



ISSUE BRIEF

SETTING THE NEXT ROUND OF FUEL ECONOMY STANDARDS: CONSUMERS BENEFIT AT 60 MILES PER GALLON (OR MORE)

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A KEY MOMENT IN SETTING FUEL ECONOMY GOALS

In the spring of 2009 the Obama Administration announced a landmark change in how standards that dictate the fuel economy of cars and light trucks (light duty vehicles) would be set. The new approach resolved an ongoing dispute between the California Air Resource Board (CARB) and the federal Environmental Protection Agency (EPA)¹ and made it clear that standards set by the EPA and the National Highway Traffic Safety Administration (NHTSA) could exist side-by-side.²

Consistency with California, NHTSA and EPA standards was ensured by EPA setting an emission standard for model year 2016 at a level that equaled the California goal and NHTSA setting a mileage standard at the equivalent level. However, the target, of approximately 34

¹ **California and the Environmental Protection Agency CO2 standards:** Under the Clean Air Act, California has the right to set its own standard for pollution control if it can demonstrate that more stringent standards are needed to meet federal air quality standards and the Environmental Protection Agency grants its request for a waiver of the federal standard. Other states that do not meet clean air standards can then choose to follow either the California standard or the Federal standard. Under legislation enacted in California, the California Air Resources Board (CARB) had implemented regulations of greenhouse gas emissions and other pollutants that were more stringent than federal standards. Thirteen states plus DC had chosen to adopt the California standard and another five (?) were in the process of doing so what a dispute erupted between California and EPA. For the first time ever, the EPA refused to grant California a waiver for its mobile source control program. California was undertaking legal action to reverse that decision. The compromise struck by the Obama administration set the federal greenhouse gas standard for 2016 at the level of the California standard.

² **Coordination of The Environmental Agency the National Highway Traffic Safety Administration Standards:** The second challenge was to resolve the potential conflict between EPA and NHSTA authority. In 2008, the Supreme Court had ruled that greenhouse gasses were pollutants that could be regulated under the Clean Air Act² and the EPA was preparing to make an “endangerment” finding, the first step in regulating any pollutant.² Because the burning of gasoline in automobiles and light trucks is a major source of carbon dioxide, EPA regulations to reduce tailpipe emission of carbon dioxide would, inevitably, force automakers to increase the fuel economy of light duty vehicles. The National Highway Traffic Safety Administration (NHTSA) sets fuel economy standards under the Energy Policy Conservation Act. Since the statutes are different, the two agencies had to ensure that their standards were technically and legally compatible

miles per gallon for model year 2016 proved to be very modest. The analysis showed that it would have been economically and environmentally beneficial to set a much higher standard.

This fall, this important reform of energy policy making will be put to the test. Both the Federal agencies and the California agency will be setting standards for future years. Because the auto manufacturers need long lead times, fuel economy and greenhouse gas emission standards for the model year 2017- 2025 period are being considered.

In comments filed in the Federal regulatory proceeding, the Consumer Federation of America put the administration on notice that, while rationalizing the institutional framework for setting this important piece of energy policy was a landmark accomplishment, a real victory can only be claimed when the standards are set at a level that captures the immense benefits that had been left on the table

It will be critically important for the agencies to move the standard well beyond the current levels. The regulatory agencies will be doing detail technology assessments and economic analyses over the next few months. In anticipation of those developments, this paper reviews the stakes for consumers and the evidence that the standards should be set at much higher levels.

WHY THE 2016 STANDARDS SHOULD BE HIGHER

Strong Fuel economy and greenhouse gas emission standards are critical to successful energy and environmental policy not only in the U.S. but globally because the U.S. consumes one-quarter of the world's petroleum products and two-fifths of the world's gasoline.³ Gasoline is a major source of the most important global warming greenhouse gas – carbon dioxide.⁴ Strong standards are also extremely important to consumers because gasoline is a major expenditure for most American households.⁵ After housing and food, expenditures on gasoline are one of the largest items in the household budget, roughly equal to health care expenditures, 50% larger than clothing, twice as large as electricity and four times as large as natural gas.

The failure of the compromise standard to capture the economic and environmental benefits available was strikingly clear in the NHTSA-EPA analyses (see Exhibit 1). The cost of increasing fuel economy to 38.1 miles per gallon,⁶ which yielded the maximum net economic benefit in the NHTSA-EPA analysis by putting more fuel saving technology in cars and trucks, is well below the cost of gasoline.

³ <http://www.eia.gov/emeu/international/oilconsumption.html>

⁴ Carbon Dioxide account for 80% of U.S. greenhouse gas emissions and transportation accounts for one-third of carbon dioxide emissions. <http://www.eia.doe.gov/oiaf/1605/ggrpt/#ercde>

⁵ Bureau of Labor Statistics, Consumer Expenditure Survey, 2008.

⁶ The highest level of fuel economy considered by NHTSA-EPA in the published economic analysis considered technologies that carried the fleet to 38.7 miles per gallon, under the assumption that fuel economy would improve by 7 percent per year. The NHTSA-EPA analyses projected the fleet average fuel economy assuming that the fleet is composed of 57.5% cars and 42.5% trucks. Recently composition in the Preliminary Regulatory Impact analysis. More recent assumptions about the fleet composition have more cars (67%) and fewer trucks (33%) so the fleet average would be 39.5 mpg. This is still far below what is technically feasible.

EXHIBIT 1: ECONOMIC, NATIONAL SECURITY AND ENVIRONMENTAL BENEFITS OF VARIOUS ALTERNATIVE STANDARD LEVELS

Conceptual Basis of the Standard	MPG 2016	Economic Benefit (Billion \$, Net NPV) Societal Consumer Pocketbook (Billion Dollars)	National Security Reduced Gasoline Consumption (Billion Gallons)	Cost per gallon saved (Billion Dollars)	Environmental Greenhouse Gas Reduction (Billion Tons)
Proposed	34.1	141	106	\$0.98	29
Max. Environmental/Economic Benefit	38.1	191	143	\$1.28	42

Sources and notes: National Highway Traffic Safety Administration and Environmental Protection Agency, *Proposed Rulemaking to Establish Light Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards. Preliminary Regulatory Impact Analysis*, Tables 1b, 7, 8, 9, and 10. The 3 percent discount rate scenario is used. The consumer pocketbook calculation subtracts the cost of meeting the standard (technology cost) from the fuel savings (lifetime fuel expenditures) and adds in the reduction in the price of gasoline (the petroleum market externality). These are the direct, monetary impacts affecting consumer pocketbooks. Fuel savings and market externalities are assumed to scale with the quantity of gasoline consumption reduction.

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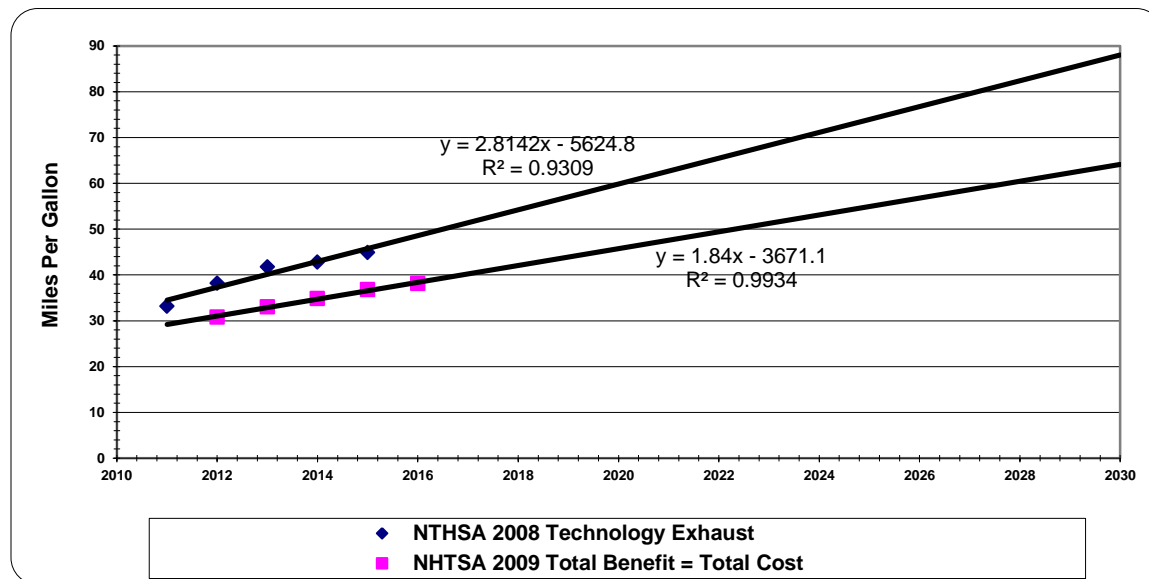
- At 38.1 mpg, it costs only \$1.28 to save a gallon of gasoline, which is less than half the current cost of gasoline of about \$2.75, so consumers would end up saving almost \$1.50 on every gallon they buy.
- Although the more fuel efficient vehicle would cost more, the increase in the monthly loan payment to purchase at more fuel-efficient vehicle is less than the reduction in expenditures for gasoline, making it cash flow positive from the beginning, and the vehicle would have higher value at resale.
- Setting fuel economy standards at the higher level helps to solve the nation’s energy and environmental problems. It can reduce gasoline consumption by a cumulative total of 95 billion gallons and yields consumer pocketbook savings of over \$140 billion, over the life of the vehicles covered by the standard. Cumulative total societal benefits are over \$190 billion while it reduces greenhouse gas emissions by over 42 billion tons.

⁷ The highest level of fuel economy considered by NHTSA-EPA in the published economic analysis considered technologies that carried the fleet to 38.7 miles per gallon, under the assumption that fuel economy would improve by 7 percent per year. The NHTSA-EPA analyses projected the fleet average fuel economy assuming that the fleet is composed of 57.5% cars and 42.5% trucks. More recent assumptions about the fleet composition have more cars (67%) and fewer trucks (33%) so the fleet average would be 39.5 mpg. This is still far below what is technically feasible.

TECHNOLOGY IS AVAILABLE FOR STANDARDS TO GO MUCH HIGHER

The highest levels of fuel economy that NHTSA-EPA considered for 2016 do not come close to identifying the level of the standard that would be economically justified. As shown in Exhibit 2, in the 2008 Corporate Average Fuel Economy (CAFE) proceeding, NHTSA examined a potential standard it called Technology Exhaustion, which is the point where the maximum usage of available technologies to reduce energy consumption is reached, disregarding the cost impacts. Under that standard, the fuel economy for the fleet would have risen to approximately 45 miles per gallon by 2016.⁸

EXHIBIT 2: POTENTIAL FOR LONG TERM IMPROVEMENT IN FUEL ECONOMY STANDARDS



Sources and notes: National Highway Traffic Safety Administration and Environmental Protection, Agency, *Proposed Rulemaking to Establish Light Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards. Preliminary Regulatory Impact Analysis, Tables 1b*; National Highway Traffic Safety Administration, *Average Fuel Economy Standards, Passenger Cars and Light Trucks, Preliminary Regulatory Impact Analysis, 2008 Table 1b*.

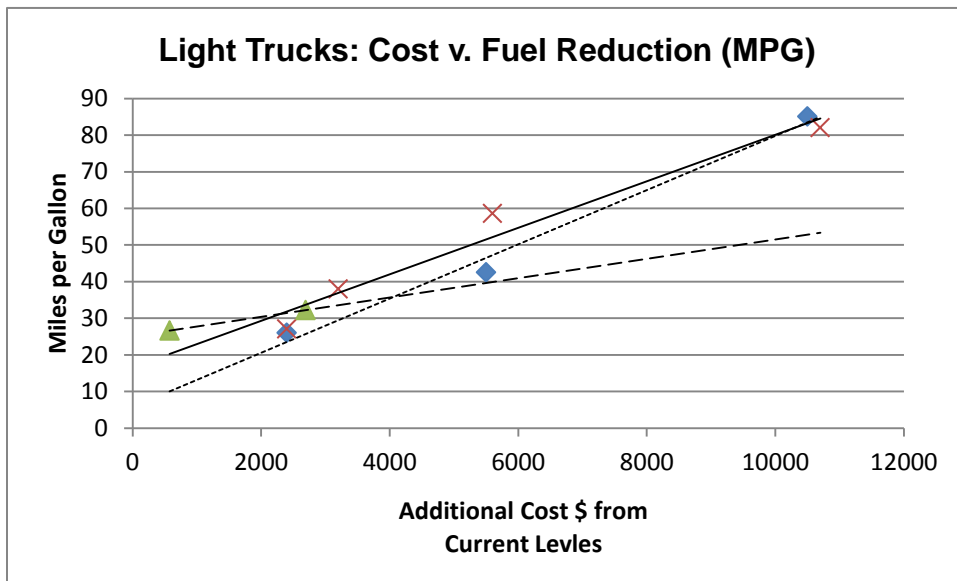
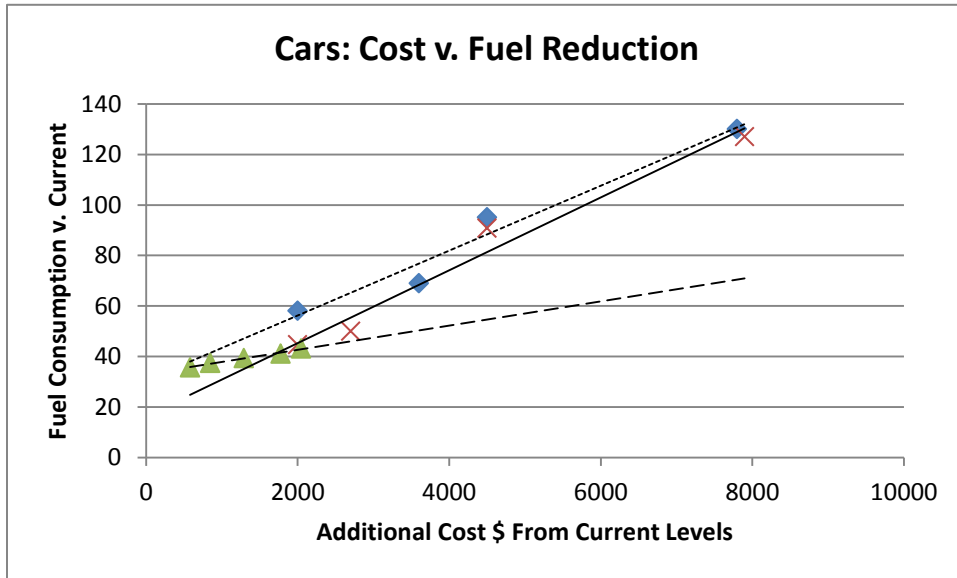
The technology exhaust limit is not fixed. The limit should advance over time as the cost of technologies declines, the automakers become more adept at incorporating new technologies and technologies move from the research and development phase into the deployment phase. Using the regression line in Exhibit 2, projecting a constant rate of growth puts the technology exhaust point at 60 mpg by 2020 and close to 90 mpg by 2030.

Projecting such gains beyond the range that NHTSA/EPA analyzed requires assumptions about the availability and cost of fuel savings technologies. Recent studies by the National Academy of Sciences (NAS) and the Laboratory for Energy and the Environment at the Massachusetts Institute of Technology (MIT) indicate that there are technologies available to do so. Exhibit 3 shows that the cost curves considered by NHTSA-EPA cover only a narrow range

⁸ This assumes the fleet mix for the 2009 analysis, to ensure we are comparing apple to apples.

of technology possibilities. In both cases, NAS and MIT have much higher levels of fuel economy at rising costs.

EXHIBIT 3: FUEL SAVINGS TECHNOLOGIES IN THE LONG-TERM



Legend and Sources:

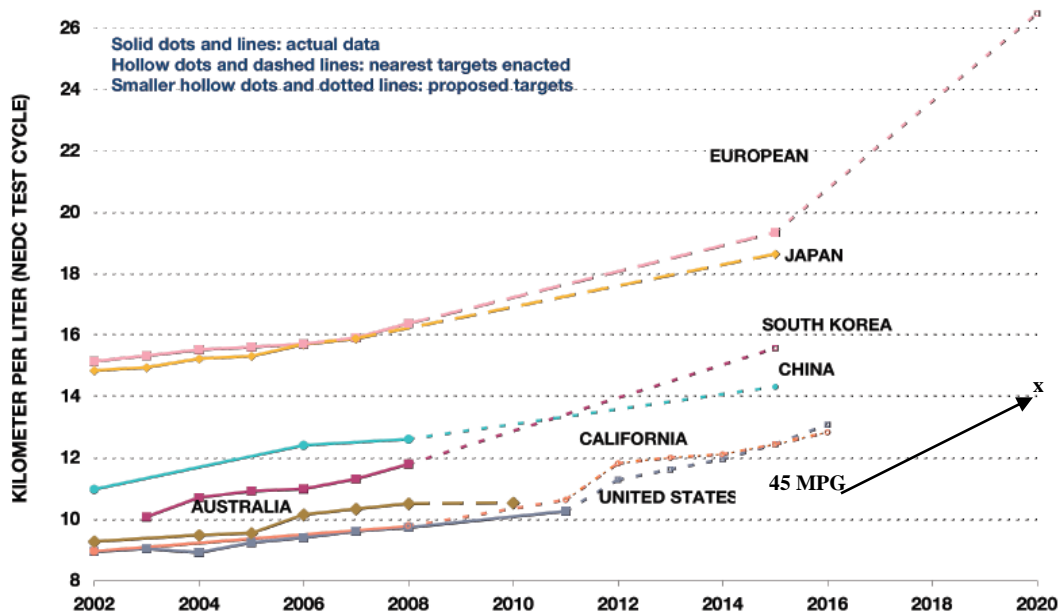
▲ = NHTSA-EPA, 2009; National Highway Traffic Safety Administration, *Corporate Average Fuel Economy for MY 2012-MY 2016 Passenger Cars and Light Trucks, Preliminary Regulatory Analysis* (Washington, D.C.: August, 2009), Tables 1b, 2, 3, 4, 5, 6, 7.

◆ = NAS, 2010; National Research Council of the National Academy of Science, *America’s Energy Future* (Washington, D.C.: 2009), Tables 4.3, 4.4.

✕ = MIT, 2007; Laboratory of Energy and the Environment, *On the Road in 2035: Reducing Transportation’s Petroleum Consumption and GHG Emissions* Cambridge: July, 2008), Tables 7 and 8.

Other data suggest that these and even higher levels of fuel economy are possible and costs could even be lower. For example, while international comparisons raise many issues because of differences in vehicle fleets a broad gauge of where fuel economy standards can be instructive (see Exhibit 4). The most recent data from the ICCT shows that the U.S. target for 2016 is among the lowest standards being implemented by major developed nations and those likely to be important sources of future vehicle growth. A target of 45 miles per gallon by 2020, identified by an “x” in the exhibit, is not very high by international standards, nor would much higher levels by 2025 and 2030.

EXHIBIT 4: INTERNATIONAL COMPARISONS OF FUEL ECONOMY TRAJECTORIES



Source: International Council on Clean Transportation, http://www.theicct.org/documents/ICCT_PVStd_Nov_09.pdf. x= 45 mpg in 2020

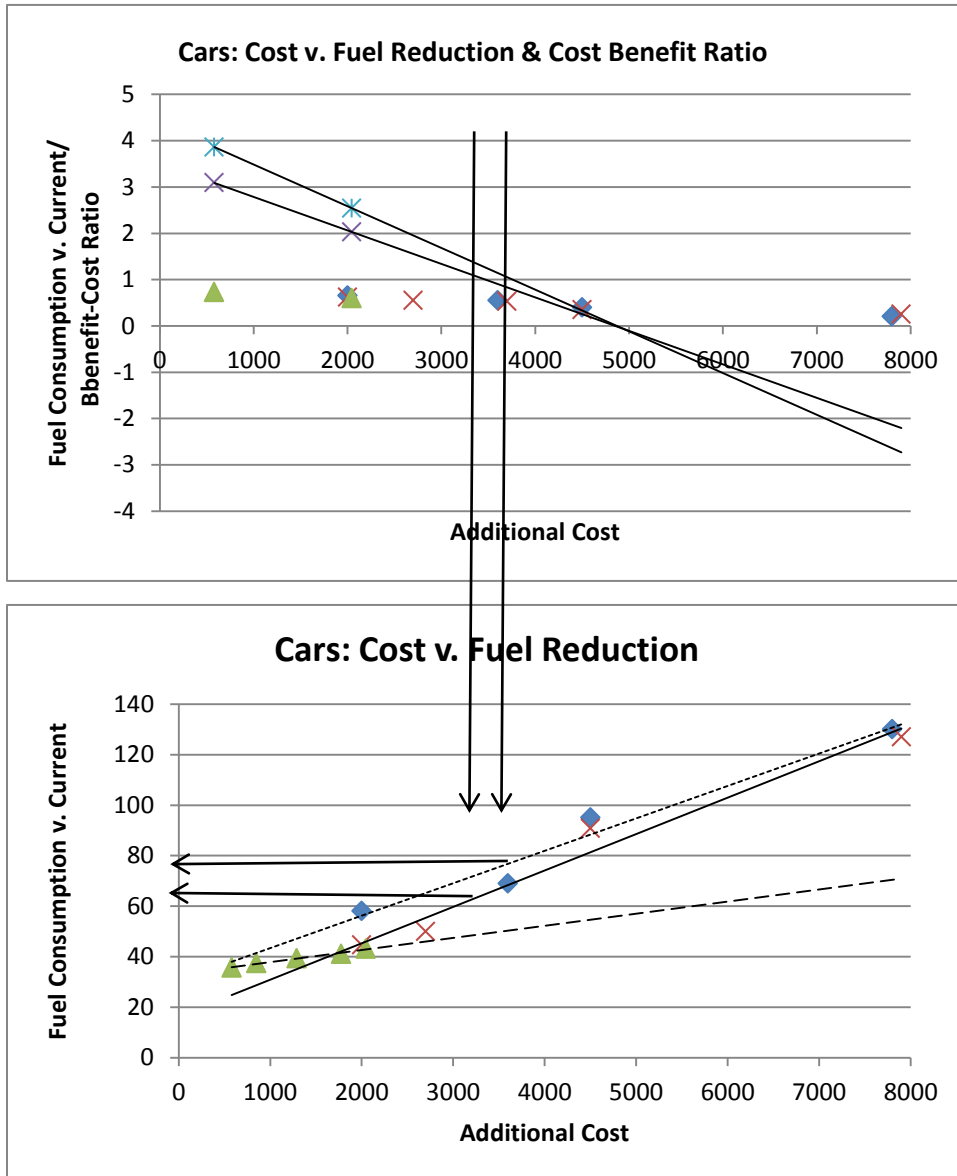
SOCIETAL COST-BENEFIT ANALYSIS SUPPORTS A 60-MPG TARGET

Technological feasibility is not the only factor that sets the pace of improvement in fuel economy under the statutes that govern both NHTSA and the EPA. The economic practicability of the technologies must also be taken into account.

To assess whether higher levels of fuel economy would be economically practicable, we developed fuel economy cost curves for the NHTSA-EPA analysis and compared them to cost curves developed by the NAS and MIT. Separate cost curves were developed for cars and trucks, which is consistent with the NHTSA-EPA approach. NAS and MIT express their finding relative to the “current” fuel economy of new vehicles. We translate those into miles per gallon, as shown in Exhibit 3 above.

To ground the analysis in the underlying NHTSA-EPA approach, we have used the two end-points of the cost benefit analysis presented by NHTSA-EPA to project the declining net benefit, as shown in Exhibits 5 and 6. Assuming a linear relationship, we identify the point at

EXHIBIT5: PROJECTING BENEFICIAL INVESTMENT LEVELS: CARS



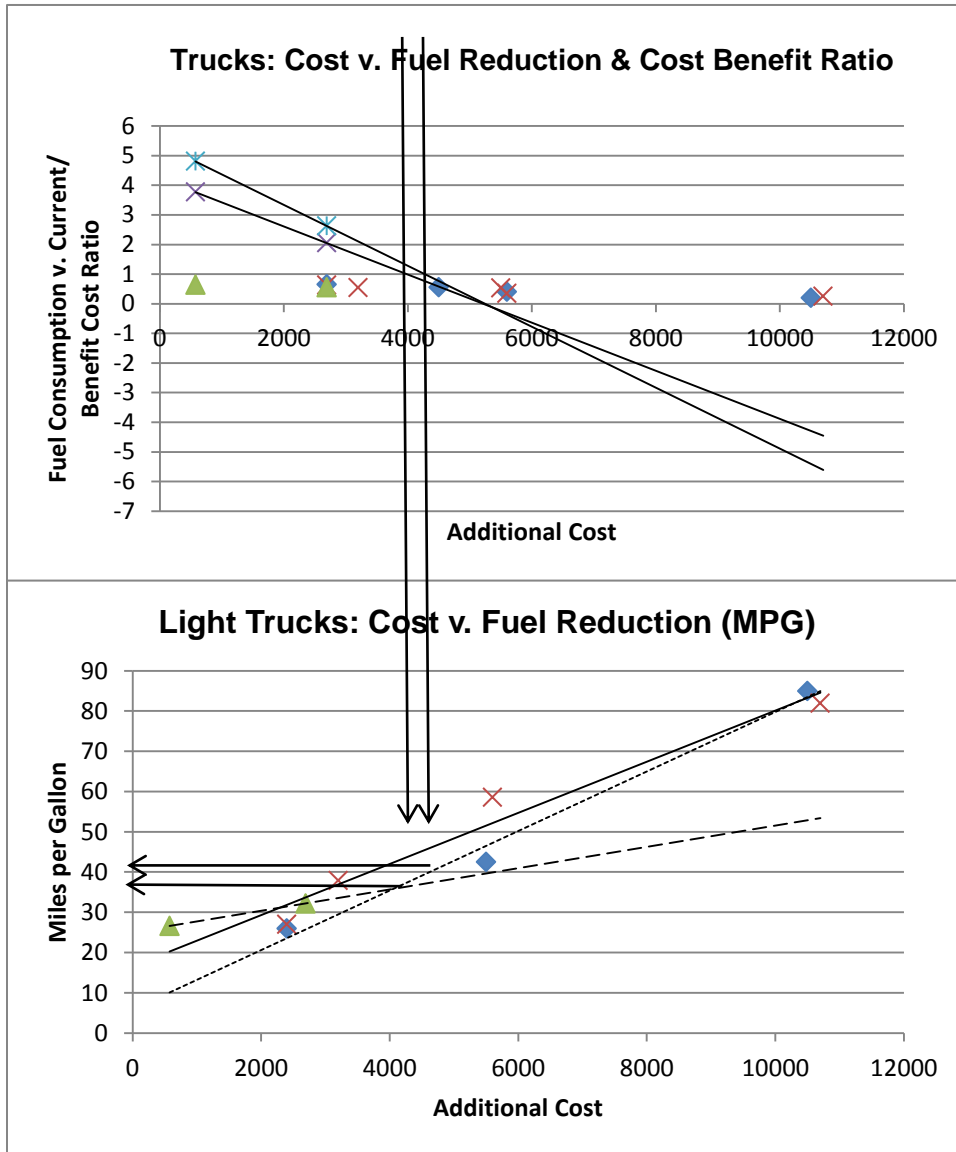
Legend and Sources:

▲ = NHTSA-EPA, 2009; National Highway Traffic Safety Administration, *Corporate Average Fuel Economy for MY 2012-MY 2016 Passenger Cars and Light Trucks, Preliminary Regulatory Analysis* (Washington, D.C.: August, 2009), Tables 1b, 2, 3, 4, 5, 6, 7.

◆ = NAS, 2010; National Research Council of the National Academy of Science, *America's Energy Future* (Washington, D.C.: 2009), Tables 4.3, 4.4.

X = MIT, 2007; Laboratory of Energy and the Environment, *On the Road in 2035: Reducing Transportation's Petroleum Consumption and GHG Emissions* Cambridge: July, 2008), Tables 7 and 8.

EXHIBIT6: PROJECTING BENEFICIAL INVESTMENT LEVELS, TRUCKS



Legend and Sources:

▲ = NHTSA-EPA, 2009; National Highway Traffic Safety Administration, *Corporate Average Fuel Economy for MY 2012-MY 2016 Passenger Cars and Light Trucks, Preliminary Regulatory Analysis* (Washington, D.C.: August, 2009), Tables 1b, 2, 3, 4, 5, 6, 7.

◆ = NAS, 2010; National Research Council of the National Academy of Science, *America's Energy Future* (Washington, D.C.: 2009), Tables 4.3, 4.4.

X = MIT, 2007; Laboratory of Energy and the Environment, *On the Road in 2035: Reducing Transportation's Petroleum Consumption and GHG Emissions* Cambridge: July, 2008), Tables 7 and 8.

which the benefit cost ratio equals one and calculate the amount of investment that would occur at that point. This is the point on the technology cost curve where total benefit equals cost. We then estimate the fuel economy that would be achieved by that level of investment on the MIT and NAS regression lines.⁹

At these mid-range levels of investment and fuel economy, the NAS and MIT analyses produce similar results. The difference in the “justified” level of additional costs and fuel economy generally is between 10 and 20 percent. The resulting targets for the fleet wide average fuel economy are in a tight range around 60 mpg (see Exhibit 7).¹⁰

EXHIBIT 7: ECONOMICALLY JUSTIFIED MID-TERM FUEL ECONOMY STANDARDS

Vehicle	Discount Rate	Incremental Investment From 34 mpg	Fuel Economy		
			NAS	MIT	Avg.
Cars	3%	\$2500	76.7	68.0	72.4
	7%	\$2673	79.0	69.3	73.6
	Avg.	\$2587	77.9	69.3	73.6
Trucks	3%	\$3028	36.0	42.7	39.4
	7%	\$3344	38.4	44.8	41.6
	Avg.	\$3186	37.2	43.8	40.5
Fleet Average					
Cars Trucks					
57.5% - 42.5% Mix					
	3%	\$2724	59.4	57.2	58.4
	7%	\$2958	61.7	59.2	60.2
	Avg.	\$2841	60.6	58.2	59.3
67% - 33% Mix					
	3%	\$2724	63.3	61.7	61.5
	7%	\$2958	65.6	61.7	63.5
	Avg.	\$2841	64.5	60.7	62.7

⁹ The benefit-cost curves are estimated as follows by setting y = 1:

3% discount rate: $y = 5.4018 - 0.001x$;

7% discount rate: $y = 4.2369 - 0.008x$

MPG achieved is estimated by inserting the investment number in the following equations

MIT; Cars: $MPG = 16.404 + 0.0144x$ ($R^2 = .9706$)

Trucks: $MPG = 5.7848 + 0.0074x$ ($R^2 = .9869$)

NAS; Cars: $MPG = 30.478 + 0.0129xx$ ($R^2 = .9647$)

Trucks: $MPG = 16.588 + 0.0064x$ ($R^2 = .959$)

¹⁰ Exhibit 9 shows the incremental cost of moving from the 2016 standard to the higher level of fuel economy in 2025. The incremental cost of moving from the 2016 standard is calculated by subtracting the cost of moving from today’s models to the 2016 standard, from the total cost of moving from today’s models to the 2025 standard of 60+. Since the relationships we observe in the underlying data are linear, this is justified. If the relationship is exponential, the incremental costs would be slightly lower. Thus, the linear estimation of incremental costs is conservative.

CONSUMER POCKETBOOK ANALYSIS

In addition to the societal cost benefit analysis, we have also generally looked at a consumer pocketbook analysis. The average consumer finances an auto purchase with a five year auto loan. Monthly payments are made in current dollars. We analyze three points in time from the consumer pocketbook point of view – cash flow in the first year, the net consumer position at the end of the loan life and the net position when the vehicle is retired (set at ten years). Given that we use annual averages, the first year is the equivalent to the immediate impact on cash flow. The five year point is the end of the loan, which means that at that point, the efficiency technology would no longer claim any household resources. The end of vehicle life is the point at which total value of high fuel economy has been extracted from the vehicle. Consumers could realize this if they held the vehicle until it was retired, or if the resale value of the vehicle reflected its fuel economy characteristics, which is increasingly the case.

For the purpose of this analysis, we evaluate the move from the 2016 standard (34.1 combined car and truck) to the highest level indicated by the societal cost benefit analysis above (the average is 63.3 mpg). We assume a five year auto loan at seven percent interest, which is high by today's standard (but the average rate for auto loans over the past twenty years).¹¹ The cost of technologies to increase efficiency is added to the total cost of the loan. All dollars are real. We use the EIA projection of gasoline prices in 2025 at the starting point for the analysis (\$3.50/gallon). We apply a 7% discount rate to all cash flows (costs and benefits).

Cars and the average combined fleet are cash flow positive in the first year (see Exhibit 8). Trucks are cash flow positive in the fourth year. By the fifth year, the average net present value of savings is over \$1,000. By the tenth year, the average net present value of savings is over \$3,000, while for trucks it is over \$10,000.

AUTOMAKERS: THE MAIN BARRIER TO GREATER FUEL ECONOMY AND CONSUMER SAVINGS

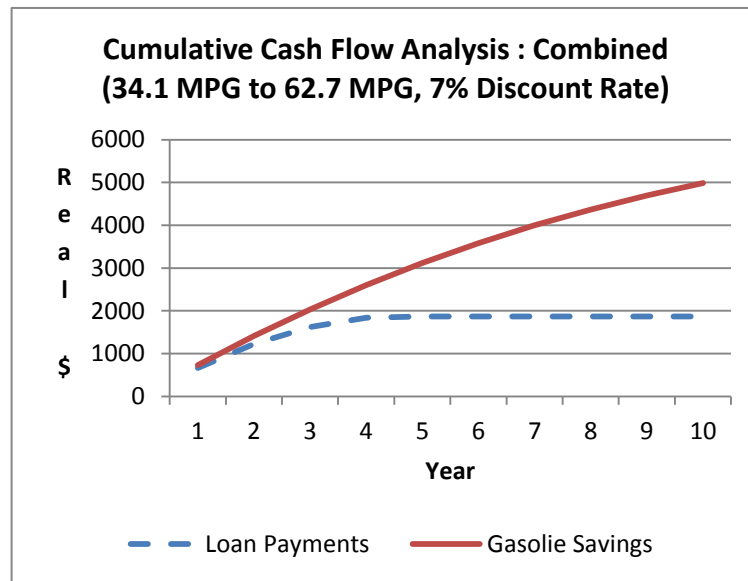
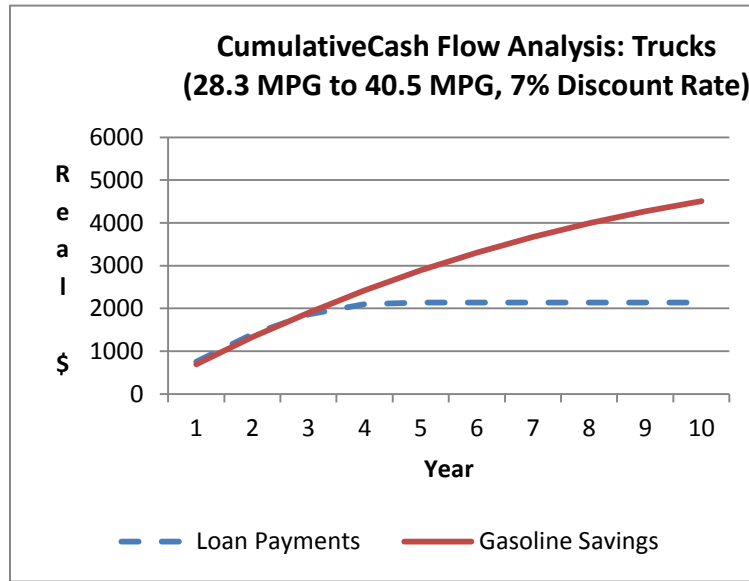
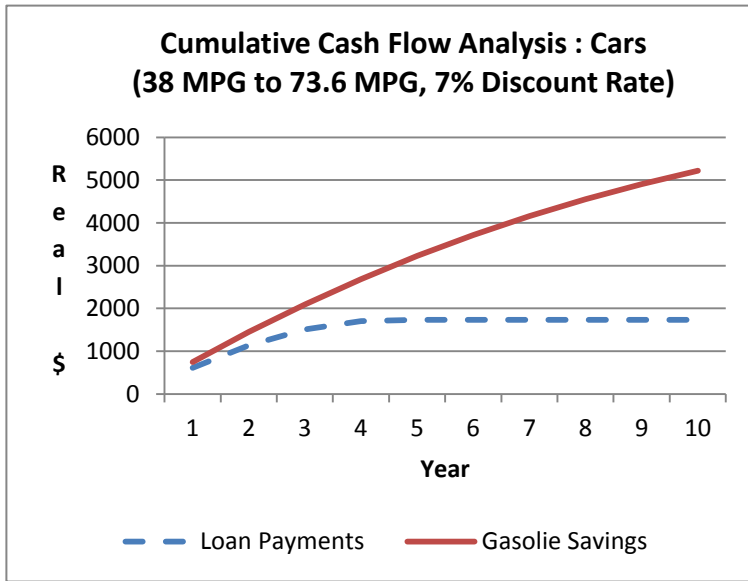
The approach to standards setting taken by NHTSA in the past allowed the ill-informed plans of the automakers to restrain the level of standards. In 2008, the standards were set to avoid forcing even the worst members of the industry to improve their vehicle fleets by setting standards at a level where even the laggards would pay few penalties.¹² In 2009 the standard was so far from the technology frontier that NHTSA-EPA did not publish the compliance analysis. The courts have ruled that NHTSA cannot set the standard to protect the worst performers in the market. The Clean Air Act generally affords the EPA greater latitude to push technology. The stage is set for more aggressive standard setting.

The technology cost curve should be central to the analysis, particularly since it has been clear for quite some time that neither technology nor economics has been the barrier to greater fuel economy. The challenge has been the unwillingness and inability of automakers to embrace and adopt new technologies. Both survey and econometric evidence show that the automakers

¹¹ http://www.federalreserve.gov/releases/g19/hist/cc_hist_tc.html.

¹² Citation to 2009 CFA comments.

EXHIBIT 8: CONSUMER CASH FLOW ANALYSIS



failed to react to clear shifts in consumer preferences, which contributed to their severe difficulties.¹³

The technology cost curves used in this analysis are defined as long-term, 2035, but the analysis in this paper focuses on standards to be set in 2025. The acceleration of a decade could be a challenge for the industry, but the technologies that underlay the cost curves are already in the vehicle fleet to some extent, or close to being in the fleet. Setting a high standard for a decade and a half in the future can push the industry to be more innovative and responsive to consumer demand, as well as national energy and environmental needs and goals. Coordinating between the three agencies with authority to set standards (CARB, EPA and NHTSA) and preserving California's important role in maintaining momentum were important procedural steps to progress, now it is vital to move the standards to the much higher levels that the consumer pocketbook and societal cost benefit analysis support.

¹³ Cooper, Mark, *U.S. Oil Markets Fundamentals and Public Opinion* (Consumer Federation of America, May 2010); *Ending America's Oil Addiction* (Consumer Federation of America, April 2008).