ENVIRONMENTAL PROTECTION AGENCY
DEPARTMENT OF TRANSPORTATION,
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

Greenhouse Gas Emissions and Fuel Efficiency	)	
Standards for Medium and	)	**40 CFR Parts 9, 22, 85, et al.**
Heavy-Duty Engines and Vehicles	)	**49 CFR Parts 512, 523, 534, et al.**
Phase 2; Proposed Rule	)	

COMMENTS OF THE CONSUMER FEDERATION OF AMERICA

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October 1, 2015

CONTENTS

SUMMARY

In the these comments, the Consumer Federation of America (CFA) demonstrates the increasing the fuel economy of medium and heavy duty trucks (work trucks) is an important consumer issue and that the proposal by EPA/NHTSA will yield substantial benefits to consumers. CFA takes a uniquely consumer approach to the analysis of performance standards, that asks a basic set of questions, always starting with the consumer pocketbook question:

- Will increasing fuel economy save consumers money? Yes, and a well-designed performance standard will address the clear "efficiency gap in the work truck market.

Our analysis of these questions in the work truck market shows that EPA/NHTSA has taken the correct approach and set a standard that is highly beneficial to consumers. While we fully support the standard, the fact that the cost per gallon of saved fuel is only $0.47 and the benefits are six time larger than the costs, leads us to call on EPA/NHTSA to provide better documentation and support for the decision not to set the standards at a higher level. .

In **Section II,** we estimate the potential benefits of increasing fuel economy in work trucks based on several sources including the EIA *Residential Consumption Survey,* the Department of Transportation's, *National Household Transportation Survey;* the Energy Information Administration's *Annual Energy Outlook*; the Bureau of Labor Statistics' Consumer Expenditure Survey; and the U.S. Department of Transportation's, *Bureau of Transportation* statistics each of which estimates fuel usage by types of vehicles.

o On a per household basis, we estimate that the cost of fuel consumed by work trucks is equal to almost half as much as households spend on gasoline and almost as much as they spend on electricity.

Moreover, our analysis in **Section III** leads us to believe that these fuel costs are recovered from consumers in the cost of goods and service that rely on work trucks. The pass-through of costs is suggested and supported by analysis of macro-economic models and widely documented elasticities of demand.

Respondents to national random sample surveys commissioned by CFA understand that they pay for big truck fuel in the cost of goods and services, and they support standards to improve truck fuel economy. The vast majority of the public (over 90%) understand that "some, most, or all" of the fuel costs of heavy-duty trucks, which transport virtually every consumer good, are passed on to consumers. In both of the CFA surveys, consumers clearly understood the possibility of these savings as nearly three quarters of the respondents favored requiring truck manufacturers to increase the fuel economy of large trucks.

As discussed in **Section IV,** studies by half a dozen research organizations, including industry groups, the National Research Council, EPA/NHTSA, indicate that a substantial reduction in work truck energy consumption could be achieved at relatively low cost by adopting technologies that are currently available. So we look to answer the next logical questions about closing the efficiency gap:

- Why is there an efficiency gap that appears to impose unnecessary costs on consumers? Because the work truck market exhibits numerous important market imperfections.

Studies of the trucking sector that are summarized in Se**ction IV** indicate that there are market barriers, imperfections and obstacles that prevent these beneficial technologies from penetrating the work truck market. Table ES-1, shows the barriers are numerous and substantial.

- Is a standard an appropriate policy and, if so, is the proposed standard well-designed to achieve the goal of lowering consumer cost? Yes, EPA/NHTSA have taken an approach that will deliver significant consumer savings. The only question is whether they should have chosen higher levels of fuel efficiency to deliver larger economic and environmental benefits.

Our research, summarized in **Section V,** shows that performance standards are an ideal approach to overcoming the barriers to efficiency investments when the exhibit six characteristics. They need to be: long-term, technology neutral, product neutral, responsive to industry needs, responsive to consumer needs, pro-competitive.

Based on our evaluation of the Phase II standard, in **Section VI** and summarized in Table ES-2, we conclude that EPA/NHTSA have done an excellent job designing the standards. While large additional potential savings lead us to call on the agencies in **Section VII** to give a hard second look at the factors that led them to not push the industry harder, the huge efficiency gap underscores the importance of the major advances the agencies have made in the economic analysis, including:

- **Discount rate:** Recognizing real world consumer discount rate of 3% and market imperfections driving observed discount rate.

- **Efficiency Gap/Market Imperfection Analysis:** Recognizing 30 years of empirical evidence demonstrating validity of efficiency gap explanation and identifying specific barriers, imperfections and obstacles that afflict specific markets.

- **Merging energy and environmental analysis:** Recognizing major impact of fuel savings on assessment of rules.

- **Macroeconomic analysis:** Reconciling important benefit of expansion of macro-economic activity resulting from greater fuel economy with realistic assessment of the rebound effect.

- **National security:** Looking carefully at the impact of imports on national security and consumption externalities created by large U.S. role in petroleum markets.

- **Effective design of standards:** Designing standards that “command but do not control,” thereby unleashing forces of competition to ensure least cost implementation.

Table ES-1: Performance Standard & Market Barriers to Efficiency, Medium and Heavy Duty Truck Sector

Nature of the Barrier	Effect on the Market	Impact of the Standard
Information Issues in the first sale market Unavailable due to public good nature Complexity due to geography, driving styles, uses Cost of gathering Cost of "redundant" production of Information	Inadequate or unreliable information about fuel saving technologies	Better information more readily available Public provision of information
Information Issues in the Secondary Market Compounded information problem Complexity due to geography, driving styles, uses Different uses may affect mileage	Resale value inadequately rewards fuel saving technology Lack of incentive to invest in fuel economy in 1st sale market	Better information more readily available
Endemic Financial, Limit d Access to Capital Short payback, First Cost Bias Time lag for retrofit Split Incentives Owner-Operator, Owner-Renter, Tractor-Trailer Contract structure	 Crowds out investment in efficiency Short payback period due to under-compensation of initial investment Owners emphasize different attributes Information does not overcome Coordination Problem	 Levels the playing field for investment Investment embedded in market, lower risk Alters the incentives Investment embedded in market Fosters coordination
Shrouded Attribute Lack of availability in bundles Positional, "status" good	Bundles of attributes maximize other characteristics --durability, maintenance costs	Increased emphasis on shrouded attribute
Market power	Ability to choose operators, dulls market signals	Investment embedded in market, lower risk
Adjustment & Transaction Cost Conservative approach to change, need to learn & evaluate technology Accelerated fleet turnover Training costs	Slows innovation and adoption Resistance to capital expenditure Resistance to increased cost	Experience with technology accelerates Levels the playing field for investment
Uncertainty Future savings, level and variance Fuel price, performance, life, use, geography Risk aversion, Option value Reliability	Savings are future, technology costs are current	Some market uncertainties removed Investment embedded in market, lower risk Hidden costs

TABLE ES-2: TRAITS OF EFFECTIVE PERFORMANCE STANDARDS; EVALUATION OF THE PHASE II TRUCK RULE

Long Term: Setting a progressively rising standard that targets a high long term goal over the course of a decade or more will foster and support a long-term perspective for the truck manufacturers, transportation companies and public, by reducing the marketplace risk of investing in new technologies. The long-term view gives the truck makers time to re-orient their thinking, retool their plants and help re-educate the transportation industry. It also gives the industry buying and using these trucks time to adjust.

Phase II: EPA/NHTSA point out that the cycle can take as long as ten years. They see this as a fundamental constraint on the ability to set standards to require technologies to be included. The agencies go through potential technologies one-by-one to assess the time frame in which they could be implemented and find several that have rather long periods. The 10 year time frame chosen by EPA/NHTSA represents a reasonable balance. It is hard to predict much beyond that period, but it gives the industry the opportunity to implement technologies. On the other hand, given the legislative mandates to maximize efficiency and reduce environmental harms to the extent feasible, the long cycle demands that the agencies actively monitor developments within the industry to see whether technologies have become feasible for the purpose of setting future standards. It also puts a spotlight on the importance of other policies, beyond standards, to speed the product cycle.

Technology Neutral: Taking a technology neutral approach to a long term standard unleashes competition around that ensures that the industry will get a wide range of choices at that lowest cost possible.

Phase II: The agencies achieve this outcome in two ways. They do not mandate any specific technology and they do not assume a very high level of penetration of many technologies. By relying on a variety of technologies that affect several of the key attributes of the vehicle that affect energy consumption, they create a rich palate of alternatives from which the manufacturers can choose to meet the standard. EPA/NHTSA assume a high penetration (over 50%) of a couple of the technologies based on their analysis of the market. However, even though they assume this high level to set the standard, manufacturers would not have to uniformly include the measures that EPA/NHTSA use to set the standard. They could meet the standard using a mix of other technologies, including many of those that were not used to set the standard. Given the level of the standard, there is a lot of head room for manufacturers to be innovative.

Product Neutral: Attribute-based approach to standards accommodates buyer preferences; it does not try to supplant them. This levels the playing field between truck makers and removes any pressure to push inappropriate vehicles into the market.

Phase II: The large amount of head room that EPA/NHTSA have left for manufacturers applies to alternative technologies across the board. Thus, entirely new approaches to meeting the standards are welcome and a small penetration of alternative engine types (Rankin and hybrid engines) factors into the level of the standards. This is a step back from Phase I in which these alternatives were given additional credits as incentives to develop and deploy the technologies.

Responsive to industry needs: Establishing a long term performance standard recognizes the need to keep the standards in touch with reality. The standards can be set at a moderately aggressive level that is clearly beneficial and achievable. With thoughtful cost estimates, consistent with the results of independent analyses of technology costs, a long term performance standard will contribute to the significant reduction of cost.

Phase II: The adoption cycle is also a constraint on the speed of penetration of technologies into the market. Given the amount of capital, the life of the product and its uses, the speed of adoption can vary substantially. Again, EPA/NHTSA evaluate specific technologies with respect to adoption cycles. The challenge of the adoption cycle reinforces the challenge of the product design cycle. Monitoring the development and adoption of technologies and using other policies to accelerate both are important activities to undertake. The agencies have outlined a list of key technologies that are already feasible or candidates for future inclusion in standards.

Responsive to consumer needs: The approach to standards should be consumer-friendly and facilitate compliance. An attribute-based approach ensures that the standards do not require radical changes in the available products or the product features that will be available to consumers. We include the principle that standards should be attribute based as the key to this criteria. Consumers purchase and use durables for specific purposes. The attributes of the durables are extremely important. To the extent that agencies design standards to ensure consumers get the functionalities they need, the standards will be more effective. The setting of a coordinated national standard that lays out a steady rate of increase over a long time period gives the market and the industry certainty and time to adapt to change.

Phase II: As in all cases, balance is necessary. Just as some consumers are more demanding, the agency may well conclude that those consumers are also more willing to pay for attributes, so higher levels of efficiency are feasible and practicable in the marketplace. EPA/NHTSA have certainly made that effort here. For example, the target levels and development paths for the fuel consumption of tractor trailers taking their class, cab height and use into account. There is a 30% difference in targets across the nine categories and a 3% difference in the rate of improvement.

Procompetitive: All of the above characteristics make the standards pro-competitive. Producers have strong incentives to compete around the standard to achieve them in the least cost manner, while targeting the market segments they prefer to serve. Well-designed performance standards that follow these principles command but they do not control. They ensure consumer needs are met while delivering energy savings and increasing consumer and total social welfare.

Phase II: Given the above description of the Phase II proposal, we conclude that it would be procompetitive. It would induce competition around the standard in which manufacturers would install those technologies in which they have an advantage, given the nature of their expertise and the customers they serve.

I. INTRODUCTION AND OVERVIEW

A. THE CONSUMER FEDERATION OF AMERICA

The Consumer Federation of America (CFA),[1] applauds the Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA) for proposing Phase II rules for medium and heavy duty trucks.[2] It is vitally important to continue the improvement of the fuel economy of these vehicles, which are a major consumer of liquid fuels in the U.S.

CFA has participated in dozens, if not hundreds, of efficiency rulemakings, regulatory negotiations, and legislative hearings involving large and small energy using consumer durables, ranging from automobiles to air conditioners, furnaces, water heaters, computers, and lightbulbs.[3] Although this is the first time we have participated in a rulemaking dealing with the fuel economy of medium-and heavy duty trucks, we see it as a natural extension of our work in these other proceedings. As discussed below, the fuel consumption of medium and heavy duty trucks is an important consumer issue and the performance standard approach taken by the agencies is exactly the right approach.

Our technical expertise is not in the design and construction of these consumer durables, it is in the design and implementation of minimum energy standards focusing on their impact upon consumers. We believe that knowing how to build an effective standard is at least as

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[1] The Consumer Federation of America is an association of more than 250 nonprofit consumer groups that was established in 1968 to advance the consumer interest through research, advocacy, and education.

[2] Environmental Protection Agency, Department Of Transportation, National Highway Traffic Safety Administration, Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium and Heavy-Duty Engines and Vehicles, Phase 2; Proposed Rule, 40 CFR Parts 9, 22, 85, et al., 49 CFR Parts 512, 523, 534, et al., July 13, 2015 (hereafter, PHASE II NOPR); Environmental Protection Agency, Department Of Transportation, National Highway Traffic Safety Administration, Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium and Heavy-Duty Engines and Vehicles, Phase 2; Proposed Rule, Draft Regulatory Impact Assessment (hereafter, PHASE II RIA), June 2015.

[3] The CFA website (http://www.consumerfed.org/issues/energy) lists over 100 pieces of legislative testimony and regulatory comments in home energy and motor vehicles, most of which involve energy use and efficiency standards.

important to arriving at a successful energy saving outcome as knowing how to build a consumer durable. Moreover, although we do not claim expertise in the technical design of consumer durables, we do claim expertise in the economic analysis of technologies. Our analysis combines a review of the technical economic studies prepared by others and evidence on the market performance of heavy duty trucks to determine whether there are significant potential consumer savings that would result from a higher standard.

B. Approach and Outline

We approach the setting of standards from a uniquely consumer point of view,[4] always starting from a series of basic questions:

- Will a standard save consumers money? If there appears to be potential savings, we ask:
- Why is there an efficiency gap that appears to impose unnecessary costs on consumers? If we find market imperfections that prevent the efficiency gap from being closed and cost savings from being realized, we then ask:
- Is a standard an appropriate policy and, if so, how can the standard be best designed to achieve the goal of lowering consumer cost? If a standard seems to be a good option, we then ask:
- Does the proposed standard do a good job? Here we evaluate the standard EPA/NHTSA has proposed against the answers to the first three questions.

These comments are divided into five sections. We answer the first question above in two steps. First, in Section II, we estimate the amount and cost of fuel consumed by the medium and heavy duty trucks subject to the proposed rule compared to the amount of money households pay for gasoline and electricity, which is the second largest home energy cost.

[4] Appendix A is a presentation to the California Energy Commission's Energy Academy that summarizes the analytic framework (Mark Cooper, "Energy Efficiency Performance Standards: Driving Consumer and Energy Savings in California, February 20, 2014). Appendix B (Mark Cooper, *Energy Efficiency Performance Standards: The Cornerstone of Consumer-Friendly Energy Policy*, October 2013) provides our comprehensive review of the literature and the detailed analytic framework we have developed to examine performance standards.

Then, in Section III, we show that consumers are very likely to "Pay the Freight. Household budgets bear the burden of truck fuel costs indirectly in the cost of goods and services they buy. As a result, the Phase II rule deserves close attention from the consumer point of view.

Section IV examines analyses of the technological potential for and cost of reducing freight truck fuel consumption. We show that there is a great deal of technically feasible and cost beneficial fuel savings available.

Section V examines the structure of the heavy duty truck market to ascertain whether there are market imperfections that might account for the failure to invest in cost effective fuel saving technologies.

Section VI evaluates the proposed, Phase II medium and heavy duty truck standards.

In Sections I-V, we make no reference to the proposed Phase II standards or their supporting documents. We rely only on third party analyses and the Phase I analysis,[5] which survived serval court challenges. In other words, Sections I-V represent our interpretation of the terrain of evidence-based knowledge about the fuel economy in the medium and heavy duty truck market, which we then apply this knowledge in Section VI to evaluate the proposed Phase II rule.

II. THE CONSUMER STAKE IN THE FUEL USE OF HEAVY DUUTY TRUCKS

Over the past decade public opinion polling by the Consumer Federation of America and other organizations has revealed strong and widespread support for energy efficiency standards

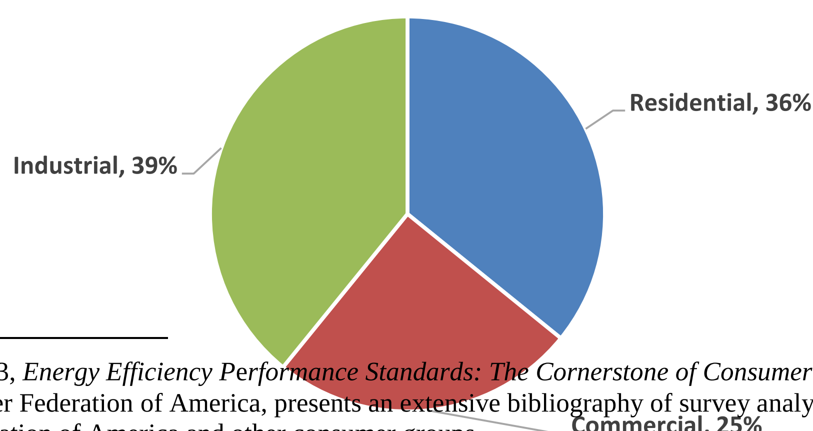
[5] Environmental Protection Agency, Department Of Transportation, National Highway Traffic Safety Administration, Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium and Heavy-Duty Engines and Vehicles, Final Rule, 40 CFR Parts 85, 86, 600, et al., 49 CFR Parts 523, 534, and 535, September 15, 2011 (hereafter, PHASE I NOPR); Environmental Protection Agency, Department Of Transportation, National Highway Traffic Safety Administration, Final Rulemaking to Establish Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium and Heavy-Duty Engines and Vehicles, Phase 1; Regulatory Impact Analysis (hereafter, PHASE I RIA), August 2011.

for consumer durables including automobiles and households appliances.[6] Because gasoline and electricity bills are such a large part of household annual expenses – currently about $2,600 for gasoline and over $1400 for electricity[7] — it is not surprising that polls consistently elicit this support. Consumers clearly feel the pain in their pocketbooks and understand the economic impact of those energy costs on their household budgets.

Economic analysis has shown that there is a sound basis for consumer support of energy efficiency standards.[8] Although energy saving technologies require an investment, when they lower energy bills by more than their cost, the result is ultimately net savings to consumers.

While direct household expenditures on personal energy consumption are significant, they are only part of the consumer's expenditures on energy. Consumers also pay indirectly for the energy consumption in the commercial and industrial sectors through the prices of goods and services. As shown in Figure I-1, the total residential energy consumption represents just over one-third of total national energy consumption. In other words, almost two thirds of the nation's energy consumption takes place in the production and distribution of goods and services and the costs incurred are recovered in the prices of those goods and services.

FIGURE I-1: ENERGY CONSUMPTION IN THE RESIDENTIAL, COMMERCIAL AND INDUSTRIAL SECTORS



[6] Mark Cooper, 2013, *Energy Efficiency Performance Standards: The Cornerstone of Consumer-Friendly Energy Policy*, Consumer Federation of America, presents an extensive bibliography of survey analysis by the Consumer Federation of America and other consumer groups.

[7] Based on Bureaus of Labor statistics, *Consumer Expenditure Survey*, for 2013 and 2013-2014

[8] Cooper, 2013

Source: Energy Information Administration, *Monthly Energy Review: August 2015.*

consumption is America's medium and heavy duty trucks. **In fact, these comments show that indirect freight truck fuel costs passed on to consumers are about half as large as direct gasoline expenditures and almost equal to household electricity bills.**

Consumers recognize that when fuel prices rise, so does the cost of consumer goods due to the cost of transporting those goods. Conversely, because of competition, a reduction in transportation costs will result lowering the cost of goods and services for consumers. Reducing the energy consumption of medium and heavy duty trucks will reduce household expenditures by lowering the cost of all goods and services. Therefore, the rulemaking currently underway regarding medium and heavy duty truck fuel consumption deserves close scrutiny and support from consumers and consumer advocates. This section examines the costs of energy used by medium and heavy duty trucks and the positive impact increased truck[9] fuel efficiency can have on America's households.

In this section we estimate the potential size of the indirect consumer expenditure. In the next section, we discuss the evidence that the costs are passed through to consumers and survey evidence that shows the public understands the impact of transport costs on their pocketbooks and the role of truck fuel economy standards in alleviating the burden.

A. Household Expenditures for Medium and Heavy Duty Truck Fuel

Expenditures for transportation fuels, whether direct or indirect, are the result of the amount of energy consumed and the price of that energy.

[9] For the purposes of simplicity, in this paper, we will refer to medium and heavy duty trucks as 'freight trucks'.

To estimate the potential consumer savings from improvements in the fuel economy of trucks, we first estimated the fuel used by the three main vehicle categories (household light duty, commercial light duty, and medium-heavy duty trucks). We undertake this analysis because different organizations that analyze energy use slightly different categorizations of energy use by different types of vehicles, and we want to make clear how we arrived at our figures. However, because light duty vehicles, which make up the vast majority of households vehicles, are already covered by CAFE standards, we do not include them in our analysis. We have been careful not to double count energy light duty consumption in our estimate of indirect household expenditures on medium and heavy duty transportation fuel.

Table II-1 (below) shows three different approaches to estimating household gasoline consumption. We used several data sources to build our estimate: EIA *Residential Consumption Survey,* the Department of Transportation's, *National Household Transportation Survey;* the Energy Information Administration's *Annual Energy Outlook*; the Bureau of Labor Statistics' Consumer Expenditure Survey; and the U.S. Department of Transportation's, *Bureau of Transportation* statistics each of which estimates fuel usage by types of vehicles.

TABLE II-1: THREE METHODOLOGIES FOR ESTIMATING THE INDIRECT, AGGREGATE, ANNUAL HOUSEHOLD CONSUMPTION OF TRANSPORTATION ENERGY

		Billion Gallons	
2009		**BLS/CE, EIA**	**NHTS/ EIABTS**
Household Gasoline		**100**	**96**
2010			
Household Gasoline	**Light Duty Short Axle**	**91**	**88**
Commercial Light Duty	**Light Duty Long Axle**	**36**	**36**
Medium & Heavy Duty	**2Axle-Six Wheel & Combination**	**43**	**45**

Method – BLS/EIA: ($per HH / $ per gallon) X No. HH; NHTS/EIA: (VMT/MPG)

Source: Consumption: Bureau of Labor Statistics (BLS), *Consumer Expenditure Survey 2010,* Energy Information Administration (EIA), *Annual Energy Outlook, 2013,* Appendix A*;* Department of Transportation (DOT), *Bureau of Traffic Statistics (BTS) Data Base,* Tables 4-11 to 4-14. Department of Transportation, *National Household Transportation Survey, 2009 Price*: Energy Information Administration, *Petroleum Database;* Households, Bureau of the Census, *Statistical Abstract of the United States: 2012,* Table 59, 118 million households. *EIA, Monthly Energy Review,* miles per gallon, total gasoline and diesel on-highway supplies.

The 2009 calculation compares an estimate based on the Bureau of Labor Consumer Expenditure Survey to an estimate based on the National Household Transportation Survey, both for 2009. Using each of the estimates, we divided the household expenditure by the average price per gallon to arrive at the number of gallons per household. We then multiplied the household consumption by the total number of households. The National Household Transportation Survey estimates the total number of vehicle miles traveled by households. We divided this by the average miles per gallon of the light duty vehicle fleet to arrive at the amount of gasoline consumed. These two estimates are quite close.

The 2010 estimate is based on EIA data that identifies the amount of energy consumed by automobiles and light duty vehicles, medium duty vehicles and heavy duty trucks. The EIA data does not separate out household and commercial use of light duty vehicles, so we used the *Consumer Expenditure Survey* from the Bureau of Labor Statistics to estimate the gasoline consumed by households. We subtracted this from the total for light duty vehicles, as reported in the *Annual Energy Outlook*, to determine the amount of energy consumed by light duty vehicles that is not consumed by households. We call this commercial light duty.

As shown in Table II-1, this approach provides an estimate that is consistent with the Department of Transportation data, which categorizes vehicles by axle length and the number of tires. Again, the estimates are quite close, although they are lower than the estimate for 2009. There was a decrease in consumption between 2009 and 2010 in the aggregate consumption. The consistency of this data provides us with a substantial level of confidence in the amount of medium and heavy duty truck fuel we use for our calculations.

Table II-2 applies the BLS/EIA approach from Table II-1 to the data for 2013 and 2014.[10] We prefer this approach since it can be updated easily. As a result, for 2013, we estimate 92 billion gallons of household gasoline consumption and 43 billion in medium and heavy duty truck consumption. We reduce the freight truck consumption by 11% to account for exports, since their cost burden would not fall on consumers.

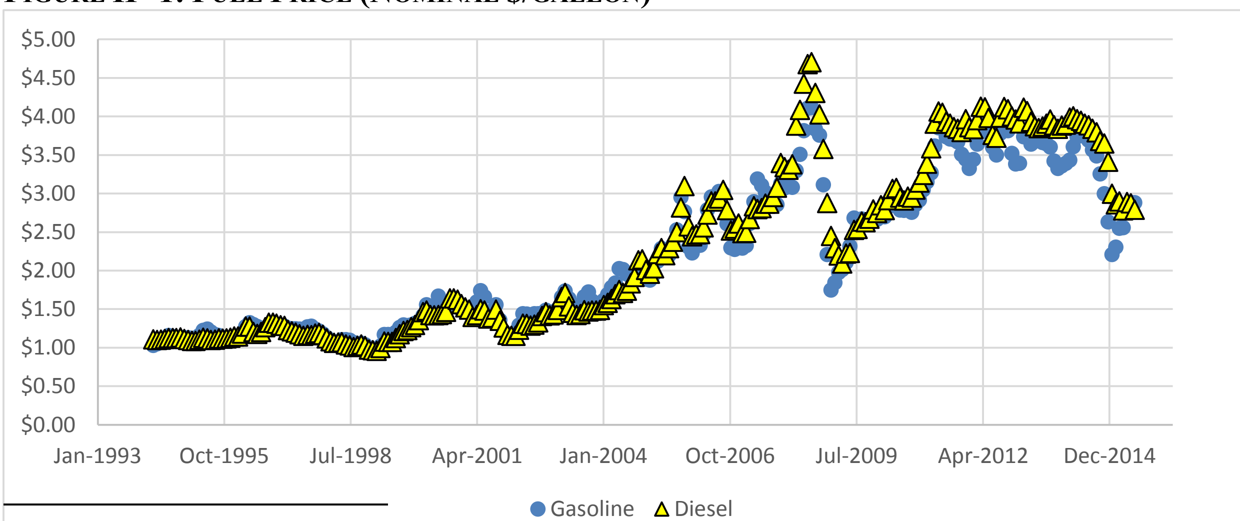
TABLE II-2: HOUSEHOLD EXPENDITURES (BLS/EIA Method)

	Fuel	Consumptions Total Bil. Gal.	Per HH Gal.	$/gal.	Annual cost
2013					
Household Gasoline	**Gasoline**	**92**	**730**	**$3.58**	**$2,613**
Medium & Heavy Duty	**Diesel**	**43**	**300**	**$3.92**	**$1,176**
2014					
Household Gasoline	**Gasoline**	**93**	**730**	**$3.54**	**$2,511**
Medium & Heavy Duty	**Diesel**	**45**	**310**	**$3.82**	**$1,184**

Source: See Table II-1.

As shown in Figure II-1, the prices of transportation fuels in recent years have been volatile while clearly trending upward. For a little over a decade, diesel fuel has cost more than gasoline.

FIGURE II--1: FUEL PRICE (NOMINAL $/GALLON)



[10] We estimate 2014 based on total products supplied and average price for the year, assuming a 1% increase in the number of households and constant consumption per household. This is consistent with the difference between the 2013 Consumer Expenditure Survey and the mid-year 2014 Consumer Expenditure Survey. While price is down 3% between 2014 and 2013, expenditures are down 1.5% in the year July 2013-July 2014. By the end of the year we would expect the increase in consumption stimulated by declining prices to be offset by the decrease in consumption reflecting more fuel efficient vehicles and the underlying trend. For diesel, we divide the total expenditures by the estimated number of households.

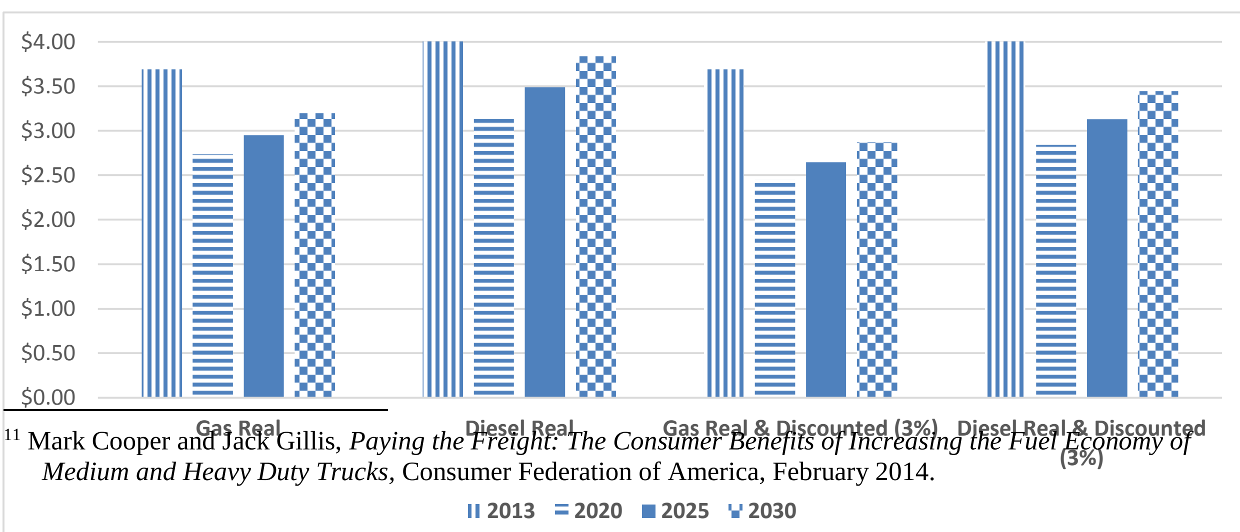
Source: EIA, Petroleum Price Database.

This confirms the conclusion we reached in our earlier analysis.[11] We estimate 730 direct gallons per household and 300 indirect gallons of diesel fuel consumption. Keeping in mind that diesel prices were 10% higher than gasoline prices in 2013, for every dollar that consumers spend on household gasoline, they spend about $0.47 on freight transport fuel consumption. At an annual cost of nearly $1,200, households spend almost as much on freight truck fuel as they do on electricity.

B. Future Household Expenditure Trends

Any cost/benefit analysis of a proposed standard must be forward looking and factor in expected costs at the time of implementation. As shown in Figure II-2, the EIA projects lower prices for both gasoline and diesel in 2020, followed by a steady increase in prices to 2030. The Figure shows both "real" prices, which are adjusted to compensate for inflation and actual expected prices. The EIA, which is the primary source that government agencies use for future pricing, projects diesel prices to rise slightly faster than gasoline prices, which has been the trend for the past decade.

Figure II-2: Future Prices, Real and Discounted



[11] Mark Cooper and Jack Gillis, *Paying the Freight: The Consumer Benefits of Increasing the Fuel Economy of Medium and Heavy Duty Trucks*, Consumer Federation of America, February 2014.

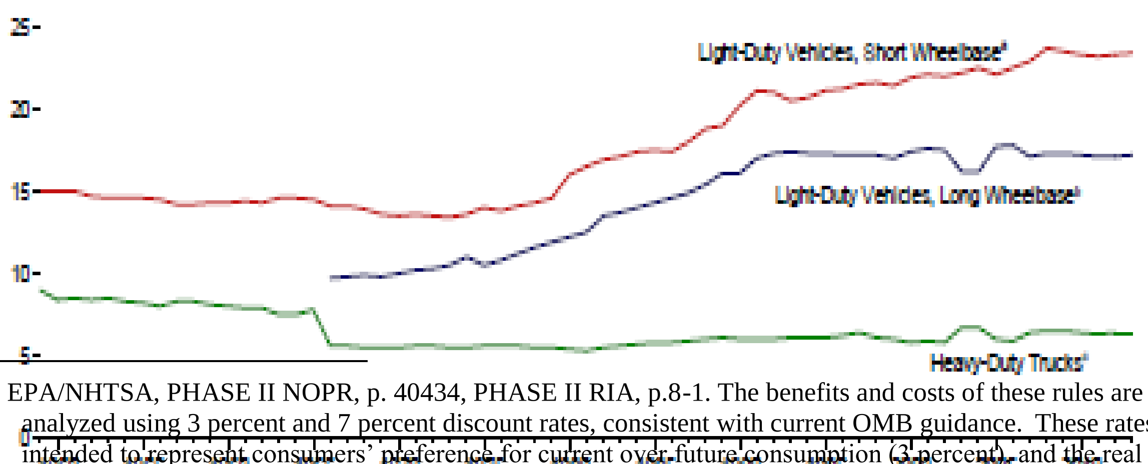
Source: Annual Energy Outlook, 2015, Appendix A.

Figure II-2 also shows the effect of "discounting" future prices. The reason to discount is that the use of money has value. It could have been put to other uses and earned a return. The standard discount rates established by the Office of Management and Budget (OMB) for regulatory analysis are 3% for the consumer discount rate and 7% for the producer discount rate.[12] In our analysis of the proposed rule, we use the consumer discount rate of 3%.

As large as current household spending is on transportation fuel used by medium and heavy duty trucks, it will become even larger in the future. Going forward, the new CAFE requirements will lower the household impact of fuel costs associated with consumer and commercial light duty vehicles. On the other hand, without some controls, the burden on households due to medium and heavy duty truck fuel costs will only increase both absolutely and relative to their direct expenditures on gasoline. Figure II-3 shows that, historically, the fuel economy of medium-heavy duty trucks has not increased.

FIGURE II-3: MOTOR ECONOMY 1949-2011 (MILES PER GALLON)

MPG

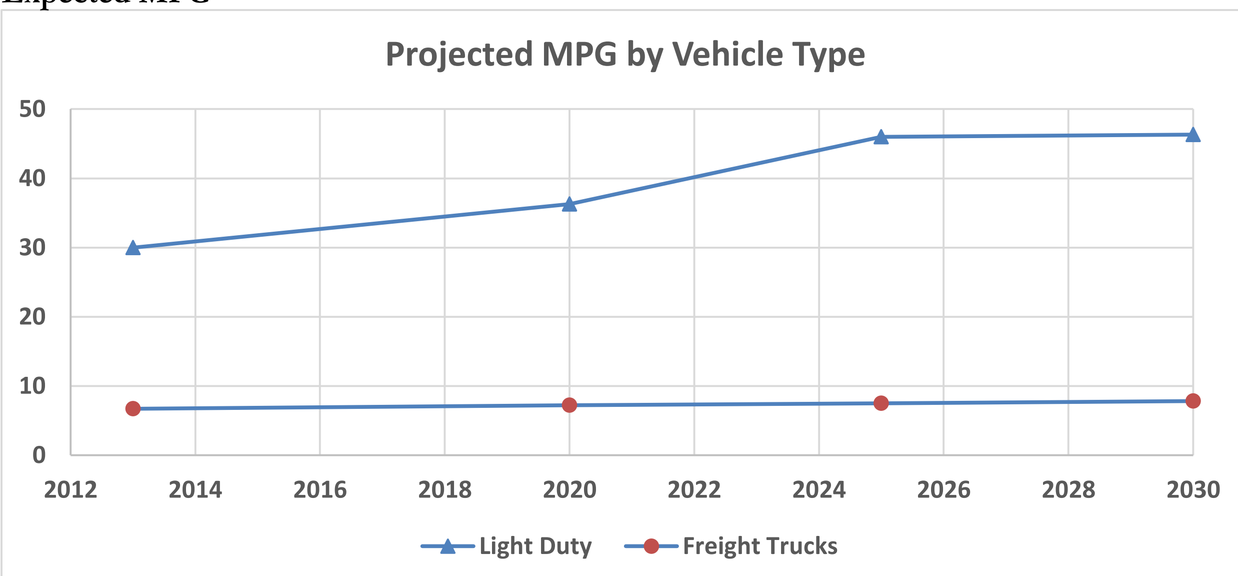


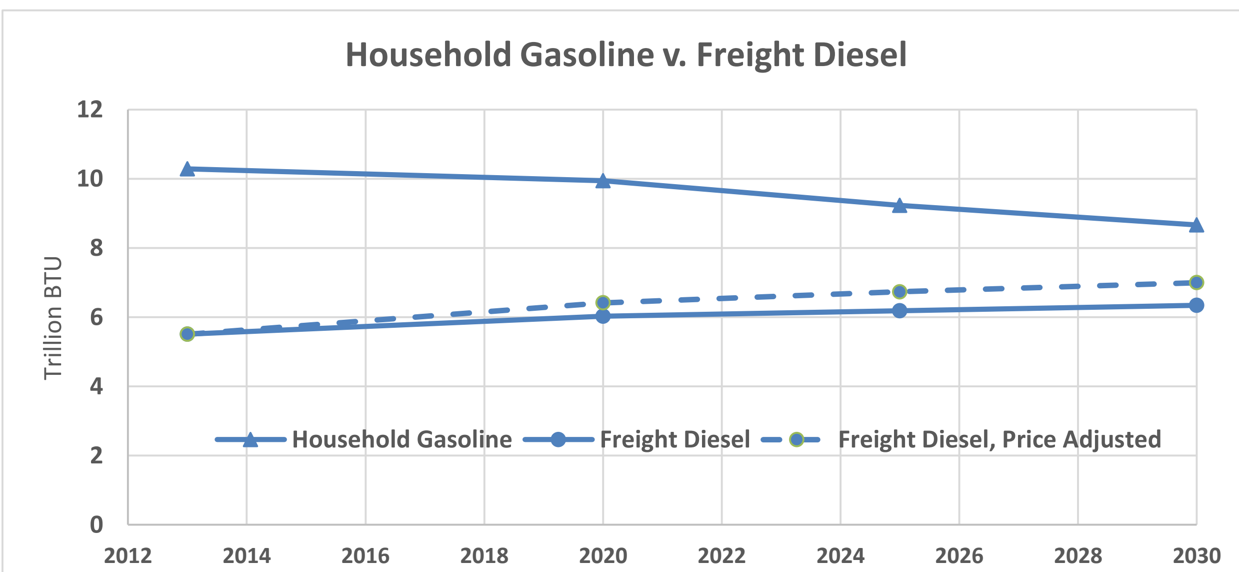
[12] EPA/NHTSA, PHASE II NOPR, p. 40434, PHASE II RIA, p.8-1. The benefits and costs of these rules are analyzed using 3 percent and 7 percent discount rates, consistent with current OMB guidance. These rates are intended to represent consumers' preference for current over future consumption (3 percent), and the real rate of return on private investment (7 percent) which indicates the opportunity cost of capital. However, neither of these rates necessarily represents the discount rate that individual decision-makers use. The program may also have other economic effects that are not included here.

Source: U.S. Energy Information Administration, Monthly Energy Review, July 2015, page 17.

The most recent *Annual Energy Outlook* from the EIA, incorporating the new fuel economy standard for light duty vehicles, projects a substantial decline in fuel consumption as a result of increasing fuel economy standards, as shown in the top graph of Figure II-4.

FIGURE II-4: TRENDS IN FUEL ECONOMY AND CONSUMPTION MILEAGE BY VEHICLE TYPE
Expected MPG





Source: Energy Information Administration, *Annual Energy Outlook*, 2015.

As shown in the bottom graph of Figure II-4, fuel consumption of light duty vehicles (and therefore household gasoline) is projected to decline because the increase in fuel economy is larger than the expected increase in miles driven.[13] On the other hand, in spite of the recently adopted truck standard (2014), the EIA projected MPG for these vehicles to remain flat. As the use of these vehicles increases, the lack of MPG improvement and rising fuel prices will significantly increase fuel costs.

Without long-term standards for freight trucks, fuel consumption of trucks is projected to increase because fuel economy improvements will not keep up with increasing demand for freight services. Within 20 years, taking the price difference between gasoline and diesel into effect, the gap between direct and indirect household expenditures on transportation energy will narrow considerably. As show above, today, the burden imposed indirectly on household budgets by truck fuel consumption equals about half the burden imposed directly by gasoline consumption. Without stronger fuel economy standards for trucks, that burden will grow to 80% of the future gasoline burden because the current light duty standard will drive down consumption.

This analysis of the indirect cost burden that medium and heavy duty trucks place on household budgets indicates that consumers have a big stake in the Phase II rule.

III. COMMERCIAL FUEL COSTS ARE PASSED THROUGH TO HOUSEHOLDS

A. A COST OF DOING BUSINESS

[13] Population growth will increase vehicles on the road and overall miles driven.

While we have calculated the size of fuel expenditures on a per household basis, we must ask, “do households actually pay these costs?” To a large degree, the answer is “Yes.” These costs are just like any other commercial costs in the economy.

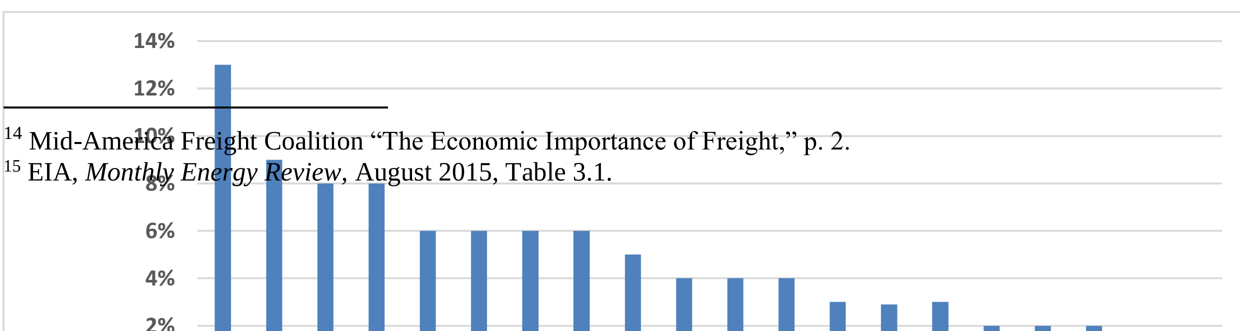
When a farmer pays for fertilizer or the delivery driver gets his paycheck, these business costs are recovered in the price of the related goods and services. The same is true with fuel costs. In fact, the Mid-Atlantic Freight Coalition confirms the pass-through of transportation costs in a report on how transportation and logistics consume a significant portion of household budgets. According to the report,

> “the freight logistics system costs nearly $4,500 per person, which is spent moving and warehousing goods. This $4,500 factors into the cost of every product we buy. Anything that industry or government can do to make the logistics system more efficient will return benefits in terms of lower cost and greater global competitiveness.”[14]

Although this estimate of the size of the expenditure on freight logistics includes all transportation modes (truck, rail, barge, etc.) and all costs, (equipment, maintenance, salaries, etc.), it acknowledges the importance of transportation costs to the economy which includes truck fuel costs. In addition to the pass-through of these costs to consumers, there is the significant dependence on foreign sources for this fuel. Imported petroleum now makes up just under half (48%) of the total U.S. product supplied,[15] which is a drain on the U.S. economy.

While the recognition that transportation costs are paid by consumers is obvious, the concept is reinforced by two observations: First, although transportation costs are a small part of the total economy (just under 3%), they are as large or larger, than several other sectors, including agriculture, mining, utilities and construction (see Figure III-1). It is widely recognized that those costs are passed on to consumers.

FIGURE III-1: GROSS DOMESTIC PRODUCT BY SECTORS

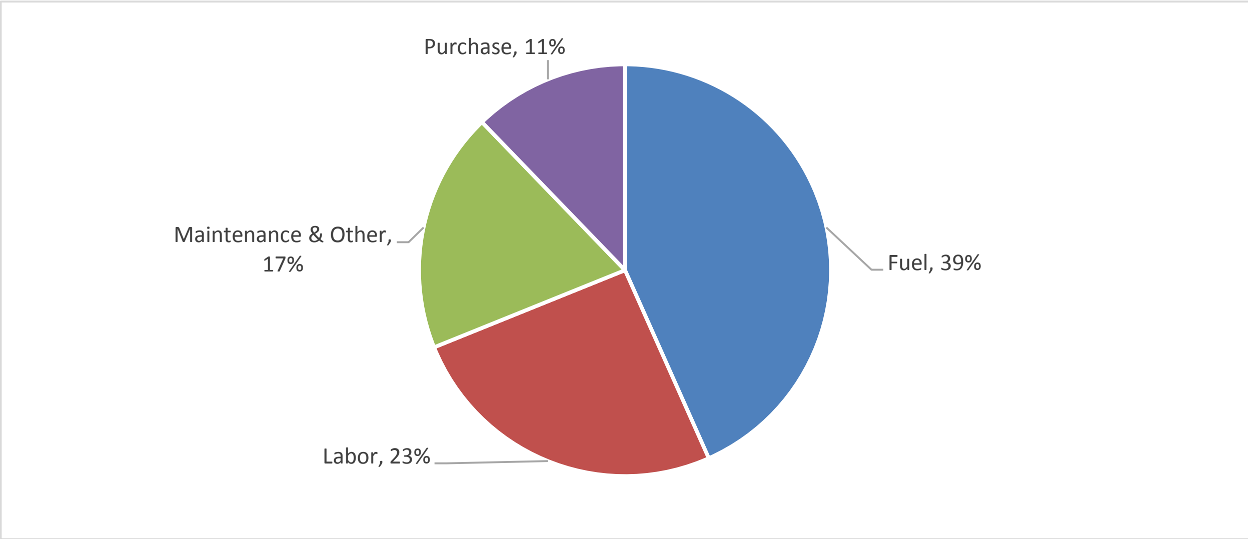


[14] Mid-America Freight Coalition “The Economic Importance of Freight,” p. 2.
[15] EIA, *Monthly Energy Review*, August 2015, Table 3.1.

Source: ***GDP by Industry*****, http://en.wikipedia.org/wiki/Economy_of_the_United_States**

Second, fuel costs are the single largest component of transportation costs, representing over one-third of the total transportation costs (see Figure III-2). Fuel costs are slightly larger than driver pay and three times as large as the cost of owning and insuring the truck. As transportation costs are passed through to consumers, fuel is the largest component of that pass-through. There is certainly no reason to believe that fuel costs are less likely to be recovered from consumers than drivers' wages or owners' capital costs.

FIGURE III-2: AVERAGE TRUCK OPERATION COSTS



Source: EPA/NHTSA, PHASE II RIA, p. 8-1

B. Econometric Models Demonstrate the Pass-Through Nature of Transportation Fuel Costs

The economic reality of the flow through to consumers of transportation fuel costs is reflected in the way econometric models describe the growth of the economy. Such models are built on input/output tables, and transportation costs are a significant input in the models. In building these models, the pass-through of transportation costs is assumed, since transportation plays a fundamental role in the overall cost of production.

> Transportation is an economic factor of production of goods and services, implying that relatively small changes can have substantial impacts on costs, locations and performance…
>
> Transport also contributes to economic development through job creation and its derived economic activities. Accordingly, a large number of direct (freighters, managers, shippers) and indirect (insurance, finance, packaging, handling, travel agencies, transit operators) employment are associated with transport. Producers and consumers make economic decisions on products, markets, costs, location, prices which are themselves based on transport services, their availability, costs and capacity.[16]

The importance of transportation in these economic models is reflected in the high multiplier it is given. In order to build a model of the economy, analysts study the places where a sector purchases inputs and sells output. Typically, the more places that are touched by a sector, the larger its multiplier. Because most economic models are built on the flow of goods and services through the economy, they depend on the geographic scope and nature of activity within the economy being modeled. Transportation is generally seen as a central input to measuring broader economic activity. To further reinforce the impact of transportation costs on consumer pocketbooks, Figure III-3 presents the sector multipliers for the state of California.

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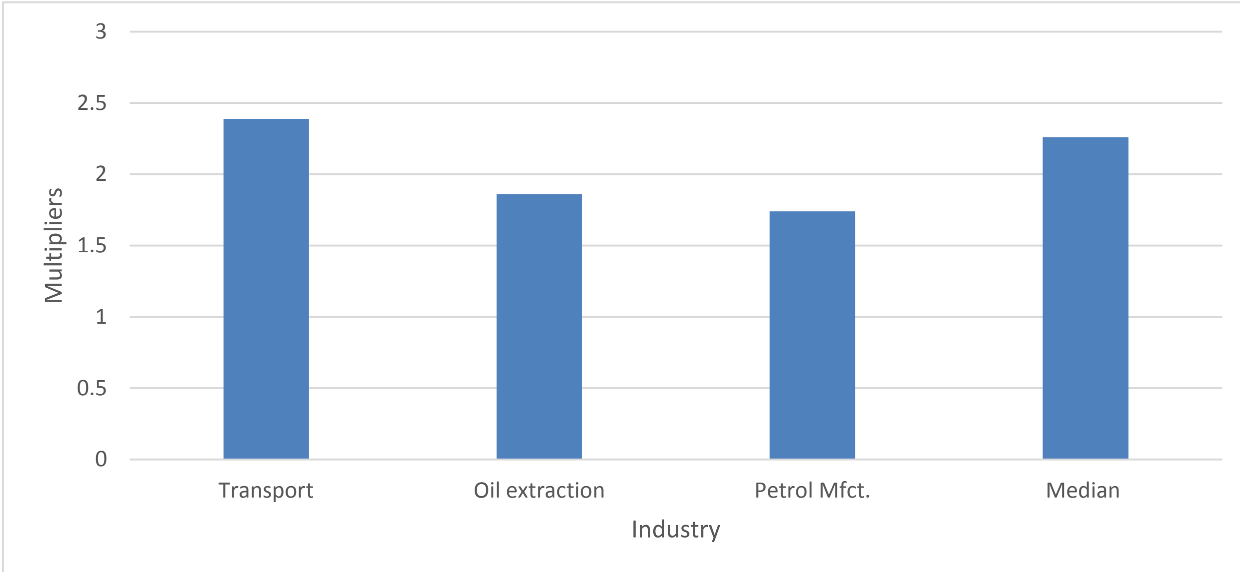
[16] Transportation and Economic Development Authors: Dr. Jean-Paul Rodriguez and Dr. Theo Notteboom, http://people.hofstra.edu/geotrans/eng/ch7en/conc7en/ch7c1en.html , A regional analysis reinforces this observation, Oregon, Transportation, Plan Update, Transportation and the Economy Manufacturing is dependent on transportation to receive raw materials and to deliver its products. Manufacturing is usually a highly competitive activity. Unless an area has other low cost attributes, high transportation costs will cause manufacturers to leave or avoid that area

FIGURE III-3: SECTOR MULTIPLIERS FOR THE CALIFORNIA ECONOMY



Source: California Economic Strategy Panel, *Using Multipliers to Measure Economic Impacts*, 2009, Table 1

Transportation has the 20th largest multiplier, in a study of 60 California sectors. Not only is the transportation cost multiplier above average, but it is substantially larger than the multipliers related to petroleum production.

In modeling the impact of higher fuel economy with these econometric models, it is important to understand certain market factors. As the cost of transportation declines, demand for transportation increases because the demand for goods and services increases due to their lower costs. In addition, as the population and economy grows, the need for commercial transportation increases as well. Nevertheless, the fuel savings from greater efficiency are much larger than the increase in consumption. The net effect is to reduce expenditures on fuel as a percent of total output. In fact, the reduction in energy consumption may be so large that the absolute level of consumption is lowered. This has a positive effect on the economy. We consume less petroleum products and more of other goods and services. Because those other goods and services have bigger multipliers, the economy expands. So it is clear that the pass-through to consumers of truck fuel costs is important for both energy policy and economic policy.

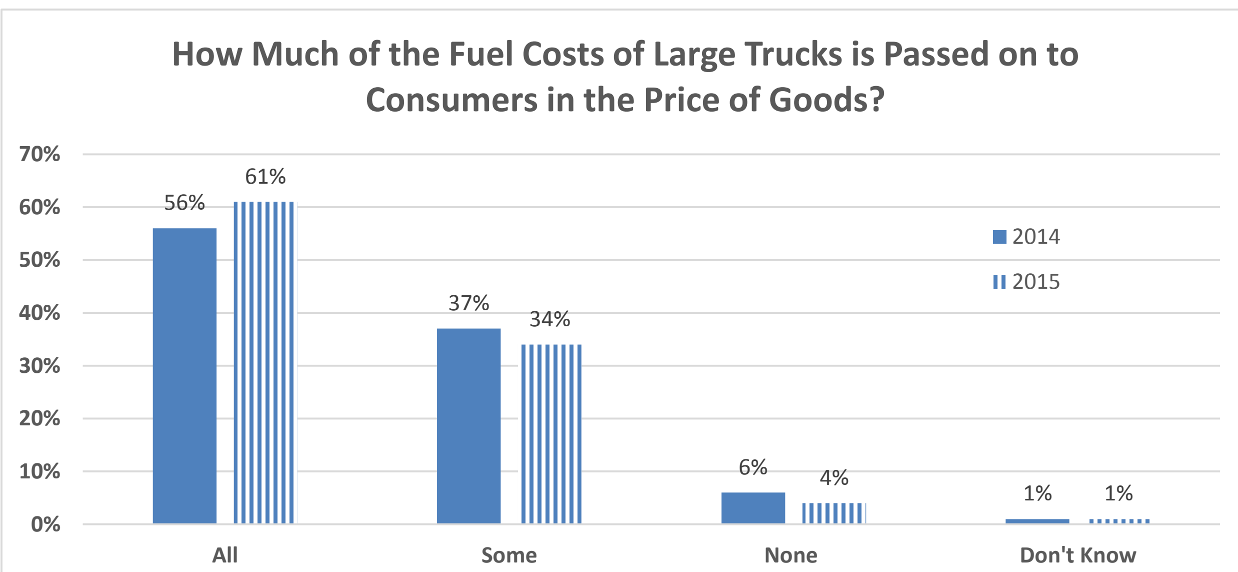
C. Public Opinion

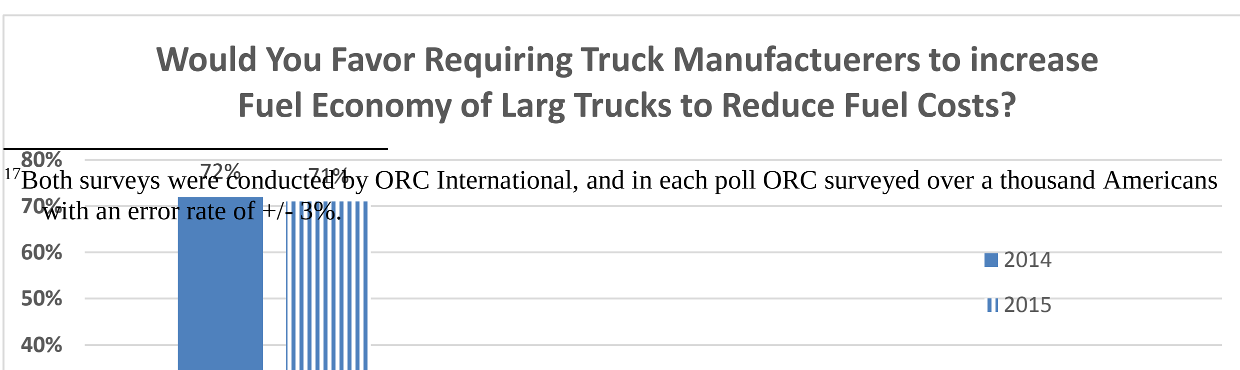
Since we have been able to demonstrate that these fuel costs are considerable and, in fact, likely to be passed on as indirect costs to households, we should not be surprised to find that consumers understand that fact (see Figure III-4).

Two recent Consumer Federation of America surveys, found that the vast majority of consumers (over 90%) understand that "some, most, or all" of the fuel costs of heavy-duty trucks, which transport virtually every consumer good, are passed on to consumers, as shown in the upper graph of Figure III-4. In fact, over 55 percent believe that "all or most" of these costs are passed on to the consumer.

In both of the CFA surveys, consumers clearly understood the possibility of these savings as nearly three quarters of the respondents favored requiring truck manufacturers to increase the fuel economy of large trucks (see the lower graph in Figure III-4).[17]

Figure III-4: Consumers Attitudes about Freight Fuel Costs and Standards





[17] Both surveys were conducted by ORC International, and in each poll ORC surveyed over a thousand Americans with an error rate of +/- 3%.

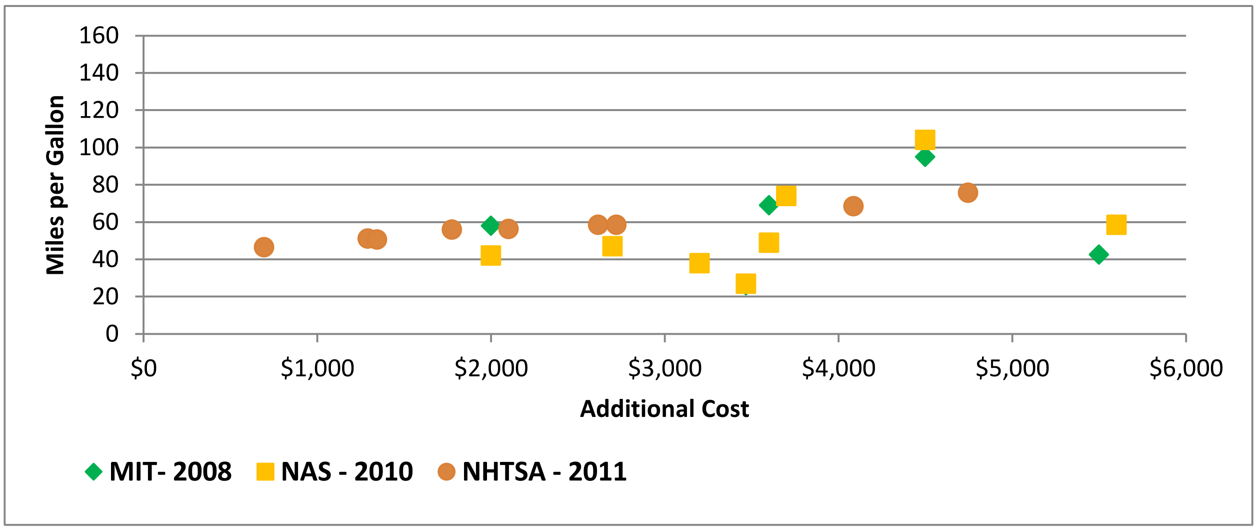
Source: **Average American Household Pays $1,100 a Year to Fuel the Nation's Trucking Fleet, August 18, 2015.**

IV. POTENTIAL FUEL AND COST SAVINGS FOR MEDIUM AND HEAVY DUTY TRUCKS

A. LIGHT DUTY TECHNOLOGY EXPERIENCE AS CONTEXT FOR HEAVY DUTY STANDARDS

In 2002, after the first gasoline price spike of the 21st century, the National Academy of Science undertook an analysis of the technological potential to increase the fuel economy of light duty vehicles.[18] It concluded that there was substantial opportunity to reduce fuel economy at relatively low costs. They determined that the value of the fuel savings was larger than the cost of the technology needed to reduce fuel use. As shown in Figure IV-1, other well-respected research reached similar conclusions over the course of the decade.

FIGURE IV-1: PREDICTED LIGHT DUTY FUEL EFFICIENCY COSTS AND RESULTING INCREASES IN FUEL ECONOMY



Sources: 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, 2008; 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; EPA-NHTSA - 2010, Environmental Protection Agency Department of Transportation *In the Matter of Notice of Upcoming Joint Rulemaking to Establish 2017 and Later Model Year Light Duty Vehicle GHG Emissions and CAFE Standards*, Docket ID No. EPA-HQ-OAR-0799 Docket ID No. NHTSA-2010-0131, Table 2.

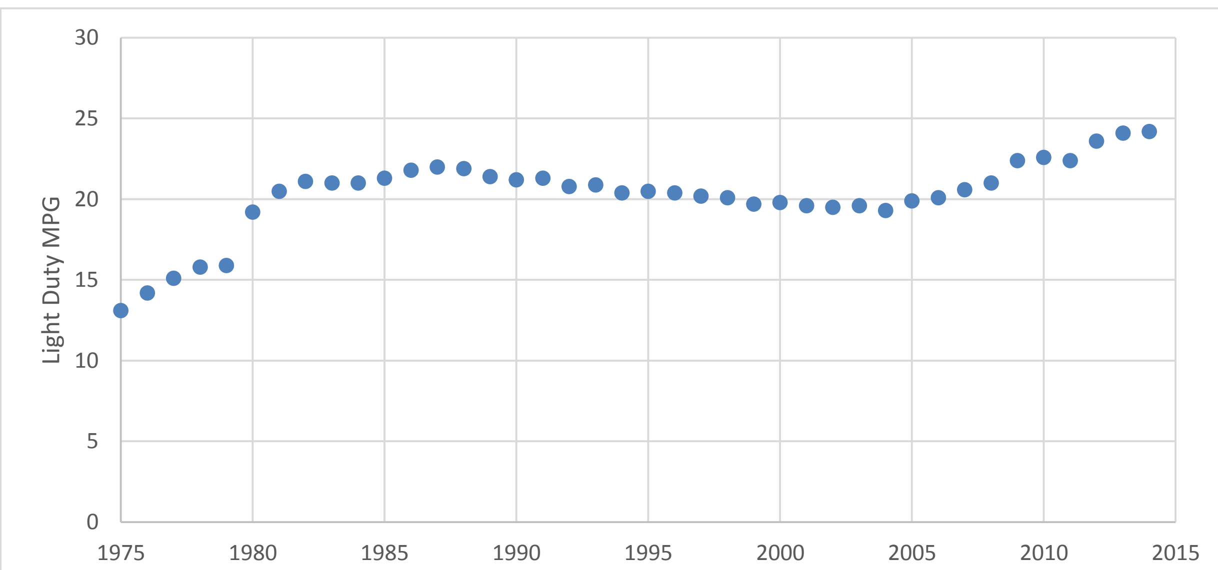
Although there were differences in the estimates, a clear consensus emerged showing a significant amount of economic benefit in developing new fuel saving technologies. This

[18] Transportation Research Board, National Research Council, 2002, *Effectiveness and Impact of Corporate Average Fuel Economy*, National Academy of Sciences.

universal conclusion was a key reason why the doubling of the fuel economy standards for light duty vehicles (CAFE) was adopted in 2012. It was particularly significant that this standard was fully supported by diverse segments of the market including: car companies, unions, consumer groups, and environmentalists.

Figure IV-2 shows the development of new light duty vehicle mileage since the adoption of fuel economy standards. The CAFE program was instituted by legislation in 1975. Mandated increases ceased in 1986. The Energy Independence and Security Act of 2007, reformed and restarted the program. The first proposed rule was issue in 2008 and went into effect in 2011. In 2009, standards through 2016 were proposed. The long term rule to double fuel economy was finalized in 2012.

FIGURE IV-2: NEW LIGHT DUTY VEHICLE FUEL ECONOMY



Source: Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2014*, October 2014, Table 2.1.

B. MEDIUM AND HEAVY DUTY TRUCK TECHNOLOGY EFFICIENCY TECHNOLOGY CURVES

The consensus around the potential for increased fuel economy and the results of recent increases in the standard in the light duty vehicle arena provide an important context for the heavy duty truck rule. The medium and heavy duty truck sector is a much more complex product space than light duty vehicles. Nevertheless, while there are different types of vehicles, equipment configurations, and use patterns, a similar consensus has emerged with respect to medium and heavy duty trucks—expenditures on fuel efficient technology will be more than offset by savings in fuel costs.

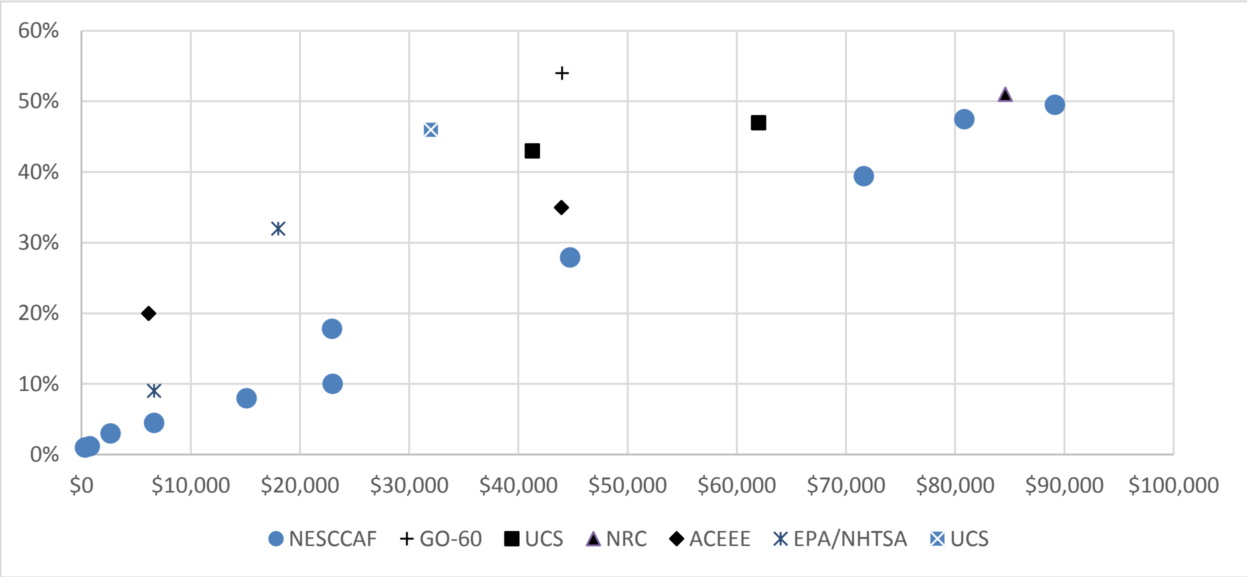
Figure IV-3 presents fuel savings in terms of percentage reduction (rather than gallons) for tractor trailers. Tractor trailers, defined as Class 8 trucks, are the most significant category of medium and heavy duty trucks, accounting for 60-75 percent of the fuel consumption for medium and heavy duty trucks. Therefore, throughout this analysis we focus attention on these vehicles.

As Figure IV-3 shows, various studies predict that significant percentages of fuel reduction (10-20%) can be made with technology investments of $10,000-$20,000. In addition, substantial percentages of reduction (40-50%) can be made with investments of $40,000-$50,000.[19] This high reduction in fuel consumption is for Class 8 trucks, and other categories may not present equally rich fuel saving potential, but the potential is substantial in all classes of trucks.[20]

[19] It is important to note that a 50% fuel consumption decrease is equal to a 100% increase in fuel economy. In other words, when the fuel economy doubles, the fuel consumption is cut in half.

[20] For example, the American Council for an Energy Efficient Economy estimates potential fuel savings from two phases of technology improvement at between 30% and 46% for heavy duty pickups and vans and Class 8 trucks respectively, http://aceee.org/files/pdf/fact-sheet/hd-oil-reduction.pdf. There are many opportunities to reduce fuel consumption that have been studied recently. See for example, Ben Sharpe and Nigel Clark, Trailer technologies for increased heavy-duty vehicle efficiency, Technical, market, and policy considerations, International Council on Clean Transportation, June 2013; Donald W. Stanton, Systematic Development of Highly Efficient and Clean Engines to Meet Future Commercial Vehicle Greenhouse Gas Regulations, Safe International, 2013-01-2421, September 2013; TA Engineering, DOE SuperTruck Program Benefits Analysis, December 20, 2012. It should also be noted that the cost analyses are being updated and, reflecting the findings in Cooper, 2013, the actual costs are likely to be lower than early estimates.

FIGURE IV-3: TECHNOLOGY COST AND FUEL SAVINGS



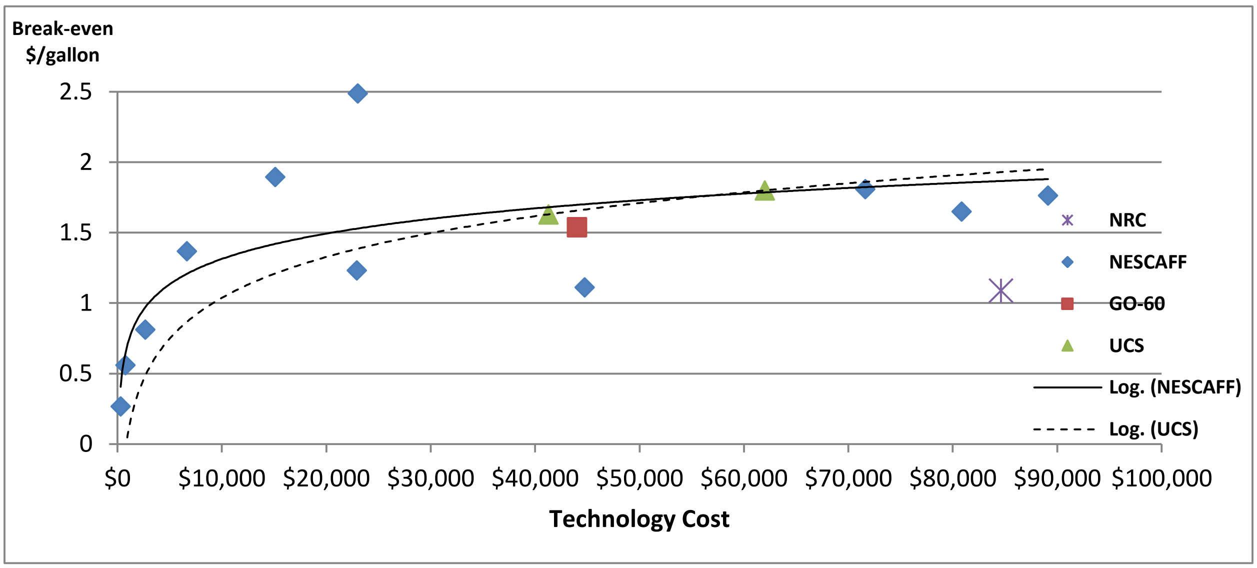
Sources: Northeast States Center for a Clear Air Future, International Council on Clean Transportation and Southwest Research Institute, *Reducing Heavy Duty Long Haul Combination Truck Fuel Consumption and CO_2 Emissions,* October *2009;* Don Air, *Delivering Jobs: The Economic Costs and Benefits of Improving the Fuel Economy of Heavy-Duty Vehicles,* Union of Concerned Scientists, May 2010; Committee to Assess Fuel Economy for Medium and Heavy Duty Vehicles, *Technologies and Approaches to Reducing the Fuel Consumption of Medium- and Heavy-Duty Vehicles,* National Research Council, 2010; Go 60 MPG, *Delivering the Goods: Saving Oil and Cutting Pollution from Heavy Duty Trucks.* A. Siddiq Khan and Therese Langer, 2011, *Heavy Duty Vehicle Fuel Efficiency and Greenhouse Gas Emissions: The 2014-2019 Standards and a Pathway to the Next Phase,* American Council for an Energy Efficient Economy, December; Dave Cooke, Engines for Change: *From Cell Phones to Sodas, How New Truck Standards Can Improve the Way America Ships Good, Union of Concerned Scientists,* March 2015

Compared to the figures for light duty vehicles, the cost of adding efficiency technologies to heavy duty trucks may appear large. However, heavy duty trucks are driven many more miles and fuel costs between $100,000-$150,000 annually. Given the much larger number of miles driven per year of heavy duty trucks and the much lower mileage per gallon, as well as the higher cost of diesel, the average annual expenditure on fuel for heavy duty trucks is almost **<u>ten</u>** times the expenditure for light duty vehicles.[21] A ten percent reduction in fuel consumption will support a much larger investment in fuel saving technology.

[21] Energy Information Administration, Monthly Energy Review for fuel consumption, of 4, 26 gallons per heavy duty truck of 4126 gallon and 460 gallons per light duty vehicle in 2011. Diesel was over 7% more expensive than gasoline.

With estimates of the technology costs and fuel savings, the National Research Council report on medium and heavy duty trucks simplifies the cost benefit analysis by focusing on the cost side and not making assumptions about fuel prices (See Figure IV-4). Instead of engaging in the uncertain and sometimes contentious exercise of projecting fuel costs over long periods, the National Research Council estimates the price per gallon that would be necessary to break even on an investment that incorporates technologies to reduce fuel consumption in medium and heavy duty trucks.

FIGURE IV-4: COST PER GALLON BREAK-EVEN ANALYSIS FOR CLASS 8 TRUCKS



Sources: Northeast States Center for a Clear Air Future, International Council on Clean Transportation and Southwest Research Institute, *Reducing Heavy Duty Long Haul Combination Truck Fuel Consumption and CO_2 Emissions*, October *2009;* Don Air, *Delivering Jobs: The Economic Costs and Benefits of Improving the Fuel Economy of Heavy-Duty Vehicles,* Union of Concerned Scientists, May 2010; Committee to Assess Fuel Economy for Medium and Heavy Duty Vehicles, *Technologies and Approaches to Reducing the Fuel Consumption of Medium- and Heavy-Duty Vehicles,* National Research Council, 2010; Go 60 MPG, *Delivering the Goods: Saving Oil and Cutting Pollution from Heavy Duty Trucks.* A. Sidddiq Khan and Therese Langer, 2011, *Heavy Duty Vehicle Fuel Efficiency and Greenhouse Gas Emissions: The 2014-2019 Standards and a Pathway to the Next Phase,* American Council for an Energy Efficient Economy, December, 2011.

NRC includes a discount rate, representing the time value of money, set at 7% to compare the estimated costs of saved fuel to projections for the future cost of fuel.[22] As shown in

[22] The discount rate also refers to the interest rate used in discounted cash flow (DCF) analysis to determine the present value of future cash flows… takes into account not just the time value of money, but also the risk or uncertainty of future cash flows; inv*estopedia.com/terms/d/**discountrate**.asp*

Figure IV-4, the NRC estimated that fuel prices would have to be just $1.09 per gallon for a very large investment in new technology to earn a 7% real rate of return. As actual fuel prices are currently over three times this amount and expected to rise over time, the payout from these technologies would far exceed their cost.

In Figure IV-4, we have also converted the results of several other recent studies to this break-even approach. While there are some differences among these studies, there is a clear consensus that large investments in increasing the fuel economy of medium and heavy duty trucks are very attractive. All but one of the analyses show that investments in technology to improve fuel economy would earn more than the 7% discount rate at diesel prices of $2 and substantially more at higher gas prices.

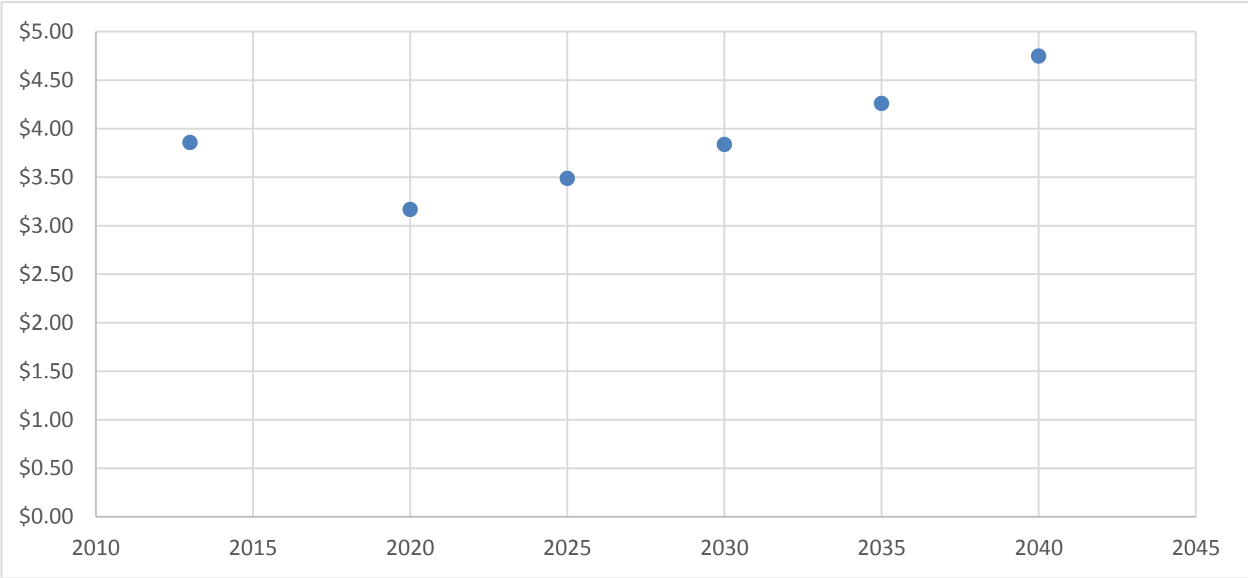
EIA's projected fuel prices over the next quarter century will average close to $4.00 per gallon, as shown in Figure IV-5. With average prices that high, over the next 25 years, the investment in energy saving technology would yield a very attractive return.

Figure IV-6 shows the size of potential fuel savings compared to technology costs. It suggests that a goal of cutting tractor trailer fuel consumption by 40 to 50 percent is economical in the long run. In order to cut fuel consumption in half, one must double the fuel economy of the vehicle.

This is exactly the target that was adopted for light duty vehicles in the 2012 CAFE rule. For example, if you reduce consumption by 50%, the breakeven cost of fuel is $1.50, which means that as long as fuel is more than $1.50, the cost of technology will be a money saver.

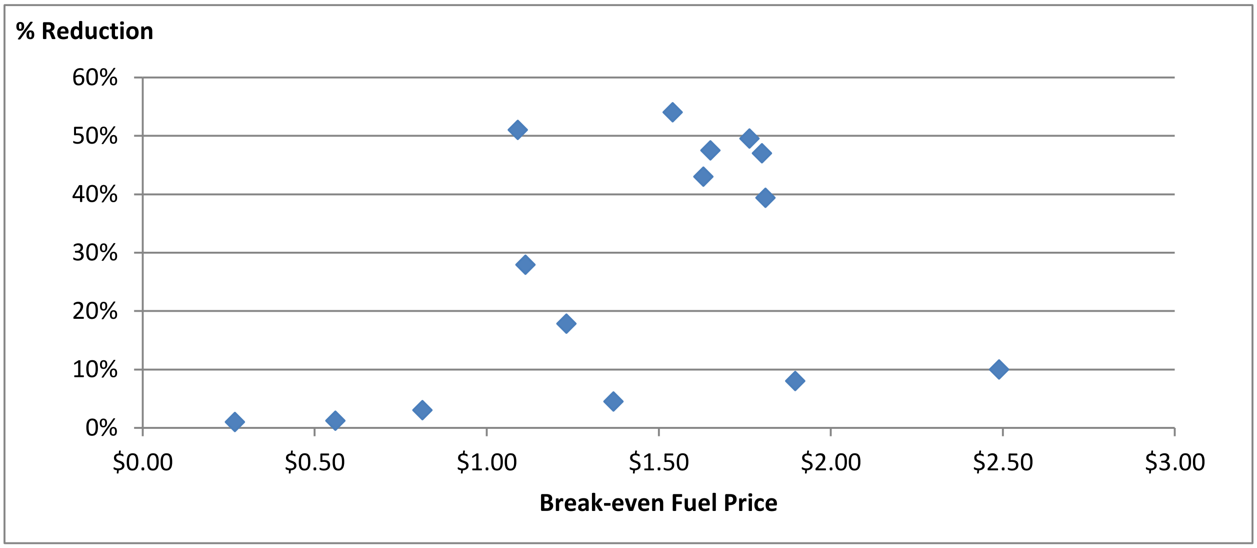
These analyses leave little doubt that there is a significant amount of technology available that would lower the consumption of fuel in the medium and heavy duty truck sectors at a very attractive cost. Consumer savings would be substantial. The next question is, why hasn't the marketplace witnessed these investments.

FIGURE IV-5: LONG-TERM DIESEL PRICES, CONSTANT $ 2013



Source: Energy Information Administration, *Annual Energy Outlook, 2015,* Table A-12.

FIGURE IV-6: TRACTOR TRAILERS: PERCENTAGE REDUCTION IN CONSUMPTION & BREAK EVEN FUEL COSTS



Sources: Northeast States Center for a Clear Air Future, International Council on Clean Transportation and Southwest Research Institute, *Reducing Heavy Duty Long Haul Combination Truck Fuel Consumption and CO_2 Emissions,* October *2009;* Don Air, *Delivering Jobs: The Economic Costs and Benefits of Improving the Fuel Economy of Heavy-Duty Vehicles,* Union of Concerned Scientists, May 2010; Committee to Assess Fuel Economy for Medium and Heavy Duty Vehicles, *Technologies and Approaches to Reducing the Fuel Consumption of Medium- and Heavy-Duty Vehicles,* National Research Council, 2010; Go 60 MPG, *Delivering the Goods: Saving Oil and Cutting Pollution from Heavy Duty Trucks.* A. Siddiq Khan and Therese Langer, 2011, *Heavy Duty Vehicle Fuel Efficiency and Greenhouse Gas Emissions: The 2014-2019 Standards and a Pathway to the Next Phase,* American Council for an Energy Efficient Economy, December.

V. ACHIEVING FUEL COST SAVINGS WITH EFFICIENCY STANDARDS

With such large potential economic gains available, this section offers answers to two important questions based on the reviews of freight truck sector by several major research institutions:

- Why don't market forces drive these technologies into the vehicles?
- What policies can be implemented to achieve the economic gains?

The evidence they provide is clear:

- The medium/heavy duty truck market exhibits significant market obstacles, barriers and imperfections that inhibit investment in energy saving technologies, and
- Performance standards are a very effective tool for overcoming these obstacles.

We examined these questions at length in our comments supporting the recently adopted light duty vehicles efficiency standard.[23] A recent paper on performance standards[24] identified over three dozen market barriers, imperfections and other causes of market failure in the residential appliances and buildings, light duty vehicles and industrial sectors. Here we add the important findings from the medium/heavy duty truck sector to our earlier analysis.

A. EXTERNALITIES LEAD TO UNDERINVESTMENT IN FUEL SAVING TECHNOLOGIES

Externalities as the source of market failure are well grounded in traditional economic analysis. These analyses of benefits and costs reviewed in the previous section recognize that externalities play a key part in driving policies to spur investment in energy saving technologies, but they focus on other obstacles to investment. Externalities are factors that are not directly included in typical cost-benefit analysis of business investment decisions. In the case of investing in fuel efficient technologies, the failure to consider externalities leads to the undervaluation of improving energy efficiency from the societal point of view and a resulting

[23] Cooper, Mark, 2011a, *Comments of Consumer Federation of America and Consumer Groups, Proposed Rule 2017 and Later Model Year*, Docket Nos. Light-Duty Vehicle Greenhouse Gas Emissions, EPA-HQ-OAR-2010-0799; FRL-9495-2 and Corporate Average Fuel Economy Standards, NHTSA–2010–0131, February 13, 2012.

[24] Cooper, *Performance Standards*.

underinvestment in efficiency because these benefits do not factor into typical and immediate business decisions. Because these considerations never enter into business calculations, they are considered market failures. They are distinct from cases where businesses do make the calculations, but arrive at the results that fail to invest in cost beneficial technologies for any of a variety of reasons. Different authors apply different labels to the various types of obstacles that inhibit investment but the underlying obstacles are similar.[25]

There are negative externalities that result from fuel consumption which do not enter into the typical business cost/benefit calculations, for example: tail pipe emissions create environmental and health problems. An externality that is unique to transportation fuel is the national security implications of dependence on oil imports. While externalities are generally not factored into business decision making, from a societal perspective they can, and should, be an important factor in standard development.

While these negative externalities that are reduced by high fuel economy receive the most attention, our focus in the prior section was on positive economic externalities. Investment in energy efficiency creates benefits for the broad public for which the firm making the investment cannot charge. As a result, the indirect macroeconomic effects of energy efficiency do not enter into typical cost/benefit decisions about investing in energy efficient technologies. While transportation companies capture some of the benefits in increased demand for their services, each company captures, at best, only a small part of the broader economic stimulus that reducing fuel consumption would cause. Therefore, such a benefit would be absent in each company's typical internal cost benefit analysis of fuel saving technology. This category of externalities has

[25] Cooper, *Performance Standards,* reviews the different approaches in the appliance, building, light duty and climate change literatures. Sanne Aarnink, Jasper Faber, Eelco den Boer, *Market Barriers to Increased Efficiency in the European On-road Freight Sector*, Delft, October 2012, introduce these distinctions for the medium/heavy duty truck sector.

expanded recently well beyond the public goods aspect that was identified in traditional economic analysis to include information and learning, network effects and innovation process.

Similarly, U.S. consumption of transportation fuels is sufficiently large that a reduction in the quantity consumed has the effect of lowering the global (and therefore the national) price of crude oil. The public enjoys a large benefit, but the firms investing in efficiency receive only a small part of that total benefit because each individual firm receives a very small share of the total. This is called a consumption externality.[26]

Ironically, these positive economic externalities can create concerns from the energy and environmental points of view. When consumers use their savings from lower fuel costs to buy more goods and services, they are likely to indirectly increase their use of energy. However, the increase in consumption due to this dynamic, called the 'rebound effect,' is much smaller than the direct reduction in energy consumption, so the net effect is still to reduce overall energy consumption.[27] From the point of view of consumer and macroeconomic analysis, "the rebound effect" represents a positive economic result for consumers. It means that consumer welfare is increasing. How consumers use their increased disposable income is of secondary importance to the fact that they have more income to spend on other goods and services. However, if the goal is to reduce energy consumption, one must subtract the rebound effect from the benefits column. But experience shows that the rebound effect erases only a fraction of the energy savings.[28]

[26] Consumer Federation of America, et al., 2012, Comments on the Proposed Rule 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards, Docket Nos. EPA-HQ-OAR-2010-0799; FRL-9495-2, NHTSA–2010–0131, 2/13/12.

[27] Barker, Terry, Paul Eakins and Tim Foxon, 2007, "The Macro-economic Rebound Effect in the UK Economy," *Energy Policy,* 35; Cambridge Centre for Climate Mitigation Research, 2006, *The Macro-economic Rebound Effect and the UK Economy,* Cambridge Econometrics and Policy Studies Institute, May 15; Goldstein, David, Sierra Martines and Robin Roy, *Are there Rebound Effects from Energy Efficiency? An Empirical Analysis, Internal Consistency and Solutions*, Electric Policy.com.; Nadel, Steven, 2012, *The Rebound Effect: Large or Small,* American Council For An Energy Efficient Economy, August.; Bornstein, Severin, 2013, *A Microeconomic Framework for Evaluating Energy Efficiency Rebound and Some Implications,* Energy Institute at HAAS, May.

[28] Cooper, *Performance Standards.*

In the freight truck sector, the link between efficiency induced fuel cost savings and positive economic impacts is particularly strong. Transportation is an important intermediate service. When truckers drive more, they are very likely to be carrying more goods or delivering more services, which means that the economy is expanding. Where the increase in truck freight results from a shift between transportation modes, it likely reflects the selection of a more efficient mode, which again indicates an improvement in the economy.

B. Market Obstacles, Barriers and Imperfections Inhibiting Investment

In all of the economic analyses of efficiency discussed earlier, only direct economic costs and benefits were included. No value was placed on environmental or national security benefits; however these are significant additional benefits. Even though we did not include externalities in the cost benefit calculation, we found that the benefits far exceeded the costs. EPA reached exactly the same conclusion in the Phase I analysis. Since externalities cannot explain the failure of firms to invest in these attractive technologies, EPA shifts it attention to the other factors that inhibit investment.

Not surprisingly, given the strong evidence of many factors that inhibit efficiency in the other sectors demonstrated in our earlier analysis,[29] we find strong support for similar factors in the medium and heavy duty truck sector. Table V-1 shows the results of the analysis of the obstacles to investment in efficiency in the medium/heavy duty truck sector prepared by three major independent institutions. It also identifies the major documents upon which they rely. We also include the EPA/NHTSA Phase I analysis of the truck market, which has been vetted through litigation. In constructing this table, we use the same criteria as we applied in the analysis of *Performance Standards* – including empirical studies or summaries of the empirical literature from the past ten years. These studies support our findings in several important ways.

[29] Cooper, *Performance Standards.*

Exhibit V-1: Performance Standard and Market Barriers to Efficiency in the Medium and Heavy Duty Truck Sector
(Based on empirical analysis within the past 10 years)

Nature of the Barrier	Effect on the Market	Impact of the Standard
Information Issues in the first sale market* Unavailable due to public good nature Complexity due to geography, driving styles, uses* Cost of gathering Cost of "redundant" production of Information	Inadequate or unreliable information about fuel saving technologies	Better information more readily available Public provision of information
Information Issues in the Secondary Market Compounded information problem Complexity due to geography, driving styles, uses* Different uses may affect mileage	Resale value inadequately rewards fuel saving technology Lack of incentive to invest in fuel economy in 1st sale market	Better information more readily available
*Split Incentives** Owner-Operator* Owner-Renter Tractor-Trailer Contract structure*	Owners emphasize different attributes Information does not overcome Coordination Problem	Alters the incentives Investment embedded in market Fosters coordination
Shrouded Attribute Lack of availability in bundles* Positional, "status" good	Bundles of attributes maximize other characteristics --durability, maintenance costs	Increased emphasis on shrouded attribute
Market power	Ability to choose operators, dulls market signals	Investment embedded in market, lower risk
Uncertainty Future savings, level and variance* Fuel price, performance, life, use, geography* Risk aversion, Option value Reliability	Savings are future, technology costs are current	Some market uncertainties removed Investment embedded in market, lower risk Hidden costs*
Adjustment & Transaction Costs Conservative approach to change, need to learn *& evaluate technology* Accelerated fleet turnover Training costs	Slows innovation Resistance to capital expenditure Resistance to increased cost	Experience with technology accelerates innovation Levels the playing field for investment
Endemic *Financial** Limited Access to Capital* Short payback, First Cost Bias* Time lag for retrofit*	Crowds out investment in efficiency Short payback period due to under-compensation of initial investment	Levels the playing field for investment Investment embedded in market, lower risk

PRIMARY SOURCES:

Bold = EPA-NHTSA, ***Greenhouse Gas Emissions Standards and Fuel Economy Standards for Medium and Heavy Duty Engines and Vehicles,*** **Federal Register 76(179), September 15, 2011, pp. 57315-57319.**

Italic **= Committee to Assess Fuel Economy for Medium and Heavy Duty Vehicles,** ***Technologies and Approaches to Reducing the Fuel Consumption of Medium- and Heavy-Duty Vehicles,*** **National Research Council, 2010.**

Underlined = Mike Roeth, et al., ***Barriers to the Increased Adoption of Fuel Efficiency Technologies in the North American On-‐-Road Freight Sector*** **Report for the International Council for Clean Transportation March 2013.**

*** = Sanne Aarnink, Jasper Faber, Eelco den Boer,** ***Market Barriers to Increased Efficiency in the European On-road Freight Sector,*** **Delft, October 2012.**

Other sources:

Carbon War Room, ***Road Transport: Unlocking Fuel-‐-Saving Technologies in Trucking and Fleets, 2012***.

Lisa M. Ellram and Susan L. Golicic. ***Environmentally Sustainable Transport,*** **Executive summary, 2011.**

Jasper Faber, et al., ***Technical support for European action to reducing Greenhouse Gas Emissions from international maritime transport,*** **CE Delft, 2009.**

Goodyear Dunlop, ***Driving fleet fuel efficiency – the road to 2020,*** **Diegem (Belgium), 2012.**

Corina Klessmann, et al. 2007, ***Making energy-efficiency happen: from potential to realization. An assessment of policies and measures in G8 plus 5 countries, with recommendations for decision makers at national and international level,*** **Utrecht: Ecofys, 2007.**

Heikki Liimatainen, et al., "Energy Efficiency Practices Among Road Freight Haulers," ***Energy Policy,*** **2012 50.**

Gunter Prockl, Henrik Sternberg and Jan Holmstrom, "ICT in Road Transport Operations: Analyzing Potential Effects on Individual Activity Level." ***In Logistics and Supply Chain Management in A High North Perspective: The 23rd Annual NOFOMA Conference Proceedings June 9-10,*** **2011.**

Greater Than, ***Analysis of the European road freight market: Business models and driving forces influencing its carbon footprint Stockholm:*** **Greater Than AB, 2011.**

Patrik Thollander, Jenny. Palm and Patrik, "Categorizing barriers to energy efficiency: An interdisciplinary perspective," In: ***Energy Efficiency,*** **Edited by Jenny Palm, S.L.: Sciyo, 2010**

David Vernon and Alan Meier, "Identification And Quantification Of Principal---Agent Problem Affect Energy Efficiency Investments And Use Decisions In the Trucking Industry." ***Energy Policy, 2012,*** **49.**

Haifeng Wang, et al., ***Marginal Abatement Costs and Cost Effectiveness of Energy-Efficiency Measures,*** **London: International Maritime Organization (IMO), 2010.**

While some argue that there are no market barriers and imperfections to inhibit investment in energy saving technologies in the medium and heavy duty truck sector,[30] the failure to make the previously cited investment in technologies, in spite of their clear benefits, indicates that there are significant inhibitors at work that have created an "efficiency gap."

In the Phase I analysis, EPA identified six broad categories of factors that have been offered as explanations for the failure of the truck market to pursue investment opportunities in

[30] Mark Cooper, Performance Standards, examines the arguments in detail.

fuel saving technologies that appear to be cost effective. The other major analyses identify these obstacles and several more, adding a great deal of detail. The findings from the medium and heavy duty truck sector reinforce several of the key aspects of our earlier analysis.

- The analysis involves commercial enterprises, which affirms the fact that economic motivation alone does not ensure optimum investment in efficiency.
- Many of the same factors are confirmed as important obstacles to energy saving investment on both the supply and the demand sides of the market.
- The supply and the demand sides interact and reinforce each other in a vicious circle. Policies that can break the circle are extremely attractive.
- The diffusion of innovation unfolds as a process in which the early challenge is to provide reliable, verifiable information to trigger the diffusion process. Experience allows the sharing of information later in the process, which creates different challenges.

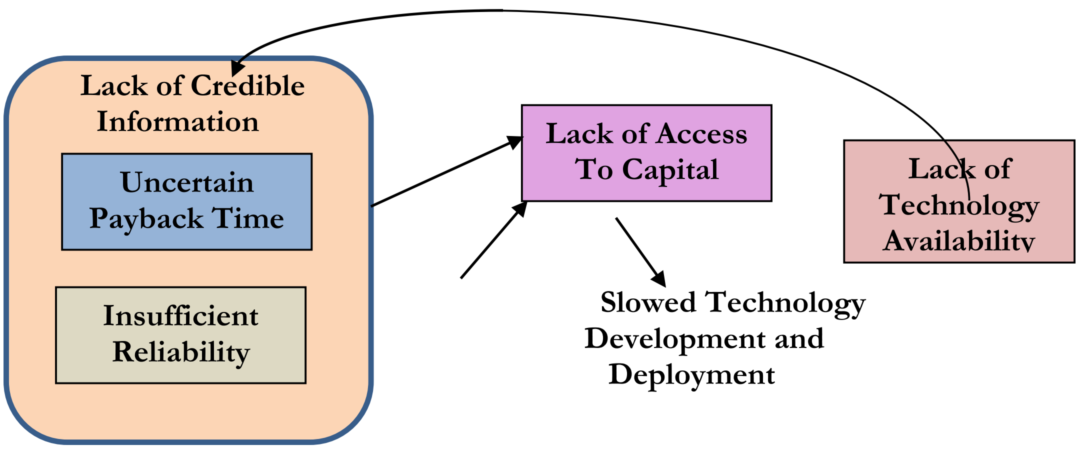
The Environmental Protection Agency and the National Highway Traffic Safety Administration (EPA/NHTSA) examined the evidence that these barriers affect the truck market and summarized their conclusion as follows:

> On the other hand, the short payback period required by buyers of new trucks is a symptom that suggests some combination of uncertainty about future cost savings, transaction costs, and imperfectly functioning market. In addition, widespread uses of tractor-trailer combinations introduces the possibility that owners of trailers have weaker incentives than truck owners to adopt fuel-saving technology for their trailers…
>
> [B]ecause individual results of new technologies vary, new truck purchasers may find it difficult to identify or verify the effects of fuel saving technologies. Those who are risk averse are likely to avoid new technologies out of a concern over the possibility of inadequate returns on the investment, or with other impacts….
>
> Both baselines used project substantially less adoption than the agencies consider to be cost-effective. The agencies will continue to explore reasons for this slow adoption of cost-effective technologies.[31]

The report from the International Council on Clean Transportation summarized the supply-and demand side factors that inhibit innovation with a simple graph that depicts a recursive loop of factors that reinforce one another, as shown in Figure V-1.

31 EPA-NHTSA, Greenhouse Gas Emissions Standards and Fuel Economy Standards for Medium and Heavy Duty Engines and Vehicles, Federal Register 76(179), September 15, 2011, p. 57319

FIGURE V-1: INTERACTION OF SUPPLY AND DEMAND SIDE FACTORS IN A RECURSIVE LOOP INHIBITING INVESTMENT IN EFFICIENCY



Source: Mike Roeth, et al., *Barriers to the Increased Adoption of Fuel Efficiency Technologies in the North American On--‐Road Freight Sector* Report for the International Council for Clean Transportation March 2013, p. 5

Given the thorough review by EPA/NHTSA, the NRC, and the International Council for Clean Transportation, as well as our own, suffice it to say that there is a significant energy efficiency gap in the medium and heavy duty truck market and there is no reason to doubt the economic analysis of the potential benefits of closing that gap. In fact, the benefits have likely been underestimated, not only because the full value of externalities has not been included in the economic analyses, but also because the costs of implementing the standards have likely been overestimated, as discussed below.

C. PERFORMANCE STANDARDS AS A POLICY TOOL TO OVERCOME OBSTACLES TO INVESTMENT

These reviews of the literature on obstacles to investment in efficiency in the medium and heavy duty truck sector also identify and discuss the ways that performance standards can improve the market performance. The regulatory analyses are required to consider alternatives. They do not conclude that the alternatives (like simple information programs) will have no impact, but that the alternatives do not address key obstacles effectively. As we showed in our *Performance Standards* paper, standards are attractive because they effectively address a wide range of obstacles. As shown in Table V-1, above, in the medium/heavy duty truck sector these beneficial effects include the following:

- Partially internalize the externalities
- Provides experience with the new technologies, lowering hidden costs.
- Creates the market by embedding the technology in products, thereby lowering marketplace risk and risk of being the first mover.
- Triggers learning and economies of scale that lower cost
- Generates and makes available reliable information in a standardized manner
- Fosters cooperation, as the efficiency attribute is giver higher visibility

We believe that one of the other major findings of our earlier analysis of fuel economy and performance standards applies in the medium/heavy duty truck sector as well. In order to effectively achieve the large net benefits, performance standards must be well-designed and carefully implemented. The following characteristics, which were critical for the success in the adoption of fuel economy standards for automobiles and light duty trucks, can successfully guide the development of performance for medium and heavy duty trucks:

Long-Term: Setting a progressively rising standard that targets a high long term goal over the course of a decade or more will foster and support a long-term perspective for the truck manufacturers, transportation companies and public, by reducing the marketplace risk of investing in new technologies. The long-term view gives the truck makers time to re-orient their thinking, retool their plants and help re-educate the transportation industry. It also gives the industry buying and using these trucks time to adjust.

Technology Neutral: Taking a technology neutral approach to a long term standard unleashes competition around the standard that ensures that the industry will get a wide range of choices at that lowest cost possible.

Product Neutral: The new attribute-based approach to standards accommodates buyer preferences; it does not try to supplant them. This levels the playing field between truck makers and removes any pressure to push inappropriate vehicles into the market.

Responsive to industry needs: As was done in the light vehicle standards, establishing a long term performance standard recognizes the need to keep the standards in touch with reality. The standards can be set at a moderately aggressive level that is clearly beneficial and achievable. With thoughtful cost estimates, consistent with the results of independent analyses of technology costs, a long term performance standard will contribute to the significant reduction of the most significant cost in the transportation industry.

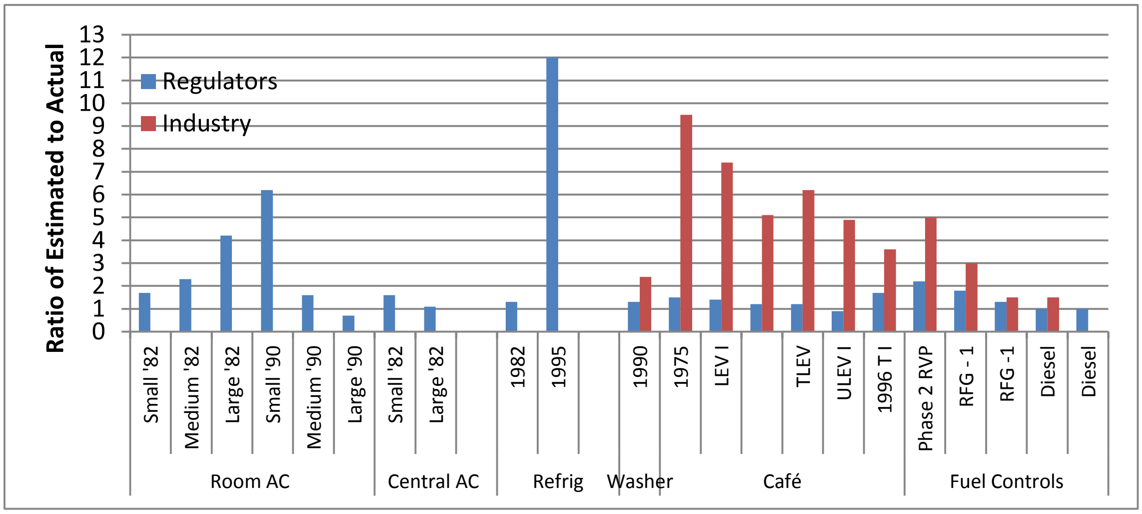
Responsive to consumer needs: The approach to standards should be consumer-friendly and facilitate compliance. The attribute-based approach ensures that the standards do not require radical changes in the available products or the product features that will be available to consumers. The setting of a coordinated national standard that lays out a steady rate of increase over a long time period giving the market and the industry certainty and time to adapt to change.

Procompetitive: All of the above characteristics make the standards pro-competitive. Producers have strong incentives to compete around the standard to achieve them in the least cost manner, while targeting the market segments they prefer to serve.

D. THE COSTS OF IMPLEMENTING STANDARDS

A final, important observation on the literature of performance standards before we turn to the Phase II proposed rule deals with the tendency for costs to be overestimated because well-designed standards trigger the competitive and innovative processes noted above. The analysis often presented in regulatory proceedings is typically static and based on current costs. On the other hand, a thoughtful, well-designed performance standard will be dynamic and facilitate multiple responses to standard compliance rather than mandate specific technologies. If companies are given broad flexibility to meet standards, they will determine the most cost beneficial approach and they will learn how to lower the cost of adopting new technologies. History has shown in virtually every other standard compliance effort, the initial cost estimates always prove to have been too high, as shown in Figure V-2. There is clear and consistent evidence across a wide range of standards that the actual costs of implementing standards were consistently well below their original projections.

FIGURE V-2: RATIO OF ESTIMATED COST TO ACTUAL COST BY SOURCE



Sources: Winston Harrington, Richard Morgenstern and Peter Nelson, "On the Accuracy of Regulatory Cost Estimates," *Journal of Policy Analysis and Management* 19(2) 2000, *How Accurate are Regulatory Costs Estimates?*, Resources for the Future, March 5, 2010; Winston Harrington, *Grading Estimates of the Benefits and Costs of Federal Regulation: A Review of Reviews*, Resources for the Future, 2006; Roland Hwang and Matt Peak, *Innovation and Regulation in the Automobile Sector: Lessons Learned and Implications for California's CO2 Standard*, Natural Resources Defense Council, April 2006; Larry Dale, et Al., "Retrospective Evaluation of Appliance Price Trends," *Energy Policy* 37, 2009.

VI. THE PHASE II MEDIUM AND HEAVY DUTY TRUCK RULE

In this section we evaluate the Phase II medium and heavy duty truck rule proposed by EPA/NHTSA. We do so by applying the framework developed in Sections II-V. Moreover, because the Phase I rule is relatively recent and has been upheld by the courts, we focus primarily on the incremental additions to the analysis presented by EPA/NHTSA. We examine four areas that reflect the four sections above.

We begin with a discussion of the fuel savings benefits and the technology costs that must be incurred to achieve the reduction in fuel consumption. Although we recognize there are other economic costs and benefits, these make up the vast majority of the total costs and benefits. They are the most obvious consumer pocketbook benefits and costs. Because they are direct and not externalities, in a properly functioning market they would be reflected in the investment decisions that affect energy consumption. The analysis shows they are not, indicating significant market imperfections, obstacles and failures.

We next examine other, indirect benefits and costs. These are generally externalities that we would not expect producers and consumers to take into account in their decision making, but as important social costs and benefits, they should be taken into account in policymaking. Here we include macroeconomic considerations, including the rebound effect and public health effects. These benefits and costs increase the total value of the proposed rule significantly.

We then examine the explanation (theory) offered for why these costs and benefits have not been reflected in market transactions. Here we address both the issue of market imperfections and the pass-through of fuel costs.

Finally, we evaluate the overall design of the rule, according to the six criteria identified in the previous section. Because there are potentially large additional savings, we conclude with a section devoted to the question of whether the agencies have set the standards at a sufficiently high level.

A. DIRECT ECONOMIC IMPACTS

Our discussion of economics developed a simple economic criteria as a way to easily summarize the very complex economic analysis – the cost of saved energy. EPA/NHTSA start with this approach, which is derived by dividing the real, discounted economic costs (including capital and maintenance costs), by the total number of gallons saved.[32] The results are eye-popping. For the proposed rule, the improvement in fuel economy works out to a cost of only $0.40 per gallon.

> As discussed below, the agencies estimate that over the lifetime of heavy duty vehicles produced for sale in the U.S. during model years 2018–2029, the proposed standards [Alternative 3] would cost about $30 billion and conserve about 75 billion gallons of fuel, such that the first measure of cost effectiveness would be about 40 cents per gallon. Relative to fuel prices underlying the agencies' analysis, the agencies have concluded that today's proposed standards would be cost effective…
>
> Our current analysis of Alternative 4 also shows that, if technologically feasible, it would have similar cost effectiveness but with greater net benefits (see Chapter 11 of the draft RIA). For example, the agencies estimate costs under Alternative 4 could be about $40 billion and about 85 billion gallons of fuel could be conserved, such that the first measure of cost effectiveness would be about 47 cents per gallon. However, the agencies considered all of the relevant factors, not just relative cost effectiveness, when selecting the proposed standards from among the alternatives considered. Relative cost effectiveness was not a limiting factor for the agencies in selecting the proposed standards. It is also worth noting that the proposed standards and the Alternative 4 standards appear very cost effective, regardless of which reference case is used for the baseline, such that all of the analyses reinforced the agencies' findings.[33]

With fuel prices projected to be about $4.00 per gallon, there is no doubt that the investment induced by the proposed rule would be very beneficial. The other measures of economic impact tell the same story. The value of fuel savings are over six times as large as the technology costs associated with the rule and over five times as large as the total cost. The payback period is less than two years for tractor trailers, which account for 65 percent of the total costs and savings of the rule, less than 4 years for medium and heavy duty pickups and vans, and less than 7 years for vocational vehicles.

The economics of the standard are so highly favorable that they raise a concern that is in the opposite direction of the usual concern about standards--Why didn't the agencies include additional technologies that would yield very positive economic returns? As suggested by the

[32] EPA/NHTSA, PHASE II NOPR, p. 40169, lists the cost per gallon saved as the first of three ratios of cost Effectiveness." It is the only one of the three that is based on economics. The other two ratio involve the value of greenhouse gas reductions.

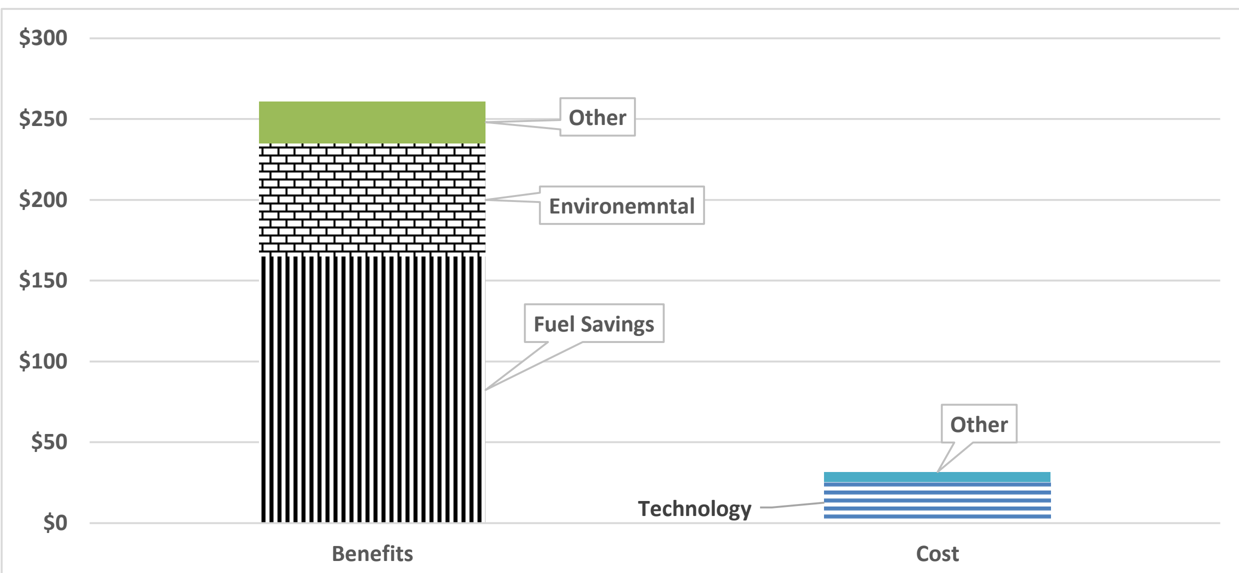
[33] EPA/NHTSA, NPRM, p. 40169.

quote above, there are other considerations, in addition to simple economics, that come into play, which led the agencies to reject including technologies that would increase costs and benefits moderately and yield a cost per gallon of only $0.47. We will address this question at the end of this section.

B. Other Benefits and Costs

Early in the PHASE II NOPR, the agencies offer a fundamental observation about the proposed rule that is highlighted in Figure VI-1. "The standards will result in significantly lower operating costs for vehicle owners (unlike the 2007 standard, which increased operating costs)." Unlike many environmental regulations, this joint fuel economy/environmental regulation produces so much fuel savings that it pays for itself. Two-thirds of the benefits come in the form of fuel savings and these benefits are over five times as large as the costs.

Figure VI-1: Phase II Truck Rule Benefits and Costs ($billions)



Source: EPA/NHTSA, PHASE II NOPR, p. 40143, Table I-8.

The other two effectiveness tests involve environmental benefits. The economic benefits of fuel savings mean the environmental benefits are "free."

> With respect to the second measure, which is useful for comparisons to other GHG rules, the proposed standards would have overall $/ton costs similar to the HD Phase 1 rule…. less than

> $50 per metric ton of GHG (CO_2 eq) for the entire HD Phase 2 program. This compares well to… the agencies' estimates of the social cost of carbon. Thus, even without accounting for fuel savings, the proposed standards would be cost effective. The third measure deducts fuel savings from technology costs, which also is useful for comparisons to other GHG rules. On this basis, net costs per ton of GHG emissions reduced would be negative under the proposed standards.
>
> This means that the value of the fuel savings would be greater than the technology costs, and there would be a net cost saving for vehicle owners. In other words, the technologies would pay for themselves (indeed, more than pay for themselves) in fuel savings.
>
> In addition, while the net economic benefits (*i.e.*, total benefits minus total costs) of the proposed standards is not a traditional measure of their cost effectiveness, the agencies have concluded that the total costs of the proposed standards are justified in part by their significant economic benefits.
>
> [T]his rule would provide benefits beyond the fuel conserved and GHG emissions avoided. The rule's net benefits is a measure that quantifies each of its various benefits in economic terms, including the economic value of the fuel it saves and the climate-related damages it avoids, and compares their sum to the rule's estimated costs. The agencies estimate that the proposed standards would result in net economic benefits exceeding $100 billion, making this a highly beneficial rule.[34]

The second largest source of benefit is the environmental and public health benefits, accounting for a little over a quarter of the total benefits.[35] The value of the reduction in greenhouse gas emissions alone equals the total cost of the proposed rule. Other public health benefits are of similar magnitude to the value of greenhouse gas reductions. Environmental benefits are almost twice as large as the costs.

A number of other benefits round out the total. The largest component of this category is the national energy security benefits of reduced oil consumption and oil imports. Unlike past rulings that paid lip service to these benefits, EPA/NHTSA value the security benefits at a little over $11/barrel in 2020, rising to almost $18/barrel in 2040.

Other benefits include reduced fueling time and increased freight hauling. These benefit the trucking industry directly and might well be reflected in the reduction of the cost of transportation service.

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[34] EPA/NHTSA, PHASE II NOPR, p. 40169. As noted above, all costs and benefits are taken from the analysis which uses a 3% discount rate. Given the flat line of fuel economy over decades, we also report the results for the less dynamic base case. Other cases and discount rates support the same conclusions.

[35] EPA/NHTSA, PHASE II NOPR, Table I-8.

The largest source of costs is the technology and maintenance costs of adding fuel saving technologies. Other costs, involving factors like increased congestion and accidents resulting from carrying more freight are small.

Combining all of the costs and benefits, the benefit to cost ratio is over 8-to-1. For tractor trailers, which account for two-thirds of the fuel consumption of medium and heavy duty trucks, the benefit cost ratio is 10-to-1. This is a very high benefit cost ratio that highlights the question of why EPA/NHTSA did not push the standard to a higher level.

C. KEY EXPLANATIONS

1. The Efficiency Gap and Discount Rates

In justifying the rule, the agencies begin by reprising the explanation offered in defense of the Phase I rule, pointing to five specific market failures and imperfections. They then review recent research and not only conclude that those five factors are still relevant, but they add several others that might come into play.

> In the HD Phase 1 rulemaking (which, in contrast to these proposed standards, did not apply to trailers), the agencies raised five hypotheses that might explain this energy efficiency gap or paradox: Imperfect information in the new vehicle market… Imperfect information in the resale market:.. Principal-agent problems causing split incentives… Uncertainty about future fuel cost savings… Adjustment and transactions costs….
>
> All of the recent research identifies split incentives, or principal-agent problems, as a potential barrier to technology adoption… Uncertainty about future costs for fuel and maintenance, or about the reliability of new technology, also appears to be a significant obstacle that can slow the adoption of fuel-saving technologies… access to capital can be a significant challenge to smaller or independent businesses, and that price is always a concern to buyers… Other potentially important barriers to the adoption of measures that improve fuel efficiency may arise from ‘‘network externalities,’’ where the benefits to new users of a technology depend on how many others have already adopted it…. Some businesses that operate HDVs may also be concerned about the difficulty in locating repair facilities or replacement parts, such as single-wide tires… Manufacturers may be hesitant to offer technologies for which there is not strong demand, especially if the technologies require significant research and development expenses and other costs of bringing the technology to a market of uncertain demand… it can take years, and sometimes as much as a decade, for a specific technology to become available from all manufacturers..[36]

[36] EPA/NHTSA, NPRM, p. 4043.

Clearly, the efficiency gap that the market has failed to close can be readily explained by market barriers, obstacles, imperfections and failure. EPA/NHTSA go a step farther in this analysis and draw out an important implication of the pervasive set of market imperfections, something we have been pointing out in these proceedings for several years. When market actors are laboring under the weight of significant market imperfections, calculating discounts rates on the basis of observed market behaviors reflects the totality of market factors, not simply consumer and producer preferences.

EPA/NHTSA stated this observation with respect to payback periods, but it applies equally to discount rates.

> In summary, the agencies recognize that businesses that operate HDVs are under competitive pressure to reduce operating costs, which should compel HDV buyers to identify and rapidly adopt cost-effective fuel-saving technologies…
>
> However, the short payback periods that buyers of new HDVs appear to require suggest that some combination of uncertainty about future cost savings, transactions costs, and imperfectly functioning markets impedes this process. Markets for both new and used HDVs may face these problems, although it is difficult to assess empirically the degree to which they actually do. Even if the benefits from widespread adoption of fuel-saving technologies exceed their costs, their use may remain limited or spread slowly because their early adopters bear a disproportionate share of those costs. In this case, the proposed standards may help to overcome such barriers by ensuring that these measures would be widely adopted.[37]

In 2008, we summarized the important role of supply side and market structural factors in affecting observed discount rates as follows; here we expand on that discussion.[38]

> We view the apparent high discount rate attributed to consumers as the result of other factors not the root cause of the demand-side problem. We do not accept the claim that consumers are expressing irrational preferences for high returns on efficiency investments; irrational because they appear to be a return that is so much higher than they can get on other investments they routinely have available. Rather, we view the implicit discount rate as a reflection of the fact that the marketplace has offered an inadequate range of options to consumers who are ill-

[37] EPA/NHTSA, NPRM, pp. 40437-40438.

[38] To underscore the fact that we have been pushing for the agencies to recognize this important reality of the efficiency gap, this discussion is taken directly from our 2009 light duty comments (Mark Cooper, Comments of the Consumer Federation of America, Environmental Protection Agency, Department of Transportation, Proposed Rulemaking to Establish Light-Duty Vehicle Greenhouse Gas, Emission Standards and Corporate Average Fuel Economy Standards, 40 CFR Parts 86 and 600, 49 CFR Parts 531,633, 537, et al., November 27, 2009, which pointed back to our 2008 comments.

> informed and unprepared to conduct the appropriate analysis and who lack the resources necessary to make the correct actions.[39]

The apparently grossly irrational discount rate reflects market imperfections and failures, not irrational consumers, a conclusion that has been clear in throughout the long history of the efficiency gap debate.

> The implicit discount rates calculated from consumer choices reflect not only individual time preferences but a whole collection of variables that may depress the ultimate level of investment. The calculated discount rate is affected by consumers' price expectations and their levels of certainty about these; the extent to which available information is imperfect, mistrusted, or ignored; the purchase of some equipment to quickly replace nonfunctioning equipment rather than to minimize life-cycle cost; the presence in the market of builders, landlords, and other purchasers who will not pay for the energy the equipment uses; the fact that consumers with limited capital do not always purchase what they would if they had more capital; differential marketing efforts for different products, and so forth. Recognizing such possibilities, some analysts say that the data reflect "market discount rates."[40]

This observation on the market discount rate, combined with the recognition that a 3% discount rate is a good estimate for the consumer discount rate, provides a realistic framework for understanding consumer discount rates and applying them in economic analyses. We applaud the agencies for arriving at this view and encourage them to affirm both in the final rule so that future rulemakings can be grounded on this solid basis.

2. Pass-through

A second theoretical explanation that played an important part in the earlier analysis and was addressed by EPA/NHTSA is the question of the pass-through of cost savings to consumers.

> As a result of this proposed rulemaking, it is anticipated that trucking firms will experience fuel savings. Fuel savings lower the costs of transportation goods and services. In a competitive market, some of the fuel savings that initially accrue to trucking firms are likely to be passed along as lower transportation costs that, in turn, could result in lower prices for final goods and services. Some of the savings might also be retained by firms for investments or for

[39] Comment of the Consumer Federation of America, on National Highway Traffic Safety Administration Notice of Proposed Rulemaking; Docket No. NHTSA 2008-0089, RIN 2127-AK29; Average Fuel Economy Standards, Passenger Cars and Light Trucks; Model Years 2011-2015, July 1, 2008, pp. 38-40.

[40] Stern Paul C., "Blind Spots in Policy Analysis: What Economics Does Not Say about Energy Use," *Journal of Policy Analysis and Management,"*5:2 (1986), p. 209.

> distributions to firm owners. Again, how much accrues to customers versus firm owners will depend on the relative elasticities of supply and demand. Regardless, the savings will accrue to some segment of consumers: Either owners of trucking firms or the general public, and the effect will be increased spending by consumers in other sectors of the economy, creating jobs in a diverse set of sectors, including retail and service industries.[41]

The pass-through issue also turns up in another key aspect of the overall analysis, the rebound effect. The increase in consumption associated with the rebound effect occurs because consumers have more money to spend. The first effect is through the reduction of the cost of travel, but there is a second effect through the increase in disposable income available for other consumption.

> Elasticities with respect to fuel price and fuel cost can provide some insight into the magnitude of the HDV VMT rebound effect….
>
> Freight price elasticities measure the percent change in demand for freight in response to a percent change in freight prices, controlling for other variables that may influence freight demand such as GDP, the extent that goods are traded internationally, and road supply and capacity. This type of elasticity is only applicable to the HDV subcategory of freight trucks (*i.e.*, combination tractors and vocational vehicles that transport freight). One desirable attribute of such measures for purposes of this analysis is that they show the response of freight trucking activity to changes to trucking rates, including changes that result from fuel cost savings as well as increases in HDV technology costs. Freight price elasticities, however, are imperfect proxies for the rebound effect in freight trucks for a number of reasons. For example, in order to apply these elasticities we must assume that our proposed rule's impact on fuel and vehicle costs is fully reflected in freight rates. This may not be the case if truck operators adjust their profit margins or other operational practices (*e.g.*, loading practices, truck driver's wages) instead of freight rates. It is not well understood how trucking firms respond to different types of cost changes (*e.g.*, changes to fuel costs versus labor costs).[42]

These observations make it clear that there is a significant level of pass-through of cost savings. Given the competitiveness of the trucking industry and its importance, we believe it is substantial. EPA/NHTSA conclude that there will be pass-through, but they do not provide an estimate. Their estimate of the rebound effect is moderate – 10% – based on a variety of factors. We have discussed this earlier. Given the very large economic benefits, the magnitude of the rebound effect does not significantly affect the bottom line of the analysis. Without specifying

[41] EPA/NHTSA, NPRM, p. 40482

[42] EPA/NHTSA, NPRM, p. 40450, 40451.

the precise level, it is clear that pass-through is significant and has important macroeconomic benefits.

D. The Attributes of the Proposed Phase II Rule

In the previous section we described six traits of performance standards that enhance their ability to be effective. Here we briefly assess the proposed Phase II rule in terms of these characteristics. Overall, we conclude that the agencies have done a good job of designing the standard, given the nature of the industry and the legislative mandates under which they operate.

Long-Term: In economics, the view of time is defined by the extent to which the capital stock can be changed.[43] In the short-term it is fixed. In the long-term it can be extensively changed. In designing performance standards, the key issue is the cycle on which the design of consumer durables is refreshed or entirely redone. In the heavy duty truck sector, EPA/NHTSA point out that the cycle can take as long as ten years. EPA/NHTSA see this as a fundamental constraint on the ability to set standards to require technologies to be included in vehicles.

> Alternative 3, the preferred alternative, the agencies propose to provide ten years of lead time for manufacturers to meet these 2027 standards, which the agencies believe is adequate to implement the technologies industry could use to meet the proposed standards. For some of the more advanced technologies production prototype parts are not yet available, although they are in the research stage with some demonstrations in actual vehicles.[49] Additionally, even for the more developed technologies, phasing in more stringent standards over a longer timeframe may help manufacturers to ensure better reliability of the technology and to develop packages to work in a wide range of applications. Moving more quickly, however, as in Alternative 4, would lead to earlier and greater cumulative fuel savings and greenhouse gas reductions.[44]

The agencies go through potential technologies one-by-one to assess the time frame in which they could be implemented and find several that have rather long periods. For example:

> The issue for heavy-duty vehicles is that the cab and/or passenger compartment is designed for a specific purpose such as accommodating an inline cylinder engine or allowing for clear visibility given the size of the vehicle. Consequently, a reduction in vehicle size and/or frontal area may not be realistic for some applications. This also may necessitate an expensive, ground-up vehicle redesign and, with a tractor model lifecycle of up to 10 years, may mean that a mid-cycle tractor design is not feasible. In addition, the frontal area is also defined by the shape behind the cab so reducing just the cab frontal area/size reduction may not be effective. Thus,

[43] John B. Taylor, *Economics*, Houghton Mifflin, 2nd Ed., glossary.
[44]EPA/NHTSA, p. 40154, Under

this approach is something that may occur in a long-term timeframe of 10-15 years from today.[45]

While the long redesign cycle presents a challenge for standard setting, the 10 year time frame chosen by EPA/NHTSA represents a reasonable balance. It is hard to predict much beyond that period, but it gives the industry the opportunity to implement technologies. On the other hand, given the legislative mandates to maximize efficiency and reduce environmental harms to the extent feasible, the long cycle demands that the agencies actively monitor developments within the industry to see whether technologies have become feasible for the purpose of setting future standards. It also puts a spotlight on the importance of other policies, beyond standards, to speed the product cycle.

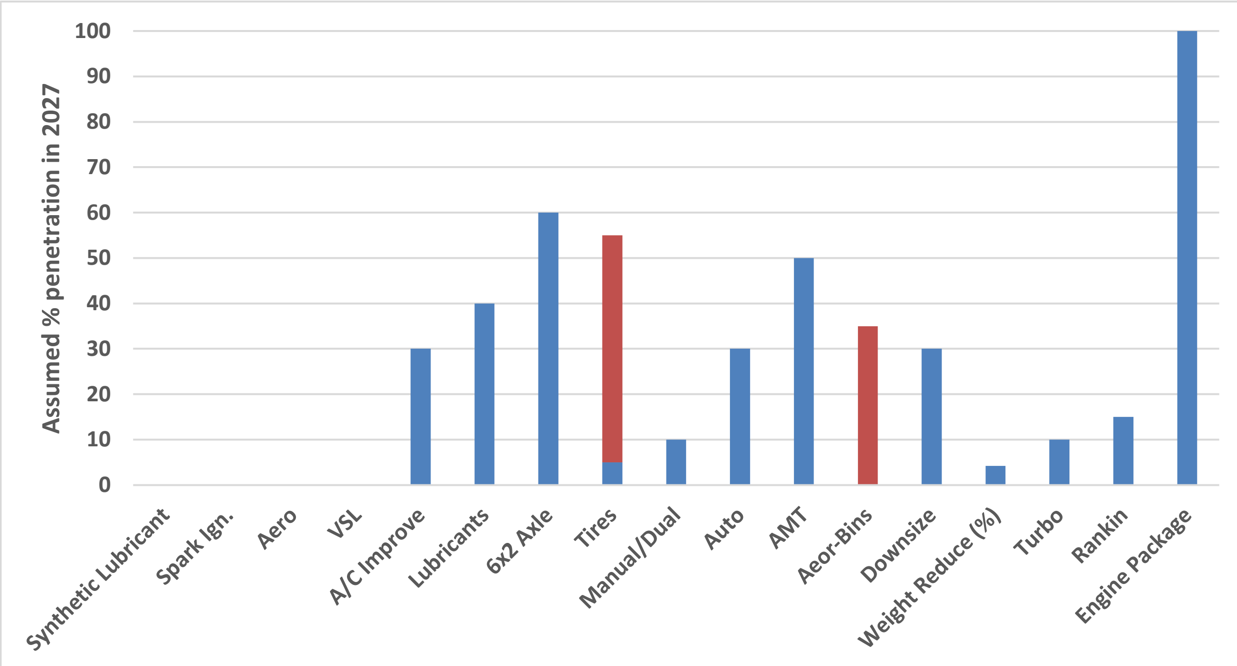
Technology Neutral: Technology neutrality leaves the choice of which technologies to utilize up to the manufacturers. The agencies achieve this outcome in two ways. They do not mandate any specific technology and they do not assume a very high level of penetration of many technologies. By relying on a variety of technologies that affect several of the key attributes of the vehicle that affect energy consumption, they create a rich palate of alternatives from which the manufacturers can choose to meet the standard (see Figure VI-2).

EPA/NHTSA assume a high penetration (over 50%) of a couple of the technologies based on their analysis of the market. However, even though they assume this high level to set the standard, manufacturers would not have to uniformly include the measures that EPA/NHTSA use to set the standard. They could meet the standard using a mix of other technologies, including many of those that were not used to set the standard. Given the level of the standard, there is a lot of head room for manufacturers to be innovative. The question that arises is not about whether the agencies have adhered to the principle of technological neutrality, they clearly

[45] EPA/NHTSA, PHASE II RIA, p. 2-16.

have. The question is that in balancing the mandates of feasibility and maximizing energy savings and emissions reduction, they have given feasibility too much weight.

FIGURE VI-2: ADOPTION RATES FOR MAJOR CATEGORIES OF TECHNOLOGIES



Source: EPA/NHTSA, PHASE II NOPR, Tables II-6 and III-10,

> For each category of HDVs, the standards would set performance targets that allow manufacturers to achieve reductions through a mix of different technologies and leave manufacturers free to choose any means of compliance.[46]

Product Neutral: The large amount of head room that EPA/NHTSA have left for manufacturers applies to alternative technologies across the board. Thus, entirely new approaches to meeting the standards are welcome and a small penetration of alternative engine types (Rankin and hybrid engines) factors into the level of the standards. In a sense, this is a step back from Phase I in which these alternatives were given additional credits as incentives to develop and deploy the technologies.

Responsive to industry needs: Above we noted that a fundamental constraint on setting standards is the refresh and redesign cycle of the product. As second constraint is the adoption

[46] EPA/NHTSA, PHASE II NOPR, p. 40143.

cycle.[47] Given the amount of capital, the life of the product and its uses, the speed of adoption can vary substantially. Again, EPA/NHTSA evaluate specific technologies with respect to adoption cycles.

> As in Phase 1, we have chosen not to base the proposed standards on performance of VSLs because of concerns about how to set a realistic adoption rate that avoids unintended adverse impacts. Although we expect there will be some use of VSL, currently it is used when the fleet involved decides it is feasible and practicable and increases the overall efficiency of the freight system for that fleet operator. To date, the compliance data provided by manufacturers indicate that none of the tractor configurations include a tamper-proof VSL setting less than 65 mph. At this point the agencies are not in a position to determine in how many additional situations use of a VSL would result in similar benefits to overall efficiency or how many customers would be willing to accept a tamper-proof VSL setting. We are not able at this time to quantify the potential loss in utility due to the use of VSLs. Absent this information, we cannot make a determination regarding the reasonableness of setting a standard based on a particular VSL level. Therefore, the agencies are not premising the proposed standards on use of VSL, and instead would continue to rely on the industry to select VSL when circumstances are appropriate for its use. The agencies have not included either.[48]

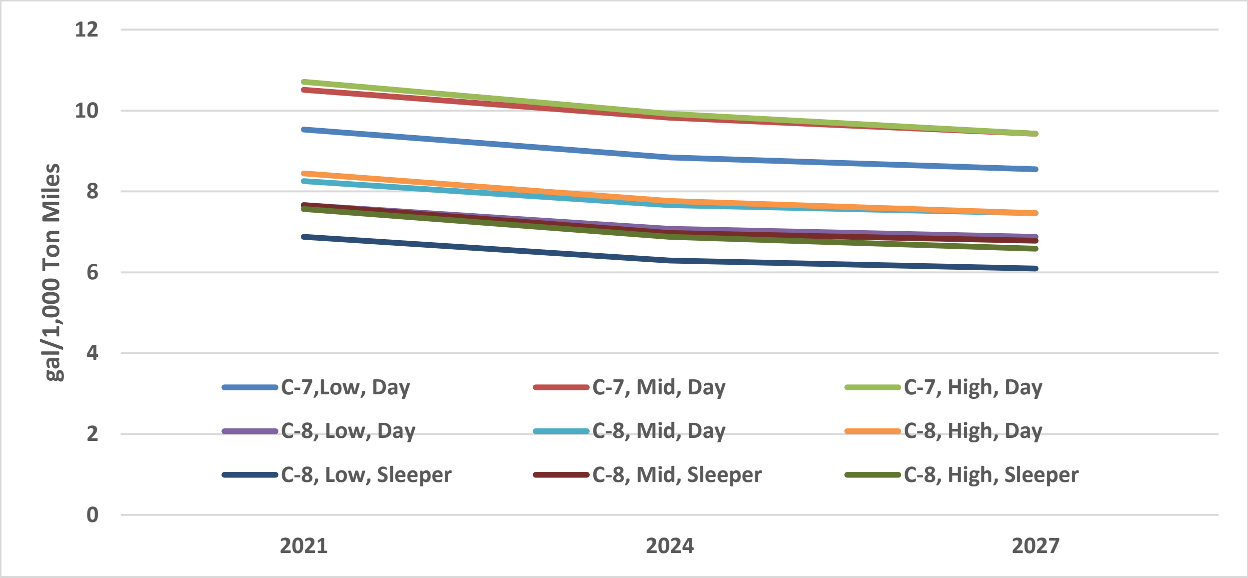
The challenge of the adoption cycle reinforces the challenge of the product design cycle. Monitoring the development and adoption of technologies and using other policies to accelerate both are important activities to undertake. The agencies have outlined a list of key technologies that are already feasible or candidates for future inclusion in standards, as shown in Figure VI-2.

Responsive to consumer needs: In the general discussion of performance standards, we include the principle that standards should be attribute based as the key to this criteria. Consumers purchase and use durables for specific purposes. The attributes of the durables are extremely important. To the extent that agencies design standards to ensure consumers get the functionalities they need, the standards will be more effective. As in all cases, balance is necessary. Just as some consumers are more demanding, the agency may well conclude that those consumers are also more willing to pay for attributes, so higher levels of efficiency are feasible and practicable in the marketplace. Thus, whether or not the statute explicitly requires

[47] Mark Cooper, *Performance Standards,* showed the important role that adoption, in the form of diffusion curves, play in the analysis of the efficiency gap and the design and evaluation of standards.
[48] EPA/NHTSA, PHASE II RIA, p. 2-89.

or defines specific attributes that should be considered, the agencies can and should take attribute based approaches under their general obligation to ensure standards are feasible and practicable.

FIGURE VI-2: STANDARDS REFLECT TRACTOR TRAILER ATTRIBUTES: CLASS, CAB HEIGHT AND USE



Source: EPA/NHTSA, PHASE II NOPR, Table III-1.

EPA/NHTSA have certainly made that effort here. For example, as Figure VI-2, above, shows the target levels and development paths for the fuel consumption of tractor trailers taking their class, cab height and use into account. There is a 30% difference in targets across the nine categories and a 3% difference in the rate of improvement.

The challenge in balancing the consumer and producer interests is to recognize that standards that are too weak impose significant harm on consumers. They end up spending much more on freight transport than they should.

Procompetitive: Given the above description of the Phase II proposal, we conclude that it would be procompetitive. It would induce competition around the standard in which manufacturers would install those technologies in which they have an advantage, given the nature of their expertise and the customers they serve.

Well-designed performance standards that follow these principles command but they do not control. They ensure consumer needs are met while delivering energy savings and increasing consumer and total social welfare.

VII. STRIKING THE BALANCE BETWEEN FUEL SAVINGS AND FEASIBILITY

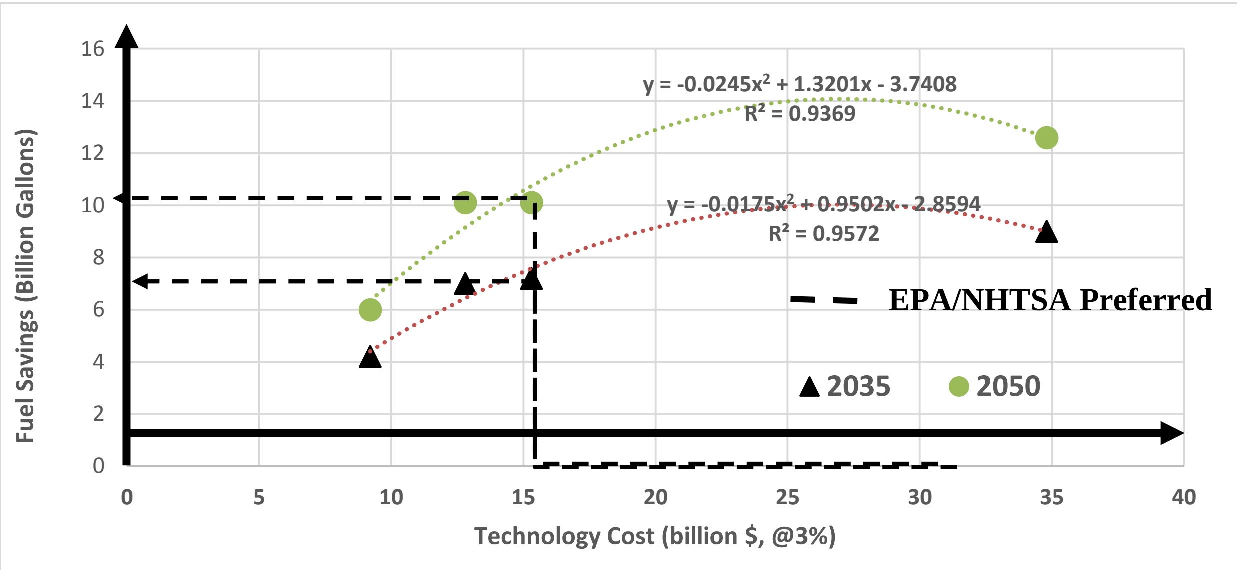
In this section we examine the challenge of striking a balance between achieving the maximum energy savings/emissions reductions and the constraints of feasibility. Failing to achieve the maximum economically beneficial savings imposes a direct and significant harm on consumers – they are forced to pay too much for the goods and services that they consume. Mandating technologies that are infeasible will drive up costs and ultimately cause the performance standards to fail. These two considerations deserve equal weight, particularly in a sector where efficiency improvements have been largely flat, while the rest of the economy has been improving dramatically. The "burden of proof" established by the underlying statutes does not favor one concern over the other and leaves the agencies a great deal of discretion.

A. DID EPA/NHTSA UNREASONABLY ROB CONSUMERS OF POTENTIALLY BENEFICIAL COST SAVINGS?

Throughout these comments we have identified the central tension in the otherwise excellent proposed rule. Did EPA/NHTSA leave too much energy savings on the table by underestimating the feasibility of adopting extremely beneficial technologies? EPA/NHTSA have said they are concerned that specific technologies cannot enter the market or cannot penetrate sufficiently to be allowed to influence the level of the standard, but they have not actually provided any evidence to support those conclusions. The fact that the industry has been a technological laggard for decades is an excuse, not an explanation.

Two aggregate perspectives on the decision of the agencies to choose a relatively low level of energy savings – one internal, one external – shed light on this dilemma. Figure VII-1 shows the cost curves implicit in the analysis. If one accepts their cost curves, they have done a pretty good job. They have chosen to set the standard at the point where the marginal benefits starts to decline (the inflection point). The level of the standard chosen for both 2030 and 2050 captures about 80% of the benefits at about 60% of the cost.

FIGURE VII-1: EPA /NHTSA COST OF SAVED ENERGY CURVES FOR TRACTOR TRAILERS

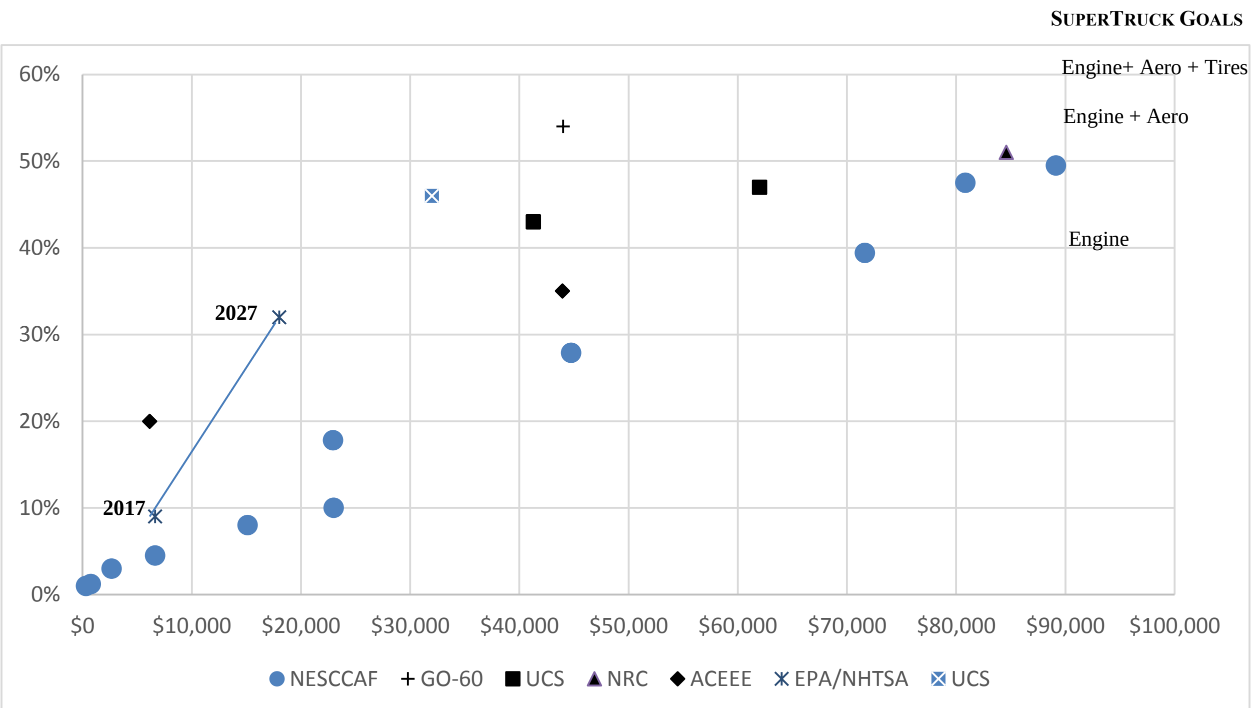


Source: EPA/NHTSA, PHASE II, NOPR, Tables X-1 and X-8.

One can argue that under both statutes the agencies are not required to "optimize" the benefit in this way. The Clean Air Act (under which EPA sets standards) calls on EPA to advance the technology. The Energy Conservation and Production Act (ECPA), under which NHTSA sets standards, only requires it to be technically feasible and economically practicable. The regulatory analysis and technical support documents raise the constraint that NHTSA faces in terms of practicability. The cost estimates note that they do not include potential costs of accelerating technology and the regulatory discussion explicitly says that there is concern that a higher standard which requires a more rapid incorporation of untested technology may not be feasible.

Figure VI-4 shows the external analysis. It plots the Phase I and Phase II standards energy savings and costs in the same axes as the third party studies discussed in Section IV. The graph highlights the anomaly. To make the cost curves comparable, we have included both Phase I and Phase II and have stated all costs in 2009$, which would be equivalent to the third party analyses.

FIGURE VII-2: EPA/NHTSA TRACTOR TRAILER TECHNOLOGY COST AND FUEL SAVINGS (PHASE I AND II) COMPARED TO EXTERNAL ESTIMATES



Sources: See Figure IV-3; EPA/NHTSA, PHASE II NOPR, Table X-1; EPA/NHTSA, PHASE I NOPR, Tables I-10, III-6; SuperTruck Goals from Nic Lutsey, "Will ne U.S. truck standards bring "SuperTrucks" to the market?", ICCT.org, blog, Dave Cooke, Engines for Change: *From Cell Phones to Sodas, How New Truck Standards Can Improve the Way America Ships Good, Union of Concerned Scientists,* March 2015.

EPA/NHTSA have developed cost curves that show relatively low costs for the smaller increases in efficiency. The graph also shows a clear shift in cost as one moves to higher levels. This would be consistent with the EPA/NHTSA concern about feasibility.

Figure VII-2 also puts a recent analysis by the ICCT in perspective. Responding to some claims by members of the industry that the proposed standards exceed even the super truck projects, the ICCT analysis shows that the super combining all the elements of the super truck program (engine, aerodynamics and tires), the improvement in fuel economy would be 2.4 times larger. They do not give costs, however. Moreover, that includes every truck maxing out on each technology, not something regulatory agencies generally require. If we consider two bundles, better engines or aerodynamics plus tires, the improvement would be 1.7 times as large. The ICCT is certainly correct in concluding that "if the US standards are going to require technology-forcing SuperTruck-like standards for tractors, it is more likely this would be in some future Phase 3 rulemaking for perhaps 2030 and beyond." The issue for regulatory analysis comes down to what would the much more aggressive standards cost? And how hard can the agencies push the industries under the statute? That is not a question that can be answered by simply identifying the technological frontier.

B. CONCLUSION

CFA has always argued that performance standards should be inframarginal, moving the industry toward its technological frontier, but not pressing the frontier outward and leaving room for competition to work its magic. We have called for benefit cost ratios of 2-to-1 based on consumer pocketbook economics (direct cost savings) as a cautiously aggressive but responsible approach. A benefit cost ratio of five-to-one, as is the case here, robs consumers of significant pocketbook cost savings. Therefore, we urge the agencies to provide a much more thorough, evidenced-based discussion of why so much cost-beneficial energy savings has been left untapped.

While the very large potential benefits lead us to call on the agencies to give a hard second look at the other factors that have led it to not push the industry harder, we believe that the huge efficiency gap also sends another strong message that should not be lost in the dickering over standard levels. The massive efficiency gap is testimony to a market that has performed abysmally for an extended period of time. We urge the agencies to seize the clear evidence on the failure of the medium/heavy duty truck market with respect to efficiency to transform the terrain of decision making in setting standards. As discussed above, they have moved in the right direction in at least half a dozen ways with the analysis of the proposed rule:

Discount rate: Recognizing real world consumer discount rate of 3% and market imperfections driving observed discount rate.

Efficiency Gap/Market Imperfection Analysis: Recognizing 30 years of empirical evidence demonstrating validity of efficiency gap explanation and identifying specific barriers, imperfections and obstacles that afflict specific markets.

Merging energy and environmental analysis: Recognizing major impact of fuel savings on assessment of rules.

Macroeconomic analysis: Reconciling important benefit of expansion of macro-economic activity resulting from greater fuel economy with realistic assessment of the rebound effect.

National security: Looking carefully at the impact of imports on national security and consumption externalities created by large U.S. role in petroleum markets.

Effective design of standards: Designing standards that "command but do not control," thereby unleashing forces of competition to ensure least cost implementation.

We applaud the agencies for crafting the proposed rule with the above factors in mind but urge that a careful examination be given as to whether greater savings that would benefit our economy and consumers can clearly be justified.