6 ENERGY EFFICIENCY IN TRANSPORTATION

6.1 TRANSPORTION ENERGY USE IN APPALACHIA

The Appalachian transportation sector consumed 11.6 billion gallons of gasoline and 2.8 billion gallons of diesel in 2006. The transportation sector offers significant energy-efficiency potential through the implementation of stricter standards, enforcement, and a variety of policies. This analysis estimates the energy savings potential from both light- and heavy-duty highway vehicles.[27]

Heavy-duty consumption of diesel fuel is expected to grow along with population to reach 3.5 billion gallons by 2030 while gasoline consumption will reach 14.8 billion gallons by 2030. However, the passage of new Corporate Average Fuel Economy (CAFE) standards by the 2007 Energy Independence and Security Act (EISA, 2007) will significantly reduce gasoline consumption in Appalachia by 2030.

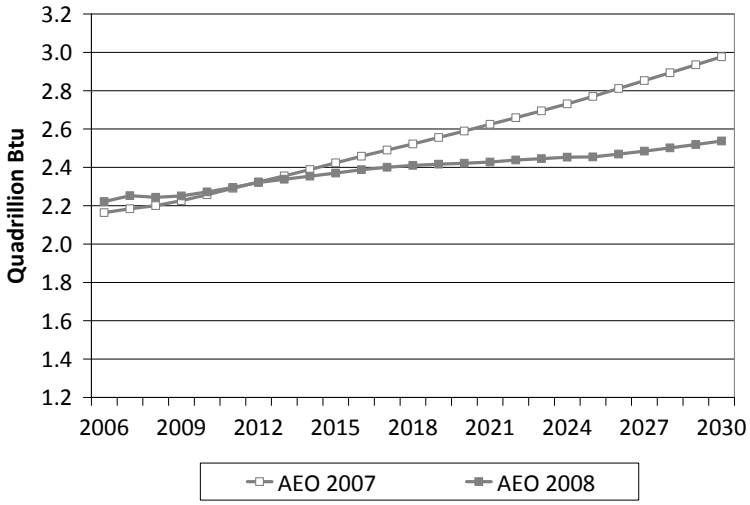

Figure 6.1 Appalachian Region Transportation Consumption Forecast (quads), 2006-2030
(EIA, 2007a; 2008a)

Light duty gasoline consumption is also projected out to 2030 in Figure 6.1. Forecast growth in consumption falls steeply when the savings that result from the new CAFE standards are considered. The 2007 projection estimates that transportation energy consumption will reach 2.98 quads by 2030 while the 2008 *AEO* ARC adjusted projection estimates consumption of 2.54 quads by 2030.[28]

EISA established a CAFE of at least 35 miles per gallon for cars and light trucks by 2020, a 40 percent increase over today's fuel economy standard. Fuel savings documented in the transportation policy options that follow are estimated based on a reference case that incorporates the effect of new CAFE standards. Our estimates of gasoline savings in Appalachia due to the increase in fuel economy to 35 mpg by 2020 are shown in detail in Table 6.1.

[27] Throughout this analysis, we have considered gasoline only in light-duty analysis, and we have considered diesel only in heavy-duty analysis. We recognize that these segments of the sector are not exclusively using these fuels, but they represent the largest percentage of consumed fuel. Savings would also be expected in other fuels used in the sector, but they are not modeled.

[28] Please note that energy savings in Table 6.1 were obtained by running a stock model and do not match the consumption figures shown in Figure 6.1.

Table 6.1 CAFE Fuel Savings

Year	Motor Gasoline (million gallons)	Total Primary Energy Saved (trillion Btu)	% of Sector Primary Energy
2010	22	3	0.1
2013	337	42	1.8
2020	1,843	229	9.5
2030	4,222	524	20.9

The bulk of energy consumed in the transportation sector comes from motor gasoline (63 percent); diesel is another important source (23 percent) while propane, natural gas, ethanol blends, electricity, and other fuels are relied on less (see Figure 6.2).

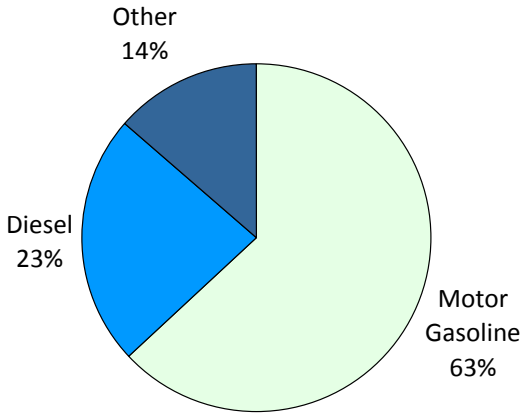

Figure 6.2 Transportation Sector Energy Sources by Fuel, 2006
(EIA, 2008a)

6.2 POLICY OPTIONS FOR TRANSPORTATION ENERGY EFFICIENCY

The policy bundles described in detail in this report include pay-as-you-drive (PAYD) Insurance, Clean Car Standards, low-interest loans for heavy-duty efficiency improvements, and a stricter enforcement of speed limits.

Progress has been made around the country on many of the policies discussed. Several experimental PAYD programs are already in place: GMAC offers a mileage-based discount in Arizona, Indiana, Illinois, and Pennsylvania; and Progressive Insurance has a pilot program in Minnesota and is launching one in Texas, where the Legislature has passed a bill allowing companies to offer mileage-based coverage. California recently approved regulations increasing the mileage-based component of insurance rates, and Oregon is providing tax credits to insurers offering pay-as-you-drive policies.

Georgia is conducting a PAYD study, and Washington a pilot project, both funded by the Federal Highway Administration.[29] Similarly, several states have taken action with regards to fuel economy standards. Fourteen states have currently signed on to California's Clean Car Standard, vowing to reduce greenhouse gas emissions by 30 percent of 2002 levels by 2016. These states are still awaiting approval from the EPA to continue with implementation.

Table 6.2 highlights the supporting policies that will ensure successful implementation of the options discussed in this chapter.

Table 6.2 Policies That Support Transportation Energy Efficiency

Actions	PAYD	Clean Car Standards	Heavy-Duty Efficiency Loans	Improved Speed limit Enforcement
Research, Development, and Demonstration	Demonstration or pilot programs for PAYD insurance schemes	Vehicle R&D to encourage development of low-emissions vehicles	N/A	N/A
Financing	N/A	N/A	*Low-interest loans for the purchase of new high-efficiency vehicles or the retrofit of existing trucks with approved energy-efficiency technologies*	N/A
Financial Incentives	Monetary incentives to insurance companies for each PAYD policy issued	Tax incentives and feebates for efficient vehicles support Clean Car Standards	Rebates and tax incentives to encourage fleet-wide adoption of efficient technologies for heavy trucks	N/A
Pricing	***PAYD Insurance***	N/A	N/A	N/A
Voluntary Agreements	Agreement from insurers to participate on a voluntary basis at the outset of the program	N/A	N/A	N/A
Regulations	Removal of regulatory obstacles to allow implementation of mileage-base insurance premiums	*Clean Car Standards*	Fuel economy standards for heavy-duty vehicles	Reduced state speed limits, *Improved Speed Limit Enforcement*

[29] Federal Highway Administration, *Value Pricing Project Quarterly Report October-December 2006*, http://ops.fhwa.dot.gov/tolling_pricing/value_pricing/quarterlyreport/qtr4rpt06/; Sightline Institute, *Pay-as-You-Drive Pilot in Washington*, http://daily.sightline.org/daily_score/archive/2007/03/29/pay-as-you-drive-pilot-in-washington (2007)

Table 6.2 Policies That Support Transportation Energy Efficiency

Actions	PAYD	Clean Car Standards	Heavy-Duty Efficiency Loans	Improved Speed limit Enforcement
Information Dissemination & Training	Industry-wide workshops on PAYD insurance schemes.	N/A	N/A	Consumer educational resources targeting road safety and fuel economy savings derived from driving at the speed limit
Procurement	N/A	Purchase of fleet vehicles that individually meet the GHG standard	N/A	N/A
Market Reforms	N/A	N/A	N/A	N/A
Planning Techniques	N/A	N/A	N/A	N/A
Capacity Building	N/A	N/A	N/A	N/A

This table describes policy actions available that could further the savings from this policy; those in *italics* are modeled in this study while the others are not.

6.3 MODELED SAVINGS IN THE TRANSPORTATION SECTOR

6.3.1 Enabling Pay-As-You-Drive Insurance

One reason that people use their vehicles as much as they do is that a high percentage of total driving costs are ―fixed" costs, i.e., they are independent of the number of miles driven. The impacts of driving, however, are very dependent on how much people drive. One approach to reducing miles driven is to convert a largely fixed cost, such as insurance, to a variable cost. ―Pay-as-you-drive" (PAYD) insurance accomplishes this by having the rate paid by an individual depend heavily on the number of miles driven. Drivers would pay a portion of their premiums up front, and the remainder would be charged in proportion to mileage, as determined by a mileage tracking device or periodic odometer readings. In principle, this makes sense from the insurance industry‘s perspective as well, because those who drive fewer miles have lower accident exposure, on average.

The 2005 Federal transportation funding law ―SAFETEA-LU" includes a $3 million per year set-aside for experimental, market-based incentive programs like PAYD insurance. Several states have already applied for funding.[30]

A PAYD program could be an insurance company policy or product, but some action on the part of states may be required to remove regulatory obstacles to changing the basis for premiums or to promote the program. The policy proposed here is to phase in PAYD insurance in the Appalachian Region, starting with a pilot program. For three years beginning in 2009, Appalachian states would offer incentives for insurance policies based largely on miles driven. More specifically, the Region (or entities within the Region) would grant $200 to insurance agencies for each one-year policy they

[30] Environmental Defense, *Pay-As-You-Drive Auto Insurance*, http://www.environmentaldefense.org/article.cfm?contentid=2205

write for which 80 percent or more of the pre-program policy cost is scaled by the ratio of miles driven to the state average miles driven. The incentive is necessary so long as PAYD is optional; without it, insurance companies may be concerned about losing revenues from the low-mileage customers who would choose such a policy without being able to offset these costs with higher premiums for high-mileage customers. Should the pilot program prove successful, we recommend phasing in a mandatory PAYD insurance program over the next ten years.

Insurance companies would be responsible for converting a percentage of their policies to PAYD, with the percentage increasing each year until PAYD is universal in 2020. Along with implementing PAYD insurance, the state should educate vehicle owners on how they can reduce their insurance payments by driving less.

The program proposed here begins with a three-year pilot program subsidized by the Region. The Region would offer insurance companies a $200 incentive per PAYD policy, with goals of 2,000 policies in 2009, 10,000 policies in 2010, and 20,000 policies in 2011. A mandatory program would then be phased in over the next ten years. Miles driven would be monitored using the odometer or an added tracking device. Numbers would periodically be reported back to insurance companies to ensure compliance with regulations. This program would be expected to result in a four percent reduction in driving and vehicle miles traveled (VMT), and consequently light-duty vehicle energy use, by 2020. Table 6.3 presents the projected impacts by year.

Table 6.3 Estimated Impacts of a Mileage Pay-As-You Drive Insurance Program

Year	Diesel	Motor Gasoline	Total Primary Energy Saved	% of Sector Primary Energy
	(million gallons)	(million gallons)	(trillion Btu)	
2010	0.00	0.65	0.08	0.00
2013	0.00	130.80	16.24	0.69
2020	0.00	540.45	67.11	2.77
2030	0.00	595.54	73.95	2.91

Insurance companies could incur substantial per-vehicle monitoring costs during the pilot phase of the proposed program for distribution of mileage tracking devices and data collection expenses. However, once the program becomes mandatory, per-vehicle costs would decline as tracking device costs decline and data collection and analysis is spread over a large number of vehicles.[31] We assume a per-vehicle cost of $40 per vehicle per year in the pilot phase and $10 per vehicle; thereafter these costs are represented as administrative costs in Table 6.4. While we have considered these costs as administrative costs in this analysis, they will not necessarily be borne by the public office administrating the enabling program; rather, they will not necessarily be borne by the insurance companies and likely passed on to consumers, who will benefit.

[31] Bordoff and Noel, 2008

Table 6.4 Energy Savings and Costs a Pay-As-You Drive Insurance Program			
Year	**Energy Savings**	**Admin Costs**	**Investment Costs**
	(million 2006$)	**(million 2006$)**	**(million 2006$)**
2010	1.60	4.69	2.00
2013	311.57	55.04	0.00
2020	1,298.31	217.44	0.00
2030	1,506.42	232.83	0.00

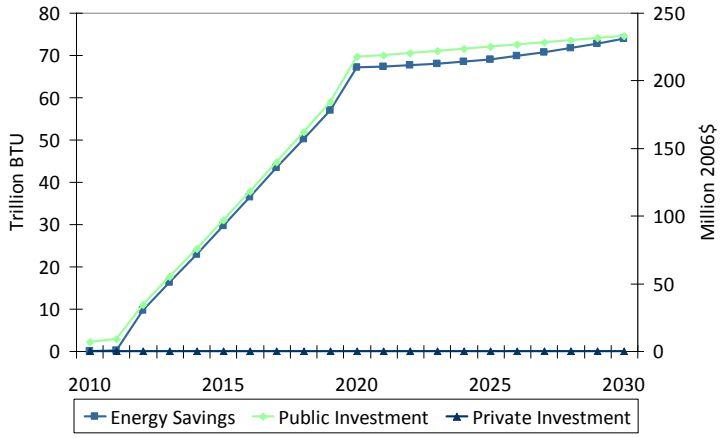

Figure 6.3 Pay-As-You-Drive Public Investment and Returns

Although many states and several insurance companies have shown an interest in PAYD insurance, implementation to date has been limited. In a voluntary program, companies already in the market could lose low-mileage customers to new companies that can afford to offer these drivers mileage-based premiums without having to subsidize coverage for high-mileage drivers. To avoid this potential source of opposition to the program, the state could offer incentives only for policies that insurance companies write for their existing customers or for drivers new to the state. When the program becomes mandatory, this concern disappears, because reduced premiums for low-mileage drivers will be offset by increased premiums for high-mileage drivers.

Like other pricing policies designed to reduce miles driven and promote alternative travel modes, PAYD insurance may raise questions of equity, especially in rural areas, where alternatives to driving are not readily available. Insurance premiums are generally lower in rural areas than in urban areas, however, so high-mileage premiums would be smaller there. Moreover, in a PAYD program, a rural driver's annual mileage would be compared to that of other rural drivers for purposes of determining the insurance premium. Also, low-income drivers generally drive less than higher-income drivers, and low-income drivers as a group consequently would be net beneficiaries of pay-as-you-drive insurance programs.[32]

Objections to PAYD insurance have also been raised based on privacy concerns. This is particularly the case when the proposed mileage verification system relies upon GPS-based information. A system based on periodic odometer readings will probably be adequate for such a program, however.

[32] Bordoff and Noel, 2008

An alternative approach to reduce VMT through monetary incentives would be increasing the state gas tax. The average gas tax in the Appalachian states stands at $0.22 per gallon.[33] As noted above, PAYD insurance would in effect increase the variable cost of driving by $0.048 per mile. Achieving the same result by raising the gas tax would require an increase of roughly $1.33 per gallon in the gas tax, something that would not be popular with the general public.[34] Also, a gas tax increase, unlike PAYD insurance, would increase the tax burden in aggregate unless offset by reductions in other taxes such as income tax.

PAYD insurance is one of many measures that could be adopted to reduce vehicle miles traveled, which include fees to enter metropolitan areas, parking pricing, enhanced transit, and improved land use policies to promote compact development. PAYD insurance is used here to signal the importance of a comprehensive approach to energy efficiency in the transportation sector, which must include system efficiency as well as vehicle efficiency.

Supporting PAYD insurance is cost-effective with a benefit-to-cost ratio of more than 1,000 for participants and about 7.3 for total resource costs. With $3.4 billion in program spending over the 2010-2030 period, the Appalachian Region could see net cumulative savings of 1.6 quads, saving $32.0 billion in energy bills by 2044. This is the equivalent of about 2.9 percent of the EIA's forecast consumption in 2030, or 27.9 percent of forecast growth (EIA 2008a).

6.3.2 Clean Car Standards

The energy efficiency of automobiles relates directly to their emissions of carbon dioxide, the dominant greenhouse gas (GHG). States developing plans to reduce GHG emissions are eager to include cars and light trucks, which contribute 27 percent to U.S. GHG emissions.[35] Fourteen states have adopted a Clean Car standard, introduced by California, that will reduce greenhouse gas emissions from new vehicles by 30 percent in 2016 while cutting emissions of traditional pollutants as well. These states are: Arizona, California, Connecticut, Maine, Maryland, Massachusetts, New Jersey, New Mexico, New York, Oregon, Pennsylvania, Rhode Island, Vermont, and Washington. Legislation has been introduced in Minnesota, Nevada, Tennessee, and Texas as well.

Measures available to meet these states' GHG requirements include increased use of alternative fuels and improved air conditioners, for example. But in practice, the primary pathway to meeting the standard will be improvements in vehicle fuel efficiency. Thus, the adoption of the Clean Car Standard throughout the ARC Region could greatly improve vehicle fuel efficiency, thereby helping to meet the energy-efficiency goal. This would come about through accelerated penetration of technologies that are already entering the market, such as variable valve timing, cylinder deactivation, and five-speed transmissions, as well as increased sales of hybrid and diesel vehicles.

Despite the recent passage of higher light-duty CAFE standards, many consumers and policymakers are still eager to see the more stringent California emissions criteria implemented nationwide. In addition to increasing efficiency faster in the near term than the new CAFE standards do, California's

[33] Federal Highway Administration, http://www.fhwa.dot.gov/ohim/mmfr/dec07/trmfuel.cfm
[34] A gas tax increase of $1.33 per gallon would in fact reduce fuel consumption by more than a PAYD policy in the long-term because it would affect not only the amount people drive but also their choice of vehicle. We are proposing other mechanisms to increase vehicle efficiency, however.
[35] U.S. EPA, "Greenhouse Gas Emissions from Transportation and Other Mobile Sources," http://www.epa.gov/otaq/greenhousegases.htm

standards will continue to rise after 2016. California has indicated its intention of extending the GHG standards to levels that would raise average fuel economy to at least 40 mpg by 2020.[36]

Based on these developments and the existence of cost-effective technologies to further increase fuel economy after 2020, we propose going above and beyond the California program to aim for a combined standard of 50 miles per gallon by 2030.

Appalachia's adoption of Clean Car Standards means that new vehicles sold in the Region by each manufacturer would need to meet the requirements shown in Table 6.5 for GHG emissions, on average and also the fuel economy goals that we propose highlighted in Table 6.6. The standards divide vehicles into two categories; larger vehicles are allowed higher emissions than smaller vehicles.

Table 6.5 Proposed Clean Car Standards for Greenhouse Gases, 2009-2020[a]

	Year	CO_2-equivalent emissions standard (g/mi)	
		Passenger cars and small trucks/SUVs	Large trucks/SUVs
Near-term	2009	323	439
	2010	301	420
	2011	267	390
	2012	233	361
Mid-term	2013	227	355
	2014	222	350
	2015	213	341
	2016	205	332
Long-term	2017	195	310
	2018	185	285
	2019	180	270
	2020	175	265

[a] CARB, 2008

[36] Comparison of Greenhouse Gas Reductions under CAFE Standards and ARB Regulations Adopted Pursuant to AB1493, CARB, 2008

Table 6.6 Proposed Fuel Economy Standards 2020-2030	
Year	**Fuel Economy Standards (mpg)**
	Combined (Passenger cars, small trucks/SUVs and large trucks/SUVs)
2021	42.1
2022	42.9
2023	43.8
2024	44.7
2025	45.6
2026	46.5
2027	47.4
2028	48.2
2029	49.1
2030	50.0

Implementing the Clean Car Standard in the Appalachian Region would result in the energy savings and costs, beyond those of the Federal CAFE program, shown in Tables 6.7 and 6.8. Table 6.7 shows that the savings, modeled only for gasoline and not diesel fueled vehicles, would amount to just 2.6 percent of forecast consumption in 2020, but more than 13 percent in 2030.

Table 6.7 Light-Duty Vehicle Fuel Savings in Appalachia from Adoption of Clean Car Standards				
Year	**Diesel**	**Motor Gasoline**	**Total Primary Energy Saved**	**% of Sector Primary Energy**
	(million gallons)	**(million gallons)**	**(trillion Btu)**	
2010	0.00	0.00	0.00	0.00
2013	0.00	87.24	10.83	0.46
2020	0.00	516.19	64.09	2.65
2030	0.00	2,720.23	337.76	13.48

Table 6.8 shows the costs and monetary savings for select years in the study period; private investment grows from just about $50 million in 2010 to more than $2 billion in 2030 to keep up with the standard. Administrative costs remain low.

Table 6.8 Energy Savings and Costs from Adoption of Clean Car Standards			
Year	**Energy Savings**	**Admin Costs**	**Investment Costs**
	(million 2006$)	**(million 2006$)**	**(million 2006$)**
2010	0.00	4.29	51.60
2013	207.82	4.29	376.65
2020	1,240.03	4.29	1,235.41
2030	6,880.83	4.29	2,207.77

Figure 6.4 shows the growth in energy savings is rapid over the study horizon with a large private investment.

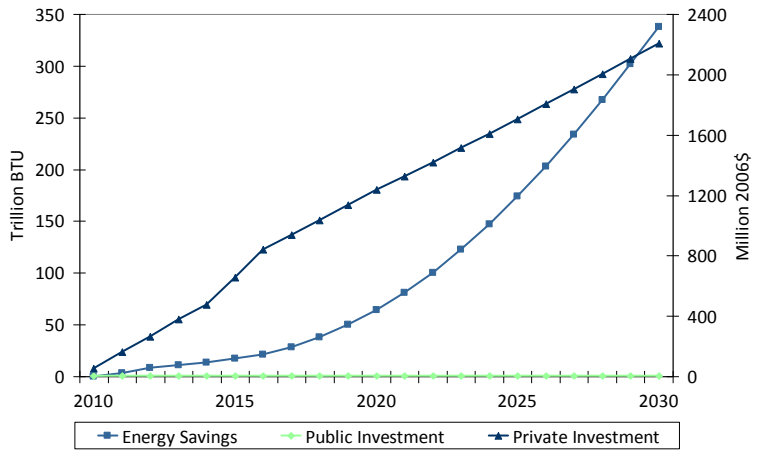

Figure 6.4 Annual Investment and Energy Savings from a New Clean Car Standard, 2010-2030

States adopting Clean Car Standards have done so through their Federal Clean Air Act compliance programs. The Clean Air Act allows states to choose between the Federal vehicle pollution control program overseen by the U.S. Environmental Protection Agency (EPA) and the Low Emission Vehicle program devised by the California Air Resources Board (CARB). The latter program is the Clean Car Standards discussed here. However, in order for the standards to come into effect, the State of California must obtain a waiver from the EPA. This waiver was denied by the EPA in February 2008, but California and the 14 other states that have adopted the Clean Car Standards have filed a suit to overturn this denial.

The New Clean Car Standard is cost-effective with a benefit-to-cost ratio of about 2.1 for participants and about 2.5 for total resource costs. With $90.1 million in program spending and an additional $24.8 billion in customer investments over the 2010-2030 period, the Appalachian Region could see net cumulative savings of 5.4 quads, saving $108.2 billion in energy bills by 2044. This is the equivalent of about 11.3 to 13.3 percent of the EIA's forecast consumption in 2030, or 46.9 to 127.4 percent of forecast growth (EIA, 2007a; 2008a).

6.3.3 SmartWay Heavy Truck Efficiency Loan Program

The Appalachian Development Highway System (ADHS) is the first highway system authorized by Congress for the purpose of stimulating economic development and will eventually be a complex

network that connects the Appalachian Region to national markets. Vehicle miles traveled by freight trucks on the ADHS is expected to grow by 400 percent by 2035.[37]

Due to the level of commercial activity that takes place on the ADHS, heavy trucks make up a significant portion of total vehicle miles traveled in the Appalachian Region. Tractor-trailers dominate heavy-duty fuel usage due to their high annual mileage and relatively low fuel economy. Trucking companies are sensitive to fuel costs, which are typically second only to labor among their business expenses; a tractor-trailer may consume well in excess of $50,000 of fuel annually. Truck manufacturers may therefore be more aggressive in improving the fuel economy of their products than are light-duty vehicle manufacturers. Yet substantial barriers to efficiency do exist in the truck market, including the rapid turnover of trucks from first to second owner and the absence of standards for heavy-duty fuel economy, or even a standardized test procedure to measure it. Consequently, there are numerous technologies and strategies available to improve fuel economy that are not fully utilized. Indeed, average fuel economy for new tractor-trailers could be raised by over 50 percent through a variety of cost-effective existing and emerging technologies, including aerodynamics, engine improvements, transmission enhancements, and weight reduction.[38]

Our proposal is to establish a low-interest loan program, beginning in 2009, to promote the purchase of new trucks or the retrofit of existing trucks with approved energy-efficiency technologies and equipment. In particular, equipment in the efficiency package identified by U.S. EPA's SmartWay Transport Partnership would be eligible. This SmartWay upgrade kit, which includes aerodynamic add-ons for trailers, efficient tires, and auxiliary power units (APUs) allowing long-distance truckers to dramatically reduce idling, has been found to reduce fuel consumption by 15 percent or more while reducing emissions.

We estimate savings from the loan program for truck efficiency equipment, beginning with its application to the improvements identified by SmartWay. Determining what trucks are likely candidates for the program requires a breakdown of the heavy-duty truck stock. By far the biggest consumers of diesel fuel in the aggregate are "heavy-heavy" trucks (those having Gross Vehicle Weight of at least 26,000 pounds), primarily tractor-trailers. Estimated diesel savings are shown in Table 6.9.

Table 6.9 Savings from Low-Interest Loans for Heavy Truck Efficiency Improvements

Year	Diesel (million gallons)	Motor Gasoline (million gallons)	Total Primary Energy Saved (trillion Btu)	% of Sector Primary Energy
2010	29.19	0.00	4.03	0.18
2013	73.75	0.00	10.18	0.44
2020	128.87	0.00	17.79	0.73
2030	138.96	0.00	19.19	0.77

[37] Cambridge Systematics, 2008
[38] Langer, 2004

Table 6.10 shows energy cost savings resulting from reduced consumption of diesel through this loan program; the savings are based on forecast diesel prices (EIA, 2008a). Administrative costs are flat over the program horizon while investment costs decline over time.

Table 6.10 Energy Savings and Costs from Heavy Truck Efficiency Improvements

Year	Energy Savings (million 2006$)	Admin Costs (million 2006$)	Investment Costs (million 2006$)
2010	74.93	4.29	337.90
2013	183.62	4.29	287.85
2020	321.16	4.29	21.35
2030	371.53	4.29	25.01

Figure 6.5 shows that a constant public investment yields dramatically increasing energy savings in the first years of the program but plateaus around 2017. Private investment is expected to be much higher in the first years of the program.

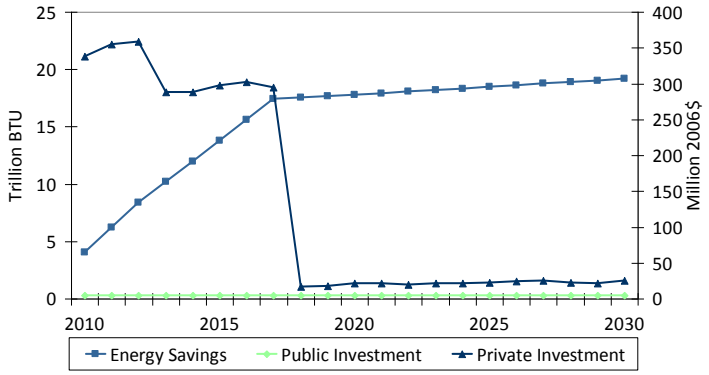

Figure 6.5 Annual Investments and Energy Savings from SmartWay Loans

The heavy truck efficiency loan program is likely to be welcomed by trucking companies, especially those with small- to medium-size fleets. With the projected expansion of commercial trucking activity that is expected to take place in the Appalachian Region by 2035, fuel efficiency will be crucial to the operation of trucking fleets, and smaller companies will have more difficulty in affording the SmartWay upgrades described here without financial assistance.

The SmartWay Heavy Truck Efficiency Loan Program is cost-effective with a benefit-to-cost ratio of about 1.3 for participants and about 1.6 for total resource costs. With $90.1 million in program spending over the 2010-2030 period, the Appalachian Region could see net cumulative savings of 0.5 quads, saving $10.1 billion in energy bills by 2044. This is the equivalent of about 0.8 percent of the EIA's forecast consumption in 2030, or 7.2 percent of forecast growth (EIA, 2008a).

6.3.4 Speed Limit Enforcement

At high speeds, vehicle efficiency falls off rapidly with further increases in speed, as aerodynamic drag begins to dominate vehicle energy requirements. The speed at which fuel economy is highest varies from vehicle to vehicle, but is typically below 60 miles per hour (mph) for a light-duty

vehicle.[39] Federal Highway Administration tests of nine light-duty vehicles in 1997 found that fuel economy declined on average by 3.1 percent when speed increased from 55 mph to 60 mph and by 8.2 percent increasing from 65 to 70 mph.[40] For a heavy truck such as a tractor trailer, fuel economy declines by about two percent per mph at highway speeds.[41] Thus, slowing high-speed driving would be one means of improving the real-world efficiencies of cars and trucks. This could be accomplished either by reducing the maximum speed limit or by more stringently enforcing the existing speed limits.

Rather than lowering current speed limits, this policy proposes more stringently enforcing the existing speed limits for vehicles in the Appalachian Region. Doing so could both increase highway safety and provide fuel savings. Given demands on the time of police and highway patrol, additional enforcement would best be approached through other means, including increased use of radar, lasers and speed cameras, and education.

In many states across the country, recommended practice is to set speed limits at the 85th percentile of driving that occurs on the roadway. In reality, speed limits are set lower than this for most roads; on average, over half of all traffic travels over the speed limit. The energy savings that result from an improved enforcement of speed limits for both light- and heavy-duty vehicles are shown below in Table 6.11.

Table 6.11 Estimated Benefits of Improved Speed Limit Enforcement – Light-Duty and Heavy-Duty Vehicles

Year	Diesel (million gallons)	Motor Gasoline (million gallons)	Total Primary Energy Saved (trillion Btu)	% of Sector Primary Energy
2010	33.03	140.13	21.96	0.97
2013	34.78	145.33	22.85	0.98
2020	36.46	150.12	23.67	0.98
2030	39.32	165.43	25.97	1.02

Table 6.12 shows that no private investment is expected to occur for reducing speed limits; however, a constant administrative cost is assumed.

[39] "Drive more efficiently." U.S.DOE and U.S. EPA, http://www fueleconomy.gov/feg/driveHabits.shtml.
[40] Davis and Diegel, 2006
[41] "Factors Affecting Truck Fuel Economy," Goodyear Tire, http://www.goodyear.com/truck/pdf/radialretserv/Retread_S9_V.pdf

Table 6.12 Energy Savings and Costs from Speed Limit Enforcement			
Year	**Energy Savings**	**Admin Costs**	**Investment Costs**
	(million 2006$)	**(million 2006$)**	**(million 2006$)**
2010	430.79	4.29	0.00
2013	432.78	4.29	0.00
2020	451.51	4.29	0.00
2030	523.57	4.29	0.00

Figure 6.6 shows that a constant public investment (administrative cost) can drive increased energy savings over time by reducing instances of speeding.

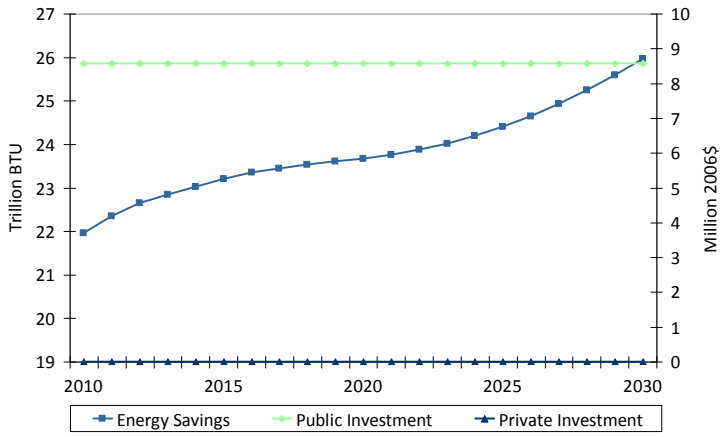

Figure 6.6 Speed Limit Enforcement

While reducing the speed limit is generally difficult politically, better enforcing of current law should be less controversial, and may be politically viable primarily on the basis of enhanced public safety and the reduction in serious injuries and deaths from vehicular accidents. On the other hand, if a large percentage of drivers regularly exceed the speed limit, as assumed above, much of the traffic engineering community would take this as an indication that existing speed limits are set too low. Most proposals to enforce speed limits are controversial, especially with regards to speed requirements for heavy trucks. The American Trucking Association recently endorsed a proposal to limit the speed of heavy trucks to 68 miles per hour; the Owner-Operator Independent Drivers Association opposed the idea.[42]

Enforcing speed limits for both light- and heavy-duty vehicles is cost-effective with a benefit-to-cost ratio of 64.3 for total resource costs; because there is no assumed private investment cost, the participant ratio is undefined. With $180 million in program spending over the 2010-2030 period, the Appalachian Region could see net cumulative savings of 0.9 quads, saving $16.8 billion in energy bills by 2044. This is the equivalent of about 1.0 percent of the EIA's forecast consumption in 2030, or 9.8 percent of forecast growth (EIA, 2008a).

[42] See http://www.truckline.com/NR/exeres/CB4D4AAD-27EB-4801-8F4A-B82F45E03D70 htm and http://www.landlinemag.com/Special_Reports/2007/Jan07/SR%2001-29-07%20OOIDA%20speed%20limiters%20by%20JJ htm

6.4 SUMMARY OF RESULTS FOR TRANSPORTATION POLICY BUNDLES

Transportation efficiency is rarely modeled in efficiency potential studies, partly because states and local governments, who usually commission such studies, do not historically regulate transportation energy distribution in the same way that they address electricity and natural gas. There have been recent state efforts in this sector, following California, to regulate vehicle efficiency through clean car standards. Our model suggests that standards could provide substantial savings, nearly three-fourths of our total transportation savings in 2030 come from new clean car savings (see Figure 6.7).

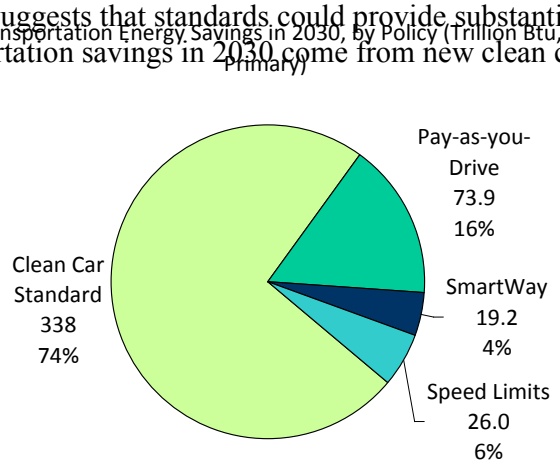

Figure 6.7 Primary Energy Savings by Policy Package (trillion Btu), 2030

Figure 6.8 shows that the combined transportation package reduces consumption to less than 2006 levels by 2022 with savings roughly doubling what is estimated by the EIA to come from the new efficiency requirements in EISA 2007.

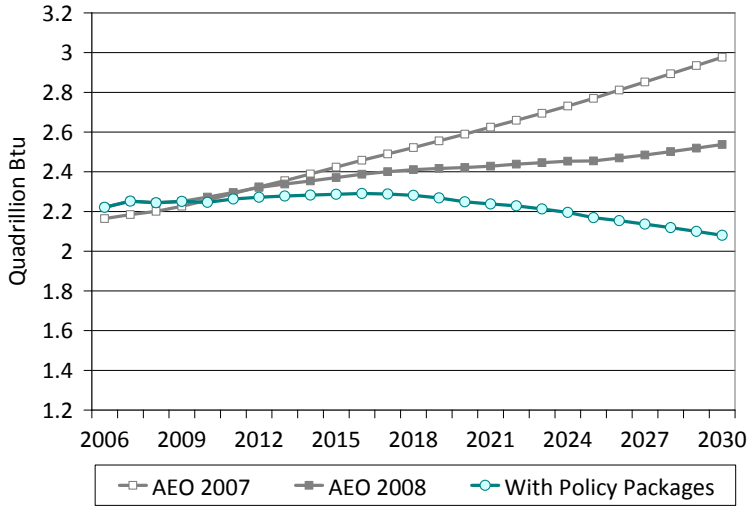

Figure 6.8 Transportation Primary Energy Consumption With and Without Policy Packages (quads), 2006-2030

Figure 6.9 shows that public investment remains low for the entire study horizon while private investment climbs quickly from 2010 to 2016 and steadily thereafter; the bumps in the private

investment line represent peaks in investment in the Pay-as-you-Drive and SmartWay programs. Annual energy savings grow, in an exponential fashion, for the entire period.

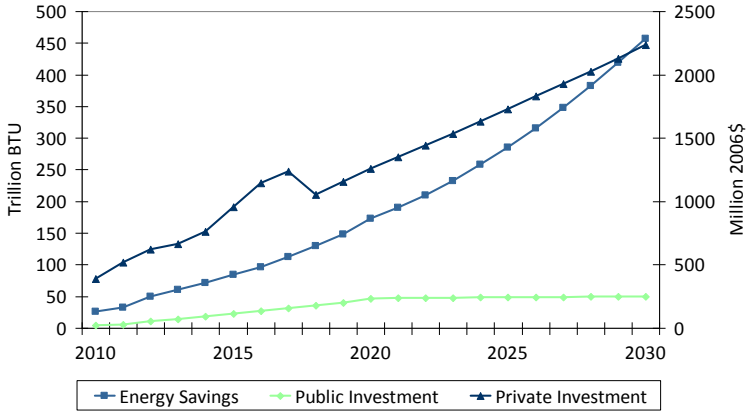

Figure 6.9 Annual Investments and Energy Savings from Transportation Policy Packages, 2010-2030

Table 6.13 shows the benefit/cost ratios for each transportation policy bundle as well as test results for combined policy implementation.

Table 6.13 Results of Economic Tests for Transportation Policy Bundles					
	Clean Car Standard	**Pay-As-You-Drive Insurance**	**SmartWay**	**Speed Limits**	**Total**
Participants Test					
NPV Benefits (billion 2006$)	14.94	6.87	2.37	4.39	28.57
NPV Costs (billion 2006$)	7.11	0.01	1.78	0.00	8.89
Net Benefits-Costs (billion 2006$)	7.83	6.86	0.60	4.39	19.68
B/C Ratio	2.10	1,340	1.34	–	3.21
Total Resource Cost Test					
NPV Benefits (billion 2006$)	25.49	10.20	3.37	5.98	45.04
NPV Costs (billion 2006$)	10.00	1.39	2.05	0.09	13.54
Net Benefits-Costs (billion 2006$)	15.49	8.80	1.32	5.89	31.49
B/C Ratio	2.55	7.31	1.64	64.32	3.33

The transportation sector policy package is cost-effective with a benefit-to-cost ratio of about 3.2 for participants and about 3.3 for total resource costs. With $3.7 billion in program spending and an additional $27.6 billion in customer investments over the 2010-2030 period, the Appalachian Region could see net cumulative savings of 8.3 quads, saving $167.1 billion in energy bills by 2044. This is the equivalent of about 30.1 percent of the EIA's forecast consumption in 2030, or 172.4 percent of forecast growth (EIA, 2008a).

Box 6.1 Intermodal Improvements

Several opportunities have been identified to improve the freight transportation network in the Appalachian Region through intermodal investments. Such improvements have been driven first and foremost by the Region's goal of economic growth, based on better integration with the rest of the country. Tapping into areas of growth in the national and global economies will require up-to-date approaches to moving goods, which today increasingly implies the use of energy-efficient technologies and modes. Consequently, energy-efficient freight movement, while perhaps not the driver of new transportation investment, could be a key element of the Region‘s economic development program. At the same time, to the extent that modern intermodal services draw freight from adjacent Regions, they could cause energy consumption within the Appalachian Region to increase, despite reducing energy consumption overall.

Among the intermodal projects in progress or under consideration to serve the Appalachian Region are:

- the Central Corridor Doublestack Initiative, to allow stacked intermodal containers to travel by rail along the Norfolk Southern route from Norfolk to Columbus;
- the South Carolina Inland Port, which would alleviate space and congestion pressures at the Port of Charleston by sending containers by rail from the port to an inland processing and transfer facility; and
- the Port of Pittsburgh Container-on-Barge, to provide a water alternative to trucking for high-value goods traveling throughout the inland waterway system of the Appalachian Region and the Gulf Coast. (Rahall Transportation Institute and Wilbur Smith Associates, 2004)

Each of these three examples represents an opportunity to increase the efficiency of the goods movement system while reducing energy use by diverting freight from trucks to other modes. Rail and barge operations generally consume far less energy per ton-mile than trucks. While these projects are designed to attract the rapidly-growing and lucrative container flows associated with international trade, is it important to note that projected growth in freight traffic is largely tied to intraregional activity (Rahall Transportation Institute and Wilbur Smith Associates, 2004). Much of this shorter-distance freight will necessarily travel by truck, but if alternative modes can serve some intraregional traffic, freight energy use will decline.

Aside from highways, freight infrastructure has historically been funded by the private sector. Today there is a crucial role for regional and national governments in the development and funding of this infrastructure, particularly for intermodal freight, given the large public costs and benefits of the goods movement system, the need for multi-state cooperation, the need for freight facilities serving multiple, competing carriers, and constraints on freight carriers‘ ability to invest in innovative projects.