWG has replaced that goal with 10% by 202, and 12% by 2025.

Important question has arisen that the MCCAG should be aware of:

The TLU sector baseline includes the biodiesel mandate, but does NOT include the state 20% ethanol by 2012 goal. Should it?

> For forecasting GHG emissions, growth in fuel consumption is also needed along with VMT. On-road gasoline and diesel fuel consumption were forecasted by developing a set of growth factors that adjusted the VMT projections to account for improvements in fuel efficiency. Fuel efficiency projections were taken from AEO2006. The 2005–2006 growth factors for on-road diesel were also adjusted to account for increased consumption of biodiesel. The recent biodiesel mandate, which requires that 2% of diesel fuel sold at filling stations is blended with biodiesel, took effect in late September of 2005. Since the 2% mandate was in effect for approximately one quarter of the year, 2005 consumption of biodiesel was assumed to be 0.5% of diesel consumption. Biodiesel consumption was assumed to increase to 2% in 2006 and to remain at this level through 2030.
>
> The Minnesota Legislature also recently passed an ethanol mandate that would require the state's gasoline supplies to contain 20% ethanol (E-20). This standard, which is to take effect in 2013, would double the current ethanol consumption. *Since Minnesota must obtain federal approval to use E-20 blends, and this approval has not yet been granted, increased ethanol consumption was not included in the business as usual projection.* [emphasis added] If, following further review of these draft emission estimates, the standards are determined to be

likely to take effect, the resulting emission reductions should be incorporated into the BAU projection.[1]

At the last TWG meeting, it was established that there is no official Minnesota DOT view on whether the federal approval is likely to be granted, or on whether the E-20 would require special technical accommodation. The MCCAG has not considered this Inventory and Forecast question, and at the moment, the 20% mandate is not part of the baseline.

TLU Area 3. Reducing per vehicle energy consumption [Improved **Vehicle Efficiency**]

- TLU-4 Infrastructure Management
- TLU-5 Climate-Friendly Transportation Pricing [in part]
- TLU-6 Adopt CA Clean Car Standards
- TLU-8 Update Road Standards [in part]
- TLU-11 Anti-Idling
- TLU-12 Mobile Source Emissions Reduction
- TLU-13 Reduced Speed Limits

The TWG has further developed these options, but has not changed recommended goals in any of them.

Summary discussion of emissions reductions by TLU Area

Context Question: If GHG reductions required by Minnesota law come from the transportation sector in same percentage as they are generated today, what is our target amount?

Answer: Keeping in mind that the MCCAG process does not require or assume proportional emissions reductions contributions from each sector:

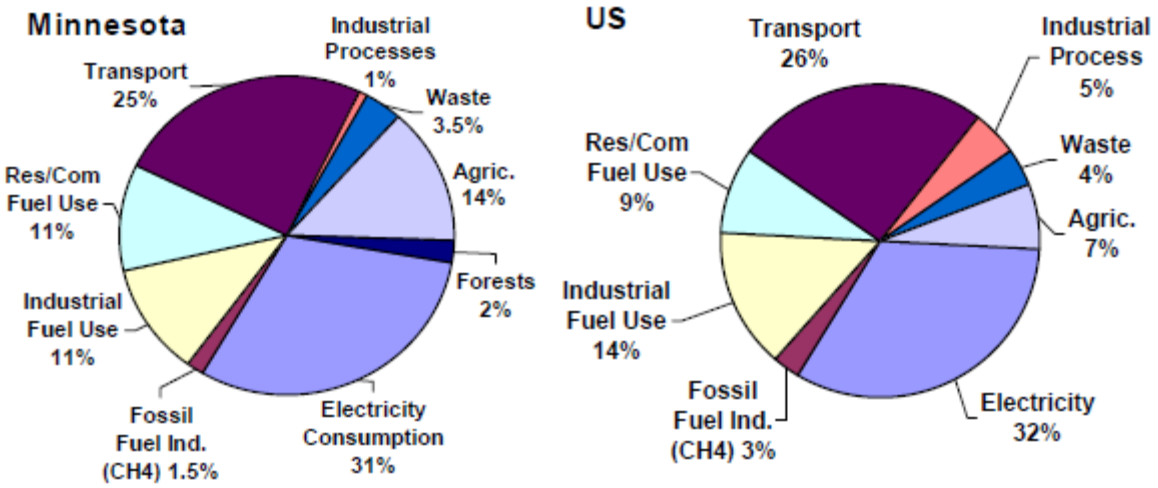
1. "Statewide greenhouse gas emission reduction goals of 15% by 2015, 30% by 2025, and 80% by 2050, using 2005 emissions as a benchmark."

2. "In 2005, activities in Minnesota accounted for approximately 151 million metric tons (MMt) of CO2e emissions."

3. Transportation is 25% of Minnesota emissions.

[1] CCS, "DRAFT Minnesota Greenhouse Gas Inventory and Reference Case Projections 1990–2020," http://www.mnclimatechange.us/ewebeditpro/items/O3F13507.pdf

Figure 2. Gross GHG emissions by sector, 2000: Minnesota and U.S.



So:

151,000,000	$MMtCO_2e$ in 2005
* 30%	reduction by 2025
45,300,000	$MMtCO_2e$ reduction in 2025
* 25%	Transportation share
11,325,000	**$MMtCO_2e$ reduction from T in 2025**

The current reductions estimates form each TLU area are:

TLU Area 1: Reduce the number of **miles driven**

Reduce to 1990 *aggregate* VMT:

	$MMtCO_2e$		
	2007	**2015**	**2025**
No action—trend (light-duty only)	22.97	24.10	25.44
Proposed overall action—Reduce to 1990 VMT		21.38	17.32
Reduction		**2.72**	**8.12**

Reduce to 1990 *per capita* VMT:

	$MMtCO_2e$		
	2007	**2015**	**2025**
Proposed action—reduce to 1990 levels of VMT **per person**	22.97	23.35	21.05
Reduction		**0.75**	**4.39**

TLU Area 2: Reduce **carbon per unit of fuel** [Cleaner Fuels]

	MMtCO$_2$e		
	2007	**2015**	**2025**
No action—trend	22.97 + 7.07 = 30.05	23.63 + 8.15 = 31.78	25.44 + 11.34 = 36.78
Under proposed action—reduce C content by 10% (2020) and 12% (2025) (gasoline + diesel)		29.78	32.37
Reduction		**2.0**	**4.41**

TLU Area 3. Reducing per vehicle energy consumption [Improved **Vehicle Efficiency**]

	MMtCO$_2$e		
	2007	**2015**	**2025**
No action— trend (light-duty)	22.97	Being revised in response to new CAFÉ	Being revised in response to new CAFÉ
Proposed action: TLU-6, CA Clean Car		Being revised in response to new CAFÉ	Being revised in response to new CAFÉ
Reduction		Being revised in response to new CAFÉ	Being revised in response to new CAFÉ

TLU-1 Improved Land Use Planning and Development Strategies

Policy Description

Improve land use planning and development practices to target growth in ways that reduce the number and length of vehicle trips, thus reducing greenhouse gas (GHG) emissions.

(Part of VMT reduction goal along with TLU-2, -5, -7, -8, -9, -10, and -14)

Policy Design

Goals:

Guide new households into currently developed areas.

***Twin Cities Metropolitan Area*—**Target a higher percentage of new development into "priority growth areas" within cities the Metropolitan Council classifies as "developed" (there are 65, including Minneapolis, St. Paul, Burnsville, Coon Rapids, Mendota Heights, Stillwater, and Minnetonka).

- Increase the percentage of housing targeted to the "developed area" to 60% for 2013–2030 (currently 27%–30% in the Metropolitan Council Development Framework for 2000–2030).
- Increase the percentage of jobs targeted to the "developed area" to 75% for 2013–2030 (currently 55% in the Metropolitan Council Development Framework for 2000–2030).

***Greater Minnesota*—**Target a significantly higher percentage of new growth in jobs and housing into incorporated cities in locations that can be accessed by bicycling, walking, and public transit.

Timing: To achieve VMT goals, policy implementation should commence as soon as possible.

- Best practices technical assistance to be developed in 2008–2009 and promoted starting in 2010.
- Statewide and regional planning goals incorporated in next Development Framework and implemented beginning in 2013.

***Statewide*—**Reduce subsidies for low-density auto-oriented development patterns and provide incentives and technical assistance to communities to target growth in "priority growth areas" where walking, bicycling, transit use, and shorter auto trips can reduce VMT.

Parties Involved: All levels of government including local, county, school districts, regional, state; developers and contractors; employers; homeowners.

Other: None.

Implementation Mechanisms

To achieve these VMT reduction goals, the state, Metropolitan Council and local communities will need to use some or all of the following strategies. All of these strategies have been used in other states and regions.

1. Priority Areas Designated For Planned Growth

Establish a process to designate types of priority growth areas within the state. Priority growth areas could include town centers, downtowns, regional centers, neighborhood centers, transit corridors, and transit station areas. Establish a process to encourage higher density housing and employment growth, mixed-use and mixed-income development, and bicycle, pedestrian, and transit-friendly development within these areas. Priority growth areas could include brownfields (old commercial or industrial sites). Development would be promoted through incentives, technical assistance, and/or regulation.

2. School Siting and Accessibility

Review and revise school siting laws in Minnesota to remove excessive acreage requirements that drive schools into undeveloped areas. Encourage the development or rehabilitation of schools in priority growth areas and to make it easier for children, teachers, and parents to get to school on foot, bicycle, and transit.

3. Jobs-Housing Balance

Plan and zone for new housing development to near existing jobs and plan and zone for new commercial development near existing housing. Implement financial incentives and/or regulation to encourage a range of housing types and affordability levels that support a community's local work force, which will create a stronger jobs-housing balance and reduce the length and number of vehicle trips.

4. Smart Growth Planning, Modeling and Tools

Institute statewide and municipal planning requirements and/or incentives to implement TLU-1. Continue planning requirements in the Twin Cities Metropolitan area, require state planning to implement TLU-1, and support planning for municipalities throughout Greater Minnesota.

Provide technical assistance to communities on best practices in zoning, parking, and street design to increase walking, bicycling and transit use; to encourage higher density, transit- and walking-oriented development; and to balance regional residential, commercial and industrial needs. Example: Oregon's Transportation and Growth Management technical assistance program for Oregon communities: http://www.lcd.state.or.us/LCD/TGM/index.shtml

Create an integrated transportation and land use forecasting model for use statewide. This tool would enable communities to predict increased vehicle miles traveled and GHG emissions based on proposed developments.

Create a development cabinet, or other government oversight group, that guides state investments to reduce vehicle miles traveled and GHG emissions.

5. Targeted open space protection

Establish programs and/or requirements to preserve key forestlands, natural areas, agricultural land, and parkland, which will help to guide development and redevelopment into targeted growth areas.

6. Transportation Investments

Transit- and Pedestrian-Oriented Development
Plan for and invest in transit- and pedestrian-oriented corridors that will draw and support higher density, mixed-use development along bus corridors and at rail station locations.

Complete Streets and Well Connected Streets
Develop statewide guidance and technical support for Complete Streets and Well Connected Streets to shorten trip distances, to make walking, and walking to transit safer and more convenient, to reduce the need for overly large urban arterial roads, and to support higher density development.

7. Funding

Target new and existing transportation and housing dollars from regional, state, and federal sources to those projects that help meet these land use and development goals.

Related Policies/Programs in Place

- Metropolitan Livable Communities Program Tax Base Revitalization Account (TBRA) grants have funded projects in the metropolitan area to clean up polluted land and buildings for redevelopment, creating new jobs and affordable housing, and directing growth to central cities and older suburbs. TBRA grant awards totaling $64.84 million were awarded from budgeted funds 1996–2006. Those funds will leverage an expected $3.4 billion in private investment.
- Metropolitan Council provides Livable Communities Demonstration Account (LCDA) grants to metropolitan area communities for projects that result in connected development patterns that link housing, jobs and services, and use regional infrastructure efficiently. LCDA grant awards totaling $74.67 million were awarded from budgeted funds 1996–2006. The Metropolitan Council expects those funds to leverage more than $2.77 billion in private development investment.
- Minnesota Housing has a priority for housing development located near regional and interregional transportation corridors and transit-ways, in proximity to existing development and services. Minnesota Housing also supports new development that is not located near wetlands, steep slopes, critical habitat, or on prime farmland or parkland.
- Some counties have sold bonds to protect open spaces. The Metropolitan Council plans to increase the regional park and open space system from 53,000 acres to 70,000 acres. The parks plan calls for three new parks by 2030 and for four new regional parks to complete the system, post-2030.

Types(s) of GHG Reductions

Primarily CO_2

Estimated GHG Reductions and Net Costs or Cost Savings

GHG impacts

This Option is part of the group of options that will contribute to fulfilling the broad VMT reduction goal.

We assume that

1. TLU-1 produces land use changes that approximate the impacts modeled for Blueprint 2030 for the Twin Cities region (while noting that the recommendations here are not for a return to Blueprint 2030 *per se*). Modeling for Blueprint 2030 forecast a ~12% decrease in VMT from the baseline, region-wide,[2]

2. That those reductions are accomplished in urban areas of the state, not just the Twin Cities region. While the numeric goals above are for the Twin Cities region, the implementation mechanisms also apply to greater Minnesota, and will be especially effective in the urban areas of greater Minnesota.

The Twin Cities 2025 baseline VMT is 29,233,300,775. Total 2025 in Minnesota urban areas is forecast to be 42,028,452,537 VMT.

A 12% decrease from the latter figure is a reduction of 5,043,414,304 VMT in 2025. That is 6.0% of *all* VMT, which is then converted to CO_2 for use in the reductions table.

Costs/cost savings:

All else being equal, buildings cost somewhat more to construct in urban areas than in suburban or exurban areas. The preponderance of the evidence and the academic review of that evidence find that increased private construction costs are more than paid for

- Through initial higher sales prices, and higher resale value over time, and
- Through substantial savings in reduced infrastructure costs.

Under a compact, transit-oriented development scenario such as would be produced under this Option, the Twin Cities metropolitan area would save $3 billion in infrastructure costs over 20 years.[3]

A portion of those benefits would come from the transit use that improved land use patterns would make possible. More compact land use alone would produce net cost savings, as the more compact development pattern by itself would save substantial portions of the $3 billion estimated by the Metropolitan Council. A wide variety of literature supports the Metropolitan Council's finding: 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

[2] Keith Bartholomew, "Integrating Land Use Issues Into Transportation Planning: Scenario Planning Summary Report," College of Architecture and Planning, University of Utah, 2005.

[3] Metropolitan Council, Blueprint 2030, Appendix E, p. 9.

higher. Preponderance of literature suggests net savings overall.[4] A National Academy of Sciences / Transportation Research Board review found substantial regional and state-level infrastructure cost savings from more compact development, as shown in Table TLU-10.

Table TLU-1. Burchell findings of savings of compact growth versus trend development[5]

Area of Impact	Lexington, Kentucky, and Delaware Estuary	Michigan	South Carolina	New Jersey
Public–Private Capital and Operating Costs				
Infrastructure roads (local)	14.8%–19.7%	12.4%	12%	26%
Utilities (water/sewer)	6.7%–8.2%	13.7%	13%	8%
Housing costs	2.5%–8.4%	6.8%	7%	6%
Cost-revenue impacts	6.9%	3.5%	5%	2%
Land/Natural Habitat Preservation				
Developable land	20.5%–24.2%	15.5%	15%	6%
Agricultural land	18%–29%	17.4%	18%	39%
Frail land	20%–27%	20.9%	22%	17%

Data Sources:

Fuel use: Minnesota Inventory and Forecast.

VMT forecasts: Federal Highway Administration, http://www.fhwa.dot.gov/ohim/hs92/roads.pdf, Metropolitan Council Transportation Planning.

VMT reductions: Metropolitan Council, *Blueprint 2030*.

Quantification Methods:

As above. In addition to the modeling done for Blueprint 2030, a wide variety of literature finds that integrated transportation and land use planning can substantially reduce VMT and its attendant emissions.[6] Because the Blueprint 2030 modeling did not use the most advance available techniques to capture the VMT impacts of the modeled policies, the reductions estimates used here are likely conservative.[7]

Key Uncertainties

Vehicle miles traveled since 1990 have increased statewide by 45%, one of the fastest growth rates in the nation, far outpacing the state population growth of 19% in the same time period. The regions outside the Seven-County Metro area are responsible for much of the immense increase in vehicle miles traveled.

[4] 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.

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

[6] 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

[7] Bartholomew, above.

Reducing the number of miles that a vehicle travels through more strategic land use planning and development is a policy approach that works primarily in urban areas where jobs and commercial services are more likely to be closer to residential growth areas. While the Seven-County Metro area held 52% of the state population in 1990, it produced only 45% of the annual state Vehicle Miles Traveled (VMT). In 2005, the Seven-County Metro area had 54% of the statewide population and 40% of the state VMT. By 2025, the percentages only continue to diverge to 58% of the statewide population in the metro area, yet only 36% of the state VMT. Per capita VMT is expected to grow very little in the metro area by 2025, yet it is projected to increase dramatically statewide.

Reducing the number of miles traveled is a crucial component to reducing harmful GHG emissions, even with increased clean fuel and efficiency. The burden of reducing the number and lengths of trips taken will be concentrated on the Seven-County Metro area and the population growth centers in greater Minnesota and should be considered when recommending policies. Whether we strive to achieve the number of annual vehicle miles traveled overall or based on per capita as we did in 1990, policies for reducing the number and length of travel trips will be targeted to the metro area and greater Minnesota growth centers.

How to manage VMT statewide needs more analysis and is a key uncertainty to pursue.

Additional Benefits and Costs

1. Makes transit service more feasible and cost effective (need a minimum of 8 residential units per acre for minimum level bus service, 15 units per acre for frequent bus service, and 30 units per acre for rail service).
2. Improves public health by making it easier and safer for people to walk.
3. Reduces the number and severity of vehicle crashes by reducing the number of high-speed, high-traffic arterial streets and by making walking and bicycling safer.
4. Supports social interaction with more people walking, bicycling, and riding public transit.
5. Reduces air pollution. Blueprint 2030 forecast a 50% decrease in NO_x emissions in 2030 relative to the baseline.
6. Reduces urban land consumption, keeping Minnesota land in agriculture and open space. Blueprint 2030 forecast a 35% decrease in land consumption relative to the baseline.

Personal risk:

There are divergent views about the change in personal risk that accompanies more compact development. Many people believe that personal danger/risk from criminal activity is greater in higher density living and the inner city and first ring suburbs, and give this reason for new development further from core cities.

The contrary view argues that the concern about personal safety and more dense forms of development is often based on perceptions of failed public housing efforts of the past that geographically isolated low-income households in high-rise residential developments.

However, new, more compact, mixed-use, and mixed-income forms of development in central cities and developed suburbs have established some of the most attractive and livable

neighborhoods in other regions. Market research by the National Association of Realtors shows that more and more buyers prefer living in neighborhoods that are more compact and offer more activities and less need to drive, and that those preferences are reflected in market premiums. These new forms of compact development provide more personal safety because they put 'eyes on the street' and give all residents a sense of ownership in the public spaces.

Cost to government to establish planning program, provide new planning tools, to review current funding and reposition funding criteria to encourage growth in priority areas, and provide technical assistance could cost $10–$20 million per year.

Feasibility Issues

TWG members raise two general feasibility questions:

- Are the numbers given in the Goals achievable given existing development patterns, market patterns, and investment trends?
- Have the "Implementation Mechanisms" included enough tools to allow communities to reach these goals?

The Metropolitan Council believes that the goals in its current Framework are at the edge of likely feasibility.

Status of Group Approval

Pending – [until MCCAG moves to final agreement at #6 or #7]

Level of Group Support

TBD – [blank until MCCAG meeting #6 or #7]

Barriers to Consensus

TBD

TLU-2. Expand Transit, Bicycle, and Pedestrian Infrastructure

Policy Description

Expand infrastructure and programs to increase transit ridership, carpooling, bicycling and walking. This strategy will reduce GHG emissions by reducing vehicle miles traveled (fewer vehicle trips and shorter trip distances). (Part of VMT reduction goal along with TLU-1, -5, -7, -8, -9, and -10.)

Policy Design

Goals:

- Implement the Metropolitan Council's transit plan to double transit ridership by 2020 (from 75 million rides annually to 150 million), 10 years sooner than the current target date of 2030. The Council's transit plan calls for investment in light rail, commuter rail, bus rapid transit and expanded bus service.
- Improve/expand transit (rail and bus) service between regional centers in Greater Minnesota and the Twin Cities region including Rochester, Marshall, Moorhead, Winona, Bemidji, Duluth, Detroit Lakes, Mankato, Grand Rapids, East Grand Forks, and other regional centers. Provide/ensure adequate service between these communities and the Twin Cities region (both MSP airport and/or downtown Minneapolis and downtown St. Paul).
- Increase bike and pedestrian infrastructure in cities across Minnesota including sidewalks, trails, bike lanes, and other amenities that make walking and bicycling safer and more convenient.

Timing: Begin implementation by 2008 and complete implementation by 2020.

Parties Involved: Legislature, Metropolitan Council, Minnesota DOT, Metropolitan Transitways Development Board, counties, cities, freight rail, private sector businesses.

Other: None cited

Implementation Mechanisms

1. Expand Transit Service

- The Metropolitan Council transit plan calls for adding light rail, commuter rail, dedicated busways and increasing regular route bus service by 80% (more routes and more frequent service) This expansion would also include additional marketing, promotion, and pricing incentives (including tax incentives for nonprofits).
- Expand transit service between Greater Minnesota and the TC Metropolitan Area via intercity bus and Amtrak.

2. Expand Bike and Pedestrian Infrastructure

- Support walk and bike access to destinations and to transit by adding and improve sidewalks, trails, bike lanes, and other amenities including lighting, landscaping, bike parking, lockers, etc.

Related Policies/Programs in Place

Recent Actions in Minnesota:

- MC/TAB programmed $95.6 million in Enhancement and STP funds starting in 1992. *[Note: Need to determine how long funding runs and what percent of state and federal funding goes for public transit, bicycling, and walking.]* Transit for Livable Communities is implementing a four-year $25 million federal pilot program to increase rates of bicycling/walking targeted to Minneapolis.
- In 2006, Minnesota voters approved a constitutional amendment requiring dedication of motor vehicle sales tax funds to transit which will result in increased finding.
- Twin Cities region has two HOV lanes (I-394 and I-35W). I-394 is a HOT lane which allows single occupant vehicles to use the HOV lane for a fee. An MOU between Metropolitan Council and Minnesota DOT provides for consideration additional HOT lanes in future highway improvements.

Type(s) of GHG Reductions

Primarily CO_2.

Estimated GHG Reductions and Net Costs or Cost Savings

Data Sources:

Average length of transit trip: Federal Transit Administration.

Quantification Methods:

GHG reductions

Transit:

75,000,000 new transit rides × 6.71 miles per 7-county transit trip[8]

13-county transit averages 8.53 miles/trip. We used just 7-county be conservative.

Total VMT reduced in 2025: 503,250,000, or 1.27% of all light-duty VMT statewide.

Assumed that transit growth from this policy started in 2008 and grew smoothly to the 2025 VMT reduction level. Then converted to CO_2.

Bike and Pedestrian:

The policy option does not include specific goals for either new bike and pedestrian spending, or new bike/pedestrian activity. A substantial literature documents the positive

[8] http://www.metrocouncil.org/planning/transportation/TBI_2000/TravelTimeTripLength_7County.pdf

response of bike and pedestrian activity to improved infrastructure,[9] but without a new infrastructure target in the option, it is difficult to quantify the likely impacts of this policy.

Costs
The additional cost to implement the Metropolitan Council transit plan on an accelerated time-frame is estimated to be $210 million per year for 13 years or nearly $3 billion.

Savings
Greatly reduce infrastructure costs. A report prepared in 2002 by a consultant to the Metropolitan Council hired to study regional growth development options showed a $3 billion savings in infrastructure costs over 20 years under a compact development scenario focused to some degree along pubic transit routes for the TC metropolitan area. (Blueprint 2030 Appendices, item E, page 9.)

The ~$3 billion cost minus ~$3 billion infrastructure savings = the net cost of $0.

That net cost of zero does not include a variety of other savings. Reducing VMT saves substantial additional costs. A greater reliance on public transit will result in a reduced need for parking, lower household costs for transportation, reduced traffic congestion, improved air quality, reduced need and cost for roadway expansion, and improved heath for new transit riders who walk or bicycle to transit.

The University of Minnesota's "Full Costs of Transportation in the Twin Cities Region" report concluded that the total cost of a mile of auto travel in the region was between $0.84 and $1.62, with a midrange estimate of $1.14. With the costs of the transit accounted for above, these are net savings:

503,250,000 VMT × $1.14/mile = $573,705,000

A wide variety of empirical experience suggests that the transit investments in this option will produce substantial additional benefits/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.10

[9] For example: Jennifer Dill and Theresa Carr. 2002. "Bicycle Commuting and Facilities in Major U.S. Cities: If You Build Them, Commuters Will Use Them—Another Look." Portland State University, Portland, (http://www.ce.umn.edu/~levinson/pa8202/Dill.pdf) "Study confirms findings that cities with higher levels of bicycle infrastructure also have higher levels of bicycle commuting."

[10] Cambridge Systematics, Inc., "Public Transportation and the Nation's Economy: A Quantitative Analysis of Public Transportation's Economic Impact," 1999, available at: www.apta.com/research/info/online/documents/vary.pdf

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.11 Similar programs at other universities show similar results.12 Universities are in some senses unique institutions, but the general types of challenges (especially demand for and cost of providing parking), and the types of benefits enjoyed in response to commute benefits programs, are equally available to businesses, even businesses located in what would normally be thought of as locations unsupportive of transit use:

   > "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% before the passes were offered to 60% afterward. The transit mode share for commuting increased from 11% to 27%. These mode shifts reduced commuter parking demand by approximately 19%.
   >
   > "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."[13]

3. *Transit and non-SOV options information and promotion:* Per public dollar, a Minnesota Transportation Management Organization (TMO) can accommodate seven times as many commuters as new highway investment.[14]

Key Assumptions: Above.

Key Uncertainties

None cited.

Additional Benefits and Costs

[The benefits of decreases in criteria air emissions will be analyzed at a later date.]

Feasibility Issues

None cited.

Status of Group Approval

Pending – [until MCCAG moves to final agreement at meeting #5 or #6]

Level of Group Support

TBD – [blank until MCCAG meeting #5 or #6]

Barriers to Consensus

TBD – [blank until final vote by the MCCAG]

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[11] 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.

[12] Jeffrey Brown, Daniel Hess, and Donald Shoup, "Unlimited Access," Transportation 28:233–267, Kluwer, 2001.

[13] Ibid., 260.

[14] Minnesota Department of Transportation, Modal Options Identify Project, "Measurement and Evaluation", 2006.

TLU-3. Low GHG Fuel Standard

Policy Description

The state of Minnesota would adopt a low GHG fuel standard (LGFS) and create a market-based program to reduce the GHG emissions from transportation fuels and diversify transport fuel options for consumers.

The LGFS would be designed to require fuel providers to reduce the GHG intensity of the fuels they sell in Minnesota. "Fuel providers" are identified as producers, importers, refiners, and blenders. The GHG intensity is specified as a CO_2 equivalent[15] per BTU. The LGFS would not be designed to encourage the use of any particular fuel: it would include fossil and renewable fuels.[16]

The LGFS is not a tailpipe standard for GHGs as it considers GHG emissions on a full fuel cycle basis, which includes not only tailpipe emissions, but also emissions associated with the production and distribution of fuels. This will result in varying carbon impact values for fuels that would ostensibly be the same to customers.[17] This would have a significant impact to Minnesota in that E10, the current maximum ethanol blend percentage for non flex-fuel vehicles, is the state mandated standard for all gasoline blends.

Policy Design

Goals: Adopt state law requiring the average carbon intensity of on-road transportation fuel to be reduced 10% by 2020 and 12% by 2025 from 2007 levels. (Note that California's LCFS requires a 10% reduction by 2020.) Other policies seek to reduce consumption of motor fuels, while this approach changes the fuel mix to reduce GHGs.[18]

Timing: As above

Parties Involved: All layers of government, fuel providers

[15] Each GHG has a global warming potential that allows it to be expressed in terms of CO_2. This notation is referred to as carbon dioxide equivalent (CO_2e). For example, methane, CH_4, has a GWP of 23. Therefore, 1 Mt of CH_4 can be expressed as 23 $MtCO_2e$.

[16] Alternative fuels are defined in the Energy Policy Act of 1992 and include biodiesel, electricity, ethanol, hydrogen, natural gas, and propane.

[17] For example, E10 where the ethanol is derived from cellulose has the potential to reduce the full fuel cycle carbon impact as compared to E10 where the ethanol is derived from corn. How the ethanol is made affects its life cycle GHG profile and not all corn ethanol is exactly the same. Cellulosic while potentially better in its GHG profile than sugar based (corn) ethanol, will also vary depending on feedstock(s) and thermal heat input source(s).

[18] Note that the goal is to reduce the average carbon intensity of a gallon of fuel, not the carbon content of the full fuel stream.

Implementation Mechanisms

- Partnership with the University of Minnesota and the Department of Transportation to create the framework for the LCFS.
- Market-based mechanisms for fuel providers to choose how they wish to meet LGFS.
- Full life cycle basis of measuring GHG impact of transportation fuels. Implemented by a cap-and-trade system for fuel providers.
- Financial incentives for refueling station creation and retrofitting based on LGFS.
- Certification process

Related Policies/Programs in Place

Recent Actions in Minnesota:

- Current state policy for fossil diesel displacement is 2% biodiesel blend. For gasoline displacement, stated current policy goal is 20% ethanol displacement by 2013; with a carve-out goal for 5% derived from cellulosic material. Current petroleum displacement goal is 20% of the liquid fuel sold in the State will come from renewable sources by the year 2015 and 25% by 2025.
- Metro Mobility uses the highest level of biofuel allowable by operating conditions and vehicle manufacturers.
- B5 (5% biodiesel) used by Metro Transit and Metro Transit is testing B20 (20% biodiesel). Metro Transit is considering use of B10 (10% biodiesel) by mid-2007 pending B20 test results. The agency is also looking for other engine technology that uses other types of renewable fuels.
- Formation of the NextGen Energy Board to determine how state can invest most efficiently to achieve energy independence—$90 million from 2010 to 2020.
- Ethanol: Minnesota established an ethanol production incentive to provide payment to producers to help develop a new market for Minnesota's agricultural products. On the market side, Minnesota requires that all gasoline sold in the state be blended with a 10% ethanol mix. In addition, Minnesota began efforts in 1997 to develop a network of fueling stations for flex fuel vehicles that could run on an 85% ethanol blend. Today Minnesota has over three hundred E85 fueling stations around the state that together sold a total of $18,160,000 gallons of E85 blended gasoline during 2006. http://www.pca.state.mn.us/programs/ethanol.html; http://www.pca.state.mn.us/programs/ethanol.html#links
- Biodiesel: According the US DOE, biodiesel has the most favorable energy balance of any transportation fuel. For every unit of energy needed to produce a gallon of biodiesel, 3.2 units of energy are gained. As of September 29, 2005, Minnesota requires nearly all diesel fuel sold in the state to contain at least a 2% biodiesel blend. It is estimated that the 2% fuels use requirement for Minnesota will replace 16 million gallons of diesel fuel. Minn. Stat. § 239.77
- Electricity: According to recent information provided by the PCA, electricity as used in a hybrid gas/electric vehicle is a very low GHG fuel source. Compared to conventional gasoline and reformulated gasoline, electric/gas hybrids show a 37.2% reduction in GHG

emissions in grams per mile. This is compared with a 1.5% reduction for E10, a 15.6% reduction for E85 flex fuel, and a 25.5% reduction for conventional and low sulfur diesel.

Recognizing the potential benefits of hybrids, plug-in hybrids, and electric vehicles for reducing GHG emissions, Minnesota has taken a number of steps to encourage their development, including an appropriation of over $2 million for the 2008–2009 biennium for study and testing of plug-in hybrid electric vehicles.

Type(s) of GHG Reductions

All GHG types in the fuel life cycle.

Estimated GHG Reductions and Net Costs or Cost Savings

Table TLU-2. Title

	MMtCO_2e			
	2007	**2015**	**2020**	**2025**
No action— continue according to trends	30.04	32.92	35.0	36.78
Proposed action— 10% by 2020, and 12% by 2025 (5% by 2015 interpolated, but not part of the formal goal): Reduction		**1.65**	**3.5**	**3.68**

Data Sources:

David Crane and Brian Prusnek, "The Role of a Low Carbon Fuel Standard in Reducing Greenhouse Gas Emissions and Protecting Our Economy," California Air Resources Board, January 8, 2007.

Quantification Methods:

Because the LGFS would mandate a 10% decrease in carbon content, the high-level analysis is relatively straightforward: a straight 10% decrease in the baseline on-road carbon emissions in 2020.

The LGFS would take into account the full fuel cycle when calculating that carbon content. Because the current Inventory and Forecast is not on a full fuel cycle basis, that analysis is not done here either.

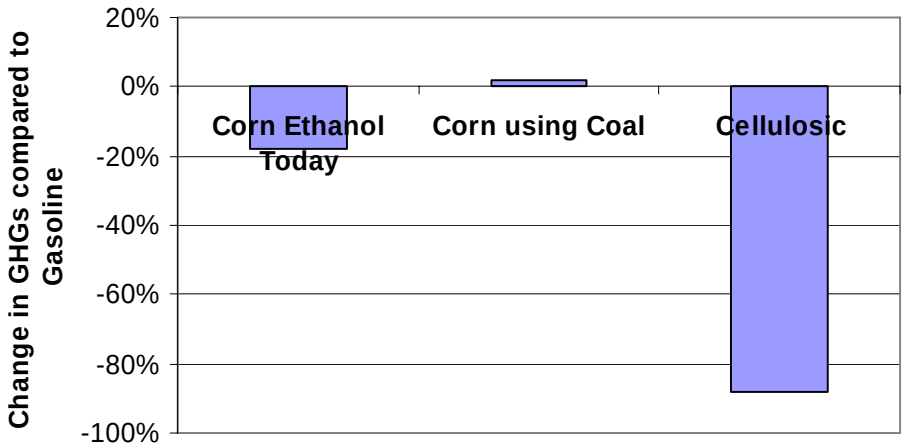
Key Assumptions:

That fuels technologies advance sufficiently to allow these goals to be met. Research by the University of California on the achievability of the CA LCFS finds:

"On the basis of a study of a wide range of vehicle fuel options, we find a 10% reduction in the carbon intensity of transportation fuels by 2020 to be an ambitious but attainable target. With some vehicle and fuel combinations, a reduction of 15% may be possible."[19]

Different full fuel cycle analysis ("well-to-wheels", or "field-to-wheels") methods show different total carbon amounts per gallon for the same fuel pathway. For example, different models show different results for ethanol using corn as a feedstock, and distilled with a given energy source (electricity from coal, natural gas on-site, etc.). Adopting this policy will require the state to establish an official analysis method. Any such method will distinguish between the carbon impacts of two fuels that are essentially the same at the pump yet have very different production origins. The following chart illustrates one analysis of the potential range of carbon impacts from ethanol. The chart is included here *not* to establish recommended or likely impacts from different methods of ethanol production, but simply to illustrate the potential range of impacts from a single fuel type using a given analysis method, which can likely range from an increase in emissions relative to gasoline, to a significant decrease. A well-specified LGFS would account for these differences.

Figure TLU-1. Low-Carbon Fuel Standard necessary to ensure GHG reductions from the use of biofuels



Source: Farrell et al., "Ethanol Can Contribute to Energy and Environmental Goals," *Science* , Jan 27, 2006.

Table TLU-3. Estimated biofuels impacts on GHG emissions

Fuel/Technology	Blend	Feedstock	Reduction (grams of GHGs per mile)*	Normalized Reduction (100% blend)
Ethanol	E10	corn	1.5%	15.0%
Ethanol	E10	cellulosic	7.2%	72.0%

19 Alexander E. Farrell, Daniel Sperling, et al. "A Low-Carbon Fuel Standard for California, Part 1: Technical Analysis," May 29, 2007. Executive Summary, p. 8, available at: www.its.berkeley.edu/sustainabilitycenter and www.its.ucdavis.edu and http://www.arb.ca.gov/fuels/lcfs/lcfs.htm

Ethanol	E85	corn	17.6%	20.7%
Ethanol	E85	cellulosic	83.2%	97.9%
Biodiesel	B20	soy	9.9%	49.5%
Biodiesel	B20	canola	11.2%	56.0%
Biodiesel	B20	palm	12.0%	59.9%
Biodiesel	B100	soy	53.9%	53.9%

*Ethanol reductions estimated relative to gasoline; biodiesel reductions estimated relative to diesel fuel. Actual reductions depend on many factors in the production, distribution, and use of fuels.

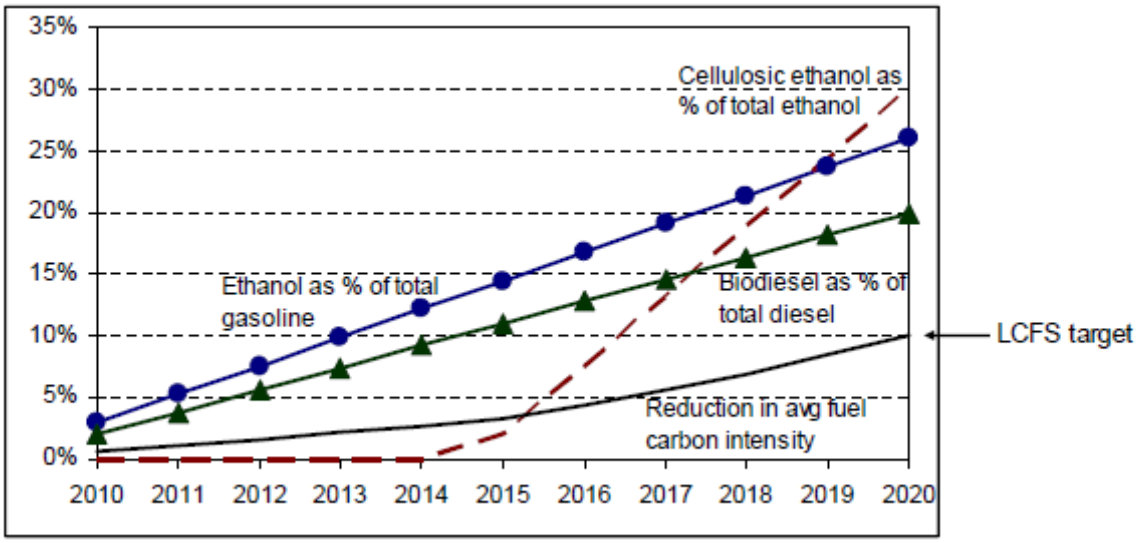
Sources: GREET v1.7 outputs; (S&T)^2 Consultants, *Sensitivity Analysis of GHG Emissions From Biofuels in Canada,* 2006.

Cost

California has not estimated the likely costs of an LCFS. A state climate planning process for Washington State developed a potential LCFS scenario, and costed it out using current prices:

> In order to estimate the likely ramp up in biofuels usage needed to meet the LCFS and the interaction with existing policies, we developed a scenario shown in the figure below. In this scenario, by 2020, ethanol sales in Washington would represent 26% of gasoline sales, with 58% of the ethanol used in flex-fuel vehicles (E85) and the remainder used conventional vehicles operating on E10. All ethanol would come from corn feedstocks through 2014. Starting in 2015, the market share of cellulosic ethanol would ramp up so that by 2020, 30% of all ethanol would be from cellulosic feedstocks. Biodiesel (from soy) would make up 20% of total Washington diesel sales by 2020. The cumulative impact of this increase in biofuels is a 10% reduction in average fuel carbon intensity in 2020.

Figure TLU-2. Title



Cost is calculated as the incremental cost of biofuels per gallon of gasoline equivalent (for ethanol) or diesel equivalent (for biodiesel) multiplied by total consumption of each fuel. We account for the consumer price of fuel plus the federal subsidy, in the form of an excise tax credit to blenders, for ethanol and biodiesel. This subsidy amounts to $0.51/gallon for ethanol [any kind] and $1.00/gallon for biodiesel from virgin oils. Ethanol and gasoline prices in future years are drawn from the Energy Information Administration's Annual Energy Outlook, 2006. Based

on recent anecdotal evidence from the Seattle area, which suggests that a gallon of biodiesel (B99) and a gallon of conventional diesel are hovering around the same price, we assume no difference in the consumer cost of these fuels. So the full cost of biodiesel is assumed to be $1 more per gallon than the cost of conventional diesel.

We have not developed a similar scenario for Minnesota, but given ample corn supplies, the scenario should work here as well.

This scenario does not account for other possible compliance routes, for example, including wind- or hydro-sourced electric vehicles. If and when they become competitive, their availability could substantially change the cost structure.

Key Uncertainties

See extensive analysis and discussion by both CARB and related research by the University of California. Those studies review the technical challenges and uncertainties facing this type of policy:

Alexander E. Farrell, Daniel Sperling, et al. "A Low-Carbon Fuel Standard for California. Part 1: Technical Analysis," May 29, 2007. Part 2: Policy Analysis, August 1, 2007. Available at http://www.arb.ca.gov/fuels/lcfs/lcfs.htm

Specifically, the assumptions about the cradle-to-grave performance of cellulosic ethanol, especially transporting the cellulosic materials to create cellulosic ethanol—will it really have a dramatic reduction in GHGs, considering there is no current transportation and distribution network for them like there is for corn?

Additional Benefits and Costs

Benefits

- Additional farm income, with attendant benefits for rural families and communities.
- Improved urban health/air quality
- Potential for market innovation in new technologies for both refiners and clean energy providers.

Costs

Environmental—There is extensive debate about the non-emissions environmental impacts of biofuel production. In Minnesota, demand for additional biofuels would have substantial effect on demand for water and for acreage, with subsequent impacts on water supplies and marginal and/or Conservation Reserve Program acreage. There is also extensive debate over the environmental impacts of a move to grass-based fuel feedstocks. Research at the University of Minnesota suggests that a return to (for example) a harvestable prairie-type ecosystem would not support extensive prairie-like biodiversity.

Those debates are too extensive to summarize here, other than to conclude that a LGFS would almost certainly increase the demand for Minnesota-based biofuels to some extent, and that that increased demand would likely have some negative environmental impact. Until the economics of an LGFS are clearer, it is not possible to forecast the extent to which an LGFS would produce

additional demand for Minnesota-based biofuels, versus other types of fossil (natural gas) or renewable (wind, hydro) fuelstocks, or the resulting impacts.

Economic—Minnesota farmers are realizing that higher grain prices are not necessarily beneficial; they raise input prices for a range of other farm products.

Feasibility Issues

See "Key Uncertainties."

Status of Group Approval

Pending – [until MCCAG moves to final agreement at meeting #6 or #7]

Level of Group Support

TBD – [blank until MCCAG meeting #6 or #7]

Barriers to Consensus

TBD – [blank until final vote by the MCCAG]

TLU-4. Infrastructure Management

Policy Description

With the state as a coordinator, build on current efforts to create a seamless multi-modal system, to serve all modes, and improve traffic flow and decrease vehicle idling and congestion (where it will not negatively impact bicycling and walking or induce additional vehicle trips).

This strategy will also reduce carbon emissions by reducing the number and length of motor vehicle trips; increasing walking, bicycling, and transit use; and supporting development patterns that use these modes.

Policy Design

1. Manage to reduce congestion

State, regional, and local transportation agencies will make investments to:

- Synchronize traffic signals to improve traffic flow,
- Provide priority signaling for buses on key transit corridors,
- Improve incident management (vehicle crashes and breakdowns),
- Provide real-time information for commuters about congestion, transit, and parking,
- Install round-a-bouts where appropriate,
- Test state of the art parking strategies, and
- Convert HOV or general lanes to HOT lanes with "profits" to transit alternatives.

2. Manage to accommodate all modes

Change rules and policies at the state, regional, and local level to ensure that the needs of all users are taken into account in the design of new and rebuilt roads.

- Adopt a Complete Streets policy in Minnesota for all new and reconstructed roads. Ensure, through an inclusive process, that roads are designed to better serve all users including vehicle drivers, transit users, pedestrians, freight and truck traffic, and bicyclists. (Exceptions can be made for rural roads between communities, etc.) Develop and apply an "Urban Preservation Route" street classification, similar to the "Natural Preservation Route" that exists today.
- Require and provide technical assistance to cities and counties to develop bicycle and pedestrian plans to identify local needs and priorities.
- Develop policies and guidelines for municipalities regarding street connectivity.

Goals: Use infrastructure management to reduce urban-area emissions by transportation emissions by 0.5% by 2025 relative to 2005.

Timing: 2008–2009 adoption and then ongoing implementation.

Parties Involved: Legislature, all state, regional, and local agencies that deal with transportation, local elected officials, bike, transit, and pedestrian interests, Minnesota Trucking Association, others.

Other: None cited.

Implementation Mechanisms

Direct cost to government for strategies under #1 could be $10–$30 million annually. Cost for strategies under # 2 could be $5 million per year. Could get costs from LA for Rapid Bus signal priority. Could get cost from Minnesota DOT to beef up incident management, could get costs from Minnesota DOT for HOT lane conversion.

[Note: CCS needs to expand implementation discussion.]

Related Policies/Programs in Place

With CMAQ funds, Minneapolis has implemented computerized traffic signals for better traffic flow. The 2007 CMAQ solicitation contains a funding program for TSM. Freeway on-ramp metering program.

Type(s) of GHG Reductions

Primarily CO_2.

Estimated GHG Reductions and Net Costs or Cost Savings

Data Sources: Minnesota Inventory and Forecast

Quantification Methods:

Infrastructure management can reduce emissions both by reducing VMT, and by reducing inefficient operation of the travel network: transit, auto, and truck. To recognize that infrastructure management can reduce emissions in several ways, the goal for this option is expressed in emissions reduction. Proportional reductions are taken from total urban emissions, starting in 2008 and ramping up smoothly to 0.5% in 2025.

Key Assumptions:

The multi-modal/complete streets portion of this option will have mode shift benefits, but these are likely captured in TLU-2.

GHG impacts

	Policy Option	GHG Reductions ($MMtCO_2e$)			Net Present Value 2008–2025 (Million $)	Cost-Effectiveness ($/tCO_2e$)	Level of Support
		2015	2025	Total 2008–2025			
TLU-4	Infrastructure Management	0.04	0.1	0.9	Not quantified		Pending

Key Uncertainties

None cited.

Additional Benefits and Costs

Strategies that reduce congestion can have significant economic benefits to the state.

Some strategies that improve highway system efficiency have safety benefits (reduce vehicle crashes).

Strategies that reduce vehicle idling or stop-and-go traffic patterns will reduce emissions of criteria air pollutants (such as particulate matter), resulting in public health benefits.

Feasibility Issues

None cited.

Status of Group Approval

Pending – [until MCCAG moves to final agreement at meeting #6 or #7]

Level of Group Support

TBD – [blank until MCCAG meeting #6 or #7]

Barriers to Consensus

TBD – [blank until final vote by the MCCAG]

TLU-5. Climate-Friendly Transportation Pricing

Policy Description

State of Minnesota to institute requirements and policies so that drivers more fully pay the full costs of driving – making it more likely for them to choose transportation alternatives, purchase more efficient vehicles, drive less, and/or drive more efficiently (combining trips). This option generally reduces the number of vehicle miles traveled and GHG emissions.

Policy Design

The University of Minnesota's "Full Costs of Transportation in the Twin Cities Region" report concluded that the total cost of a mile of auto travel in the region was between $0.84 and $1.62, with a midrange estimate of $1.14.[20] Drivers do not see all of those costs, for three general reasons.

1. A substantial portion is not variable, meaning that driving less does not save the person money. A good example of this is insurance, paid every 3 or 6 months. One goal of this policy is to increase the proportion of that cost that drivers and society can save by driving less.

2. A substantial portion is paid for by revenue streams that are not necessarily directly related to auto use. For example, property taxes pay for a large portion of the costs of local roads. That nexus may be appropriate for various reasons, but one result is that the cost of vehicle mobility (of all kinds) is not borne by those vehicles.

3. Driving (of all kinds) produces substantial externalities, both positive and negative. Drivers do not see all of either positive or negatives externalities. The impacts of the emitted CO2 are the externality most central to the MCCAG process.

As a result, this set of policies recommends that Minnesota take action in four areas:

- Implement a system of incentives and/or fees to encourage purchase and operation of low-GHG emitting passenger vehicles
- Provide an incentive for auto insurance companies to institute a "pay as you drive" system for policyholders.
- Implement policies and strategies that change the fixed costs of driving to reflect the costs related to VMT and emissions. Possibilities include CO2-based registration fees, VMT tax, congestion pricing, fuel tax and others.
- Use new revenue streams for less GHG-intensive travel options (e.g., public transit, vanpooling, commuter benefits and commuter options).

[20] David Anderson and Gerard McCullough, "The Full Cost of Transportation in the Twin Cities Region", TRG Report No. 5, Center for Transportation Studies, University of Minnesota, August 2000, http://www.cts.umn.edu/trg/research/reports/TRG_05.html

In all cases, design and implement policies with an explicit consideration of equity impacts on both low-income and on rural drivers.

Goals:

For "pay as you drive" insurance, assume market penetration of 25% in 2015 and 50% in 2025.

Timing: Passage of a comprehensive transportation funding package with some or all of these strategies during the 2008 Legislative Session, effective July 1, 2008.

Parties involved: Highway and transit users, automobile manufacturers and retailers, insurance companies, state departments of commerce, transportation, public safety, revenue, finance, and pollution control, Metropolitan Council, Minnesota Department of Transportation.

Other:

1. Increasing the price of driving reduces the number of miles driven and can be accomplished in a variety of ways. Among the possible strategies is increasing the gas tax, which is likely to both reduce the number of miles driven and provide additional transportation revenue to the State of Minnesota. The TWG discussed various issues raised by a gas tax increase, including the economic/personal impact of higher taxes and the constitutional issues that exist around the use of gas tax revenues. In light of these issues and concerns expressed by the current Administration, the TWG makes no recommendation on the gas tax to the MCCAG. However, the group believes that serious consideration should be given to financial strategies that would make the full (including environmental) cost of driving more apparent to drivers.

2. Significant policy innovation and development is occurring in this area. In the future, additional options may exist that would both accomplish the goals of reducing VMT and providing additional revenues to support lower GHG transportation options, including transit. The fact that these ideas, such as cordon pricing, for example, are not analyzed here means only that they are not yet ripe for analysis, not that they are without merit.

Implementation Mechanisms

Increase the Consumer Cost of Driving

Increasing the cost of automobile use can reduce fuel consumption and travel while encouraging the use of alternative fuels and public transit.

Encourage Purchase of Low GHG Vehicles

The state could adopt a variety of programs to increase purchase of fuel-efficient or low-GHG vehicles (including pure electric, hybrid, plug-in hybrid, and other alternative-fuel vehicles). State incentives could include lower registration fees, feebates, and/or tax credits. Higher vehicle registration fees could be charged for vehicles that have lower fuel economy/higher GHG emissions. Vehicle licensing fees could be based upon vehicle weight and/or emissions, with, for example, use of a dollar-per-vehicle-ton multiplier instead of the present broad categories of vehicle weight.

Pay-as-You-Drive Automobile Insurance

The state would encourage and support the provision of pay-as-you-drive auto insurance, possibly including state support for additional pilot programs. This would also require the state commission to conduct an active review of possibilities.

Related Policies/Programs in Place

Minnesota DOT pilot underway to test VMT fees. (No results yet available.)

Pay-as-You-Drive Insurance

1. GMAC and OnStar Offers Low-Mileage Discount Rates[21]

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

Table TLU-3. Title

Miles	Discount
1–2,500	40%
2,501–5,000	33%
5,001–7,500	28%
7,501–10,000	20%
10,001–12,500	11%
12,501–15,000	5%
15,001–99,999	0%

Value Pricing Program PAYD Pilot projects [22]

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

Distance-Based Program

Progressive Insurance[23] 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 discount program, which measures your actual driving habits and allows you to earn discounts on your insurance by showing us how much, how

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

[22] See http://www.fhwa.dot.gov/policy/13-hmpg.htm.

[23] See http://www.progressive.com.

fast and what times of day you drive. TripSense gives you more control over what you pay for insurance, because your driving habits determine your discount."[24]

Type(s) of GHG Reductions

Primarily CO_2

Estimated GHG Reductions and Net Costs or Cost Savings

Data Sources:

The Arizona Public Interest Research 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 over time, and that all drivers in Arizona are eventually covered.

To calculate GHG savings, the Arizona PIRG Education Fund converted Arizona state automobile collision and liability insurance expenditures to an insurance cost per mile ($0.64/mile). If insurance consumers pay 80% of their collision and liability insurance on a per-mile basis, then drivers would be assessed about a $0.051 charge per mile. This per-mile insurance charge would reduce vehicle-miles traveled by about 8%.[25] (To put this charge in context, at 20 mpg, $0.051/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 GHG 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:

2015 reduction = statewide LDV × 4% reduction
2015–2025 reduction = statewide LDV × 8% reduction
Convert to CO_2

[24] See http://tripsense.progressive.com/about.aspx

[25] Elizabeth Ridlington and Diane E. Brown, *A Blueprint for Action: Policy Options to Reduce Arizona's Contribution to Global Warming*, Arizona Public Interest Research 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.

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, then economic efficiency will increase.

Key Assumptions:

State regulation of the Minnesota automobile insurance industry requires insurance companies to offer PAYD insurance

Eventual application of PAYD insurance to 50% of the light-duty fleet.

Key Assumptions: TBD

Key Uncertainties

1. The specifics of the PAYD insurance programs are to be determined.
2. Until there is broader implementation beyond the current pilot programs, the effects of PAYD insurance on driver behavior are subject to significant uncertainty.
3. Until there is broader implementation beyond the current pilot programs, economic impacts on insurance companies are unclear. A common question is, "If distance-based pricing is better, why do insurance companies not offer it without a mandate?"

In general, as has been demonstrated repeatedly in other consumer sectors, individual firms may innovate and not be followed by other firms for a wide variety of reasons, but when the market is transformed through policy changes, the industry adapts and remains healthy. Specifically to vehicle insurance:

> "Individual insurers face several barriers to implementing distance-based pricing. An individual company faces relatively high administration costs to establish an odometer auditing system. Insurance regulators are often unsupportive of pricing innovations. An individual insurance company only captures a small portion of the total benefits, since most financial savings are passed back to customers or accrue to competitors. Insurers do not profit from reductions in uncompensated crash costs, congestion, infrastructure costs, or pollution, or benefit directly from increased equity.
>
> "Insurance companies currently maximize profits by maximizing their gross revenue, because they are dependent on investment income. A pricing strategy that reduces total crashes could reduce profits if regulators or market competition required a comparable reduction in premiums. Although there are potential financial and marketing benefits, these longer-term saving which would have to offset an individual insurer's short-term revenue losses and risks. It is therefore not surprising that few insurers have implemented distance-based pricing." [26]

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. Since lower-income motorists drive their vehicles significantly less on average than higher-income motorists, this

[26] Todd Litman, "Pay-As-You-Drive Vehicle Insurance: Converting Vehicle Insurance Premiums Into Use-Based Charges," *TDM Encyclopedia*, Victoria Transport Policy Institute, March 2007, http://www.vtpi.org/tdm/tdm79.htm

> 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…. Distance-based insurance would provide significant savings to workers during periods of unemployment, when they no longer need to commute."[27]

Other equity issues may be addressed through policy design.

Feasibility Issues

None cited.

Status of Group Approval

Pending – [until MCCAG moves to final agreement at meeting #6 or #7]

Level of Group Support

TBD – [blank until MCCAG meeting #6 or #7]

Barriers to Consensus

TBD – [blank until final vote by the MCCAG]

[27] Litman, Ibid. This article discusses a wide variety of questions about PAYD in some detail and provides additional references.

TLU-6. Adopt California Clean Car Standards

MCCAG please note:

On December 18, 2007, President Bush signed the Energy Independence and Security Act of 2007, which established new federal Corporate Average Fuel Economy (CAFÉ) standards. The TLU TWG spent the holidays trying to understand the relationship between the new CAFÉ standards and the California Clean Car standards, and whether adopting the California standards in Minnesota would produce additional GHG reductions on top of those from the new CAFÉ standards. A preliminary analysis is given in the "Reductions" section below. On January 2, the California Air Resources Board released its analysis of the relationship between California Clean Car and federal CAFÉ, providing much more detail on the subject than had previously been available from any source. In sum, the landscape around this option has changed very quickly.

There is not a consensus in the TWG about how best to serve the MCCAG in this developing situation. The new CARB analysis was released the evening after the TLU TWG meeting on January 2, and no one on the TWG had time to digest it prior to this posting for the MCCAG. In part because the CARB study adds substantial new information to what was available beforehand, the CARB results suggest that the analysis below is incorrect. Whether or not the TWG and CCS decide, after reviewing it, that the CARB study is correct, it is clearly relevant information.

Given all that, after extensive consultation with the DOC and MPCA, the approach taken in this current text is to:

- Share with the MCCAG the TLU-6 draft that was discussed at the TLU TWG meeting on January 2,
- Caveat that analysis with this note up front,
- Point the MCCAG to the new CAFÉ + California Clean Car materials to help them inform themselves but not otherwise evaluate them until we have had a little more time.

Those materials are:

1. Press release on California's petition for review of EPA's denial of its waiver request, January 2, 2008 in the U.S. Court of Appeals for the Ninth Circuit: http://ag.ca.gov/newsalerts/release.php?id=1514&. Petition itself and EPA's denial letter are at the bottom of the page.

2. Petition was supported by "California Air Resources Board Technical Assessment: Comparison of Greenhouse Gas Reductions Under CAFÉ Standards and ARB Regulations Adopted Pursuant to AB1493," January 2, 2008. At: http://www.arb.ca.gov/cc/ccms/ab1493_v_cafe_study.pdf

3. EPA release on its denial of the California waiver, December 19, 2007: http://yosemite.epa.

gov/opa/admpress.nsf/d0cf6618525a9efb85257359003fb69d/41b4663d8d3807c5852573b6008141e5!OpenDocument

4. White House statements on new CAFÉ, December 18, 2007: http://www.whitehouse.gov/infocus/energy/

Again, the text below does not represent a consensus and will almost certainly undergo substantial change. The TLU TWG will continue to work on this POD and bring the MCCAG the best information it can, including a more complete analysis, for the next MCCAG meeting.

Policy Description

Reduce GHG emissions from new motor vehicles (cars and light trucks) sold in Minnesota by adopting legislation equivalent to the California Clean Car Standards (Assembly Bill 1493, also known as "Pavley" the name of the California lawmaker who sponsored the legislation).

California adopted legislation in 2002 (and regulations in 2004) requiring a reduction in GHG emissions from new cars and light trucks sold in that state beginning with model year 2009. California plans an 8-year phase-in. The California standards incorporate the four main global warming emissions including carbon dioxide, methane, and nitrous oxide resulting directly from the operation of the vehicle (tailpipe emissions) as well as hydrofluorocarbon emissions resulting from leakage from or operation of the air conditioning system.

Policy Design

Goals: Adopt California's Clean Car program

Timing: If adopted, the standards would take effect no earlier than the 2011 model year and be phased in over a specified period of time (assuming the legislature would act in 2008).

Parties Involved: Legislature, state, Minnesota auto dealers.

Other: None.

Implementation Mechanisms

Adopt via legislation.

Current legal situation

The Clean Air Act allows California to establish its own vehicle emissions standards, and to implement them after receiving a waiver from the US Environmental Protection Agency. Other states may then adopt the California standards. In December 2007, EPA denied California's waiver request. California and most of the other adopting states have said they will sue to have the EPA decision overturned.

Given this situation, at least two possibilities for moving forward on this policy option present themselves.

1. Minnesota could adopt the California standards, and join the other 17 states in awaiting the outcome of the pending lawsuits.

2. Minnesota could use the time during which the lawsuits are argued to examine the issue in more detail, via a legislative and/or Governor's Task Force.

Related Policies/Programs in Place

Since California's adoption of the Clean Car Standards, 16 additional states have adopted similar standards.[28]

EPA is developing GHG standards for motor vehicles because of a recent Supreme Court ruling.

The just-signed federal "Energy Independence and Security Act of 2007"[29] established a 35-mpg Corporate Average Fuel Economy (CAFÉ) standard for cars + light-duty trucks—that is, 35-mpg for the new vehicle fleet—to be reached by 2020.

The California (AB 1493) standard differs from the new federal CAFÉ standard in many ways, (see Table TLU-X).

Table TLU-4. Title

	California Clean Car	HR 6 "Energy Bill" CAFÉ
1. Type of standard / what is regulated on new cars	GHG emissions per mile	Miles per gallon
2. Main target dates	2016	2020
3. Ending targets, in mpg equivalents	36 mpg[30]	35 mpg

Each of these three differences affects both the likely GHG and other emissions reductions in Minnesota, and the costs/benefits of those reductions.

Type of standard

When calculating GHG emissions per vehicle per mile, California Clean Car takes into account GHG emissions reductions from the air conditioning system as well as the tailpipe, and tailpipe

[28] The 17 states have 105 million registered vehicles, about 42% of the nation's total. In one view, these states are such a large portion of the auto industry sales that automotive manufacturers would likely improve technologies for all vehicles rather than utilize inefficient two-tier production lines.

[29] http://www.whitehouse.gov/infocus/energy/

[30] California Attorney General's Office, "A Comparison of California GHG Standards and the Senate CAFÉ Target," November 9, 2007:

> "The automobile industry is asserting, in its litigation against the States, that the model year 2016 standards are equivalent to 43.2 miles per gallon (mpg) for the PC/LDT1 category and 26.7 mpg for the LDT2 category. In California, the PC/LDT1 category has about 58% of the entire fleet. (Other States have roughly that percentage, or have more LDT2s, and so compliance with California's standards will most assuredly ensure compliance with the California standards adopted by other States.) Thus, even assuming the automobile industry's assertions (which are based solely on tailpipe emissions of carbon dioxide from traditional gasoline powered vehicles), the California standards when fully phased in are equivalent to a fleet-wide average of approximately 36 mpg."

calculations can take into account different fuel types. From the California Attorney General's comparison of the California standards and CAFÉ: [31]

GHG emissions reductions from air conditioning
Analysis by California suggests that substantial, speedy reductions in GHG emissions per vehicle are available from further controlling air conditioner emissions:

> The California GHG standards establish a credit scheme for air conditioning improvements. These improvements include hoses and connections that leak less, refrigerants with less global warming potential, and more efficient systems. We expect most manufacturers to take advantage of these air conditioning credits, given the state of technology and the low costs involved. The credits can be as much as 18.5 CO2-e grams per mile (g/mi) per vehicle. This is the equivalent of between 1 and 3 mpg, with it being more significant with more fuel efficient vehicles. As an example, a manufacturer that meets the California model year 2014 standards through other improvements can meet the model year 2016 standards just by adding air conditioning improvements.

GHG emissions reductions from alternative fuel use

> The California GHG standards also provide credits for the use of alternative fuels. These include ethanol (E85), natural gas, electricity (including plug-ins), and hydrogen. These credits are based on the lifecycle emissions of the fuels, to take into account upstream emissions, and will be calculated based on certification data that the manufacturers provide (as a matter of course) to the California Air Resources Board. Different fuels have different greenhouse gas emissions, even holding fuel economy constant. Because of this, the greenhouse gas "footprint" of cars does not necessarily match their fuel efficiency.
>
> These alternative fuel credits have great potential. For example, for every vehicle run exclusively on corn-based E85, automobile manufacturers will receive a credit of 26% of that vehicle's tailpipe emissions due to the significantly lower upstream emissions from growing and producing corn-based ethanol (the credit would be even higher if the source of the ethanol were to change to cellulosic or sugarcane). For a car run exclusively on electricity (and with zero tailpipe emissions), the regulation sets the emissions at 130 CO2e g/mi (to account for greenhouse gases in producing the needed electricity), well below the fleet-average standard for model year 2016.

Both California and CAFÉ set up various arrangements for trading credits which also add flexibility.

Type(s) of GHG Reductions

Carbon dioxide, methane, and nitrous oxide resulting directly from the operation of the vehicle (tailpipe emissions)

Hydrofluorocarbon emissions from leakage from or operation of the air conditioning system.

Estimated GHG Reductions and Net Costs or Cost Savings

Summary
The new CAFÉ standards, having been signed by President Bush, now become part of the Minnesota baseline. The TLU TWG anticipates that the MCCAG will want to know whether California Clean Car would reduce GHG emissions additively to the new law. They would.

[31] Ibid.

Because California Clean Car standards reach *higher* mpg-equivalencies *sooner*, they would produce additional GHG emissions reductions in the MCCAG timeframe on top of the new CAFÉ standards.

Because the California Clean Car standards allow more ways to reduce emissions than does CAFÉ, all else being equal, the California standards should be able to produce equivalent improvements in MPG more cheaply.

Analyzing the Energy Bill's impact on the baseline, and thus the additional reductions that could be gained from California Clean Car, is made very difficult by the fact that the Energy Independence and Security Act of 2007 not only sets new MPG targets, but also changes the way those targets will be implemented. The law requires the National Highway Traffic Safety Administration (NHTSA) to develop the details of the new approach. To the best of our knowledge, no one has yet published a useful guide to what most observers agree is potentially confusing legislative language. As a result, the analysis below is necessarily both rough, and draft.

GHG reductions

Table TLU-5. Title

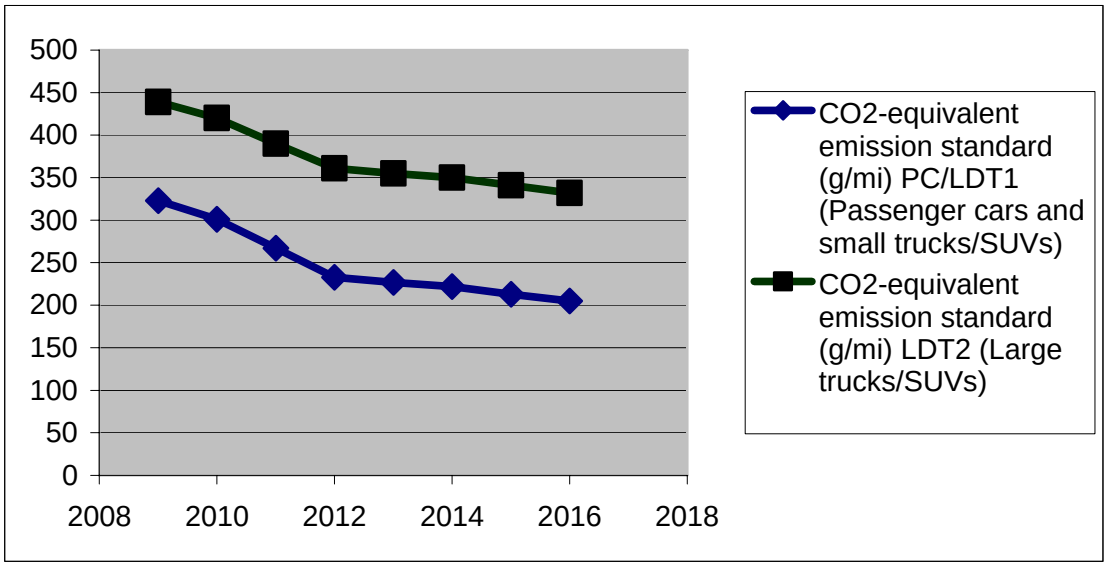
	MMtCO_2e		
	2007	**2015**	**2025**
No action—trend (light-duty)	22.97	24.10	25.44
Proposed action: California Clean Car		Being revised to reflect new CAFÉ	Being revised to reflect new CAFÉ
Reduction		Being revised to reflect new CAFÉ	Being revised to reflect new CAFÉ

GHG emissions impacts analysis DRAFT AND UNDER REVIEW.

Table TLU-6. California Clean Car–specific standards, by vehicle type and model year

	CO_2e Emission Standard (g/mi)		Change Relative to Pre-New-CAFÉ			
Year	**PC/LDT1 (Passenger cars and small trucks/SUVs)**	**LDT2 (Large trucks/ SUVs)**		**LD1**	**LD2**	**Average @50/50**
2009	323	439	2009–2012			
2010	301	420				
2011	267	390				
2012	233	361		–28%	–18%	–23%
2013	227	355	2013–2016			
2014	222	350				
2015	213	341				
2016	205	332		–7%	–5%	–6%
			2009–2016	–37%	–24%	–30%

Figure TLU-3. Title



Modeling turnover in response to a changing mix of manufacturer offerings, together with a regulatory environment that would change first on adoption of the California standard, and then again in 2012, is complex and beyond the scope of this process. Further, the new CAFÉ standards essentially leave intermediate (pre-2020) standards to NHTSA to set, so we can only do a rough analysis of the impacts of California Clean Car on top of new CAFÉ.

In order to provide *general* estimates of the impacts of California Clean car in Minnesota on top of new CAFÉ, we made the following assumptions:

Assumption 1: Following the analysis by the state of California, in 2016, California Clean Car reduces emissions per vehicle equivalent to 1 mpg relative to new CAFÉ in 2020.

Assumption 2: 100% of the light-duty fleet turns over in 15 years. Thus, 6.7% of the fleet turns over every year.

Simplifying assumption: do the analysis using only the last year, when each approach hits full strength.

Thus, whatever else happens, in 2025:

60% (9 years/15-year lifetime) has turned over to the final California standard.

33% (5 years/15-year lifetime) has turned over to the final CAFÉ standard.

There is not, as far as we know, a forecast for the Minnesota LD total fleet number for 2025. Total LD vehicle population in 2004 was 4.4 million. If for the sake of calculation we say there will be 5 million in 2025, then:

5 million × 60% = 3,000,000 California vehicles

5 million × 33% = 1,665,000 CAFÉ vehicles in the baseline
1,335,000 more vehicles, at 1 mpg-e better.

If each vehicle travels 12,000 miles/year, then

1,335,000 more vehicles × 12,000 miles = 16,020,000,000 miles

16,020,000,000 miles @ 35 mpg = 457,714,285 gallons
16,020,000,000 miles @ 36 mpg = 445,000,000 gallons
12,158,730 gallons = ~0.13 $MMtCO_2e$

If the reductions are so small, why are all the states denied the California waiver suing? Because Minnesota is just one, relatively small state. The earlier California reductions, multiplied times the 42% of the nation's vehicles covered by current California Clean Car commitments would produce substantially larger impacts:

> Environmental Defense has done computer modeling comparing the two scenarios: the new CAFÉ standards alone versus the new CAFÉ standards coupled with EPA approval of the waiver. […]
>
> If we look at the 17 states that were ready to take action if EPA had approved, by 2020 the new CAFÉ standards alone would reduce greenhouse gases in those states by 418 million metric tons. However, if EPA had approved the waiver and allowed these states to proceed with improved standards, the cumulative reduction in heat-trapping gases is estimated at 723 million metric tons. That is more than 300 million metric tons less global warming pollution.
>
> Furthermore, the improvements in cumulative greenhouse gas reductions with the waiver in place would continue through following years.
>
> More important, the 17 states that were denied the waiver account for 105 million registered vehicles or 42% of the traffic in the nation. These states are such a large portion of the auto industry sales that automotive manufacturers would be compelled to improve technologies for all vehicles rather than utilize inefficient two-tier production lines.[32]

Environmental Defense has not, as far as we know, released its modeling (yet), so we have not checked their approach.

Costs/savings summary
Pre-new-CAFÉ, CARB estimated that the ultimate GHG standards will add an average cost of $1,064 per vehicle, and that the fuel savings will more than offset those additional costs. CARB further estimates that the fuel savings, by starting immediately, will immediately begin offsetting the higher costs of a leased or financed vehicle.

The auto industry estimates the cost per vehicle will be, on average, $3,000 for complying with these requirements, and that the fuel savings will not offset that higher cost. The auto industry estimates that the higher initial cost will delay the turnover of the fleet to cleaner, safer vehicles.

These figures remain the same under the new CAFÉ, but a portion of those costs will be incurred under the new baseline. Isolating the cost of the additional California reductions would require an analysis of auto industry cost curves, beyond the scope of this analysis. As noted above,

[32] John M. DeCicco, "Do-nothing EPA sadly stops others from trying," *Contra Costa Times*, December 29, 2007, http://www.contracostatimes.com/columns/ci_7836988?nclick_check=1

California believes that its inclusion of credits from air conditioning measures increases manufacturer freedom and thus reduces costs relative a tailpipe-only approach.

Data Sources:

California Environmental Protection Agency Air Resources Board. "Regulations to Control Greenhouse Gas Emissions from Motor Vehicles: Final Statement of Reasons." August 4, 2005, http://www.arb.ca.gov/regact/grnhsgas/fsor.pdf

California Environmental Protection Agency Air Resources Board. "Fact Sheet: Climate Change Emission Control Regulations." December 10, 2004, http://www.arb.ca.gov/cc/factsheets/cc_newfs.pdf

National Resources Defense Council. "Comments on the Proposed Adoption of Regulations by the California Air Resources Board (CARB) to Control Greenhouse Gas Emissions from Motor Vehicles." September 23, 2004, http://www.nrdc.org/globalWarming/crh0904.pdf

Daniel Sperling, et al. "Analysis of Auto Industry and Consumer Response to Regulations and Technological Change, and Customization of Consumer Response Models in Support of AB 1493 Rulemaking." Institute of Transportation Studies, University of California, Davis. June 1, 2004, http://www.its.ucdavis.edu/publications/2004/UCD-ITS-RR-04-17.pdf

California Environmental Protection Agency Air Resources Board. "ARB Staff Reponses to Comments Raising Significant Environmental Issues Regarding the Proposed Regulations to Control Greenhouse Gas Emissions from Motor Vehicles." August 4, 2005, http://www.arb.ca.gov/regact/grnhsgas/att3.pdf.

Quantification Methods:

Key Assumptions:

Issue—The California Air Resources Board (CARB) and automakers disagree on the cost of compliance with California's new Clean Car standards (AB 1493). CARB estimates that the additional cost of compliance for a new car in model year 2016 will be approximately $1,000. The net benefit to consumers, accounting for reduced fuel consumption, will be slightly positive. Automakers contend that the price will be in the vicinity of $3,000 and that the net benefit to consumers will be negative.

CCS's conclusion—CARB's estimates are more rigorously produced and are likely to be closer to actual values.

Cost summary

A review of $/ton estimates prepared for the Pavley-type regulation for California Air Resources Board (CARB), Northeast States for Coordinated Air Use Management (NESCAUM), and CCS produces an estimate of between $117 saved for each metric ton of CO_2e reduced at the high end, and roughly a third of that (~$39 saved for each ton) at the low end. To be conservative, we used $39 saved per ton reduced.

Key Uncertainties

Predicting how long it will take to resolve lawsuits over this issue is beyond the ability of this group. Clearly the law will be in litigation for some time.

According to auto manufacturers, vehicles for the 2011 model year are already being designed. A new engine lines take 6–7 years to develop. Because of the timelines and requirements in the California GHG standards that occur in the 2010–2013 timeframe, the auto industry says that the only way to meet the standards in the early years would be to drop models. The current highest court rulings on these claims found that in the Court's view, sufficient existing technology existed to allow manufacturers to meet the California standards.[33,34]

Additional Benefits and Costs

Reducing the total amount of on-road fuel burned in Minnesota would, all else being equal, reduce emissions of ground-level pollution, with accompanying reductions in health impacts.

Feasibility Issues

Manufacturers have stated under oath that they cannot meet the California GHG standards using their current mix of models. They would attempt to comply by severely restricting model availability.

There is some concern that California standards may constrain the sale of E85 vehicles. This is due to the PZEV standard and the testing on worst case blend of fuel (E10). It may require switching back to metal fuel tanks, which add weight and packaging issues. Also, SULEV tailpipe emissions are difficult at cold temperatures required by CARB. HC emissions exceed the standard before the catalyst is warmed up.

This claim is disputed by the Union of Concerned Scientists which, through its UCS Vanguard program, has designed a full range of vehicle types which meet the California standards and run on E85. www.ucsusa.org/clean_vehicles/vehicles_health/ucs-vanguard.html. The fact that California Clean Car gives credit for E85 vehicles also suggests that this is unlikely to be a major barrier.

Status of Group Approval

Pending – [until MCCAG moves to final agreement at meeting #6 or #7]

Level of Group Support

TBD – [blank until MCCAG meeting #6 or #7]

Barriers to Consensus

TBD – [blank until final vote by the MCCAG]

[33] http://www.vtd.uscourts.gov/Supporting%20Files/Cases/05cv302.pdf

[34] John M. Broder, "Federal Judge Upholds Law on Emissions in California," *New York Times*, December 13, 2007, http://www.nytimes.com/2007/12/13/washington/13emissions.html

TLU-7. "Fix-it-First" Transportation Investment Policy and Practice

Policy Description

Legislature to require that state and federal transportation investments be prioritized in the following order:

1. Maintenance of existing roads, and

2. New and expanded roads designed to serve higher density, more compact, pedestrian friendly development in priority growth areas (examples might include downtowns, town centers, Main Streets, neighborhood hubs, regional centers, transit corridors, transit station areas, and others).

Significantly reduce investment in new roads and roadway expansion that accommodates/ encourages low-density development and more and longer vehicle trips.

This strategy will increase trips by bicycling and walking and reduce the number and length of vehicle trips thus reducing emissions of GHGs. (Part of VMT reduction goal along with TLU-1, -2, -5, -9, and -10)

Policy Design

Goals: Place a much higher priority on maintenance of existing roads. Strategically target roadway expansion dollars as described above. Expansion projects comprise approximately 40% (approximately $600 million) of $1.6 billion in transportation investments planned for 2008–2011 in the Twin Cities metropolitan area. (See metro Transportation Improvement Plan [TIP] document p. 48).

[Note: Need to review Statewide Transportation Improvement plan (STIP) to get dollar amounts and percentages for Greater Minnesota.]

Timing: Legislation drafted in 2008–2009 and adopted in 2009; changes in investments starting 2011 (federally required Transportation Improvement Program document with listed projects is already in place for 2008–2011). Need legislation adopted by 2009 that identifies goals, investments policies including targeted growth areas, and implementation steps.

Parties Involved: Minnesota DOT, local units of government, metropolitan council, legislature, developers, business community.

Other: None cited.

Related Policies/Programs in Place

Recent Actions in Minnesota:

Regional highway plan in Metropolitan Council Transportation Policy Plan states that highway expansion investments are only considered after preservation and management investments have been funded.

Type(s) of GHG Reductions

Mostly CO_2

Estimated GHG Reductions and Net Costs or Cost Savings

Contributes to total VMT goal; not separately analyzed.

Key Uncertainties

None cited.

Additional Benefits and Costs

Safety from improved existing infrastructure.

Feasibility Issues

None.

Status of Group Approval

Pending – [until MCCAG moves to final agreement at meeting #6 or #7]

Level of Group Support

TBD – [blank until MCCAG meeting #6 or #7]

Barriers to Consensus

TBD – [blank until final vote by the MCCAG]

TLU-9. Workplace Tools to Encourage Carpooling, Bicycling, and Transit Ridership

Policy Description

Reduce emissions by requiring certain employers and encouraging other employers to offer a Commuter Benefits program at the workplace to increase the use of transit, ride-sharing and non-motorized transportation. Commuter Benefits include: reducing the amount of free or subsidized parking; providing paid or pre-tax transit passes or mode-neutral transportation allowances, guaranteeing rides home for non-drive alones; providing bicycle parking and employee lockers, telecommuting programs, and converting employee ID cards to transit passes. Also, reduce emissions by requiring large employers (over 200 employees) to develop and implement "transit demand management" plans ("TDM") that customize commuter benefits and transit-supportive building design to specific building locations.

Policy Design

Goals:

Commuter Benefits

- All Minnesota non-rural employers over 200 employees located within an incorporated municipality offer Commuter Benefits (CB) programs
- All colleges and universities offer Commuter Benefits
- All government units offer Commuter Benefits, especially the State of Minnesota
- State adopts employee parking management and incentive programs to promote alternatives to drive alone (SOV) commuting.

Commuter Choice

- State establishes a public/private partnership to develop and run telecommuting centers that offer office-type services in locations close to commuters' residences.
- State would establish best practices in TDM, and assist employers of over 200 employees in developing and implementing TDM plans. (State is already committed to doing this in the Twin Cities Metro through Metro Transit and five transportation management organizations).

State Tax Credits for Employer-provided Commuter Benefits

- Expand the current Minnesota Employer Transit Pass tax credit to include more employers and more commuters (i.e. non-profit organizations and commuters that bike, carpool, or telecommute).

Timing: Implement by 2010.

Parties Involved: Metropolitan Council, Minnesota State College and University, University of Minnesota, other colleges, municipalities, transit providers, Transportation Management Organizations, employers, state legislature.

Other: None

Implementation Mechanisms

Expand current Minnesota Employer Transit Pass tax credit.

Establish technical assistance for employers.

Related Policies/Programs in Place

Employee Discount Transit Passes: Metro Transit offers passes for regular route bus service for sale to employers at a 30% special discount rate for their employees to promote mass transit and reduce both congestion and emissions in the Metro area, http://www.metrotransit.org/metroPass.asp

Type(s) of GHG Reductions

Primarily CO_2.

Estimated GHG Reductions and Net Costs or Cost Savings

	Policy Option	GHG Reductions ($MMtCO_2e$)			Net Present Value 2008–2025 (Million $)	Cost-Effectiveness ($/tCO2e)	Level of Support
		2015	2025	Total 2008–2025			
TLU-9	Workplace Tools to Encourage Carpooling, Bicycling, and Transit Ridership	0.3	0.4	5.3		–$1	Pending

Data Sources:

ICF Consulting, "Analyzing the Effectiveness of Commuter Benefits Programs," Transit Cooperative Research Program Report 107, 2005[35]

ICF Consulting, "Strategies for Increasing the Effectiveness of Commuter Benefits Programs," Transit Cooperative Research Program Report 87, 2003.[36]

Quantification Methods:

We could not find a breakdown of Minnesota employers by size above 50 employees (64% of Minnesotans work for employers with 50 or more employees). We will work with DOC to get the right number. In the meantime, we assume that half that, or 32%, work in covered employers.

Key Assumptions:

GHG impacts

- After the introduction of a commuter benefits program at covered companies, transit usage increases by 25% in 2015, and 30% in 2025.

[35] http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_107.pdf

[36] http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_87.pdf.

More than half of the surveys reported an increase in transit riders between 10% and 40%, and nearly one-quarter reported increases of more than 60%. Two surveys—one in San Jose in 1997 and one in Atlanta in 2003—suggest that transit ridership more than doubled after a transit benefits program was implemented.[37]

Thus:

Table TLU-7. Title

	2015	2025
Percent of VMT that is commuting-related	25%	25%
Percent Minnesota employees affected	32%	32%
Average percent VMT reduction per workplace	25%	30%
Total reduction	**704,913,896**	**993,972,902**

Costs
The costs of providing commuter benefits at the work place vary widely. Although contributing to employee commute benefit financially produces the largest mode shifts, simply allowing an employee to participate in a pre-tax transit pass deduction actually saves the employer money, and generally produces almost as much mode shift. Employers also save money on parking. In a national survey of employers about why they did or did not offer commuter benefits, the main concern was not cost, but the hassle factor of adding an additional benefit.

At the IRS mileage rate of $0.49/mile, cost savings to commuters would total over a $400 million a year in 2025.

Talbe TLU-8. Title

	2015	2025
Total reduction	704,913,896	993,972,902
@ $0.49/mile	$345,407,809	$487,046,721

At the University of Minnesota's *Full Cost* study rate of $0.84/mile, in 2025 total social savings from reduced VMT would be over $800 million a year.

Since the policy option does not require a workplace contribution to a commute benefit, only that one be offered, which can be satisfied through a no-cost pre-tax option, we do not subtract employer costs from these benefits.

Because these numbers start to look very large over the time frame of the study, we will consult with the TWG on how to convey.

Key Uncertainties

None cited.

[37] ICF Consulting, "Analyzing the Effectiveness of Commuter Benefits Programs," p. 43.

Additional Benefits and Costs

Commute times are the most congested time of day; reductions in peak-period commuting can have substantial benefits for traffic flow and congestion relief.

Feasibility Issues

None cited.

Status of Group Approval

Pending – [until MCCAG moves to final agreement at meeting #6 or #7]

Level of Group Support

TBD – [blank until MCCAG meeting #6 or #7]

Barriers to Consensus

TBD – [blank until final vote by the MCCAG]

TLU-11. Heavy-Duty Idle Reduction

Policy Description

Reduce idling-induced emissions from heavy-duty engines (diesel trucks, buses, and railroad locomotives) by providing increased

- Electrical hook-ups to power heating, cooling, and other needs while stopped;
- Education;
- Access to loans to speed technology adoption; and
- Other policies.

Policy Design

Currently available technologies, such as anti-idle equipment, newer and more efficient locomotive engines, and hybrid equipment have high capital improvement costs. Smaller operators may lack capital to invest in these technologies even though fuel savings would make them cost effective. Other added costs may not contribute to increased return on capital and thus may only be weighed as public priorities to the extent they are valued for their emission reduction potential. Likewise, investments in future technologies may require a distinct public commitment to funding emission reductions from hydrocarbon-based fuels.

The goal of this policy is to invest state resources in public–private partnerships to help private operators overcome these market imperfections.

Goals: TBD.
Timing: TBD

Parties Involved: TBD

Other: TBD

Implementation Mechanisms

Increase Fuel Efficiency

- Upgrade equipment to meet EPA mandated emissions standards
- Encourage operating and loading practices that reduce GHG emissions
    - Improve idling practices
    - Efficiently use capacity
    - Fuel efficient operating techniques
    - Encourage carriers to participate in programs such as the EPA's Smartway Partnership http://www.epa.gov/smartway/

Incentivize the Purchase of GHG Reduction Technology

Implement one or both of the following programs for truck idle reduction technology

- Establish a tax incentive program with the following guidelines:
  - Allow a nonrefundable tax credit with unused credit expiring after five years
  - The maximum credit per year is 50% of the purchase and installation price of idle reduction equipment with a cap of $3000 per unit
  - Qualifying equipment must reduce emissions and/or reduce energy consumption by the vehicle.
  - Credit sunsets at the end of calendar year 2011
- Establish a grant program with the following guidelines:
  - Provide a 50% matching state grant for the purchase and installation price of idle reduction equipment with a cap of $3000 per unit
  - Qualifying equipment must reduce emissions and/or reduce energy consumption by the vehicle.
  - Credit sunsets at the end of calendar year 2011
- Establish a similar program for locomotive idle reduction equipment

Truck Stop Electrification

- Encourage private truck stop owners to install electrification and climate control units by providing tax incentives.
- Instruct Minnesota DOT to study the feasibility of installing and maintaining electrification and climate control units at Minnesota DOT rest areas and truck stops.

Related Policies/Programs in Place

Idle Reduction Program: The MPCA, in cooperation with the US EPA, offers loans to help small trucking companies pay for idle reduction devices such as auxiliary power units. This equipment can reduce fuel consumption by 75%, which conserves resources, helps achieve energy independence, and reduces the emissions that contribute to soot and smog. During 2006, 30 loans were issued ranging from $7,500 to a maximum of $50,000, http://www.pca.state.mn.us/programs/sbomb_loan.html.

EPA Smartway Transportation Partnership, (http://www.epa.gov/otaq/smartway/idlingtechnologies.htm#truck-mobile).

Type(s) of GHG Reductions

CO_2, black carbon

Estimated GHG Reductions and Net Costs or Cost Savings

GHG reductions:

Need a goal

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

EPA Smartway Transportation Partnership (http://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.

Data from EPA's MOBILE6 model to estimate the proportion of CO_2 emissions attributable to Class 8 trucks.

Data from US DOE/EIA *Annual Energy Outlook 2005* to estimate the amount of fuel consumed annually per truck.

Quantification Methods: The estimated reduction in CO_2 emissions from reduced idling was calculated based on estimating the portion of emissions and fuel consumption in the Minnesota inventory that were attributable to Class 8 diesel trucks, estimating the portion of the total fuel consumption that would be consumed during idling, and applying a targeted reduction of 80% to this amount starting in 2008 and a reduction of 100% starting in 2015.

Key Assumptions: This analysis will assume idle reductions are achieved only by Class 8 diesel truck population; these trucks idle for an average of 6 hours per day; they consume 0.8–1.2 gallons of diesel per hour during idling; and that a 80% (by 2010) or 100% (by 2020) reduction of diesel idling from these Class 8 trucks will be achieved.

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/gallon diesel cost.

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

Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

Pending – [until MCCAG moves to final agreement at meeting #6 or #7]

Level of Group Support

TBD – [blank until MCCAG meeting #6 or #7]

Barriers to Consensus

TBD – [blank until final vote by the MCCAG]

TLU-12. Voluntary Mobile Source Emissions Reduction programs

Policy Description

Mobile emissions account for X% of Minnesota's total GHG emissions profile. Of this number, mobile emissions from private fleets operating in Minnesota account for Y%. There are approximately X cars and light-duty fleet vehicles in Minnesota and Y trucks.

There are many ways for businesses to voluntarily reduce GHG emissions from their fleets. Typically, fleets will determine a methodology to measure their GHG impact, review their current vehicle mix and vehicle operation parameters, and then analyze options to see where efficiencies can be gained. Efficiencies generally come through improved driver behavior, more efficient vehicles (either new models or technology enhancements to existing models), and/or improved operating processes (e.g., more efficient routing systems).

This current state in private fleet efficiency programs points to certain challenges. First, there is no centralized support to help fleets manage these initiatives. Fleets have little support in selecting which metrics to measure and how to do it. Second, funding resources for retrofits and other technology-based efficiency solutions are limited and may be restricted to specific vehicle types. Part of this challenge is necessary because some solutions for heavy-duty trucks are inherently different from what a fleet of sedans would be facing. Third, there is no centralized, Minnesota-based registry for businesses to post, track, and share fleet-based GHG improvements.

This policy aims at creating new services and adding additional support to existing incentive based programs that help private fleets reduce their GHG emissions.

Policy Design

Goals: The primary goal of this policy would be to reduce the amount of total fleet generated GHG emissions 20% by 2025.

Data needed to validate goal:

- Annual numbers of private fleets operating in Minnesota (going back to 2000)
- Annual average annual CO_2 emissions from these fleets (number gathered from assumptions on annual miles traveled, average MPG, and percentage of fuel type) (going back to 2000)
- Assumption on number of businesses that would participate in the program and the amount of their targeted emissions reductions

Levers that fleet managers can operate to mitigate the GHG impact of their fleets include:

- Managing fleet size (e.g., retiring unused vehicles),
- Right-sizing engines for business need (e.g., choosing smaller vehicles that still do the job),
- Retrofitting engines for efficiency and safety (project green Fleet),

- Utilizing low-carbon fuels (e.g., E85, biodiesel),
- Purchasing new OEM technology (e.g., hybrid, C/LNG, propane, electric),
- Purchasing aftermarket technology (e.g., APUs, PHEV conversion),
- Investing in process efficiencies (e.g., driving fewer miles through route planning), and
- Promoting driver education (e.g., speeding, tire inflation).

Private fleet reductions will need to be measured in two broad categories: total fleet GHG emissions from fuel combustion and normalized GHG statistics (e.g., GHG per mile, GHG per vehicle). This would ensure that companies whose overall emissions may be growing due to business growth can still participate by enabling a growing fleet to operate more efficiently.

As lead-by-example, the State-owned fleet should immediately start working toward the 2025 goal of a 25% reduction of GHG emissions. (See also Cross-Cutting CC-3, State Lead By Example.)

Timing: Immediate; many of these projects are ongoing and will be expanded in the near future.

Parties Involved: Minnesota Environmental Initiative (Project Green Fleet and Clean Air Minnesota) and multiple public and private funders and partners; Minnesota Trucking Association; Minnesota Chamber of Commerce; Minnesota Center for Environmental Advocacy; GE Fleet Services; MPCA; EPA SmartWay Program; Hennepin County; Minnesota Regional Railroad Association; Midwest Clean Diesel Initiative, Minnesota Climate Registry

Other: Idle reduction activities in other areas of the country have shown that drivers can safely cut idling time by approximately 15 minutes per day through the use of idle reduction techniques. Based on this information, and average fuel use data from the US EPA,[38] 15 minutes of idle reduction per day on 500 school buses could result in diesel fuel savings of over 11,000 gallons per year, or over 900 gallons per month. Fuel savings can be higher when training and awareness are coupled with data logging and reporting activities.

Currently available technologies, such as anti-idle equipment, newer and more efficient locomotive engines, and hybrid equipment can add significantly to engine owners' capital improvement costs. For example, in rail operations, smaller locomotive operators may lack capital to invest in these technologies even though future fuel savings would make them cost effective. Other added costs may not contribute to increased return on capital and thus may only be weighed as public priorities to the extent they are valued for their emission reduction potential. Likewise, investments in future technologies such as fully electric equipment and facilities, require a distinct public commitment to funding emission reductions from hydrocarbon-based fuels.

[38] U.S. Environmental Protection Agency. (1998). "Emission Facts, Idling Vehicle Emissions," EPA Document No. EPA420-F-98-014, Washington, DC: EPA Office of Mobile Sources.

Implementation Mechanisms

Establish a Fleet Efficiency Consortium within the (need to choose: Department of Transportation, MPCA, Other). This Consortium would be comprised by volunteer businesses with fleets as well as state and additional resources with fleet efficiency expertise. The Consortium would select a methodology for calculating and tracking mobile GHG emissions that would be standardized among participating fleets. Headcount and overhead cost for Consortium from Public sector will need to be estimated.

Create a source of funds in the amount of $X that supports existing successful voluntary GHG reduction efforts at fleets (e.g., Project Green Fleet, MPCA APU Project, MPCA Small Business Environmental Improvement Loan Project). See types of programs available for fleet managers in "Types of GHG reductions." Amount of funds required will be based on average cost for multiple types of upgrades to various fleet types (e.g., APUs for heavy-duty truck fleets, hybrids for sedan fleets).

Add mobile emissions to the state Climate Registry project to ensure emissions are tracked appropriately and that volunteer businesses are recognized for their efforts.

Methodology—Create a standard methodology to establish baseline processes (CO_2e modeling), selection criteria, emissions reporting standards, and additional requirements for mobile source emission reduction plans.

Use of funds—These programs would continue existing programs and help fund the purchase of lower-emitting fleet vehicles, such as HEVs, as well as investments in aftermarket technology such as diesel retrofits, PHEV conversions, and APUs.

State liaison—Create a set of standards to administer funding program. Management would include application and selection process for grants as well as recognition programs and best practices.

Related Policies/Programs in Place

Project Green Fleet (PGF) is the primary Minnesota collaborative for voluntary, diesel and mobile source emission-reduction projects. PGF currently works with dozens of school districts, the Minnesota Pollution Control Agency (MPCA), the Minnesota Departments of Health and Education, Laidlaw, First Student, bus operator associations, tribes, private school bus and diesel fleet owners, and units of local government.

PGF will have done the following retrofits by the end of 2007:

- More than 500 school buses statewide
- 41 heavy-duty trucks
- 10 transit buses

PGF uses only EPA and/or CARB verified technology. Depending upon the combination, each retrofit will guarantee a minimum emission reduction of between 25% and 50%, depending upon the pollutant.

Idle Reduction Program: The MPCA, in cooperation with the U.S. EPA, offers loans to help small trucking companies pay for idle reduction devices such as auxiliary power units. This equipment can reduce fuel consumption by 75%, which conserves resources, helps achieve energy independence, and reduces the emissions that contribute to soot and smog. During 2006, 30 loans were issued ranging from $7,500 to a maximum of $50,000. However, these funds are limited and the program's definition of "small business" for the purposes of the loan availability is prohibitive. http://www.pca.state.mn.us/programs/sbomb_loan.html

Many private truck stops have electrification or window mounted climate control units available. Advertising those locations may generate greater use.

Examples need to be quantified in terms of number of fleets impacted, number vehicles impacted (already done for PGF), capital cost, and annual GHG benefits (actual and expected).

Type(s) of GHG Reductions

Vehicles have broad GHG impacts. From the combustion of fuel, carbon dioxide, nitrous oxide, methane, ozone precursors, and black carbon are released. In addition from the operation of air conditioning units, hydrofluorocarbons (HFCs) are released.

A recent U.S. House of Representatives committee reported that black carbon's contribution to climate change is second only to carbon dioxide.[39] Black carbon, or soot, results from the incomplete combustion of fossil fuels. While black carbon absorbs heat when airborne, it stays in the atmosphere for a relatively short period of time and mitigating such emissions would provide immediate climate change and health benefits.

Estimated GHG Reductions and Net Costs or Cost Savings

At a minimum, with the equipment currently used in PGF, for every 100 buses retrofitted the estimated emission reductions are CO, 860 lbs; PM2.5, 120 lbs; and VOCs, 620 lbs. The emission and exposure reductions will be tracked over at least a 5-year period. (Source: Minnesota Environmental Initiative and MPCA)

As an estimate, for 500 school buses, fuel savings of 11,250 gallons per year, or 937 gallons per month, are based on average reported idle reductions achieved in other areas of the country, and vehicle fuel use and emissions data provided by the US EPA. Idle reduction activities, which include anti-idling policies and driver training, have shown that drivers can safely cut idling time by approximately 15 minutes per day through the use of idle reduction techniques.[40] US EPA data shows that diesel-powered buses use approximately 0.5 gallons of fuel per hour when idling.[41] Assuming that school buses operate 180 days of the year, 15 minutes of idle reduction on 500 school buses results in fuel savings of 11,250 gallons per year, or 938 gallons per month. Fuel savings can be higher when training and awareness are coupled with data logging and reporting activities.

[39] U.S. House of Representatives, Committee on Oversight and Government Reform, October 18, 2007.

[40] Estimate from Massachusetts Department of Environmental Protection, May 6, 2006.

[41] U.S. Environmental Protection Agency. "Emission Facts, Idling Vehicle Emissions," EPA Document No. EPA420-F-98-014, Washington, DC: EPA Office of Mobile Sources, 1998.

Data Sources: TBD

Quantification Methods: TBD

Key Assumptions: Each gallon of gasoline not burned represents 20 pounds of CO_2 not emitted and each gallon of diesel fuel not burned represents almost 23 pounds of CO_2 not emitted.

Key Uncertainties

None cited.

Additional Benefits and Costs

Estimates indicate that PGF's early efforts will directly reduce emissions exposure for approximately 30,000 school children statewide. Given the goal in this Option of doubling current programs, would reduce direct emissions exposure for another 30,000 school children.

If Minnesota continues to experience poor air quality, it could be designated as a non-attainment area for ground-level ozone or fine particulate matter. A 1998 Minnesota Chamber of Commerce study estimates that it would cost Minnesota businesses $189 to $266 million annually to comply with regulatory requirements associated with non-attainment for ground level ozone. Other significant restrictions, such as loss of federal transportation funding and limits on expansion, affect businesses in non-attainment regions. This program will help Minnesota avoid that designation.

Mobile source emission-reduction options gained greater relevance to climate change with the release of a study recently in the journal Nature. The study points out the significance of ground-level ozone levels to climate change improvement activities. Mobile sources are one of the primary sources of ground-level ozone precursors. According to the study, "Ozone could be twice as important as we previously thought as a driver of climate change." The study reports that "ozone near the ground damages plants, reducing their ability to mop up carbon dioxide from the atmosphere."

Feasibility Issues

None cited.

Status of Group Approval

Pending – [until MCCAG moves to final agreement at meeting #6 or #7]

Level of Group Support

TBD – [blank until MCCAG meeting #6 or #7]

Barriers to Consensus

TBD – [blank until final vote by the MCCAG]

TLU-13. Reduce Maximum Speed Limits

Policy Description

Reduce maximum speed limits on highways in Minnesota to improve fuel economy and reduce GHG emissions per mile traveled.

Policy Design

Goals: Reduce maximum speed limit on urban interstates to 55 mph (from 65 mph today) and to 60 mph on rural interstates (from 70 mph today). Speed limits will be 55 on highways not specified by statute (same as today). This strategy reduces GHG emissions per mile traveled but does not reduce vehicle miles traveled.

Timing: Change law during 2008 legislative session with an effective date of January 1, 2009 so that there is enough time to educate the public about the change.

Parties Involved: Highway users, Minnesota Department of Transportation, Minnesota State Patrol, local law enforcement

Other: None

Notes: The speed a vehicle is driven has a major impact on fuel economy. While each vehicle reaches its optimal fuel economy at a different speed (or range of speeds), gas mileage usually decreases rapidly at speeds above 55-60 mph according to the US EPA and the US Department of Commerce.

Implementation Mechanisms

Would require increased enforcement so cost for state and local law enforcement would be required.

Should ask Minnesota DOT for a cost estimate for the change over signs and educational materials for the current higher speed limits.

Related Policies/Programs in Place

Speed limits are currently 55 on urban interstates and 65 on rural interstates in nine states (Alaska, Connecticut, Delaware, Illinois, New Jersey, Oregon, Pennsylvania, Rhode Island, and Vermont. The only state that specifies 60 mph for a rural interstate is Hawaii.

Type(s) of GHG Reductions

Primarily CO_2.

Estimated GHG Reductions and Net Costs or Cost Savings

Quantification Methods:

Calculate difference in fuel and time from:

Diesels:	70 mph at ~6 mpg to	60 mph at ~7 mpg
Gasoline vehicles:	70 mph at ~26 mpg to	60 mph at ~30 mpg

Value for the cost of time:

Diesels:	$25.53
Gasoline vehicles:	$14.76/hour

Basis: National after-tax wage rate.

Data Sources:

U.S. Department of Labor, Bureau of Labor Statistics, "Establishment Data; Hours and Earnings," Table B-14 and "Employer Costs for Employee Compensation—December 2005," Table 10.

U.S. Environmental Protection Agency, Office of Transportation and Air Quality, Smartway Transport Partnership, "A Glance at Clean Freight Strategies: Reducing Highway Speed," EPA420-F-04-007, February 2004.

U.S. Environmental Protection Agency, Office of Transportation and Air Quality, MOBILE6 model, documented in "User's Guide to MOBILE6.1 and MOBILE6.2: Mobile Source Emission Factor Model," EPA420-R-03-010, August 2003.

Jeffrey Ang-Olson and William Schroeer, "Energy Efficiency Strategies for Freight Trucking: Potential Impact on Fuel Use and Greenhouse Gas Emissions," *Transportation Research Record 1815*, Transportation Research Board of the National Academy of Sciences, Washington, DC, 2002.

Quantification Methods:

Fuel Savings—The diesel fuel consumption from Class 8 diesel trucks was multiplied by 60% (low) or 80% (high) to account for the amount of fuel consumed at speeds above 60 mph from 2008 through 2014. Starting in 2015, the speed for Class 8 trucks was reduced to 55 mph. This fuel consumption was then multiplied by 50% to account for the expected penetration rate of this measure. This quantity was then multiplied by the percentage increase in fuel economy. The ratio of reduction in fuel consumption was then multiplied by the baseline CO_2 emissions to estimate the reduction in CO_2 from this measure. Fuel cost savings were calculated by multiplying the per unit fuel cost by the number of gallons reduced.

Increased Driving Time—This was estimated as the product of the increased time required for traveling the same distances at 60 mph (prior to 2015) or 55 mph (2015 and later) rather than 70 mph multiplied by the hourly trucking industry cost.

Same process for automobiles.

Key Assumptions: 60%–80% of Class 8 diesel truck travel (fuel consumption) is spent at speeds above 60 mph, assumed to be at 70 mph on average. 50% of this truck travel is assumed to be reduced to 60 mph or 55 mph (Ang-Olson and Schroeer).

Each one mile per hour reduction of speed from 70 mph to 55 mph yields a fuel economy increase of 0.1 miles/gallon (EPA) for heavy-duty diesel trucks.

Average hourly truck transportation wage is $17.22/hour (BLS), with an industry average overhead rate of 1.48 (BLS).

Base fuel economy assumed to be 6.42 mpg (EPA MOBILE6 model); assumed to increase to 7.42 mph with this measure.

Key Uncertainties

The ability to enforce a speed limit significantly lower than current policy is uncertain.

Additional Benefits and Costs

A significant additional benefit of lowering speed limits is reduced injuries and fatalities. The Canada Safety Council writes on its web site, that "As speed increases over 100 km/h,(60 mph) the fatality rate of vehicle occupants goes up exponentially. For example, the chances of being killed in a vehicle traveling at 120 km/h (72 mph) are four times higher than at 100 km/h." (60 mph).

The Canada Safety Council also notes that "A recent study examined the impact of higher travel speeds on US rural interstates after the repeal in November 1995 of the national speed limit. Researchers found states that had increased their speed limits to 75 mph (120 km/h) experienced a shocking 38% increase in deaths per million vehicle miles than expected, compared to deaths in those states that did not change their speed limits. States that increased speed limits to 70 mph (112 km/hour) showed a 35% increase in fatalities."

Feasibility Issues

TBD

Status of Group Approval

Pending – [until MCCAG moves to final agreement at meeting #6 or #7]

Level of Group Support

TBD – [blank until MCCAG meeting #6 or #7]

Barriers to Consensus

TBD – [blank until final vote by the MCCAG]

TLU-14 Freight Mode Shifts: Intermodal and Rail

Policy Description

Transportation of freight by railroad generally results in less fuel use and GHG emissions than transportation by truck. This option would support the expansion of intermodal rail service for Minnesota shippers through public/private partnerships. In addition, the state would strive to increase the competitiveness of rail rates for all Minnesota shippers.

Implement incentive policies to reduce GHG emissions from private mobile, freight sources and fleets. State owned fleets shall reduce GHG emissions by 25% in 2025.

Develop public/private partnerships to support mode shifts to rail, and decrease truck VMT relative to the baseline.

Policy Design

Improved rail service and the ability of the rail system to meet future demand *implicitly* leads to system-wide GHG reductions by shifting projected freight and passengers to rail or by preventing a shift to a less efficient mode. Improvements to the rail system or associated equipment can also have *direct* impacts on GHG emissions. Locomotive idling produces significant emissions and can be mitigated by reducing system congestion and choke points and by using improved technology.

Goals

Goals: As the population of Minnesota and the world increases, so does the volume of freight. The ten year freight forecast indicates a 25% increase in total freight by 2017. Moving goods in the most economical way is an essential component of our economy and lives. Additionally, seeking policies that balance the need for GHG reduction and consumer affordability will best serve our future.

The TWG highlights for the MCCAG the importance of the freight sector, especially given its rapid growth. Minnesota DOT has in progress a statewide freight plan. The TWG is not yet ready to develop its own emissions reduction targets, but recommends that the in-progress study ensure that its goals include a substantial freight mode shift towards growth in rail freight, and explicitly address the GHG emissions implications of its Freight Plan, with respect to the Governor's GHG commitments.

- Decrease inefficiencies and limitations in the existing Minnesota rail network and increase overall capacity by reducing system congestion, bottlenecks, and chokepoints.
- Prevent modal shift of freight from rail to truck due to lack of capacity. Maximize the amount of freight that can be moved by rail in order to sustain projected growth in domestic and international goods movement in the State.

[CCS will propose an overall target goal #.]

Timing: Policy implementation should commence during the 2008 legislative season.

Parties Involved: Minnesota DOT, Minnesota PCA, MEI, Minnesota Center for Environmental Advocacy, Minnesota Chamber of Commerce, US EPA, Minnesota Regional Railroad Association, Minnesota Trucking Association.

Other: None.

Implementation Mechanisms

- Create more effective freight transition between modes at intermodal yards, ports and airports
- Establish tax credits for rail expansion/preservation
- Direct Minnesota DOT to preserve existing corridors and consider new regional rail options in the State Transportation Infrastructure Plan (STIP)
- Increase Road User Fees (i.e., fuel taxes, registration taxes, MVST)
- Increase road user fees to alleviate congestion and bottlenecks, thereby reducing in-transit idling. Moving goods more efficiently reduces cost and GHG emissions.

Related Policies/Programs in Place

The Minnesota PCA small business environmental low-interest loan program has been made available to trucking companies, however funds are very limited and the PCA definition of small business for the purposes of the loan is very prohibitive.

Many private truck stops have electrification or window mounted climate control units available. Advertising those locations by mapping them at public rest stops may generate greater use.

Project Green Fleet (Minnesota PCA)

Various EPA funding programs

Grant aids allocated in the Federal energy bill. Section 1112 of the bill sets aside $200 million for short-line (class II and III) rail improvements.

Types(s) of GHG Reductions

Primarily CO_2 emissions.

Estimated GHG Savings and Costs per $MtCO_2e$

Data Sources: US EPA, US DOE, WRI

Quantification Methods: TBD

Key Assumptions: TBD

Key Uncertainties

The success of this strategy depends on sufficient shipper demand and willingness of the railroads to provide intermodal service.

Additional Benefits and Costs

By shifting freight from truck to rail, this option could result in small additional benefits related to highway congestion and highway safety.

Feasibility Issues

As noted above, the success of this strategy depends on sufficient shipper demand and willingness of the railroads to provide intermodal service. These factors are largely outside government control.

Status of Group Approval

Pending – [until MCCAG moves to final agreement at meeting #6 or #7]

Level of Group Support

TBD – [blank until MCCAG meeting #6 or #7]

Barriers to Consensus

TBD – [blank until final vote by the MCCAG]