

# Chapter 5

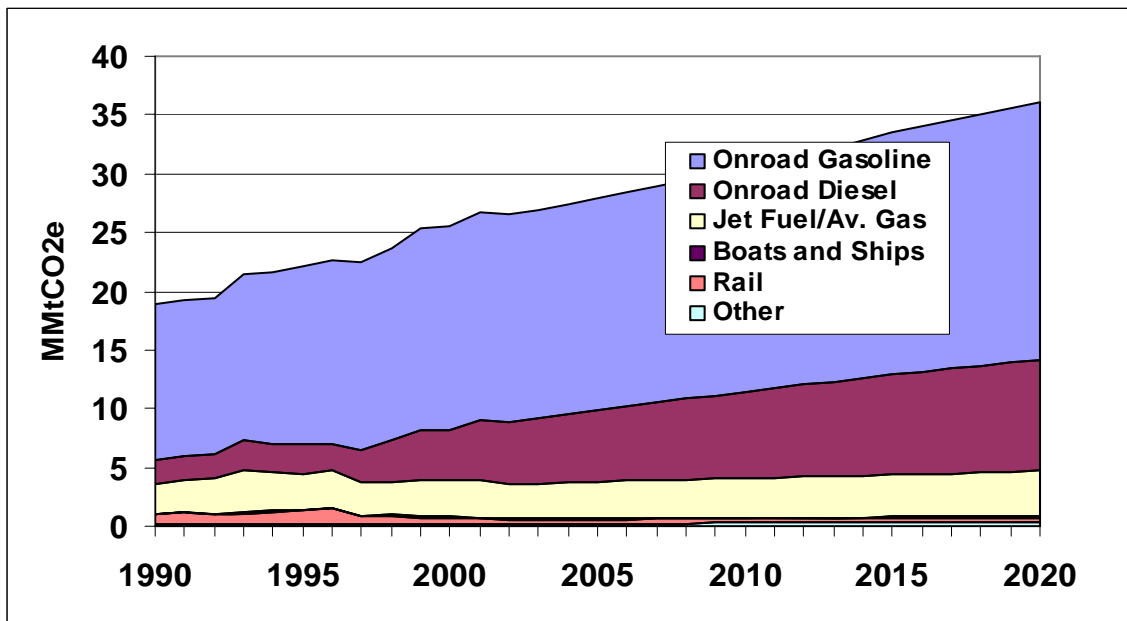
## Transportation and Land Use

### Overview of GHG Emissions

The Transportation and Land Use (TLU) sector is a major source of greenhouse gas (GHG) emissions in Colorado, currently accounting for about 24% of the State's gross GHG emissions in 2005. The transportation technologies and fuels used are key determinants of those emissions, along with population, economic growth, and various land use policies that all affect the demand for transportation services. Colorado GHG emissions from the TLU sector totaled 28 million metric tons of carbon dioxide equivalent (MMtCO<sub>2e</sub>) in 2005.

Figure 5-1 shows historical and projected transportation sector GHG emissions by fuel and source, illustrating rapid growth. Total transportation emissions are expected to nearly double between 1990 and 2020, reaching 36.2 MMtCO<sub>2e</sub> in 2020 under the reference case projection. Growth in vehicle miles traveled (VMT) will account for most of the increase. VMT from gasoline-fired vehicles is projected to grow by 34% between 2005 and 2020, while VMT from diesel vehicles is projected to grow 68%, largely due to growth in freight movement.

**Figure 5-1. Historical and projected GHG emissions from the transportation sector, Colorado, 1990 to 2020**



### Key Challenges and Opportunities

The principal means to reduce transportation emissions include improving vehicle fuel efficiency, substituting gasoline and diesel with lower-carbon fuels, reducing vehicle travel, and improving the efficiency of transportation system operations. The first three approaches are particularly important areas for policy development at present.

In Colorado and in the nation as a whole, vehicle fuel efficiency has improved little since the late 1980s, yet many studies have documented the potential for substantial increases in efficiency while maintaining vehicle size and performance. Opinions differ on the extent to which vehicle fuel efficiency can be increased in the near term and the impacts of mandated efficiency standards on automakers. Increases in federal fuel economy standards are likely in the near future, but the scale of increase is unknown.

The use of alternative fuels with lower per-mile GHG emissions is growing in Colorado, and larger market penetration is possible. Conventional gasoline- and diesel-fired vehicles can use low level blends of biofuels. Alternative technology vehicles can also use higher level biofuel blends, as well as other types of alternative fuels such as natural gas, electricity, and hydrogen. The type of fuel and its origin are crucial determinants of impacts on GHG emissions, as some alternative fuels have relatively little life-cycle GHG benefit. Currently, the most prevalent biofuel in Colorado is corn-based ethanol, which has minimal GHG benefit from a life-cycle perspective. Ethanol from cellulosic feedstocks can achieve much larger GHG reductions, but the production of such fuels is not yet commercially viable. Fuel distribution infrastructure is also a constraining factor for wide distribution of many alternative fuels.

The reduction of per capita VMT is a critical component of mitigating GHG emissions from the transportation sector. Expanded use of smart growth land use patterns can contribute substantially to this goal by reducing trip length and encourage the use of transit, ridesharing, bicycling, and walking. A variety of pricing policies and incentive packages can also help to reduce VMT. Some localities in Colorado have taken steps to increase transit options and encourage smart growth. The development of better planning methods and regulations and the increase of funding in support of alternative modes of transportation will be key mechanisms to achieve these goals.

## **Overview of Policy Recommendations and Estimated Impacts**

The CAP recommends a set of 11 policy recommendations for the TLU sector that offer the potential for major economic benefits and emissions savings. All 11 recommendations were adopted by unanimous consent of the CAP members present and voting. These policy recommendations could lead to emissions reductions of

- 7.8 MMtCO<sub>2</sub>e per year by 2020,
- 47 MMtCO<sub>2</sub>e cumulative savings from 2007 through 2020, and
- \$3.2 billion net cost savings to the Colorado economy through the year 2020 on a net present value (NPV) basis.<sup>1</sup>

The weighted average cost of the policy recommendations for which quantitative estimates of both costs and savings were prepared is -\$141 per ton of CO<sub>2</sub>e.

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<sup>1</sup> The net cost savings are based on fuel expenditures, operations, maintenance, and administrative costs, and amortized, incremental equipment costs. All NPV analyses here use a 5% real discount rate.

The estimated impacts of the individual policies are shown in Table 5-1. The CAP policy recommendations are described briefly here and in more detail in Appendix G of this report. The recommendations not only result in significant emissions and costs savings, but offer a host of additional benefits as well.

**Table 5-1. CAP-recommended policies and results for the transportation and land use sector**

	Policy Recommendation	GHG Reductions (MMtCO <sub>2</sub> e)			Costs (Savings) 2007–2020 (Million \$)	Cost-Effectiveness (\$/tCO <sub>2</sub> e)	Climate Action Panel Action
		2012	2020	Total 2007–2020			
TLU-1	Reduce light-duty vehicle miles traveled 2% by 2020 by promoting “smart growth” land use planning and development. Require that GHG emissions be considered in long-range transportation plans by 2010.	0.08	0.47	2.43	Less than \$0	Less than \$0/ton	Unanimous Consent
TLU-2	Incentives for the purchase of low-GHG vehicles. [An alternative if the TLU-6 clean car standards are not implemented.]	Quantified as part of TLU-6					Unanimous Consent
TLU-3	Reduce light-duty vehicle miles traveled 6% by 2020 by improving transit service quality and funding expansion of transit infrastructure.	0.17	0.97	5.09	N/A	N/A	Unanimous Consent
TLU-4	Reduce heavy-duty vehicle idling.	0.07	0.11	0.91	–\$123	–\$134/ton	Unanimous Consent
TLU-5	Adopt a low carbon fuels standard that will reduce carbon intensity of passenger vehicle fuels by 10% by 2020.	0.38	2.21	16.1	N/A	N/A	Unanimous Consent
TLU-6	Adopt California GHG emission standards for cars and trucks.	0.70	3.40	18.8	–\$1,880	–\$100/ton	Unanimous Consent
TLU-7	Expand transit use marketing and employer-sponsored transit fare programs.	Quantified as part of TLU-3					Unanimous Consent
TLU-8	Move toward basing motor vehicle insurance on the distances vehicles are driven.	0.32	0.94	7.19	Less than \$0	Less than \$0/ton	Unanimous Consent
TLU-9	Local parking management programs to encourage alternative travel choices and transit-oriented development.	0.03	0.03	0.34	–\$37	–\$110	Unanimous Consent
TLU-10	Require employers with more than 100 employees to offer commuter benefits programs.	0.42	0.45	4.77	–\$1,145	–\$240/ton	Unanimous Consent
TLU-11	Incorporate vehicle maintenance, operation, and transportation choice GHG reduction information in driver training and education.	Not quantified					Unanimous Consent
	Sector GHG reduction total of <b>8 analyzed policies</b> after adjusting for overlaps among policies	2.14	7.84	46.7	N/A	N/A	
	Sector cost-effectiveness total of <b>4 analyzed policies with cost estimates</b> after adjusting for overlaps among policies				–\$3,185	–\$141/ton	

GHG = greenhouse gas; N/A = not applicable.

\* Cumulative Net Present Value and Cost-Effectiveness values reflect options 4, 6, 9, and 10 only. Cumulative Net Present Value and Cost-effectiveness values for all options cannot be quantified.

Negative cost numbers indicate cost *savings*. The cost (savings) shown are calculated as in terms of net present value in constant 2005 dollars using a 5% annual real discount rate for the period 2008 through 2020. Capital investments are represented in terms of levelized or amortized costs through 2020.

These benefits include reduced local air pollution, more livable, healthy communities, and economic development and job growth. In order for the TLU policies recommended by the CAP to yield the levels of savings described here, the policies should be implemented in a timely, aggressive, and thorough manner.

Technology is an important component of the recommended policies. The State Clean Car program (TLU-6) would result in the largest GHG reduction of any single TLU policy recommendations. However, before Colorado or any other state can adopt it, U.S. EPA must grant a waiver approving the original California GHG standards for new vehicles. If for any reason Colorado is not able to implement the Clean Car Program, other technology-based policies could play a larger role. For example, the policies to be studied under the Incentives for Purchase and Operation of Low-GHG Vehicles (TLU-2) could improve fuel efficiency through a multi-state “feebate” program. Such a program would be revenue-neutral, assessing a fee on relatively high emissions/low fuel economy vehicles and offering a rebate or tax credit on low emissions/high fuel economy vehicles. A multi-state approach to feebates is recommended because of the drawbacks of Colorado, or any other state, acting alone in this area.

Other policies can promote technological improvements in the heavy-duty diesel fleet. TLU-4, Heavy-Duty Vehicle Idle Reduction, would limit unnecessary idling by heavy-duty trucks and buses and would promote technological alternatives to extended idling. Less idling means less fuel consumed and fewer GHG emissions.

Colorado can achieve greater alternative fuel use through a combination of voluntary and mandatory measures. A Low Carbon Fuel Standard (TLU-5) can increase the use of alternative transportation fuels that result in lower GHG emissions. The policies recommended in Chapter 6 (AFW-4 and AFW-5) can promote in-state production of these fuels through methods with lower lifecycle GHG emissions. The Low Carbon Fuel Standard would also promote the use of vehicles powered by electricity or hydrogen. When produced from renewable sources, these fuels can dramatically reduce GHG emissions.

A number of policies would work together to reduce VMT by increasing the viability of alternative modes of travel and providing incentives to use alternative modes. These policies will require increased coordination between state government, local government, and businesses in many cases. Smart Growth and Related Planning (TLU-1) presents the greatest institutional challenge. The promotion of more compact and mixed-use development patterns requires significant reform in local planning practices. Yet implementation of this policy is essential to make travel by walking, bicycling, and transit more feasible. In fact, transit use is on the rise nationwide and can be increased in many areas. TLU-3 (Improve and Expand Transit Service) and TLU-7 (Transit Marketing, Promotion, and Pricing Incentives) involve a policy package for the improvement, expansion, and promotion of public transit in Colorado. Commuter Benefits Programs (TLU-10), offered by employers to their employees, also promote use of transit as well as other alternatives to driving to work.

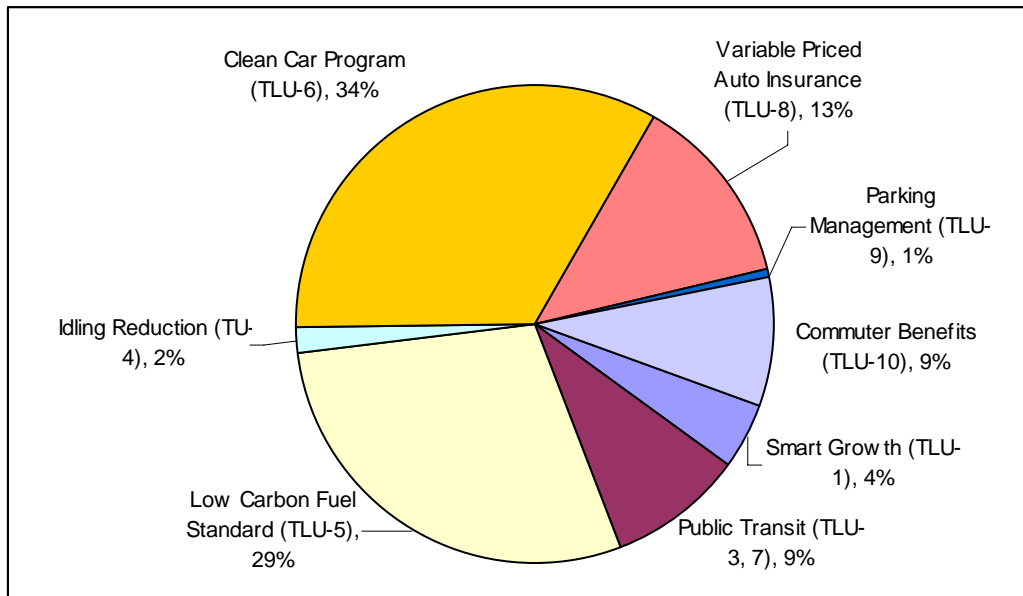
Other policies would change the price or perceived convenience of driving. Variable Priced Automobile Insurance (TLU-8) and Parking Management (TLU-9) increase the attractiveness of alternative modes relative to driving. Together these policies address the built environment, transportation infrastructure, and the behavior of individuals to reduce per capita VMT.

Finally, driver and consumer education provides users of the transportation system with the information they need to make choices that results in lower GHG emissions. TLU-11 would develop a curriculum to be incorporated into all driver training programs to promote voluntary reductions of fuel use and GHG emissions.

There is overlap in the expected emissions reductions among some of the policies within the TLU sector, so the GHG reductions resulting from individual stand-alone policies are not purely additive. In particular, policies that reduce VMT will erode the GHG benefits of policies that improve vehicle fuel economy or reduce fuel carbon intensity (TLU 5 and 6). It was assumed that there is no overlap among the policies that affect VMT (TLU-1, 3/7, 8, 9, and 10), so the VMT effects of these policies were summed to arrive at an adjusted statewide VMT (by vehicle class and urban/rural designation). Using the adjusted VMT, statewide fuel use and GHG emissions were calculated, and this result was reduced by the impacts of TLU-5 and TLU-6. TLU-4 affects only heavy-duty vehicles and therefore has no overlap with other policies. There is no overlap between TLU policies and those from the other sectors. More detail on the calculation of net cumulative impacts is included in Appendices D and G.

Figure 5-2 illustrates the distribution of total (2007-2020) emission reductions by policy recommendation. The Clean Car program (TLU-6) and Low Carbon Fuel Standard (TLU-5) account for the largest shares of emission reduction, together making up 63% of the total reductions from the recommended TLU policies. Variable priced auto insurance (TLU-8), commuter benefits programs (TLU-10), and public transit improvement and expansion (TLU 3/7) each contribute approximately 10% to the total TLU reductions. The other policy recommendations contribute smaller shares.

**Figure 5-2. Percent of avoided greenhouse gas emissions by policy**



## Transportation and Land Use Sector Policy Recommendations

The TLU sector includes emissions and mitigation opportunities related to vehicle technologies, fuel choices, public transit options, and demand for transportation services.

### TLU-1 Smart Growth and Related Planning

The CAP recommends, by unanimous vote of those members present and voting, that Colorado implement land use planning, development, and analysis that supports protection of natural and cultural resources, strengthens communities, creates more compact development, and reduces growth in driving and emissions. Specific policies and strategies to be considered and undertaken include the following:

- Provide incentives to developers for density and mixed use.
- Improve techniques for estimating reductions in vehicle trip generation for land uses with mixed use developments.
- Include reductions in estimated traffic generation as a result of intelligently located development.
- Implement a concurrency management system or adequate public facilities requirement.
- Encourage the use of intergovernmental agreements to implement urban growth boundaries.
- Provide a means for local governments to share local sales tax proceeds.
- Implement inter-jurisdictional planning and/or regional review of local plans.
- Program infrastructure investments so as to encourage and reward compact development.
- Undertake local planning for local street patterns prior to development.
- Increase property owners' awareness of conservation easements in Colorado.
- Promote brownfield development through rebates of property taxes to offset cleanup costs.
- Increase funding for a Conservation/ Land Protection Fund.

Together, these Smart Growth policies reduce GHG emissions by giving municipalities the tools needed to shift development patterns and reduce vehicle trips and total vehicle miles traveled.

In addition, the CAP recommends that the Colorado Department of Transportation (CDOT) and metropolitan planning organizations (MPOs) quantify and report GHG emissions from long-range transportation plans by 2010, provided that financial and technical assistance is provided as needed.

## **TLU-2 Incentives for Purchase and Operation of Low-GHG Vehicles**

The CAP recommends, by unanimous vote of those members present and voting, that Colorado further study, develop and/or maintain policies and programs that encourage the purchase of low GHG emission vehicles. These policies include

- Performing a multi-state study of the feasibility and effectiveness of a regional feebate system;
- Continuing the current income tax credit program for hybrid, alternative fuel, and low-emission vehicles so that it continues in its present form beyond 2010; and
- Maintaining current preferential state-controlled infrastructure (high-occupancy vehicle (HOV) lanes) access for alternative fuel vehicles (natural gas, propane, 100% electric) with possible provision of “green license plates” to designate alternative fuel vehicles.

Additionally, the CAP recommends, by unanimous vote of those members present and voting, that tax-funded, non-tax paying entities (state and local governments) be required to purchase the lowest GHG vehicle suitable for their usage. Together, these incentives could change the vehicle fleet technology mix through a combination of demand- and supply-side changes.

## **TLU-3 Improve and Expand Transit Service**

The CAP recommends, by unanimous vote of those members present and voting, that Colorado make improvements to existing transit service and expand current transit routes to reach more of the state’s population. The provision of better and more extensive transit service can shift passenger transportation from single-occupant vehicles to public transit, thereby reducing emissions. This recommendation involves a number of actions to be undertaken by state government, local government, and transit agencies. Transit investments that encourage greater use of public transportation may include

- Improving service frequency on selected existing transit routes,
- Supporting and encouraging improvements in intercity bus service,
- Reducing travel times on selected existing transit routes (e.g., signal prioritization, exclusive lanes),
- Improving service quality on selected existing transit routes (safety, cleanliness, and improvements to shelters/stations), and
- Expanding transit service and infrastructure (commuter rail, light rail, bus, bus rapid transit [BRT]).

TLU-3 also works in conjunction with TLU-7 (Transit Marketing, Promotion, and Pricing Incentives) to reduce VMT growth. TLU-3 is the service and infrastructure component of an overall strategy to increase the mode share of public transit.

#### **TLU-4 Heavy-Duty Vehicle Idle Reduction**

The CAP recommends, by unanimous vote of those members present and voting, that Colorado develop and implement a statewide regulation banning extended idling by heavy-duty vehicles. This regulation would reduce idling from diesel and gasoline heavy-duty vehicles, buses, and other vehicles. In addition to the regulation, the policy would promote and expand the use of technologies that reduce heavy-duty vehicle idling. These technologies include truck stop electrification stations as well as vehicle equipment modifications such as auxiliary power units, direct fired heaters, and automatic engine shut down/startup system controls.

The CAP also recommends, by unanimous vote of those members present and voting, that Colorado create programs aimed at increasing voluntary adoption of idling reduction technologies. Components of such programs would include:

- Collaborative outreach and education timed with the implementation and enforcement of a statewide anti-idling regulation
- Conducting pilot projects and demonstrations to evaluate the effectiveness of various idle reduction technologies
- Seeking funding from federal and other sources for such programs.

#### **TLU-5 Low Carbon Fuels Standard**

The CAP recommends, by unanimous vote of those members present and voting, that Colorado promote greater use of low-carbon transportation fuels by adopting a “Low Carbon Fuels Standard.” The Low Carbon Fuel Standard would require all transportation fuel providers in Colorado to ensure the mix of fuel they sell into the Colorado market meets, on average, a declining standard for GHG emissions measured in CO<sub>2</sub> equivalent gram per unit of fuel energy sold. Low carbon fuels could include biodiesel, ethanol from cellulosic feedstocks, hydrogen, compressed natural gas, liquefied petroleum gas, and electricity. The program does not mandate that any particular fuel be used to meet the performance standard.

Related elements of this strategy include:

- Fuel Quality Standards
- State Government Fleet ‘Leadership’ Programs for adoption of Low Carbon Fuels
- Low Carbon Fuel Infrastructure Development

The CAP recommends that the Low Carbon Fuel Standard require a reduction in the carbon intensity of passenger vehicle fuels sold in-state by at least 10% by 2020. The standard would be measured in CO<sub>2</sub>e grams per unit of fuel energy sold, calculated on a lifecycle basis in order to include emissions from fuel production. Fuel providers (defined as refiners, importers, and blenders of passenger vehicle fuels) would need to demonstrate compliance with the standard.

## **TLU-6 Clean Car Program for Autos and other Light-Duty Vehicles**

The CAP recommends, by unanimous vote of those members present and voting, that Colorado adopt the State Clean Car Program in order to reduce GHG emissions from new light-duty vehicles. Under the current federal law, states have the option of choosing between the federal standard for air pollution emissions and the California standard. This policy assumed the California standards, which must still be approved by US EPA, would take effect in Colorado beginning with Model Year 2011 (calendar year 2010). Other Clean Car Program elements can include standards requiring reductions in smog- and soot-forming pollutants and promoting introduction of very low-emitting technologies into new vehicles.

In 2005, California finalized a set of GHG standards for new light-duty vehicles, to be phased in from 2009 to 2016. The regulations are estimated to result in an average reduction of GHGs from new cars and light trucks of about 22% in 2012 and about 30% in 2016, compared to today's vehicles. States that already have adopted or stated an intention to adopt the Clean Car Program standards include, at least, Arizona, California, Connecticut, Florida, Maine, Massachusetts, Montana, New Jersey, New Mexico, New York, Oregon, Pennsylvania, Rhode Island, Utah, Vermont, and Washington.

## **TLU-7 Transit Marketing, Promotion, and Pricing Incentives**

The CAP recommends, by unanimous vote of those members present and voting, that Colorado promote greater use of public transit and a reduction in automobile travel through various forms of marketing and pricing incentives. Travel patterns are affected by public knowledge and attitudes; therefore marketing becomes an important tool in order to increase transit usage. Instead of merely advertising its availability, transit marketing could be an ongoing dialogue between community partners and transit agencies to develop programs in metropolitan areas.

Complementing policy recommendations TLU-3 and TLU-10, TLU-7 would increase the use of transit service by expanding employer-provided transit benefit programs that encourage commuting by transit. Public transit can be made more affordable by offering other price incentives, such as group discounts or discounted pricing for multi-modal purchases. The state would also work with transit agencies to develop and implement new transit marketing programs in metropolitan areas.

## **TLU-8 Variable Priced Automobile Insurance**

The CAP recommends, by unanimous vote of those members present and voting, that Colorado take steps to promote provision of a variable priced automobile insurance. Variable priced insurance transfers some of the fixed cost of annual auto insurance premiums to a variable basis, thereby providing an incentive for vehicle owners to drive less. One form of this concept is "pay-at-the-pump insurance," whereby insurance premiums are paid as a fuel tax surcharge. Another form is Pay-As-You-Drive (PAYD) insurance, whereby a portion of vehicle insurance payments is assessed on a per-mile basis. Benefits of variable priced insurance include emissions

reductions, increased safety (through decreased driving) and fairer distribution of costs (by tracking the portion of individuals' risk associated with miles driven).

The CAP recommends that Colorado change insurance regulations to allow private companies to offer a variable priced insurance option. Additionally, the CAP recommends that Colorado initiate and promote a pilot program of PAYD. Assuming a pilot program is successful, market penetration could increase to 50% by 2020. This could happen either through competitive market pressure (increasing numbers of companies offer it in order to stay competitive) or through a change in state policy mandating insurance companies to offer PAYD at some point after it has been proven to work.

#### **TLU-9      Parking Management**

The CAP recommends, by unanimous vote of those members present and voting, that Colorado encourage innovative parking management by local governments as a way to reduce automobile use and encourage infill and transit-oriented development. The location, supply, and pricing of parking can have a major impact on travel decisions, including choice of mode. Parking management refers to policies and programs that result in more efficient use of parking resources. Managing parking by restricting parking availability or encouraging market rate pricing can encourage more transit usage, ridesharing, bicycling, and walking. Reducing requirements for parking supply can also encourage infill and transit-oriented development by lowering the cost of such projects.

#### **TLU-10     Commuter Benefits Programs**

The CAP recommends, by unanimous vote of those members present and voting, that Colorado promote commuter benefits programs by employers. Employers can significantly reduce automobile travel by their employees by offering amenities such as free or low cost transit passes, strong telework programs, carpool matching and vanpool subsidies, guaranteed ride home services, parking cash-out, and facilities for bicyclists.

State and local government agencies can offer these programs to their employees and can encourage private employers to offer such programs. Commuter benefits programs could also be part of a larger Colorado corporate climate challenge. The CAP recommends that Colorado adopt an employee trip reduction act and require large employers to participate in an employee trip reduction program. The goal of this policy recommendation is that, by 2010, all employers in Colorado served by a transportation authority or district with more than 100 employees will offer a commuter benefits program.

#### **TLU-11     Driver and Consumer Education**

The CAP recommends, by unanimous vote of those members present and voting, that Colorado develop and implement a driver and consumer education curriculum on energy efficient driving behaviors. Drivers will voluntarily reduce fuel use and GHG emissions from their activities when they have the information necessary to make proper decisions.

A driver and consumer education curriculum would address improved vehicle maintenance, improved vehicle operation and improved transportation choice. This curriculum would be a requirement for all driver training programs with questions pertinent to training included on the written/driving portion of private and commercial driver licensing tests. Currently, driver training programs in Utah and Arizona incorporate this type of curriculum in classroom settings.

This policy would also involve a state marketing program for fuel efficient replacement tires and energy efficient driving practices and devices, and training for state and municipal fleet operators.