Appendix J
Transportation and Land Use Policy Recommendations

Summary List of Alaska Climate Change Mitigation Policy Recommendations

Policy No.	Policy Recommendation	GHG Reductions ($MMtCO_2e$) 2015	2020	2025	Total 2010–2025	Net Present Value 2010–2025 (Million 2005$)	Cost-Effective-ness ($/tCO_2e$)	Level of Support
TLU-1	Transit, Ridesharing, and Commuter Choice Programs	0.002	0.003	0.005	0.046	$29.9	$651	Unanimous
TLU-2	Heavy-Duty Vehicle Idling Regulations and/or Alternatives	0.004	0.009	0.009	0.095	$24.3	$255	Unanimous
TLU-3	Transportation System Management	0.006	0.006	0.006	0.092	–$9.7	–$105	Unanimous
TLU-4	Promote Efficient Development Patterns (Smart Growth)	0.019	0.043	0.066	0.501	Net Savings	NQ	Unanimous
TLU-5	Promotion of Alternative-Fuel Vehicles	0.026–0.084	0.054–0.173	0.09–0.288	0.669–2.139	$207.3–$494.8	$135–$740	Unanimous
TLU-6	VMT and GHG Reduction Goals in Planning	0.019	0.043	0.066	0.501	NQ	NQ	Unanimous
TLU-7	On-Road Heavy-Duty Vehicle Efficiency Improvements: a. SmartWay®	0.050	0.075	0.084	0.930	–$52.3	–$56	Unanimous
	b. Phase Out	0.025	0.012	0.000	0.198	$20.9	$106	
	c. Public Fleets	0.016	0.033	0.037	0.364	NQ	NQ	
TLU-8	Marine Vessel Efficiency Improvements	0.012	0.022	0.032	0.269	$20.4	$76	Unanimous
TLU-9	Aviation Emission Reductions	NQ	NQ	NQ	NQ	NQ	NQ	Unanimous
TLU-10	Alternative Fuels Research and Development	NQ	NQ	NQ	NQ	NQ	NQ	Unanimous
	Sector Total Before Adjusting for Overlaps	**0.210**	**0.363**	**0.500**	**4.444**	**$364.3**	**$82**	
	Sector Total After Adjusting for Overlaps	**0.187**	**0.313**	**0.423**	**3.850**	**$364.3***	**$95***	
	Reductions From Recent Actions	**0.397**	**0.531**	**0.732**	**5.995**	**NQ**	**NQ**	
	Sector Total Plus Recent Actions	**0.412**	**0.844**	**1.155**	**9.845**	**NQ**	**NQ**	

*Does not include any cost for policies TLU-4, TLU-6, or TLU-7c, but does include emission reductions for those policies.

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $/$tCO_2e$ = dollars per metric ton of carbon dioxide equivalent; NQ = not quantified; VMT = vehicle miles traveled.

Note: Negative numbers indicate cost savings.

TLU-1. Transit, Ridesharing, and Commuter Choice Programs

Policy Description

Under this policy, the state would provide the leadership and resources necessary to help expand Alaska's public transit and ridesharing system. To alter Alaskan driving habits to reduce greenhouse gas (GHG) emissions, issues of convenience, choice, and finance must be major elements in expanded transit and ridesharing operations. Public education will also be paramount to success.

To reduce GHG emissions though expanding transit opportunities, commuters need to be provided with progressive incentives to change their behavior. Intense, long-term education must be undertaken to demonstrate the financial savings for transit users. Current successful van routes from Wasilla into Anchorage appear to offer cost savings to the users. The overall system connections, from parking lots to rail to bus routes, must meet citizen demands to get from home to workplace and lead to a public awareness of system functionality. Piecemeal programs will fade away with the lack of public buy-in.

The majority of GHG reduction with increased transit and ridesharing services is expected to be achieved in the state's larger population areas.

If funding is not allocated to initiate the larger programs, then beginning with individual large employers incorporating financial incentives may be the best method to achieve success.

Policy Design

This policy would:

- Develop park-and-ride systems that are coupled to increased urban transit schedules. Estimates of new infrastructure will be needed in cold areas to keep car engines heated.
- Develop outlying collector routes with buses or vans to high-employment destinations—e.g., university campuses, oil industry offices, and state offices. A daytime shuttle or van offer to provide for personal lunchtime trips has been demonstrated in the private workplace.
- Provide funding support to expand the current transit systems' operations to increase the frequency of in-town schedules.
- Develop rail tie-in along existing track. Diesel multiple-unit cars from Wasilla to Anchorage and North Pole–University of Alaska (UA) Fairbanks campus through Fairbanks would be leased on an initial winter basis. Funding would be provided to invest in these cars and a program operator, a possible statewide or regional transit authority.
- The Alaska Department of Transportation and Public Facilities (ADOT&PF) will help achieve an expansion of transit services in Alaskan communities, including coordinated transit solutions, and will seek additional funds to support this expansion.

Goals:

- Double transit ridership in Alaska by 2025, compared to 2007 levels.
- Double vanpooling in Alaska by 2025, compared to 2007 levels.
- Increase the carpool mode share in Alaska by 2025.
- Support the development of a Regional Transportation Authority in Anchorage and Fairbanks to integrate all alternatives into one coordinated regional system. This system would eventually include rail, bus transit, paratransit, and ferries, where appropriate.

Timing: See above.

Parties Involved: Local transit authorities, Alaska Railroad, local and state governments, ADOT&PF.

Other: None.

Implementation Mechanisms

Alaska should develop legislation that provides transit funding that augments current Future Teachers of Alaska grants and/or should pass through funds in combination with local government operational funding. A state funding source could be an incentive for small local governments to consider implementing limited transit operations in central core areas.

To the extent that commuter van ridesharing is operated primarily by rider subscription, this approach may offer a fractional reduction in GHG emissions in less densely populated locales associated with urban work environments.

Related Policies/Programs in Place

Transit in Anchorage

Since 2002, People Mover[1] ridership in Anchorage has exceeded estimations. Service enhancements through route restructuring and increases in operations, combined with high fuel prices, have attracted more commuters, resulting in 2008 ridership being the highest in People Mover's history. Future plans include improving service frequency to a bus every half hour from 6 a.m. to 6 p.m., as well as increased peak-hour frequency on seven routes in corridors that have the highest ridership.

While the trend in Anchorage is matching the success of transit systems in the lower 48 states, Anchorage riders are more responsive to service increases. The industry standard for new service is that a 10% increase in service will result in a 7% increase in riders. Changes made since 2002 have increased service 18%, with a corresponding 28% increase in riders, indicating a strong latent demand for public transportation.

[1] See: http://www.muni.org/transit1/index.cfm.

Anchorage's Long Range Transportation Plan[2] addresses high-frequency, high-performance express bus service on the Glenn Highway corridor to pick up 5%–7% of the peak-period commuters.

Currently, the transit fixed-route fleet has 55 buses. People Mover's long-range goals double the size of the fleet. In the short term, approximately $7 million is needed to replace the aging fleet, and another 20–25 buses are needed to meet the goals of the increased frequency on key corridors. The increased transit availability and ridership provide a direct benefit to reducing GHG and managing congestion by reducing the number of overall vehicles on the road.

Transit and Intelligent Transportation Systems in Anchorage

Anchorage's People Mover system has implemented a number of intelligent transportation systems (ITS) in the past 5 years. Scheduling and dispatching systems, bus schedule information via a 24-hour telephone system, and most significantly, TransitRealTime provide the actual time a bus will arrive at a stop via the Internet and signs at major bus stops. This technology is being implemented to enhance the reliability, predictability, and attractiveness of transit services for existing and potential bus riders.

Ridesharing in Anchorage

Anchorage's Ridesharing program provides carpool- and vanpool-matching services for residents in Anchorage and metropolitan areas. Ridesharing's primary objective is to encourage and support alternatives to single-occupant-vehicle (SOV) commuters by coordinating with employers, disseminating information, sponsoring vanpool services, and providing rideshare-matching services.

The current most significant need in addressing ridesharing is the commuting traffic between Mat-Su and Anchorage. Currently, 700 residents travel in 49 vanpools between Mat-Su and Anchorage and in 3 vanpools between Anchorage and Girdwood. Park-and-ride lots are full, and more than 700 residents are on the waiting list to enroll in the vanpool program. The lack of vans used in the rideshare program is the largest obstacle. Anchorage and Mat-Su are working to solve this need, including seeking financial support from the state legislature.

Statewide Actions

The September 2008 Governor's Coordinated Transportation Task Force approval of Administrative Order #243 is an important step in advocacy for transit improvements.[3]

Types(s) of GHG Reductions

Primarily carbon dioxide (CO_2). Small reductions in nitrous oxide (N_2O) and methane (CH_4).

[2] See: http://www.muni.org/transplan/.

[3] See: http://gov.state.ak.us/admin-orders/243.html.

Estimated GHG Reductions and Net Costs or Cost Savings

Table J-1. Estimated GHG reductions and costs of or cost savings from TLU-1

Policy No.	Policy Recommendation	GHG Reductions ($MMtCO_2e$)				Net Present Value 2010–2025 (Million $)	Cost-Effective-ness ($/t$CO_2$e)
		2015	2020	2025	Total 2010–2025		
TLU-1	Transit, Ridesharing, and Commuter Choice Programs	0.002	0.003	0.005	0.046	$29.9	$651

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $/t$CO_2$e = dollars per metric ton of carbon dioxide equivalent.

Data Sources:

- *Transit and Vanpool Ridership and Passenger Miles Traveled in Anchorage and Fairbanks:* National Transit Database, 2007. Available at: http://www.ntdprogram.gov/ntdprogram/data.htm.
- *Transit and Vanpool Fuel Use:* National Transit Database, 2007. Available at: http://www.ntdprogram.gov/ntdprogram/data.htm.
- *Transit Operating Costs:* National Transit Database, 2007. Available at: http://www.ntdprogram.gov/ntdprogram/data.htm.
- *Mode Shift Factor for Transit Systems in Small Urban Areas:* American Public Transportation Association (APTA), "Recommended Practice for Quantifying Greenhouse Gas Emissions from Transit (Draft)," August 2008.
- *Fuel Prices*: U.S. Department of Energy (DOE) Information Administration (EIA), *Annual Energy Outlook 2009* (AEO2009). Available at: http://www.eia.doe.gov/oiaf/aeo/.

Quantification Methods:

- Passenger miles traveled (PMT) in transit and vanpool vehicles was assumed to double, along with ridership, by 2025.
- PMT was multiplied by the mode shift factor from APTA guidance to determine the number of vehicle miles traveled (VMT) displaced by bus, rail, and demand-response ridership. For vanpool ridership, we consider PMT to replace VMT on a 1:1 basis. This assumption is consistent with the methodology that the City of Anchorage uses to calculate the VMT displacement of its vanpool program. Vanpools target the commuter population, whose main alternative mode tends to be SOV driving—i.e., driving alone.
- The increase in VMT displaced in each year was multiplied by standard emission factors to arrive at GHG reductions.
- An increase in buses and vans in service was calculated assuming that average passenger-load factors would increase by 50% by 2025. This is equivalent to a 2.7% annual improvement in load factors. We assume that the average route miles traveled per vehicle will not change. Therefore, 33% more vehicles will be required to double transit ridership.

- We calculated transit vehicle emissions using data on diesel and gasoline consumption reported by transit agencies to the National Transit Database. We assume that by 2025, 25% of the bus fleet will be diesel-electric hybrid vehicles, with 30% better fuel economy than conventional diesel buses (based on the experience of King County, Washington [WA] Metro Transit). We assume that other new vehicles purchased will use the same fuel types and achieve the same mileage as current vehicles.
- For policy cost, we calculated the following components:
  - *Capital Cost Increase:* We calculated the cost of new vehicles based on current vehicle prices. An average 35-foot bus costs about $350,000 (Luke Hopkins, Fairbanks North Star Borough). An average van costs about $40,000 (Paula Kangis, City of Anchorage). We assume that other capital costs, including facilities, stations, systems, guideways, and replacement costs for existing vehicles, are unaffected by this policy.
  - *Operating Cost Increase:* We assume that operating costs for each mode will increase by 33% to 2020, proportional to the increase in transit service.
  - *User Cost Savings:* Users of transit save money on vehicle expenses for every mile they do not drive their cars. Users save on gas, depreciation of vehicle value, and maintenance expenses. Fuel costs are calculated from the *Annual Energy Outlook 2009*.[4] Depreciation and maintenance costs are drawn from http://www.commutesolutions.org.

Key Assumptions: Ridership increase begins in 2010 and rises steadily to 2025. Vehicle passenger loads increase by 50% to 2025.

Key Uncertainties

The appropriate mode shift factor for the proposed transit and vanpool expansions may be higher than estimated in APTA guidance. The guidance estimates that only one-third of transit trips would have been made in a unique vehicle trip if no transit were available. Commute trips on transit are more likely to replace an SOV trip than non-commute trips.

Additional Benefits and Costs

Transit expansion in urban areas can facilitate more compact development patterns and help reduce roadway congestion. Both of these benefits produce additional reductions in GHG emissions.

Feasibility Issues

None identified.

Status of Group Approval

Completed.

Level of Group Support

Unanimous consent.

[4] See: http://www.eia.doe.gov/oiaf/aeo/.

Barriers to Consensus

None.

TLU-2. Heavy-Duty Vehicle Idling Regulations and/or Alternatives

Policy Description

Alaska will focus on reducing idling times for diesel and gasoline heavy-duty vehicles, buses, and other vehicles through a combination of statewide anti-idling regulations and by promoting and expanding the use of technologies that reduce heavy-duty vehicle idling. These technologies include vehicle equipment modifications, such as auxiliary power units (APUs), direct-fired heaters, and automatic engine shutdown/startup system controls. Other effective means of idle reduction come through the use of ITS technology, such as electronic weigh station bypass systems. These systems allow safe and legal vehicles to pass a weigh station, at highway speed, without stopping for inspection. This bypass eliminates the need for a heavy-duty vehicle to idle its engine for a period from as few as 10 minutes to as many as 60–90 minutes.

Recognizing Alaska's severe arctic and subarctic winter conditions, accommodations must be made for below-zero winter temperatures. APUs, for example, can ameliorate the effects of idling, but idling cannot be entirely prohibited, such as when extreme weather conditions warrant.

Alaska will encourage the adoption of statewide statutes or regulations and local ordinances to promote idle reduction for all vehicles. All vehicle owners, public and private, will be subject to these regulations and to the penalties prescribed in the statute or regulations.

Policy Design

Alaska will develop and implement a statewide regulation banning extended idling by heavy-duty vehicles given accommodations for below-zero arctic and subarctic winter conditions. As with all regulations, they must be enforceable, with a reasonable expectation of penalty for noncompliance. Alaska will also provide local governmental units with model language for adoption as local anti-idling ordinances.

Alaska will encourage and promote reduced idling through programs aimed at increasing voluntary adoption of idle-reduction technologies. Components of such an effort should include collaborative outreach and education timed with the implementation and enforcement of a statewide anti-idling regulation, and seeking funding for pilot projects and demonstrations as well as funds available though any federal or other programs to evaluate the effectiveness of various idle-reduction technologies.

Alaska may also provide additional incentives to fleet or individual heavy truck owners to purchase and install idle-reduction technologies on their vehicles. These incentives may come in the form of full grants, matching grants, tax credits, and low- or no-interest loans.

Alaska may also provide incentives to assist the private fleets to convert some of their vehicles to hybrid operation. Such engine technology is or soon will become available in the marketplace.

Goals: Accomplishment of the following goals should result in significant reductions in GHG emissions and should also show significant fuel savings.

- ADOT&PF will lead by example with the installation of idle-reduction technology and/or idle-reduction policies/procedures for its fleet of heavy-duty vehicles. This goal will be phased to accomplish installation of these technologies or adoption of policies; 20% will be so equipped by 2012, with the remaining 80% equipped by 2020, with exception for vehicles used only seasonally.
- Local governments and school districts will install idle reduction for their fleets at a rate similar to or slightly lagging that of ADOT&PF.
- Commercial and private fleets will be encouraged through regulation and through incentives to meet the same timetables.

Timing:

- The target date for the development and implementation of anti-idling regulations for state and local governments is the end of 2011. Legislation can be introduced in the 2010 session of the Alaska Legislature to establish the statutory authority to require that regulations and local ordinances be adopted to implement these requirements.
- The target date for partial and full implementation of idle-reduction technologies by all parties is 20% by 2012 and the remaining 80% by 2020, with exception for vehicles used only seasonally.

Parties Involved: The Alaska Department Environmental Conservation (DEC) will be the lead agency to adopt and enforce the statute or regulations on both public and private vehicle owners. Other parties include ADOT&PF, the Alaska Departments of Commerce and Community Development and Revenue, local governments, school districts, commercial and private truck fleets, tour bus operators, trucking associations, unions, shippers, and metropolitan planning organizations (MPOs), including the Fairbanks Metropolitan Area Transportation Study (FMATS) and the Anchorage Metropolitan Area Transportation Solutions (AMATS).

Other: None.

Implementation Mechanisms

- Alaska DEC will adopt idling regulations for private and public agency vehicles by the end of 2011. Legislation can be introduced in the 2010 session of the Alaska Legislature to establish the statutory authority for these regulations. The regulation will include concise language so that the agency with enforcement responsibilities is clearly delineated and has full authority to enforce the ordinance. The language should also include any exemptions to the idling policy that can be easily observed. In developing the idling regulation, the U.S. Environmental Protection Agency's (EPA’s) recent Model State Idling Law should be reviewed for potential language.
- Alaska DEC will develop a program to provide incentives for idle-reduction technologies by the end of 2010. Funding can come from both state and federal sources.

- For vehicles it owns, ADOT&PF will install idle-reduction technologies and/or promote idle reduction through internal policies and training.
- The state will also provide information and education to targeted audiences. Trucking companies should be encouraged to do their own supervision. Outreach materials should emphasize the fuel-saving benefits, reductions in toxic emissions, and reduced engine wear associated with reducing idling. The state should provide information to fleet carriers, shippers, retailers, bus companies, school districts, and others involved in the diesel fleet industry, indicating the economic and environmental benefits of applying idle-reduction technologies. The state should identify best practices within the industry and recognize companies with these best practices in place within Alaska, to encourage companies to select these carriers for their shipments.

Related Policies/Programs in Place

U.S. EPA-approved idle-reduction devices are excluded from the 12% federal excise tax under Section 206 of the Energy Improvement and Extension Act of 2008 (Public Law 110-343). EPA has published a complete list of idle-reduction devices that are eligible for the retail excise tax exemption. The types of devices include fuel-operated heaters, battery air conditioning systems, APUs/generator sets, thermal storage systems, and shore connection systems. The complete list of EPA-approved idle-reduction devices can be found at: www.epa.gov/smartway/transport/what-smartway/idling-reduction-fet.htm.

Types(s) of GHG Reductions

Primarily CO_2. Small reductions in N_2O and CH_4.

Estimated GHG Reductions and Net Costs or Cost Savings

Table J-2. Estimated GHG reductions and costs of or cost savings from TLU-2

Policy No.	Policy Recommendation	GHG Reductions ($MMtCO_2e$)				Net Present Value 2010–2025 (Million $)	Cost-Effective-ness ($/tCO_2e$)
		2015	2020	2025	Total 2010–2025		
TLU-2	Heavy-duty Vehicle Idling Regulations and/or Alternatives	0.004	0.009	0.009	0.095	$24.3	$255

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

Data Sources:

- *Vehicle Populations for State and Local Government and Private and Commercial Vehicles:* Federal Highway Administration (FHWA), *Highway Statistics 2006* (Tables MV-7 and MV-9). Available at: http://www.fhwa.dot.gov/policy/ohim/hs06/index.htm.
- *Alaska Population Forecasts:* Alaska Department of Labor, *Alaska Economic Trends: Population Projections 2007 to 2030*, October 2007. Available at: http://labor.state.ak.us/trends/oct07.pdf.

- *Fuel Prices:* EIA, *Annual Energy Outlook 2009,* Early Release, Table 12. Available at: http://www.eia.doe.gov/oiaf/aeo/index.html.

Quantification Methods:

- *Highway Statistics 2006* provides limited data on heavy-duty truck populations in Alaska. Based on these data, we estimate the population of private- and state and local government-owned combination trucks (truck tractors) and buses in Alaska (2,584 buses and 4,323 truck tractors in 2007). Data from the state Department of Motor Vehicles (DMV) suggest there are private 9,994 trucks over 12,000 pounds (lbs) gross vehicle weight registered in the state (a portion of which is combination trucks). Thus, we assume 5,671 heavy-duty single-unit trucks (9,994 minus 4,323).
- The population of heavy-duty trucks in future years was estimated to increase proportionally to the population of the state until 2025.
- The number of hours of idling reduced was calculated from assumed total hours of idling, target penetration rates, and assumed policy effectiveness. Fuel savings and emission reductions were calculated based on hours of idling reduced.
- Cost was calculated based on the installation costs of anti-idling technologies and the fuel cost savings incurred by anti-idling measures. To estimate costs, we assumed the following:
  - Installation of PonyPack APUs on new combination trucks, at a cost of $10,000 each.
  - Fuel use in PonyPack is 0.2 gallons per hour (gal/hr), compared to the average rate of 0.75 gal/hr for the truck engine.
  - For other heavy-duty vehicle types (buses and single-unit trucks), no equipment installation is required. Idle reduction is achieved through training, education, and regulation.

Key Assumptions:

- Buses and heavy-duty trucks idle an average of 312 hours per year (hr/yr) each. (Assumption from the Puget Sound Clean Air Agency and the Washington State Department of Ecology. Consistent with estimates from the California Air Resources Board.)
- There is no substantial overnight idling of long-haul vehicles in Alaska.
- 25% of idling is discretionary idling that can be reduced by vehicles installing anti-idling technologies or complying with new regulations. Discretionary idling includes idling during vehicle loading and unloading, idling at rest stops, and extended idling at station stops (for transit vehicles). The remaining 75% of idling is non-discretionary, which includes vehicles stopped in traffic, operating power equipment, emergency situations, and when the engine is needed to keep the vehicle warm.
- 20% of vehicles will be compliant by 2012; 100% of vehicles will be compliant by 2020. Reductions begin in 2011.

Key Uncertainties

None identified.

Additional Benefits and Costs

Reducing idling by heavy-duty vehicles and locomotives would reduce particulate matter (PM) emissions. Many scientific studies have linked breathing PM to a series of significant health problems, including aggravated asthma, difficult breathing, chronic bronchitis, heart attacks, and premature death. Diesel PM is of specific concern, because it is likely to be carcinogenic to humans when inhaled.

Feasibility Issues

None identified.

Status of Group Approval

Completed.

Level of Group Support

Unanimous consent.

Barriers to Consensus

None.

TLU-3. Transportation System Management

Policy Description

Alaska would seek to reduce GHG emissions from the transportation sector through improvements to transportation system management. These efforts would focus on the improvement, management, and operation of the transportation infrastructure, with a focus on the roads and highway systems.

Policy Design

- Roundabouts can reduce traffic queuing and delay, thus saving fuel and reducing GHG emissions; they also have safety benefits. ADOT&PF will encourage the installation of roundabouts.
- To improve fuel economy and reduce GHG emissions per mile traveled, the state will reduce maximum speed limits on state highways to 60 miles per hour (MPH), or lower where appropriate. Additional benefits are reduced traffic injuries and fatalities.
- ADOT&PF will continue its commitment to providing a multimodal transportation system by continuing to invest in transit, bike, and pedestrian facilities. ADOT&PF spends an average of roughly $5 million annually on these facilities and expects this level of commitment to continue or increase.
- All urban areas (i.e., >5,000 population) will continue to include consideration of bike and pedestrian facilities in their urban transportation plans.
- ADOT&PF, in partnership with urban communities, will work to improve traffic signal synchronization on all state-managed routes (mostly arterials) in urban areas (i.e., >5,000 population) by 2012. Signal synchronization reduces start/stop traffic on arterial routes, as the lights are timed to continuously move traffic forward at the target pace. This strategy also helps reduce traffic queuing, thus saving fuel and reducing GHG emissions.
- ADOT&PF will complete conversion of all traffic lights to light-emitting diode (LED) bulbs by 2010 and will work with cities to convert roadway luminary lighting under city jurisdiction. LED bulbs significantly conserve energy, and thereby indirectly reduce GHG emissions.
- All urban transportation plans will be updated by 2012, with an emphasis on operations and safety. The operations elements in urban transportation plans will improve traffic flow and reduce conflict points, and can result in turn lanes, reconfiguration of intersections, or access control. In metropolitan areas, the transportation plans will meet air quality conformity requirements for criteria pollutants.
- Congestion management plans for all high-traffic-volume construction projects will be considered by ADOT&PF. These plans implement strategies to keep traffic flowing through construction zones, thus reducing fuel use and GHG emissions.
- Access management will continue to be pursued consistent with Alaska statutes and ADOT&PF policies. Access management is intended to reduce the number of street and

- The state will install traffic management technologies and provide public information of travel conditions on high-volume commuter routes, especially those lacking practical bypasses. ADOT&PF, along with partner communities, will complete by 2010 a comprehensive ITS Plan for the Glenn Highway corridor between Anchorage and the Mat-Su valley.
- The state will improve the manner in which incidents and accidents on high-volume routes are processed, and will require drivers involved in crashes to pull away from travel lanes. Implementation will require educational signs, and possibly a statutory change requiring moving vehicles to the side of a road in non-injury accidents. The state will also accelerate accident-scene processing, following the Washington state model (faster accident scene cleanup, faster documentation of scene evidence, while not compromising investigation of facts); this may require some trial deployment and testing of the new approach in the courts.

Goals: See above.

Timing: See above.

Parties Involved: ADOT&PF, FMATS and AMATS, local governments.

Other: None.

Implementation Mechanisms

Roundabouts

ADOT&PF, FMATS, and AMATS should evaluate potential intersection locations for roundabout installation.

ADOT&PF will:

- Report on its roundabout evaluation criteria and list all locations evaluated annually for potential roundabout installation, to be no less than 5 intersections/locations annually.
- Encourage the installation of roundabouts when the installation is based on sound engineering principles.
- Work cooperatively with local governments seeking information on the principles of roundabout installation.
- Assist the cities and boroughs in their analysis of roundabout suitability for intersections under their jurisdiction.
- Consider roundabout treatment at planned right-angle intersections for new construction and upgrades and when completing routine safety reviews.

ADOT&PF has previously adopted roundabouts in the 2007 *Alaska Strategic Highway Safety Plan* as a preferred solution, where practicable, for safety reasons (see: http://dot.alaska.gov/stwdplng/shsp/index.shtml).

ITS Plan

Routes, such as the Glenn Highway between Anchorage and the Mat-Su Valley, experience considerable traffic during peak conditions. Due to a lack of alternative routes, such incidents as accidents and spilled loads can tie up traffic for hours. ADOT&PF, along with partner communities, will strive to complete by 2010 a comprehensive ITS Plan for the corridor that would:

- Evaluate and prioritize installation of speed and congestion sensors and Internet-accessible cameras.
- Use these technologies to monitor conditions, respond to incidents, and inform the public of incidents and congestion.
- Use all available means of communication, including radio, e-mail/text message, Variable Message Signs, Highway Advisory Radio, and Internet media.
- Deploy (perhaps on a trial basis) courtesy patrols that can respond to breakdowns, vehicles out of fuel, flat tires, and accident scenes.
- Capture better data on incidents so that progress can be evaluated (e.g., benefit-cost analyses).

Related Policies/Programs in Place

LED Lights

To improve the energy efficiency of traffic signal and roadway lighting, several efforts are underway in Anchorage. The Municipality has already installed LED lights in all of its traffic signals to reduce energy costs. It is estimated that the energy cost for traffic signals alone is reduced by about 30%. In addition, the Municipality is reviewing all outdoor lighting, which includes over 16,000 streetlights, as well as pedestrian lighting, parking garage lighting, and trail lighting. Streetlights currently utilize a 150 watt (W) - 400W high-pressure sodium (HPS) fixture, which operates approximately 4,400 hr/yr at an annual energy cost of $2.2 million. It is also possible to reduce the load or wattage of the streetlights and/or provide dimming devices for greater energy and cost savings.

As of December 2008, Anchorage has finalized design criteria for low-speed, residential street lighting, and is installing over 4,000 LED fixtures in neighborhoods throughout the city. The Municipality is undergoing testing of LED fixtures for higher-speed roadways and hopes to finalize criteria for this application in 2009.

The quality, amount, brightness, glare, and uniformity of lighting are all key elements in the effort for better and lower-cost lighting. In addition to cost and energy savings, lighting can provide a better color of light (white instead of orange or blue), enhanced safety through improved visibility, less light trespass into homes, and less light pollution into the night sky. The effort to minimize the operational maintenance cost is a significant benefit. The LED fixtures being installed in Anchorage use 50% of the energy of HPS fixtures, and the lamps last roughly five to seven times as long.

Transit Improvements

The recently approved (September 2008) Governor's Coordinated Transportation Task Force (Administrative Order #243) is an important step in advocacy for transit improvements.

Types(s) of GHG Reductions

Primarily CO_2. Small reductions in N_2O and CH_4.

Estimated GHG Reductions and Net Costs or Cost Savings

Table J-3. Partial quantification only based on reduced speed limits

Policy No.	Policy Recommendation	GHG Reductions ($MMtCO_2e$)				Net Present Value 2010–2025 (Million $)	Cost-Effectiveness ($/tCO_2e$)
		2015	2020	2025	Total 2010–2025		
TLU-3	Transportation System Management	0.006	0.006	0.006	0.092	–$9.7	–$105

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

Data Sources:

- *Speed Limits, Average Vehicle Speeds, and Daily Traffic Counts on Alaska State Highways*: ADOT&PF.
- *VMT*: Alaska GHG Inventory and Projections (Appendix D of this report).
- *Annual VMT by Vehicle and Facility Type:* FHWA, *Highway Statistics 2006* (Table VM-1). Available at: http://www.fhwa.dot.gov/policy/ohim/hs06/.
- U.S. EPA, Office of Transportation and Air Quality, SmartWay Transport Partnership, *A Glance at Clean Freight Strategies: Reducing Highway Speed*, EPA420-F-04-007, February 2004. Available at: www.epa.gov/smartway/smartway_fleets_strategies.htm.
- Dierkers, Greg, et al., *CCAP Transportation Emissions Guidebook*, Guidebook Emissions Calculator, Center for Clean Air Policy. Available at: www.ccap.org/guidebook.
- *Fuel Prices*: EIA, *Annual Energy Outlook 2009*, Early Release, Table 12. Available at: http://www.eia.doe.gov/oiaf/aeo/index.html.

Quantification Methods:

- VMT for each future year for affected highways was calculated using data on VMT by vehicle and facility type from FHWA and projections of VMT for Alaska. VMT on routes currently posted at 65 MPH is assumed to increase proportionally with total statewide VMT.
- Improvements in fuel economy for affected vehicles were calculated based on the assumptions below.

- The cumulative reduction in CO_2 emissions from the improved fuel economy of targeted vehicles was calculated beginning in 2010.
- Cost savings were calculated based on forecast fuel prices and estimated fuel savings. Education and enforcement costs are calculated based on the assumptions below.

Key Assumptions:

- Reducing the speed limit from 65 to 60 MPH will cause 25% of vehicles to reduce their speed by 5 MPH.
- Each 1-MPH reduction of speed from 70 MPH to 55 MPH yields a fuel economy increase of 0.1 mile per gallon for heavy-duty diesel trucks (EPA).
- Each 1-MPH reduction of speed down to 55 MPH yields a 1% reduction in CO_2 emissions per mile (Dierkers et al.).
- Education and enforcement for reduced speed limits will require four new full-time employees at a cost of $100,000/yr each.
- Public education campaign (media ads and other communication techniques) will cost $100,000/yr. (Alaska currently spends about $30,000/yr on media ads discouraging speeding and aggressive driving.)

Key Uncertainties

Compliance with lower speed limits is uncertain, as noted below under Feasibility Issues.

Additional Benefits and Costs

- Strategies that reduce congestion can provide 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 PM), resulting in public health benefits.

Feasibility Issues

Optimal traffic speeds from a safety standpoint are a function of the roadway and driver's perception of what is a safe speed. If the legal speed limit is lowered below what the majority of drivers perceive as a safe speed, the ability to enforce the new speed becomes difficult. This is because people respect laws they feel are reasonable, and tend to ignore laws that they believe are unreasonable.

Lowering speed limits can create a pattern of law breakers and law abiders on the same highway. As the difference in speeds of these two groups expands, the likelihood of accidents and aggressive driving is likely to increase. If this were to occur, the hidden cost of this strategy is much more than just signs, enforcement, and education. It may also be a higher accident rate as a direct result of the lower speed limit.

Status of Group Approval

Completed.

Level of Group Support

Unanimous consent.

Barriers to Consensus

None.

TLU-4. Promote Efficient Development Patterns (Smart Growth)

Policy Description

GHG emission reduction through efficient, sustainable (i.e., smart growth) land development patterns will need to be incorporated with reduced VMT, transit improvements, and sustained implementation of multimodal links to facilitate biking, walking, and winter trail use in residential and urban areas.

Issues and items to be developed would include:

- State policy issues detailing funding parameters and funders' policies distributing state and federal dollars.
- Changes to state laws and regulations.
- Local development plans—e.g., *Anchorage 2020*,[5] Fairbanks North Star Borough Regional Comprehensive Plan.
- Local zoning code changes.
- Increased urban/residential density factors.
- Land "disposal" sales and auctions, including UA and the Alaska Mental Health Land Trust.
- Subdivision codes and standards to set aside people-friendly open spaces and greenbelt reserves.
- Tax credits/incentives to developers.
- Must be combined with infrastructure planning—roads and utilities.
- Public buy-in is necessary. There must be strong incentives to have people accept programs.

Policy Design

This policy will focus on promoting land-use changes that result in higher densities in developed, urban areas. It will also focus on incorporating retail zones and small limited commercial nodes in residential developments, with a goal of reducing driving needs by facilitating walking or bicycling, and also reducing the length of driving trips. Changes to residential development patterns, including new subdivisions around population centers, will require a full gambit of incentives to produce the desired change. Efforts to promote land-use changes should be coordinated with the Alaska Municipal League.

The Department of Education will require school boards in selecting new school sites to favor sites that can be reached by walking and biking for the majority of the population the school will serve. Travel of school children by parent-driven vehicles is widely practiced, and is considered a major component in traffic volumes due peak periods. The benefits of walking and biking to

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[5] See: http://www.muni.org/Planning/prj_Anch2020.cfm.

schools include not only reduced vehicular fuel consumption and GHG emissions, but also a more physically fit youth population.

Goals: By 2020, increase the share of Alaska's annual new residential and commercial construction that occurs within the denser parts of urban areas (compared to a business-as-usual baseline) through redevelopment, infill, and mixed uses that take advantage of the existing public investment in infrastructure, public services, and facilities. Simulation studies performed in other metropolitan areas have shown that efficient development patterns can reduce VMT in the range of 3%–20% over a 20–30-year time horizon. Using the lower end of this range, the goal for Alaska should be to reduce urban area VMT by 3% by 2025.

Note that implementation of this strategy may be affected by new federal regulations on metropolitan transportation planning and GHG reduction.

Timing: See above.

Parties Involved: State and local governments, developers, transit agencies, Alaska Municipal League, ADOT&PF, MPOs.

Other: None.

Implementation Mechanisms

The state should:

- Require all new elementary schools to be located on sites with good pedestrian and bicycle access.
- Require that all state government work centers to be located in the central business district or other established core business areas of municipalities or, if this is not possible, in a suburban location with good pedestrian and bicycle access.
- Enable and encourage local governments to adopt financial incentives for infill or location-efficient development, such as fast-track permitting and reduction of building permit fees and system development or impact fees.
- Enable and encourage local governments to modify zoning codes to allow land-use mixing, which can reduce the length of driving trips and encourage walk trips. Also, encourage amendments to zoning codes to allow mother-in-law apartments in single-family residential zones.
- Establish financial incentives (density bonuses, property tax credits) for developers to construct more multifamily dwellings, including senior/retirement units for denser development in urban areas.
- Designate green spaces in urban areas, including street trees and landscaping, to create pedestrian-friendly streetscapes and improve the pedestrian environment.
- Establish incentives for alternative non-motorized travel to workplaces, such as tax-free transit passes.

- Enable and encourage local governments to develop building design guidelines or standards that incorporate energy efficiency, a smaller CO_2 footprint, and lower dwelling utility costs. Higher design standards offer higher quality to draw existing populations into denser urban centers.
- Modify state law to allow differential tax rates for energy efficiency and reduced GHG footprint.

Where regional or comprehensive land-use plans are in place, municipalities should develop maps that show land suitable for residential and light commercial development, focusing on infill and transit-oriented parcels that can reduce VMT.

Related Policies/Programs in Place

FMATS and AMATS are working with UA Fairbanks to improve its travel models to include GHG emissions. The enhanced models may improve the quantification of this policy in the future.

Types(s) of GHG Reductions

Primarily CO_2. Small reductions in N_2O and CH_4.

Estimated GHG Reductions and Net Costs or Cost Savings

Table. J-4. Estimated GHG reductions and costs of or cost savings from TLU-4

Policy No.	Policy Recommendation	GHG Reductions ($MMtCO_2e$)				Net Present Value 2010–2025 (Million $)	Cost-Effective-ness ($/t$CO_2$e)
		2015	2020	2025	Total 2010–2025		
TLU-4	Promote Efficient Development Patterns (Smart Growth)	0.019	0.043	0.066	0.501	Net Savings	NQ

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; NQ = not quantified; $/t$CO_2$e = dollars per metric ton of carbon dioxide equivalent.

The GHG impacts of this policy are identical to policy TLU-6, which has a goal of reducing per-capita light-duty vehicle GHG emissions in urban areas 3% by 2025.

Data Sources:

An extensive body of research has demonstrated the ability of smart growth development policies to reduce VMT in urban areas. By creating denser, mixed-use developments served by transit, bicycle, and pedestrian infrastructure, smart growth policies reduce the distances that people need to travel to reach their destinations, and reduce the need to travel by car. A number of regional studies throughout the United States have estimated the specific benefits of smart growth to various urban regions. Ewing et al. estimate that compact development can reduce VMT per capita by 30% over the sprawling development patterns typical of the last few decades in the United States. (For more information, see Ewing et al., *Growing Cooler: The Evidence on*

Urban Development and Climate Change, Urban Land Institute, 2008. Available at: http://www.smartgrowthamerica.org/gcindex.html.)

For a summary of other relevant literature, see:

- U.S. EPA, *Our Built and Natural Environments: A Technical Review of the Interactions Between Land Use, Transportation, and Environmental Quality,* EPA 231-R-01-002, January 2001. Available at: http://www.epa.gov/dced/built.htm.
- FHWA, Toolbox for Regional Policy Analysis. Available at: http://www.fhwa.dot.gov/planning/toolbox/index.htm.

Quantification Methods: Not applicable.

Key Assumptions: Not applicable.

Key Uncertainties

Achieving the target reduction in VMT depends on implementation of the policy initiatives at all levels of government. It is possible that required planning could be done in a way that does not change development patterns, and thus does not reduce VMT and emissions. That is, the policy language does not require these outcomes.

External forces can have a significant effect on VMT and land development patterns, which creates additional uncertainty regarding the impacts of this policy. For example, fuel prices affect vehicle use. A major increase in fuel prices would help to encourage use of alternative travel modes, and might increase the benefits of this policy. Conversely, a reduction in fuel prices would make it more difficult to reduce VMT through smart growth and multimodal transportation planning efforts. Land development patterns are strongly influenced by regional and state macroeconomic forces. The ability of governments to influence land-use patterns depends to some extent on developer demand.

Additional Benefits and Costs

Land-use policies, such as the densification of developed land, mixing of compatible land uses, and other urban design measures, have beneficial spin-offs for other strategies. Land-use-based policies further mode-switching policies because these policies help create an environment that is easier served by transit, biking, and walking.

Compact development patterns also reduce public expenditure on infrastructure and services. A variety of literature finds that integrated transportation and land-use planning produces net savings on the total costs of buildings + land + infrastructure + transportation. While some components may be higher, the preponderance of literature suggests net savings overall (see U.S. EPA, 2001, above). A National Academy of Sciences/Transportation Research Board review found substantial regional and state-level infrastructure cost savings from more compact development.[6] An analysis of the New Jersey State Plan found that municipalities, counties, and

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[6] Robert Burchell et al., *The Costs of Sprawl—Revisited* (TCRP Report 39), Transportation Research Board, Washington, D.C., 1998. Available at: http://www.trb.org/news/blurb_detail.asp?ID=2578.

school districts would save an estimated $160 million from 2000 to 2020 by pursuing smart growth patterns.[7]

Feasibility Issues

Land-use changes will not have a large impact on transportation systems and GHG emissions over the short term. However, over longer time spans, land-use changes aimed at creating denser, mixed-use settlements may offer important opportunities to reduce vehicle use and GHG emissions.

Status of Group Approval

Completed.

Level of Group Support

Unanimous consent.

Barriers to Consensus

None.

[7] Robert Burchell et al., *The Costs and Benefits of Alternative Growth Patterns: The Impact Assessment of the New Jersey State Plan*, Center for Urban Policy Research, Rutgers University, September 2000. Available at: http://www.state.nj.us/dca/divisions/osg/docs/iaexecsumm090100.pdf.

TLU-5. Promotion of Alternative-Fuel Vehicles

Policy Description

Alternative-fuel vehicles (AFVs) offer significant opportunities to reduce GHG emissions from the light-duty fleet. Alternative fuels include natural gas, propane, biodiesel, electricity, ethanol, hydrogen, and fuel cells. AFVs include hybrid vehicles that utilize more than one power source to move the vehicle. Because of Alaska's large deposits of natural gas, compressed natural gas (CNG) vehicles may be a particularly viable option for the state. However, questions remain about the feasibility and benefits of CNG vehicles in Alaska.

This mitigation policy consists of two parts. The first part is working toward the replacement of existing light-duty vehicle fleets with AFVs. The second part consists of better informing the public of the benefits of purchasing AFVs and providing incentives as well.

Public-sector agencies[8] and some private-sector firms own large numbers of vehicles. Converting these fleets to AFVs can result in large reductions of pollutants and GHGs.

The second component of this policy consists of providing information to consumers about the benefits of AFVs, such as fuel efficiency, cleaner air, cost savings, and technological benefits.

The policy would be implemented through a series of federal- and state-supported low-cost loans, grants, attractive financing of trade-in vehicles, tax incentives, and other incentives and subsidies to promote the use of AFVs.

Implementation of this policy would be supported by TLU-10: Alternative Fuels Research and Development.

Policy Design

Goals:

- Increase the use of light-duty AFVs by public-sector agencies and private-sector firms to 25% of on-road fuel consumption by 2020 and 35% by 2030.
- Increase the use of AFVs by consumers to 10% of on-road fuel consumption by 2020 and 25% by 2030.
- The AFV technologies chosen should produce a minimum 15% life-cycle reduction in GHG emissions per mile, compared to conventional fuels.

Timing: See above.

Parties Involved: *Parties affected*—government at all levels, other fleets; *implementers*—government, military.

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[8] Public-sector agencies include federal, state, and local governments, school districts, and utilities.

Other: None.

Implementation Mechanisms

- State legislation should authorize financing (2% loans) for AFV purchases by 2012.
- State legislation should create a rebate program to encourage consumer purchases of AFVs.
- State legislation should create incentives for local governments to purchase AFVs or convert existing fleet vehicles to alternative fuels. Because local governments cannot benefit from tax incentives, one option is to create a state program that converts tax incentives into a rebate, allowing local governments to purchase AFVs at a lower price.
- The state should also encourage conversion of gasoline vehicles to CNG in appropriate situations. The U.S. Congress has encouraged conversion of cars to CNG, with tax credits of up to 50% of the auto conversion cost and the CNG home filling station cost. However, while CNG is a much cleaner fuel, the conversion can only be performed by manufacturers certified to perform aftermarket conversions on vehicles to operate on alternative fuels. There do not appear to be any certified manufacturers for conversion in Alaska. One challenge preventing more widespread conversion of standard engines to operate on alternative fuels is the high cost associated with becoming certified to perform the conversion; meeting the requirements imposed by EPA can cost up to $50,000.

Related Policies/Programs in Place

- Under the 2005 federal Energy Policy Act (EPAct), approximately 5% of gasoline sales will be replaced by ethanol nationally by 2012.
- FMATS and AMATS are working with UA Fairbanks to improve their travel models to include GHG emissions. The enhanced models may improve the quantification of the costs and benefits of this policy in the future.

Types(s) of GHG Reductions

Primarily CO_2. Small reductions in N_2O and CH_4.

Estimated GHG Reductions and Net Costs or Cost Savings

Table J-5. Estimated GHG reductions and costs of or cost savings from TLU-5

Policy No.	Policy Recommendation	GHG Reductions ($MMtCO_2e$)				Net Present Value 2010–2025 (Million $)	Cost-Effective-ness ($\$/tCO_2e$)
		2015	2020	2025	Total 2010–2025		
TLU-5	Promotion of Alternative Fuel Vehicles	0.026–0.084	0.054–0.173	0.09–0.288	0.669–2.139	$207.3–$494.8	$135–$740

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

Data Sources:

- *GHG Reduction Factors from Alternative Fuels*: The GREET (Greenhouse gases, Regulated Emissions and Energy use in Transportation) model v1.8. Available at: http://www.transportation.anl.gov/modeling_simulation/GREET/.
- *Electricity Generation Mix in Alaska:* from EPA's eGRID (Emissions & Generation Resource Integrated Database) 2007. Available at: http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html.
- *VMT Forecasts*: Alaska GHG Inventory and Forecast (Appendix D of this report).
- *Vehicle Fleet Data:* FHWA, *Highway Statistics 2006* (Table VM-1). Available at: http://www.fhwa.dot.gov/policy/ohim/hs06/index.htm.
- *Fuel Price Forecasts:* EIA, *Annual Energy Outlook 2009*, Early Release, Tables 12 and 13. Available at: http://www.eia.doe.gov/oiaf/aeo/index.html.
- *Current Year Fuel Prices by State:* EIA, State Energy Data System, 2008, Tables S5a and S2a. Available at: http://www.eia.doe.gov/emeu/states/_seds_updates.html.

Quantification Methods:

Three possible scenarios were evaluated for compliance with the AFV goals:

- 100% of AFV run on CNG for 100% of mileage.
- 100% of AFV are electric vehicles.
- 100% of AFV are plug-in hybrid electric vehicles (PHEVs).

Table J-6 shows life-cycle (well-to-wheels) GHG emissions per mile for automobiles, calculated using GREET v1.8. These figures take into account Alaska's electricity generation mix and proximity to reserves of petroleum and natural gas.

Table J-6. Life-cycle (well-to-wheels) GHG emissions per mile for automobiles

Energy Source	GHG per Mile (gCO_2e)	Reduction From Gasoline
Gasoline	482	
CNG	410	–15.1%
Electric	250	–48.2%
PHEV	315	–34.6%

CNG = compressed natural gas; GHG = greenhouse gas; gCO_2e = grams of carbon dioxide equivalent; PHEV = plug-in hybrid electric vehicle.

These figures assume average driving cycles for light-duty vehicles driven in the United States. Typical driving cycles in Alaska may be different from those in other parts of the country, given the limited urban development and longer distances between settlements in the state. These potential differences may affect the relative reductions in GHG emissions achievable using the various alternative-fuel propulsion technologies.

The following proportions were assumed for VMT in light-duty vehicles. These assumptions are based on available data on vehicle populations from *Highway Statistics 2006*:

- Public vehicles: 1%.
- Commercial vehicles: 20%.
- Private vehicles: 79%.

Penetration rates are assumed to increase smoothly starting in 2011 to reach the stated goals. For each year, we calculate VMT affected by the goal. Reduction percentages from GREET are applied to calculate total GHG reductions. Results for each scenario are presented in Table J-7.

Table J-7. Life-cycle (well-to-wheels) GHG emissions per mile for automobiles

AFV Scenario	Reductions ($MMtCO_2e$)		
	2012	2012	Cumulative Reductions (2008–2025)
CNG	0.009	0.009	0.611
Electric	0.029	0.029	1.954
PHEV	0.021	0.021	1.403

AFV = alternative-fuel vehicle; CNG = compressed natural gas; GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; PHEV = plug-in hybrid electric vehicle.

We drew information on the cost of alternative vehicle technologies from studies comparing each of the three technologies to conventional vehicles:

- Electric Power Research Institute (EPRI), *Comparing the Benefits and Impacts of Hybrid Electric Vehicle Options for Compact Sedan and Sport Utility Vehicles*, Final Report, July 2002. Available at: http://mydocs.epri.com/docs/public/000000000001006892.pdf.
- EPRI, *Advanced Batteries for Electric-Drive Vehicles: A Technology and Cost-Effectiveness Assessment for Battery Electric Vehicles, Power Assist Hybrid Electric Vehicles, and Plug-in Hybrid Electric Vehicles*, Final Report, May 2004. Available at: http://mydocs.epri.com/docs/public/000000000001009299.pdf.
- Yocobucci, Brent, *Natural Gas Passenger Vehicles: Availability, Cost, and Performance*, 2008. Available at: http://opencrs.com/document/RS22971.

Each of the studies estimates the difference in cost between a conventional vehicle and the alternative vehicle type in three categories: vehicle purchase cost, cost of fuel, and vehicle maintenance cost. (The Yocobucci study did not provide any difference in maintenance costs for CNG vehicles; therefore, we assume that maintenance costs for CNG vehicles are comparable to those for conventional vehicles. Anecdotal evidence suggests that CNG vehicles are on average cheaper for owners to maintain than conventional vehicles; however, repair shops may need to be retrofitted in order to service CNG vehicles.) Using these findings, we calculate the costs to increase the share of each AFV to the target percentage by 2025. These costs would typically be borne by the owners of the AFVs, unless the state subsidizes any portion of the vehicle purchase or operating costs.

For CNG vehicles, an additional cost for refueling equipment was included. There is currently very little infrastructure for CNG refueling in Alaska. The Yocobucci study assumed that CNG vehicle owners would need to purchase and install home refueling equipment, at a cost of approximately $3,900 each. If CNG becomes widely used as a fuel for passenger vehicles in Alaska, we expect that centralized infrastructure will be provided, perhaps at a lower cost. Still, infrastructure costs for CNG will almost certainly be higher than those for PHEV or electric vehicles. These vehicle types require little to no new infrastructure, since they can be charged using existing home electrical outlets.

We updated information on fuel costs in each of the studies with the latest energy price forecasts from EIA. To account for generally higher costs of petroleum in Alaska versus the continental U.S., we scale national fuel price forecasts by the current differential between average national prices and prices in Alaska. Although CNG in Alaska is currently cheaper than CNG in the continental U.S., prices are expected to converge in the near future. Therefore, we use the U.S. average price forecast for CNG.

Information about the capital, fuel, and maintenance costs of each vehicle type is provided in Table J-8. Costs for each vehicle type were drawn from separate studies that use potentially different methodologies. The reader should take care in comparing costs across vehicle types using this information.

Table J-8. Additional cost compared to conventional gasoline vehicle

Vehicle Type	Capital Costs	Fuel Costs (cents per mile)	Maintenance Costs ($ per year)
CNG	$9,480	–6.5¢	ND
Electric	$4,258	–3.0¢	–$350
PHEV	$6,351	–6.4¢	–$94

CNG = compressed natural gas; carbon dioxide equivalent; ND = no data available, but anecdotal reports suggest likely cost savings; PHEV = plug-in electric hybrid.

Key Assumptions: See above.

Key Uncertainties

Transportation fuel providers would need to change their production and distribution methods to achieve the goals. Because the policy does not prescribe particular technology pathways, and because technology in this area is changing quickly, there is substantial uncertainty about which fuels and technologies fuel providers will use to meet the standard. The program assumes that providers will use the most cost-effective options to meet the standard, but compliance costs are unknown at this time.

Additional Benefits and Costs

Most alternative fuels produce lower emissions of PM and other localized pollutants, therefore, this strategy will produce air quality and public health benefits.

Feasibility Issues

AFVs use fairly new technologies, many of which have not been tested extensively in cold climates, such as Alaska's climate. Very cold operating conditions may present problems for electric motors and biofuels particularly. The feasibility of this option will depend upon the development of a viable mass-market AFV for Alaska.

Status of Group Approval

Completed.

Level of Group Support

Unanimous consent.

Barriers to Consensus

None.

TLU-6. VMT and GHG Reduction Goals in Planning

Policy Description

Transportation planning has historically focused on meeting the user demands for transportation, reacting primarily to changes in population growth, land use, and other demands, such as freight or resource movements. In many respects, the profession has been reactive or passive to these other considerations. Transportation planning generally evaluates the tradeoffs of agency costs, travel time, and user costs. The idea of using planning as a means of reducing both the number of miles driven and the production of GHGs is the cornerstone of this policy. By empowering transportation planners to evaluate alternative proposals on the basis of VMT and/or GHG generation, decision makers can further improve the organization of communities so as to reduce the impacts of transportation on the environment.

It is important that personal mobility be retained as a paramount goal. Such mobility is a hallmark of modern society, for it empowers people to live, work, shop, play, and go to school at locations they choose, rather than those for which no other alternative exists due to lack of mobility. Historically in the United States, VMT has risen much faster than population, including a 3:1 ratio in Alaska since statehood. Thus, any policy that attempts to reduce the per-capita VMT and GHG production must be carefully tailored and include follow-up monitoring during implementation, to ensure it does not have a negative effect on the economy. Moreover, the real goal of this policy should focus on emission reductions, even if VMT is unfettered. The fact that VMT can occur without emissions, depending upon the means of propulsion, suggests the ultimate goal should be on the form of energy and not the use of vehicles.

Unlike other states, where highway travel is the predominant source of transportation emissions, in Alaska the predominant emissions source is aviation, with highways a distant second. Thus, many Alaska communities are limited in their mobility options, relying solely on aviation and seasonal barge deliveries of freight and fuel. Nearly 30% of the state's population is limited in mobility options, and any analysis must consider these circumstances. Currently, due to high energy costs, villages are experiencing out-migration to Alaska's cities, where employment is more readily found and the cost of living is lower. This will increase per-capita VMT within the state, as a cohort of the population is moving into the ranks of drivers.

Transportation planning is one tool to better inform decision makers. Many important decisions affecting VMT are made by various other entities. For example, the decision made in siting a new school may make busing and/or driving by parents the unavoidable option for pupil transport. Yet, seldom is this even considered by school boards when they make decisions for new school locations. When a new school is sited where walking and biking are not safe or practical, it results in millions of vehicle trips being necessary over the long life of the school. This is but one example of how TLU-6 can help inform transportation planners of the consequences of their decisions.

Policy Design

Greenhouse Gases

Calculating CO_2 emissions associated with an individual transportation project is not straightforward. The analysis can be quite complicated, as most projects form only one piece of a larger network. Transportation planners' models do not generally predict the land use, induced demand, changes in speed and fleet that will occur during the project life, or travel characteristics of the user population. For example, such phenomena as trip linking or what has happened in modern Alaska, when a large cohort of young people who arrived in the 1970s later age and thus have fewer children at home and follow a different life style, are generally not considered in even today's most sophisticated models. However, whether adopted by the state, or later mandated under federal law,[9] predicting the GHG emissions of any given project, including all considered alternatives, is likely to become a requirement soon.

Goals: Require all significant transportation system plans developed at the state and MPO level, and all actions that would change or provide a new mode of transportation or enlarge capacity, to evaluate their contribution to GHG emissions. Currently, traffic models to assist in such evaluations exist only at the metropolitan level in Alaska; thus, time may be needed to develop tools for non-metropolitan areas.

Timing: The two MPOs (FMATS and AMATS) would work with ADOT&PF to start developing consistent methods to evaluate GHG emissions from transportation system plans, and relevant projects by the end of 2010.

Parties Involved: ADOT&PF, FMATS, and AMATS.

Other: None.

Vehicle Miles Traveled

Goals:

- Support and promote public and private planning and development practices, including smart growth planning (see TLU-4) and infrastructure provisions, such as expanded opportunities for non-vehicular travel that reduce the number and/or length of trips made in Alaska.
- By 2015, reduce the per-capita light-duty VMT by 1% in communities that offer transit services and 3% by 2025.

Timing: See above.

Parties Involved: ADOT&PF, FMATS, and AMATS.

Other: None.

[9] The Ninth Circuit, which includes Alaska, recently held that federal agencies must assess climate change impacts in environmental documents prepared under the National Environmental Policy Act (9th Cir., November 15, 2007).

Implementation Mechanisms

- The two MPOs (FMATS and AMATS) would work with ADOT&PF to develop consistent methods to evaluate GHGs from transportation system plans and relevant projects by the end of 2010.
- The state legislature would enact a policy that requires per-capita reductions in VMT in communities that offer transit services.

Related Policies/Programs in Place

None identified.

Types(s) of GHG Reductions

Primarily CO_2. Small reductions in N_2O and CH_4.

Estimated GHG Reductions and Net Costs or Cost Savings

Table J-9. Estimated GHG reductions and costs of or cost savings from TLU-6

Policy No.	Policy Recommendation	GHG Reductions ($MMtCO_2e$)				Net Present Value 2010–2025 (Million $)	Cost-Effective-ness ($/t$CO_2$e)
		2015	2020	2025	Total 2010–2025		
TLU-6	VMT and GHG Reduction Goals in Planning	0.019	0.043	0.066	0.501	NQ	NQ

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; NQ = not quantified; $/t$CO_2$e = dollars per metric ton of carbon dioxide equivalent; VMT = vehicle miles traveled.

The GHG impacts of this policy are identical to option TLU-4, which has a goal of reducing per-capita light-duty-vehicle GHG emissions in urbanized areas by 3% by 2025.

Data Sources:

- *Statewide VMT Projections:* Alaska GHG Inventory and Forecast (Appendix D of this report).
- *Population Forecasts for Alaska and Alaska Urban Regions*: *Alaska Economic Outlook*, October 2007. Available at: http://www.labor.state.ak.us/research/trends/oct07pop.pdf.

Quantification Methods:

- Baseline VMT in the Anchorage/Mat-Su, Fairbanks, and Juneau regions was projected based on the assumptions below.
- VMT reduction in Anchorage/Mat-Su, Fairbanks, and Juneau was estimated based on the stated goals.

Key Assumptions:

VMT per capita in the Anchorage/Mat-Su, Fairbanks, and Juneau regions is assumed equal to statewide VMT per capita.

Key Uncertainties

The goal of limiting the per-capita use of light-duty vehicles by 1%, then 3% by 2015 and 2020, respectively, may be considered short of a "stretch goal" by some observers. Further, as written, the goal exempts heavy-vehicle VMT, and further exempts communities that lack transit systems. However, the Alaska circumstance is so significantly different; the following factors are put forward to justify this seemingly "soft" goal.

- *Gas Line Construction:* Alaska is facing the construction of one and possibly two major pipelines in the coming decade, which will substantially amplify the economy and the number of trips being made, since most of the line's construction lies beyond the reach of transit, walking, or biking. The larger gas line project will be the largest private-sector construction project in North American history, and will have a material impact on VMT.
- *Migration to Other Modes:* Alaskans rely extensively on aviation as a means of travel, and in some cases, where possible, their travel mode of choice may be changed to highway travel. Since highway travel is often less fuel intensive than aviation, this is a good outcome for GHG production, even if it results in increased VMT.
- *Not Including Heavy-Vehicle Trips in the Goal:* Much of Alaska's reliance on freight and construction vehicles (non-light-duty vehicles) is related to oil and gas industry or other resource production. Including these types of trips in any goal is not realistic, since there are very limited options for such freight and equipment movements.
- *Historic Pattern of VMT Growth:* Alaska has seen its VMT measure increase by about 300%, as compared to its population. This is higher than in the United States, where 250% growth has been observed. Yet nearly 30% of Alaskans cannot drive beyond the confines of their community due to an incomplete road network; thus, the actual ratio might have been higher if more roads were available. In a state larger than Texas, Montana, and California combined, long-distance travel is sometimes unavoidable. Thus, any VMT and GHG reduction goal must keep this in mind.
- *Land-Use Changes Are Slow Moving:* Once developed, land use in Alaska is relatively fixed. Thus, the pattern of vehicle use from developed locations is not easily addressed by transportation planners. Examples include the practice of large-lot subdivisions within the rapidly growing Mat-Su area, the hillside development in south Anchorage, and residential land development outside the Fairbanks bowl area that requires 20–50-mile round trips. Encouraging walking and biking to schools that are miles from their pupils is another example of prior decisions that lock in vehicle use for many more years into the future.
- *Alternatives May Not Exist:* If a community is too small or too spread out for transit and walking, what choices are there for residents, but to drive as they do today? Many of Alaska's communities are not likely to see transit systems in the foreseeable future. The van ridesharing options become the primary methods to reduce SOV driving. Thus, any VMT reduction goal in such communities is not founded in reality.

Additional Benefits and Costs

Reducing VMT creates a number of ancillary benefits, including reduced congestion, reduced pollutant emissions and negative public health effects, fewer roadway crashes, and economic benefits to vehicle owners.

Feasibility Issues

See Key Uncertainties above.

Status of Group Approval

Completed.

Level of Group Support

Unanimous consent.

Barriers to Consensus

None.

TLU-7. On-Road Heavy-Duty Vehicle Efficiency Improvements

Policy Description

Alaska should create new services and provide additional support to existing voluntary and incentive-based programs that help public and private on-road heavy-duty diesel-powered fleets reduce GHG emissions.

Policy Design

This policy employs a combination of three primary strategies to achieve GHG emission reductions:

- Develop incentives to encourage public and private on-road diesel fleets to participate in the EPA SmartWay® Transport Partnership Program.
    - *Goal:* Achieve the following public and private fleet participation in Smart Way: 30% of total trucks in Alaska by 2012, and 50% by 2020.
- Provide incentives to phase out "old" (1988 and older) high-GHG-emitting on-road heavy-duty diesel engines, and replace them with modern lower-GHG-emitting diesel engines if appropriate. Vehicles replaced by the program must be permanently scrapped in order to achieve a net emission reduction. They may not be sold into the used truck market.
    - *Goal:* Phase out 50% of "old" (1988 and older) high-GHG-emitting on-road heavy-duty diesel engines by 2015.
- Develop incentives for state, borough, and municipal government-managed vehicle fleets to develop and implement plans to reduce GHG emissions from their public transit, school bus, and maintenance vehicles. Examples could include idling reduction strategies, alternatively powered engines—liquefied natural gas, natural gas, electric, hybrid, resource sharing, etc.
    - *Goal:* Achieve a minimum 20% GHG emission reduction from the 2008 benchmark by 2020.

Goals: See above.

Timing: Immediately—no need to wait.

Parties Involved: ADOT&PF, DEC, municipal and local governments, Alaska Railroad, Alaska Trucking Association, public and private partners, local and statewide businesses, several not-for-profit organizations.

Other: None.

Implementation Mechanisms

- The state will develop a program to offer subsidized low-interest loans as an incentive to replace pre-1988 on-road heavy-duty diesel engines and or tractors.

- The state will develop a program to offer significant vehicle registration fee discounts for vehicles participating in the EPA SmartWay® program.

Related Policies/Programs in Place

None identified.

Types(s) of GHG Reductions

Primarily CO_2. Small reductions in N_2O and CH_4.

Estimated GHG Reductions and Net Costs or Cost Savings

Table J-10. Estimated GHG reductions and costs of or cost savings from TLU-7

Policy No.	Policy Recommendation		GHG Reductions ($MMtCO_2e$)				Net Present Value 2010–2025 (Million $)	Cost-Effective-ness ($/t$CO_2$e)
			2015	2020	2025	Total 2010–2025		
TLU-7	On-Road Heavy-Duty Vehicle Efficiency Improvements	a. SmartWay®	0.050	0.075	0.084	0.930	–$52.3	–$56
		b. Phase Out	0.025	0.012	0.000	0.198	$20.9	$106
		c. Public Fleets	0.016	0.033	0.037	0.364	NQ	NQ

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $/t$CO_2$e = dollars per metric ton of carbon dioxide equivalent; NQ = not quantified.

Data Sources:

- *Fuel Economy Impacts of Truck Efficiency Strategies:* Based on U.S. EPA FLEET (Freight Logistics Environmental and Energy Tracking Performance) model. http://www.epa.gov/smartway/transport/calculators/loancalcfreight.htm
- *Vehicle Registration Data:* Alaska DMV.
- *Heavy-Duty-Vehicle Fuel Efficiency:* Vehicle Inventory and Use Survey (VIUS): 1992, 1997, 2002. Available at: http://www.census.gov/svsd/www/vius/products.html.
- *Vehicle Populations:* FHWA, *Highway Statistics 2006* (Tables MV-7 and MV-9). Available at: http://www.fhwa.dot.gov/policy/ohim/hs06/index.htm.
- *Fuel Price Forecasts:* EIA, *Annual Energy Outlook 2009*, Early Release, Tables 12 and 13. Available at: http://www.eia.doe.gov/oiaf/aeo/index.html.
- ICF International, *Analysis of Goods Movement Emission Reduction Strategies*, Task 1 Draft Report, prepared for the Southern California Association of Governments (SCAG), May 14, 1007. Available at: http://www.scag.ca.gov/goodsmove/pdf/AnalysisGoodsMovementEmission_DraftReport.pdf.
- California Air Resources Board, *Evaluation of Port Trucks and Possible Mitigation Strategies*, April 2006. Available at: http://www.arb.ca.gov/msprog/onroad/porttruck/execsum.pdf.

Quantification Methods:

Part a—SmartWay®

Based on information from the EPA FLEET model, we estimated that the average vehicle can improve fuel efficiency by 6% by participating in SmartWay®. We applied this fuel efficiency improvement to the target population stated in the policy goal, as a share of the entire heavy-duty fleet population in Alaska.

To estimate costs, truck efficiency strategies were assumed to involve:

- Installation of single-wide tires and wheels on new combination trucks, in lieu of dual tires and wheels, at a cost savings of $1,040 per truck.
- Installation of trailer side skirts on a combination truck trailer at a cost of $2,400, and installation of NoseCone on single-unit trucks at a cost of $700.
- Use of low-friction engine and drive train lubricants at a cost of $118 per year for combination trucks and $18 per year for single-unit trucks.

Part b—Phase Out

Registration data from the Alaska DMV were used to determine the average turnover rate of heavy-duty vehicles. We estimated that under normal conditions, only 14% of the fleet in 2015 will date from 1988 or before; by 2025, only 2% of the fleet will date from 1988 or before. We estimated the impact of reducing the share of 1988 or older vehicles by half, to 7% in 2015 and to 1% in 2025. We assumed that average VMT is the same for older and newer heavy-duty vehicles. We also assumed that new vehicles introduced by the program will achieve an average fuel efficiency improvement of 16% (the average efficiency improvement reported by VIUS for short-haul trucks from 1992 to 2002).

We assumed that scrapped vehicles will be replaced with used vehicles, 5 years old on average. The $42,000 cost per replacement vehicle was drawn from an analysis of heavy-duty vehicle replacement measures by ICF International for SCAG, and from cost data compiled by the California Air Resources Board. This value represents the full cost of the vehicle, which may be partly or wholly subsidized by the State of Alaska.

Part c—Public Fleets

Based on data from *Highway Statistics 2006*, we estimated that 6.7% of heavy-duty vehicles in Alaska are owned by government agencies. We assumed that, on average, these vehicles travel the same number of miles annually as private vehicles and commercially owned heavy-duty vehicles. We calculated linear emission reductions to reach the goal of 20% reduction for publicly owned heavy-duty vehicles in 2020.

We did not estimate the cost of this measure, since no particular implementation measures are specified by the policy. Costs will vary, depending on the specific compliance mechanisms, and could be either positive or negative (cost savings).

Key Assumptions: Described above.

Key Uncertainties

None identified.

Additional Benefits and Costs

This policy will reduce diesel PM emissions. Many scientific studies have linked breathing PM to a series of significant health problems, including aggravated asthma, difficult breathing, chronic bronchitis, heart attacks, and premature death. Diesel PM is of specific concern because it is likely to be carcinogenic to humans when inhaled.

Feasibility Issues

None identified.

Status of Group Approval

Completed.

Level of Group Support

Unanimous consent.

Barriers to Consensus

None.

TLU-8. Marine Vessel Efficiency Improvements

Policy Description

Actions by the state can promote efficiencies and conservation options for commercial and recreational fishing, marine tourism, and other forms of marine transportation.

Because Alaska's commercial fishing economy powers most coastal communities and provides employment levels higher than any other private industry in the state, it is critical to mitigate GHG emissions from the sector as a way to ensure continued commercial fishing activities. Registration information available from the state through the Commercial Fisheries Entry Commission for 2007 shows that there are 9,695 registered Alaska commercial fishing vessels, including 6,028 diesel and 3,510 gasoline vessels, with 1981 as the average year of construction and a mean horsepower rating of 311. While the vessel registrations range from two-cycle gasoline-powered outboard skiffs to sophisticated factory ships, the larger vessels are more likely to be newer and have operational plans that include engine and hull efficiency improvements. The medium and small vessels that typically operate seasonally are more likely to need government assistance to encourage installation of more fuel-efficient engines.

It may also be possible to improve the efficiency of commercial fishing operations through improved management of fisheries. Regulations that govern the opening and closing of fishing seasons, as well as the transportation of commercial catches, could be adjusted to reduce fuel consumption. GHG reductions may also be achieved through regulations that minimize travel requirements for all fisheries—commercial, commercial sport, recreational, personal use, and subsistence.

Charter vessels are generally less than 50 feet, and are likely to have issues similar to those faced by the small and medium vessels in the commercial fleet; information on the charter vessel fleet's makeup is not as readily available. Determining the nature of the recreational fleet and issues relating to fuel efficiency is more problematic. Larger vessels, such as cruise ships and ferries, would typically have sophisticated operational plans that consider fuel efficiency issues with government oversight well established.

Policy Design

The basic policy recommendation for promoting installation of more fuel-efficient engines or hull design is to provide financial incentives, such as low-cost loans, that would encourage vessel owners to implement changes without unduly compromising industry economics. For the Alaska resident commercial fleet, Alaska's Department of Commerce, Community, and Economic Develop (DCCED) already has a commercial fishery revolving loan fund that could be further altered to allow for targeting energy efficiency improvements. For the out-of-state residents, options include a DOE loan program or inclusion of fishermen in equipment upgrade programs established for farmers under the U.S. Department of Agriculture (USDA). Charter and recreational vessels are currently not eligible under the DCCED program and need an alternate avenue for financial assistance.

Efficiency improvements relating to conduct of a given commercial, commercial sport (charter), recreational, personal use, or subsistence fishery are regulatory in nature and would require action by the Alaska Board of Fisheries (BOF). Currently, there are no BOF criteria specifically relating to efficiency or GHG emissions, other than cost considerations. A policy requiring the BOF to consider energy efficiency when setting regulations would not require any funding or subsidy, but would allow the BOF to at least consider GHG emissions.

Goals:

- Provide financial incentives to accelerate replacement of marine vessel engines, such that by 2020, no more than 50% will be pre-2000 engines. (EPA's Tier 1 standards for marine engines took effect in 2000.)
- Encourage federal and state agencies that regulate commercial fishing to consider GHG emissions when making policy decisions.

Timing: See above.

Parties Involved: DCCED, Alaska Departments of Energy and Fish and Game, BOF, Alaska State Legislature, DOE, and USDA.

Other: None.

Implementation Mechanisms

- For the Alaska resident commercial fleet, expand the DCCED commercial fishery revolving loan fund to targeting energy efficiency improvements. This could involve lowering the interest rate for improving vessel fuel efficiency (which may be unnecessary if the current House Bill 20 is signed).
- For the out-of-state residents, encourage development of a DOE loan program that could target commercial marine vessels. Also encourage inclusion of fishermen in equipment upgrade programs set up for farmers under USDA.
- For charter and recreational vessels, which are currently not eligible under the DCCED program, develop a new state program to encourage energy efficiency improvements.
- Develop regulations that can reduce the GHG footprint of fisheries in Alaska that include a policy that requires the BOF to take energy efficiency into account for commercial, commercial sport (charter), recreational, personal use, and subsistence fisheries. The Alaska Department of Fish and Game also needs direction to manage fisheries in a way that can accommodate GHG reductions.

Related Policies/Programs in Place

DCCED has a commercial fishery revolving loan fund.

Types(s) of GHG Reductions

Primarily CO_2. Small reductions in N_2O and CH_4.

Estimated GHG Reductions and Net Costs or Cost Savings

Table J-11. Estimated GHG reductions and costs of or cost savings from TLU-8

Policy No.	Policy Recommendation	GHG Reductions ($MMtCO_2e$)				Net Present Value 2010–2025 (Million $)	Cost-Effectiveness ($/tCO_2e$)
		2015	2020	2025	Total 2010–2025		
TLU-8	Marine Vessel Efficiency Improvements	0.012	0.022	0.032	0.269	$20.4	$76

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

Data Sources:

- *Vessel Age Distributions*: Alaska Commercial Fisheries Entry Commission, Permit Holder Database (2008).
- California Air Resources Board, *The Carl Moyer Program 2006 Status Report*. January 2007. Available at: http://www.arb.ca.gov/msprog/moyer/status/status.htm.
- *Fuel Price Forecasts*: EIA, *Annual Energy Outlook 2009*, Early Release, Tables 12 and 13. Available at: http://www.eia.doe.gov/oiaf/aeo/.
- *Current Year Fuel Prices by State:* EIA, State Energy Data System (SEDS), 2008, Tables S5a and S2a. Available at: http://www.eia.doe.gov/emeu/states/_seds.html.

Quantification Methods:

- The quantification method uses vessel age as a proxy for engine age; we are not aware of any data on the actual age of operating marine engines. We calculated the percentage of vessels that are 20 years old or older using data from the Permit Holder Database. Approximately two-thirds of vessels in 2008 are more than 20 years old.
- We assumed that the age distribution of vessels will remain constant in future years. We calculated the percentage of vessel engines that should be replaced by the incentive each year in order to attain the goal of no more than 50% pre-2000 engines in 2020. We assumed that the program will continue funding engine replacements at a similar rate after 2020. We also assumed that vessels taking advantage of the incentives have average fuel use and GHG emissions. For engines affected by the turnover incentives, we applied an improvement in fuel economy of 12%, according to the key assumptions below.
- Emission reductions in each year were calculated as follows:
  - tCO_2e reduced = total vessels repowered in all previous years x 12,500 gallons diesel per vessel x 12% x carbon content of diesel fuel.
- Note that the use of vessel age as a proxy for engine age overstates the benefits of this policy, since many older vessels will already have replaced their original engines.
- The cost of the policy was calculated based on data from the Carl Moyer Program in California. The program provides grants for owners of vehicles, including fishing vessels, to replace equipment in order to reduce emissions of criteria pollutants. Fishing vessel engines

typically cost about $50,000 to replace. We calculated the capital cost of these replacements, in addition to the cost savings on diesel fuel. Fuel price forecasts were scaled up to reflect higher costs in Alaska using data from SEDS.

Key Assumptions:

- Engines replaced by the program will improve fuel economy an average of 12%, based on information provided by Alaska fleet operators.
- The average fishing vessel uses 12,500 gallons of diesel fuel per year. This assumption is based on fishing vessels in California. Alaskan fishing vessels may travel longer distances and therefore burn more fuel per year. Higher annual fuel use would increase the emissions impact and reduce the cost of the policy. For example, if fishing vessels burn 17,000 gallons of fuel annually, the policy would produce a net cost savings within the period of analysis.

Key Uncertainties

None identified.

Additional Benefits and Costs

This policy could promote economic development by supporting Alaska's commercial fishing industry.

Feasibility Issues

None identified.

Status of Group Approval

Completed.

Level of Group Support

Unanimous consent.

Barriers to Consensus

None.

TLU-9. Aviation Emission Reductions

Policy Description

In addressing GHG emissions from the aviation sector, Alaska must take into account its unique interests in the sector, the policies and practices of other states and territories, and other national and international laws and policies affecting aviation and environmental goals.

Aviation plays a critical role in the Alaskan economy and society. Alaska's location on the great circle route connecting Asia, North America, and Europe affords the state a vital role and unique opportunities within the international aviation system. At the intrastate level, vast distances between population centers and relatively underdeveloped infrastructure supporting other transportation modes require Alaska to rely more on intrastate aviation than other jurisdictions. Alaskan policy must take in account and protect these unique interests.

At the same time, both commercial air transportation and the climate change challenge are manifestly global in character. These factors intensify the need to calibrate policies carefully to ensure they do not merely deter or deflect economically beneficial aircraft operations (and associated emissions) to other jurisdictions.

Climate change policy also must account for and operate within the long-standing and complex frameworks of environmental and aviation policies. In the environmental sphere, Alaska has the responsibility to meet National Ambient Air Quality Standards for criteria pollutants, such as PM and carbon monoxide. Recognizing that many measures aimed at reducing GHG emissions could have the co-benefit of reducing criteria pollutant emissions, policies should allocate limited resources accordingly. Similarly, aviation is subject to comprehensive federal regulation designed to ensure safety and maximize the availability of affordable air transportation services throughout the country. State and local authority to directly regulate air carrier operations is necessarily limited by that framework, and Alaska, like other states, must calibrate policies accordingly.

Policy Design

This mitigation option includes three components:

- Support modernization of the air traffic management system.
- Identify existing and new operational best practices.
- Promote alternative fuels for aviation.

Support Modernization of the Air Traffic Management System

Support the Federal Aviation Administration (FAA) in the redesign and improvement of the existing, outdated, air traffic management system through the implementation of the Next Generation Air Transportation System project (NextGen). Implementation of NextGen, which will include enhanced communications, navigation, and surveillance, will reduce air traffic delays and shorten routes, resulting in a more efficient National Airspace System with a significant reduction in GHG emissions. According to the FAA, full implementation of NextGen has the potential to reduce GHG emissions by 10%–15%. Alaska will take measures to support the implementation of NextGen and document the associated emission reductions.

Goals:

- Identify opportunities to assist the FAA's implementation of NextGen.
  - Advocate for implementation of NextGen in the U.S. Congress.
  - Identify state-specific actions that will assist with the timely implementation of NextGen.
- Determine potential GHG emission reductions in Alaska resulting from implementation of NextGen.
  - Catalog emission reductions associated with the existing use of advanced navigation technology.
  - Project potential emission reductions associated with additional NextGen improvements.

Timing:

- *2010*—Identify opportunities to assist the FAA in achieving the goals in its Roadmap for Implementation, including carrying out the actions identified above on a timely basis.
- *2010*—Identify existing emission reductions resulting from advanced navigation technologies.
- *2011*—Identify potential emission reductions associated with full implementation of NextGen.
  - Revise the projections as NextGen is implemented to determine whether they are accurate and what level of emission reductions is being achieved.

Parties Involved: The State of Alaska will lead this effort, with input and assistance from airports and aircraft operators.

Other: None.

Identify Existing and New <u>Operational Best Practices</u>

Identify existing and new operational best practices for maximizing fuel efficiency in the aviation sector, facilitate (including through financial incentives) voluntary implementation of such practices where practical, and evaluate resulting emission benefits where possible. Potential operational strategies include:

- Using electric power supplied from airport gates in lieu of running aircraft APUs.
- Developing infrastructure to support the operation of electrified airport ground support equipment, which typically is provided by the airport but may be funded through federal programs.
- Applying strategies under pilot control that may result from a system-wide assessment of airline operations, such as increasing use of single-engine taxi, decreasing use of reverse thrust, and minimizing excess fuel loading (to reduce weight).

Many of these practices require the cooperation of multiple parties. Therefore, the state will facilitate cooperation among airports, aircraft owners and operators, and other parties where necessary, to implement operational best practices.

Goals:

- Identify measures currently used and evaluate the emission benefits they achieve.
- Identify new measures that will lead to additional benefits.
- Identify means to facilitate voluntary implementation of identified measures.

Timing:

- Identify existing measures and means to facilitate voluntary implementation (2010–2011).
- Identify new measures and means to facilitate voluntary implementation (ongoing—prepare initial report in 2011).

Parties Involved: Aircraft operators, airports, State of Alaska.

Other: None.

Promote Alternative Fuels for Aviation

Adopt a clear statement that it is the policy of the State of Alaska to facilitate the rapid introduction of alternative fuels for aviation that both are economically viable and have a reduced emissions profile on a life-cycle basis. Identify and implement measures to support the production, distribution, and use of alternative aviation fuels. Implementation of this policy would be supported by TLU-10: Alternative Fuels Research and Development.

Goals: Similar to the operational best practices measure, above.

Timing: Similar to the operational best practices measure, above.

Parties Involved: Aircraft operators, airports, State of Alaska, fuel providers.

Other: None.

Implementation Mechanisms

See Policy Design, above.

Related Policies/Programs in Place

None identified.

Types(s) of GHG Reductions

Primarily CO_2. Small reductions in N_2O and CH_4.

Estimated GHG Reductions and Net Costs or Cost Savings

Not quantified.

Data Sources: Not applicable.

Quantification Methods: Not applicable.

Key Assumptions: Not applicable.

Key Uncertainties

None identified.

Additional Benefits and Costs

None identified.

Feasibility Issues

None identified.

Status of Group Approval

Completed.

Level of Group Support

Unanimous consent.

Barriers to Consensus

None.

TLU-10. Alternative Fuels Research and Development

Policy Description

The state will support research and development of alternative transportation fuels that are feasible in the Alaska climate, result in significant life-cycle GHG reductions when used in Alaska, and can benefit Alaska's economy. Some alternative fuels being promoted in the lower 48 states do not work well in arctic climates. Furthermore, most of the existing research on life-cycle GHG impacts of alternative fuels does not consider the Alaska context, so there is uncertainty regarding which fuels and technologies will result in net GHG reductions in Alaska. This strategy would support research to answer these questions.

If viable low-carbon alternative fuels are identified for Alaska, the state should encourage in-state production and distribution of these fuels. This can help to ensure that Alaska receives economic benefits from the expanded use of alternative fuels.

Various incentives can encourage companies to continue or begin producing alternative fuels, such as granting state tax credits based on the amount of alternative fuel produced, reducing taxes for alternative-fuel production facilities, or providing loans or grants to companies that are producing or want to produce alternative fuels.

Alaska would need to promote alternative fuels that are most appropriate for Alaska's climate, and can encourage collaboration with other research entities across the Arctic region (e.g., Norway) to identify such alternatives. The state could organize a public/private fuel-buying consortium that enters a long-term contract with a supplier to help overcome the risk of producing alternative fuels. Application of these incentives should always consider the full cycle of energy and GHG impacts.

Policy Design

Research should focus on existing alternative propulsion technologies and methods to make existing technologies more viable in Alaska, rather than on development of new propulsion technologies. For example, biodiesel performs poorly in cold weather conditions, but vehicles with two fuel tanks can warm engines and biodiesel fuel using conventional fuel. Research might include pilot programs to evaluate the costs and benefits, including GHG emission reduction, of various alternative propulsion technologies.

Goals:

- Determine the market potential, cost, and GHG impacts of existing alternative fuel and vehicle types in Alaska.
- Determine methods to encourage the in-state production and use of alternative fuels.

Timing: Begin immediately.

Parties Involved: ADOT&PF, Alaska Energy Authority, UA, Alaska Department of Natural Resources, energy and electricity providers, vehicle manufacturers.

Other: None.

Implementation Mechanisms

- The Alaska Center for Energy Power, at UA Fairbanks, is a likely lead organization for the research program. The center should be consulted on the appropriate scope and design of the research program.
- Alaska should set aside dedicated funding for the proposed research. Federal funding may also be available through such programs as the Rural Energy for America Program, the State Energy Program, or the 2009 Recovery Act. Additional funding may be contributed by any private-sector research partners.

Related Policies/Programs in Place

- EPAct includes provisions requiring an increasing volume of renewable fuel to be included in the gasoline sold in the United States, starting in 2006 with 4 billion gallons, and increasing to 7.5 billion gallons by 2012. Under EPAct, renewable fuel includes motor vehicle fuel produced from grain, starch, vegetable, animal, or other biomass material; cellulosic biomass ethanol; waste-derived ethanol; and biodiesel.
- Alaska Waste is testing biodiesel as a fuel for refuse and recycling collection trucks in the Anchorage area. The company is constructing a facility capable of processing used cooking oil into biodiesel. The facility is expected to become operational in 2009.
- The Indiana Soybean Alliance has developed a new type of biodiesel that can be used in extremely cold conditions. The group is testing the fuel in Alaska.

Types(s) of GHG Reductions

Primarily CO_2. Small reductions in N_2O and CH_4.

Estimated GHG Reductions and Net Costs or Cost Savings

Not quantified. This is an enabling policy for TLU-5 and TLU-9.

Data Sources: Not applicable.

Quantification Methods: Not applicable.

Key Assumptions: Not applicable.

Key Uncertainties

None identified.

Additional Benefits and Costs

This policy could support economic development by helping to catalyze production of alternative fuels in Alaska.

Feasibility Issues

None identified.

Status of Group Approval

Completed.

Level of Group Support

Unanimous consent.

Barriers to Consensus

None.