Consumer Federation of America

50 BY 2030

WHY $3.00 GASOLINE MAKES THE 50 MILE PER GALLON CAR FEASIBLE, AFFORDABLE AND ECONOMIC

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Contents

I. FUEL EFFICIENCY IMPLICATIONS OF $3.00/GALLON GAS

Over the past month, consumers have confronted $3.00 per gallon gasoline in a way that they never had before. Unlike last fall's spike above $3.00 after hurricanes in the Gulf, this spring's price spike seems to be grounded much more in the long-term fundamentals of the industry. Many analysts are saying that $3.00 per gallon, or something close to it, might be a permanent situation.[1] There has clearly been an angry reaction among consumers, which has sent their elected officials scrambling for policy responses.[2]

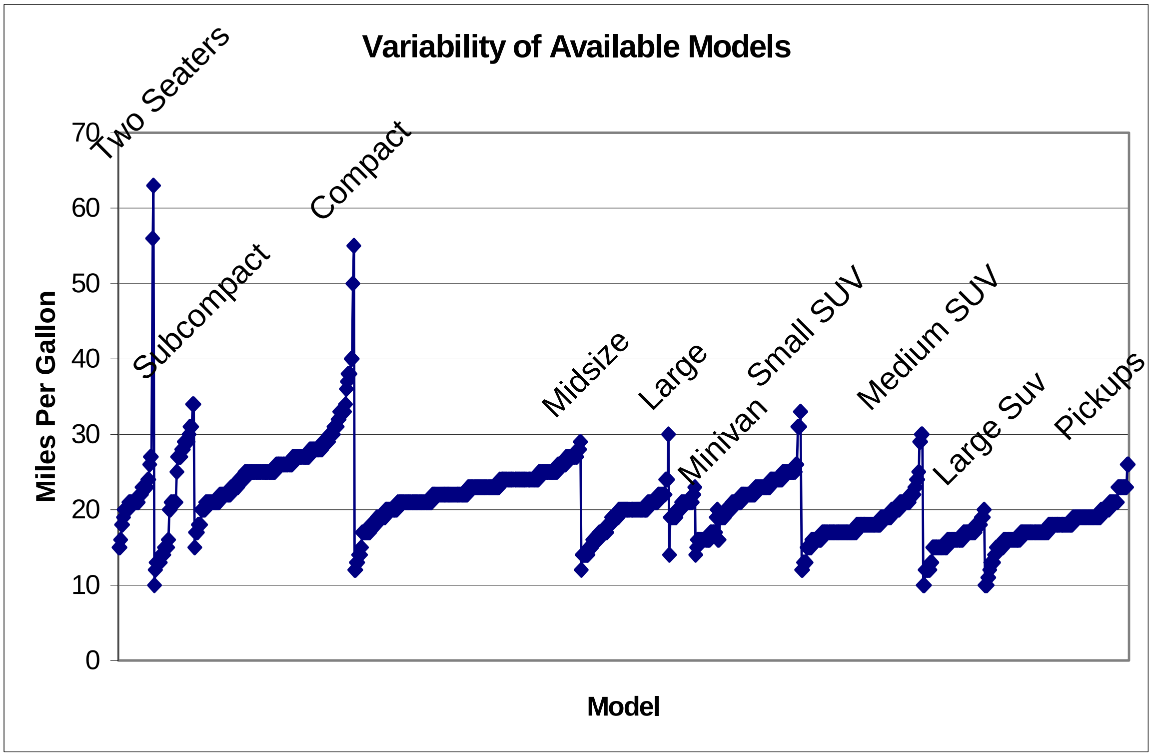
This paper examines the implications of $3.00 per gallon from a consumer economic and societal cost benefit analysis of car and truck fuel efficiency. A price of $3.00 per gallon has a dramatic impact, so much so, that consumer economic and societal cost benefit analysis support a recommendation that all the new light duty vehicles (cars, SUVs and light trucks) sold in the U.S. achieve an average fuel efficiency of 50 miles per gallon (mpg) by 2030 – ***50 BY 2030***. This would be a major accomplishment, doubling the average fuel efficiency for new light duty vehicles from the approximately 25 miles per gallon they get today.[3]

Radically Changing the Math for Car Buyers

To understand how fundamentally high gasoline prices have changed the equation consider the typical American family walking into an auto dealership in search of a large family vehicle. The family plans to finance the purchase with a five-year loan, which is about the average length of an auto loan in America.[4]

There will be a range of alternatives available within every class of vehicle with extremely wide differences in gas mileage. In Exhibit I-1, the label for the class of vehicles is placed at the highest mileage model in the class. In most classes the least efficient model is in the range of 10 to 15 miles per gallon. In the smaller vehicle classes, the highest mileages are in the range of 40 to 50 miles per gallon. In the larger vehicle classes, the highest mileages are about 30 miles per gallon.

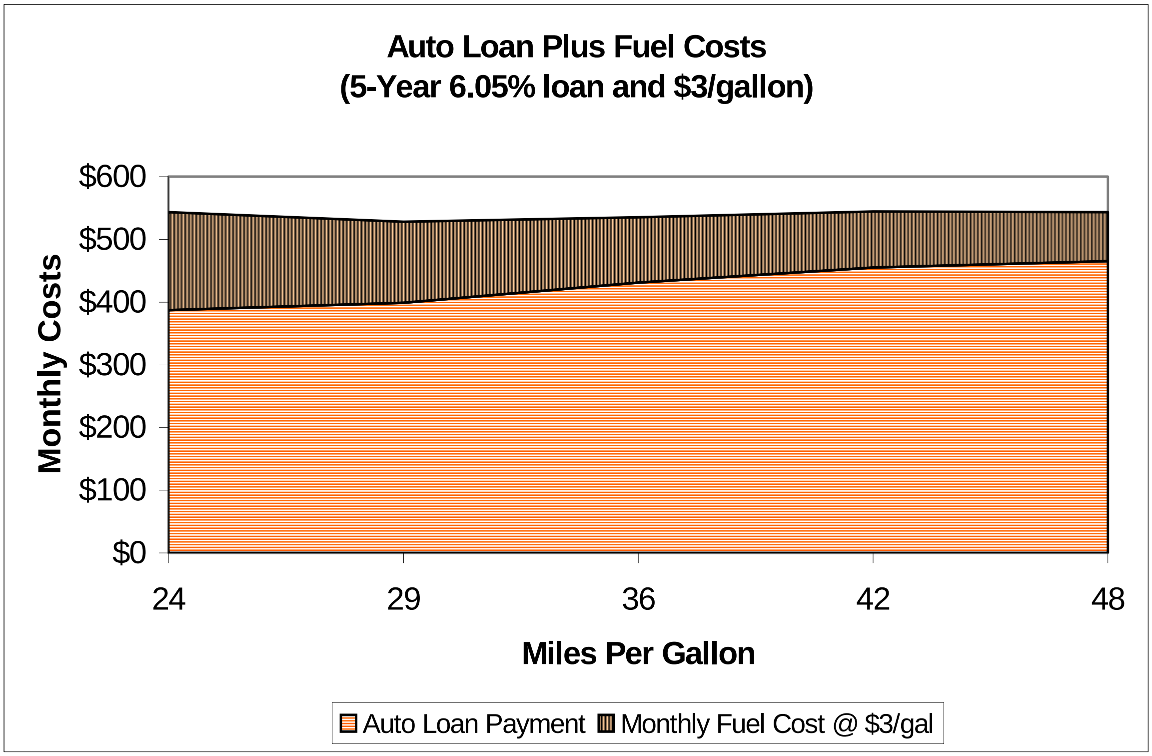
EXHIBIT I-1:



Source: EPA database on 2004 Vehicles, with Vehicle Categories defined by Consumer Federation of America.

As an example, let us consider a choice between a vehicle that gets 24 miles per gallon and one that gets 48 miles per gallon. This is indicative of the cutting edge that will be available in the future. It is one of the cases studied in detail in the remainder of this paper. It is also the case that challenges the economic analysis most, since it involves the largest investment in conservation. Of course, the more efficient vehicle costs more. A four thousand dollar price difference would add about $78 to the monthly auto loan payment. That sounds like a lot of money, but at $3 per gallon, the monthly fuel cost for the more efficient vehicle would be $78 lower. So the investment pays for itself. Economists would say it is cash flow neutral. Exhibit I-2 shows the total monthly bills for a variety of levels of fuel efficiency examined in more detail in the report. They are all quite close and all are cash flow neutral.

Exhibit I-2:



Source: Calculated by author. See text for a discussion of the methodology.

The family would have the lowest monthly bill (loan payment plus fuel cost), by $15, at 29 miles per gallon because even though the fuel savings are much smaller, the cost of moving from 24 to 29 miles per gallon is only $600 additional dollars that must be financed in the auto loan. But, if the family keeps the car for a year and a half after the loan is paid off (or the resale value of the car gets a boost due to greater efficiency, which is entirely possible with gasoline at $3.00 per gallon), the family would be better off buying the most efficient vehicle.

Key Assumptions and Important Benefits of Efficiency

Several key assumptions underlie this simple calculation:

- How much more does greater efficiency cost today and in the future?
- Will gasoline stay at three dollars per gallon, go down, or go up?
- What is the interest rate on the auto loan?

The example above uses widely cited costs of significant increases in efficiency estimated a couple of years ago by the National Research Council.[5] It assumes gasoline stays at $3.00 per gallon, although some believe it will go higher, while others predict an easing of price. And it uses an interest rate of 6 percent, which was available in March 2006. Thus, the assumptions in the example are quite reasonable.

When we take a broader societal view, other benefits of increased efficiency become apparent. The societal view involves a number of impacts that are not reflected in the price of gasoline – like the national security implications of being dependent on oil imports in a world where many major oil producers are not very friendly to our interests, the economic impacts of exporting huge sums of dollars abroad, or the military costs of ensuring the oil supply. Economists call these externalities. They are not factored into (internalized in) the private calculation or transaction. And indeed, public opinion polls show that Americans are increasingly concerned with these externalities.[6] Thus, with cash flow neutral choices, if the consumer thinks for a moment about other impacts of oil consumption that are not reflected in the price, it would be easy to argue that a higher level of fuel efficiency would be well worth it.

The critical public policy questions have come into sharper focus with gasoline at $3.00 per gallon.

- How much improvement in fuel efficiency makes sense from the consumer economic point of view?
- How much improvement in fuel efficiency should we aim for as a society?
- How fast can such an increase be achieved?

Unfortunately, there are not a lot of 48-mpg models available today, certainly not across all types of vehicles, which are needed because families have very different needs. Moreover, not all households buy a new vehicle every year. We cannot scrap the whole fleet and start all over again. In short, it will take time to move the vehicle fleet to much higher fuel efficiency levels. What this analysis shows, from the consumer and societal points of view, is that we can confidently aim at a much higher target than we have been contemplating as a society. Gasoline at $3.00 per gallon changes the landscape of energy policy dramatically.

Consumer economic and societal cost benefit analyses have converged to show that achieving a doubling of the fuel efficiency of the national vehicle fleet over the next quarter century, an aggressive goal that would achieve an unprecedented level of oil savings, is easily justified from both the consumer and the societal perspectives.

We call it ***50 mpg by 2030***, which means we should aim for new vehicles (cars, SUVs and light trucks) entering the fleet in 2030 that average 50 miles per gallon. This would pull the overall average of light duty vehicles on the road to more than 42 miles per gallon.

We can reach this goal with technologies that, according to the 2002 National Research Council report,[7] are on the shelf or very nearly so. In other words, no technological breakthroughs are necessary. And it’s probable that technological progress will be more dramatic, especially with new public policies to promote fuel efficiency. In short, technology is not the constraint here. The constraint is time: How long it takes for the auto manufacturing industry to retool, the vehicle fleet to turn over, and consumers to embrace more fuel-efficient vehicles.

Specific policies to accelerate the process are not discussed in this paper, but will be outlined in a future report. Picking the policy instruments for achieving the goal is a very different type of exercise than setting the goal.

II. METHODOLOGY AND ASSUMPTIONS FOR THE CONSUMER FINANCIAL AND SOCIETAL COST-BENEFIT ANALYSES

The traditional approach to the economic analysis of auto fuel efficiency is primarily a financial analysis. It treats the increased cost of a more fuel-efficient vehicle as an investment. The front-end cost is the investment and the reduced expenditure on gasoline that results from lower consumption is treated as the revenue stream that flows from the investment.

Such an analysis involves a number of components. First and foremost, one must estimate the investment cost of increased fuel efficiency. Interestingly, there appears to be a consensus on the range of costs for improving vehicle fuel efficiency that was published by the National Research Council.[8] Although the range of cost estimates varied by a factor of two between the high and the low, the NRC estimates have been used repeatedly without much controversy.

Other components of the traditional financial analysis are debated. The analysis is usually done in constant or real dollars, with inflation taken out. However, since most analysts agree that the real price of gasoline will increase over the next couple of decades, in order to evaluate the investment, the price of gasoline must be projected (guessed). In order to put a dollar value on the stream of future benefits, one must pick a price of gas.

In its most recent Annual Energy Outlook, the Energy Information Administration projects a rising real price of gasoline of .6 percent per year for 25 years.[9] The EIA sets the 2010 price at $2.85 per gallon (in 2005 dollars), which rises to approximately $3.10 by 2030.

The traditional analysis also includes a discount rate or opportunity cost of capital. That is, the consumer could have invested the money in something other than fuel efficiency. To be a “good” investment, fuel efficiency must at least equal the return that could have been earned on other investments.

Exactly what discount rate/opportunity cost should be used, however, is a controversial issue. The real risk free rate of return is – for example on government bonds – only in the 2 to 3 percent range. With inflation running in the range of 3 percent, this is more than consumers earn on savings accounts or short-term certificates of deposit. They can earn more on riskier investments and they pay more for shorter-term loans on risky investments, e.g. three, four or five year auto loans. Given recent trends and projections about gasoline prices, conservation investments would appear to be relatively low risk.

There is also a debate over the time horizon one should use for the analysis. Cash strapped consumers may take a very short-term view. They want a very short payback period, which is the equivalent of demanding a high discount rate. This has particular relevance to automobiles, because the purchaser of a new car tends to own it for a short period – three or four years on average – but vehicles tend to stay in the fleet for nine or ten years. In the current environment, the difference between the ownership period and the life of the vehicle may be less important, however, at least for efficiency investments. With efficiency receiving so much attention, the value of the fuel efficiency investment should be captured in the sale price of the used vehicle.

Notwithstanding these uncertainties, from this individual financial point of view, the approach makes good sense. However, from the societal point of view, it leaves a lot to be desired.

For example, from the societal point of view, who owns the car is irrelevant. The fact that it will be on the road for ten years or more is what matters. But this is only a small part of the large gap between the consumer and the societal points of view.

The individual does not take externalities into account in the financial calculation. Externalities, by definition, are factors that are not included in the transaction. The real economic cost of oil consumption in terms of drain on resources and trade imbalance, the geopolitical cost of dependence on insecure supplies and the costs of environmental harm do not enter into the individual financial calculation. They should enter into the societal calculation, however.

A Transparent Approach That Highlights Policy Issues

In order to present a simple calculation that is more comprehensible to the public and makes these debates and uncertainties more transparent, we have taken a somewhat different approach. Since all of the analyses must start with an estimate of how much it will cost to reduce fuel consumption by a specific amount, we can calculate the cost per gallon saved. We can show this calculation under various sets of assumptions about time horizons and discount rates. Each set of parameters yields an estimated cost per gallon saved.

The consumer and the public policymaker can then apply their preferences in evaluating what level of investment makes economic sense. Moreover, since society should always be willing to pay more for energy savings than the individual, because of the external costs associated with gasoline consumption, this approach also enables us to get a feel for the gap between the private and the public perspectives on this problem.

The analysis focuses on new vehicles. It starts from an average of 24 miles per gallon, which is close to the average of light duty vehicles today. Below, we will show how increasing the mileage for new vehicles interacts with the existing stock of vehicles to increase the fleet-wide average.

Because the calculation is done in gallons saved, it is a real calculation. It is independent of gasoline prices at the pump, which will include inflation and real changes in gasoline prices.

We assume a constant 15,000 miles driven per vehicle per year. This is the number EPA uses in its analysis of fuel efficiency. This is a simplification. Autos tend to be driven more when they are new, with use declining slowly.[10]

We separate out conventional and hybrid engines. The fuel efficiencies used are the efficiencies used by the NRC. We have two cost estimates for conventional engines.[11] [12] which is based upon the National Research Council study. These represent the extremes in the range of estimates in the NRC study. These are the low cost and high cost estimates in the following analysis.

We have one hybrid estimate, which is from David Friedman, *A New Road: The Technology and Potential of Hybrid Vehicles.*[13] We assume the conventional improvements are also included in the hybrids. For hybrids, miles per gallon were estimated as real world, rather than claimed, since the former is lower. This lower figure is what the consumer is likely to experience. There is only one cost estimate for hybrids.

We provide calculations for a five-year and a ten-year estimate. The five-year estimate only counts gasoline savings in the first five years. This is roughly the length of a new car loan. The ten-year estimate counts the savings over ten years, which is somewhat shorter than the current life of the typical vehicle. The transition to a high gasoline price environment is likely to shorten the lives of the existing stock. This is closer to the societal point of view.

We also consider two cases for discount rates. One is a zero discount. The other is a 5% discount rate, calculated by reducing the amount of gasoline saved by 5% per year.

These two cases can be interpreted as capturing various aspects of the real world situation. For example, in the zero discount case, we might argue that rising real prices and increasing external economic, geopolitical and environmental costs offset any claims for discount rates, reduced mileage over the life of the vehicle, or consumer short-term financial bias. The 5% discount rate is a little low for financial analysis, but a substantial increase in the real price of gasoline would increase the effective discount rate. These two cases bracket the range of likely future conditions and perspectives.[14]

III. RESULTS

Consumer Economic Analysis

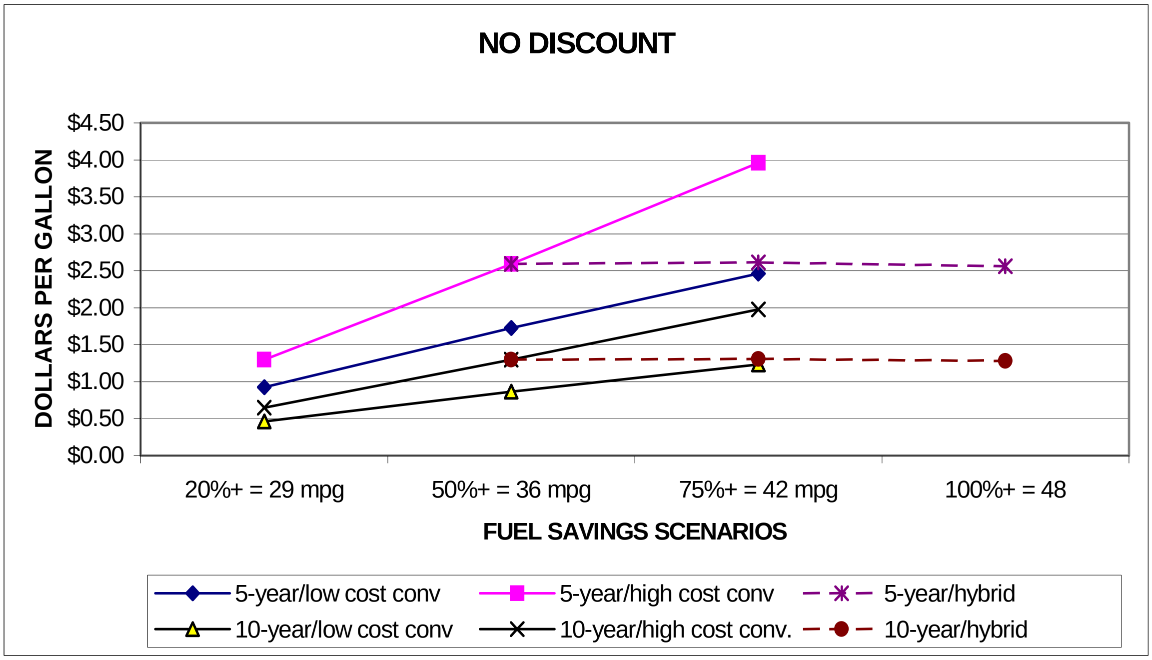
Exhibit III-1 shows the results of the economic analysis applied to the cost and savings data from the NRC study. The data points are typical vehicles that could enter the fleet at the specified cost. Some of them cost-savings data points are already available. These results give us confidence that pursuing policies that target new vehicle fuel efficiency in the range of 50 miles per gallon over the course of the next quarter century makes good sense from the consumer and societal points of view.

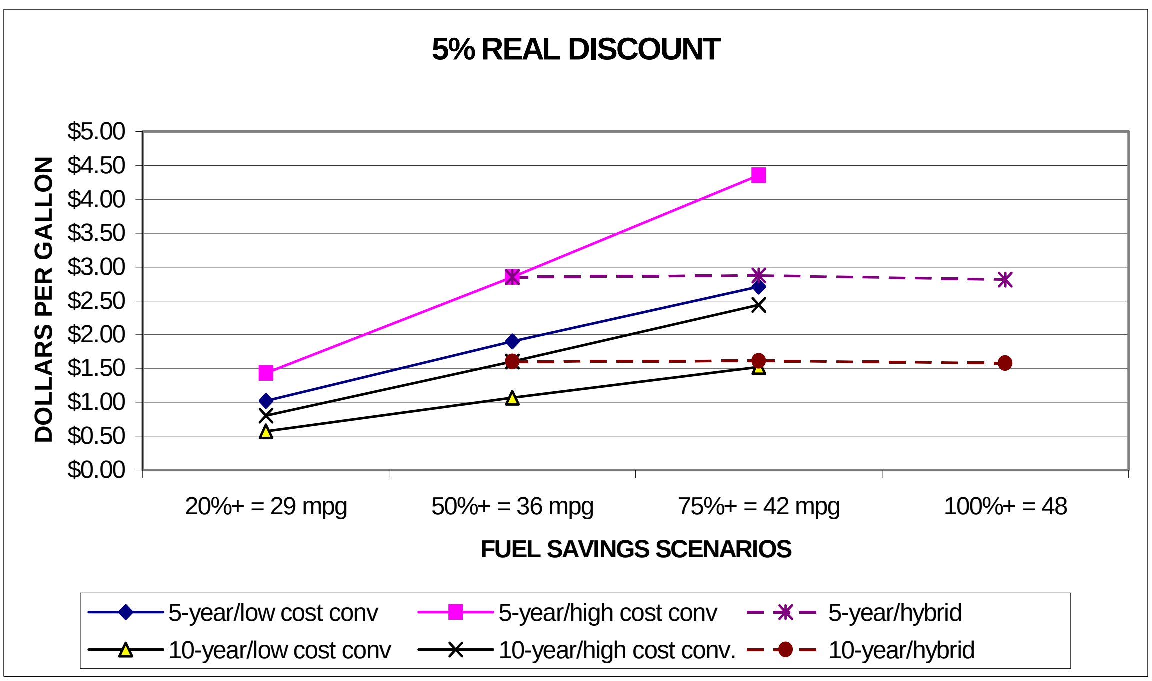
Under all sets of assumptions, there are options available that combine conventional and hybrid vehicles that cost less than $3.00 per gallon. The five-year, 5 percent discount rate analysis, which approximates the consumer point of view, is just under $3 per gallon. The ten-year, 5 percent discount case, which is probably closest to actual consumer financial situation, with the increasing ability to capture the value of greater efficiency in resale, is just over $1.50. The ten-year, no discount analysis, which is a good approximation for the societal view, given the large externalities associated with our “addiction” to oil, is about $1.40 per gallon.

As described in Chapter I, consumers do not generally pay cash up front for their autos. They finance most of the purchase with a loan over three to six years. The average loan period is 5 years. Thus, another way to look at the narrow consumer cost-benefit of efficiency is to ask what it does to monthly payments. We do so again by calculating the cost per gallon saved. We found auto finance rates by searching the web as follows 36-month = 5.6 ; 48-month = 6.0 ; 60-month = 6 ; 72-month = 6.6 .

As Exhibit III-2 shows, only for shortest-period loans is the cost above $3 per gallon. In other words, all of these efficiency investments are cash flow neutral at $3 per gallon under the typical car loan (60 months). As was evident in the earlier analysis, hybrids become the vehicle of choice above 40-mpg. Even at $2.50 per gallon, the 48-mpg hybrid is cash flow neutral.

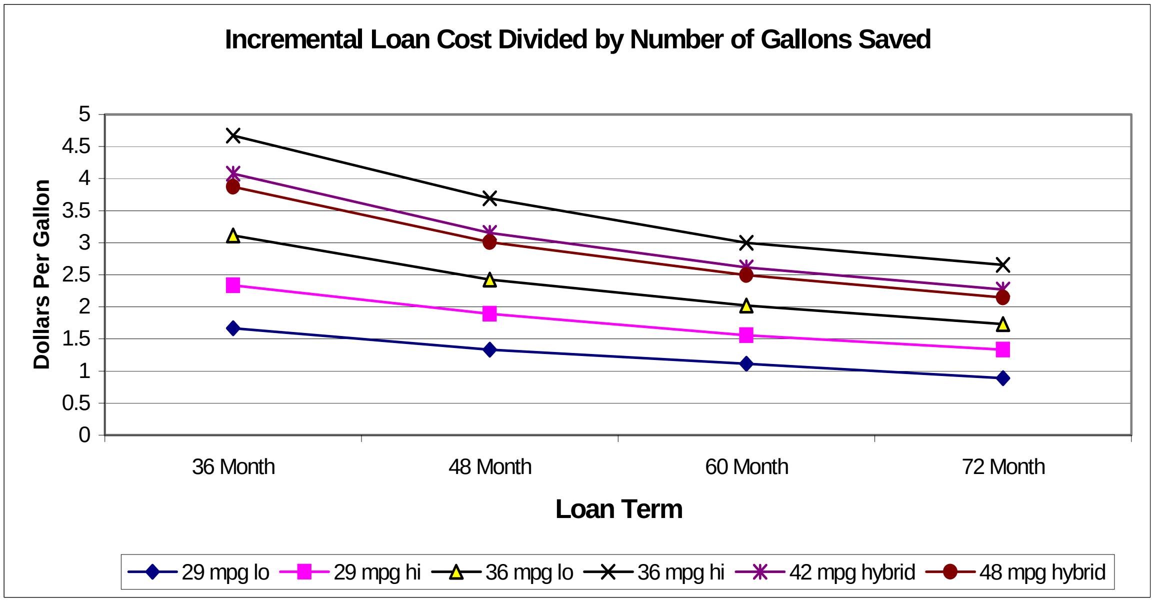
EXHIBIT III-1:
THE COST OF INCREASING FUEL EFFICIENCY OF VEHICLES EXPRESSED AS COST PER GALLON OF GASOLINE SAVED





Source: See text for method and sources.

EXHIBIT III-2



Source: Calculated by author. See Text.

Shorter loans involve cash flow costs (i.e. total monthly loan costs are much higher, so fuel savings do not offset the costs) for the assumption of high costs and higher levels of efficiency. The 48-mpg vehicles and the 36-month loans have negative cash flows.

Since this level of efficiency would be a target for the later years of the program, this is not a great concern. To the extent that the cost of fuel efficiency declines over time as the number of units sold increases (i.e. economies of scale drive down costs) and greater competition lowers margins on these vehicles, or the real cost of gasoline rises, these negative cash flows may shrink or disappear.

Interestingly, we do observe purchases of high efficiency large vehicles at present. Commentators on the auto scene have sometime denigrated these as “status” or “statement” choices.[15] However, it is not clear why decisions that take externalities into account and are motivated by environmental or nationalistic citizenship deserve such derision. As the next section shows, these external values are quite large.

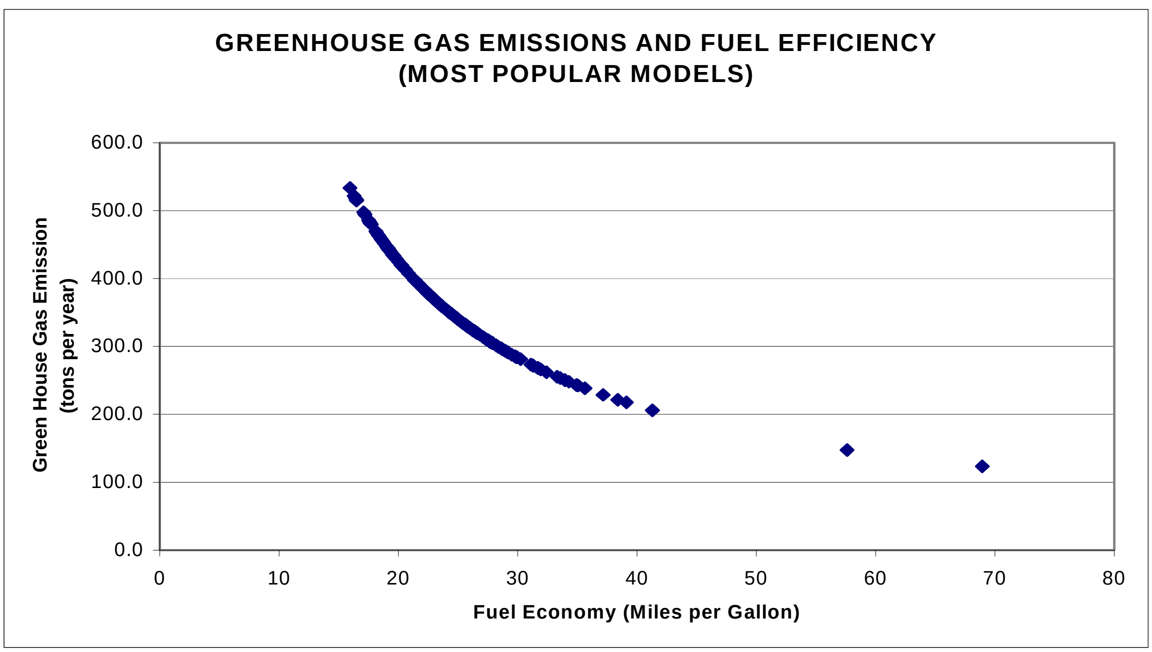
Other Societal Benefits of Reduced Oil Consumption

Quantifying the external benefits of reduced gasoline consumption is challenging, since these are not priced in transactions. One area that has received a great deal of attention recently is the issue of emissions of greenhouse gases, which are associated with global warming. Indeed, for years the energy efficiency debate was driven by environmental concerns.

The impact of gasoline consumption on emissions can be defined with some precision. Resources for the Future estimates the emission of 20 pounds of carbon dioxide (a greenhouse gas) per gallon of oil consumed. CFA merged its database on fuel consumption of new autos (derived from the EPA fuel mileage tests) with the Union of Concerned Scientists' analysis of carbon emissions from new vehicles (see Exhibit III-3). We discover a near perfect correlation. Fuel efficiency and clean cars go hand-in-hand.

Measuring the amount of emissions is one thing. Translating that value into a cost to society is quite another.

EXHIBIT III-3:



Source: Merger of Consumer Federation of America Mileage Rating Scale database and Union of Concerned Scientists, Clean Car Discount database.

A number of estimates of a variety of environmental impacts have been made. These include, in addition to global warming, impact on agriculture, visibility, buildings, and water pollution. However, we should not include in this analysis many of the environmental costs associated with vehicles – like noise, land use or congestion – which are not associated with oil consumption as such.

External economic impacts present a similar complexity. For example, in a series of studies, David Greene has calculated "the economic costs of oil dependence" for three precisely defined economic costs – wealth transfers, loss of potential gross domestic product and macroeconomic adjustment costs.[16] Others include a much broader range of costs including subsidies for vehicle transportation and oil production.[17]

Geopolitical vulnerability is extremely difficult to measure. One obvious possibility to which some have turned is to calculate the cost of deploying military power to protect oil production. The argument about what would have been done in terms of military deployment absent a dependence on oil is extremely difficult to unravel,however.

As a result of the uncertainties in how costs are defined, the range of estimates is extremely wide. Since these costs are not central to our analysis and the benefits of reducing them are "gravy" atop the consumer analysis, we need not spend a great deal of time trying to sort out the complexities. An order of magnitude estimate is helpful to put the consumer economic analysis at $3.00 per gallon in perspective.

Exhibit III-4 presents the estimates for a very narrow range of externalities. All the external costs are attributable to the broader consumption of oil and have been converted to a per gallon basis using total oil consumption. This does not include any of the subsidies for vehicle transportation or oil production.

EXHIBIT III-4:
ESTIMATES OF NARROWLY DEFINED OIL CONSUMPTION EXTERNALITIES
(in dollars per gallon)

EXTERNALITY	LOW	HIGH
Environment	$.13	$.72
Economic	$.52	$.70
Military	$.20	$.40
Total	$.85	$1.82

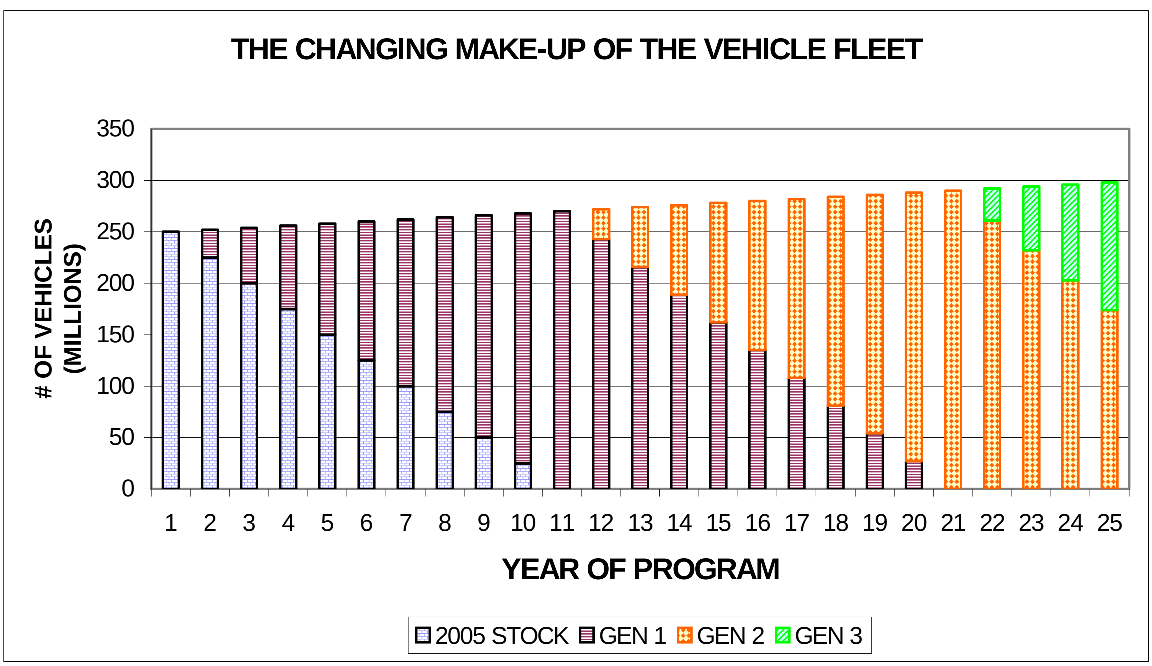
International Center for Technology Assessment, *The Real Price of Gasoline,* 1997, *Gasoline Cost Externalities Associated with Global Climate Change,* September 29, 2004; *Gasoline Cost Externalities: Security and Protection Services,* January 25, 2005; Lovins, Amory, et al., *Winning the Oil Endgame* (Rocky Mountain Institute, 2004); Greene, David L., and Sanjana Ahmad, *Costs of U.S. Oil Dependence: 2005 Update* (Oak Ridge National Laboratory: Tennessee, February 2005)..

IV. THE PROCESS OF IMPROVING THE FLEET AVERAGE

Having concluded much greater fuel efficiency of the vehicle fleet is justified, we examined the impact of a program to increase fuel efficiency by roughly one mile per gallon per year after a short ramp up period.[18] For purposes of comparison with the recent Energy Information Administration long-term forecast and because the automobile industry needs lead time to make substantial changes, we focus on the twenty years in which the program will be in full effect. We assume an increase of one mile per gallon per year for 20 years after a short transition. The heart of the program would cover 2010 to 2030.

The effort to increase fuel efficiency would focus on new vehicles. This is the way the CAFÉ program works. The analysis started with 250 million-vehicle fleet (see Exhibit IV-1). We assume that 25 million of the current stock are retired every year (a 10 year life). Each year is a cohort; the number of vehicles in use increases by 2 million per year

EXHIBIT IV-1:



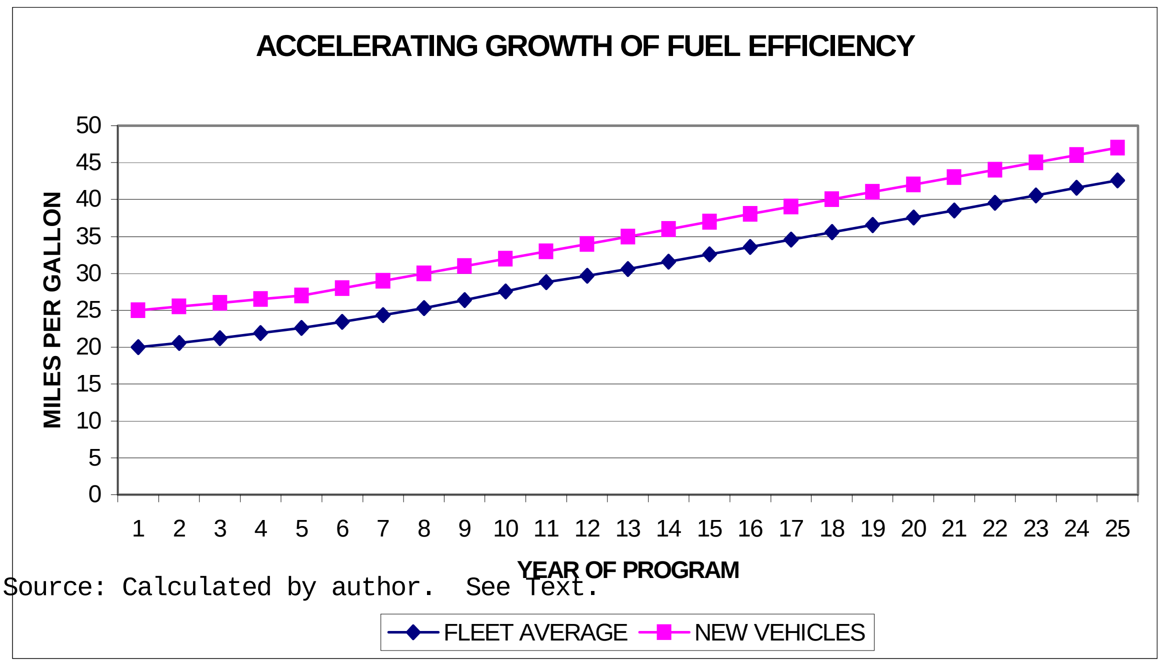
Source: Calculated by author. See Text.

for each new cohort. A generation is the set of cohorts of new vehicles needed to retire the entire current fleet.

Thus, all the cars on the road today are assumed to be retired by Generation 1 over ten years. Generation 2 is the set of cohorts needed to retire Generation 1, etc. Over 25 years the program only gets into the first couple of cohorts of the third generation.

The program fits comfortably into the consumer economic analysis (see Exhibit IV-2). That is, we arrive at 42 MPG for the fleet and 47 MPG for new vehicles, which was easily cost justified in the consumer economic and societal cost benefit analysis.

EXHIBIT IV-2

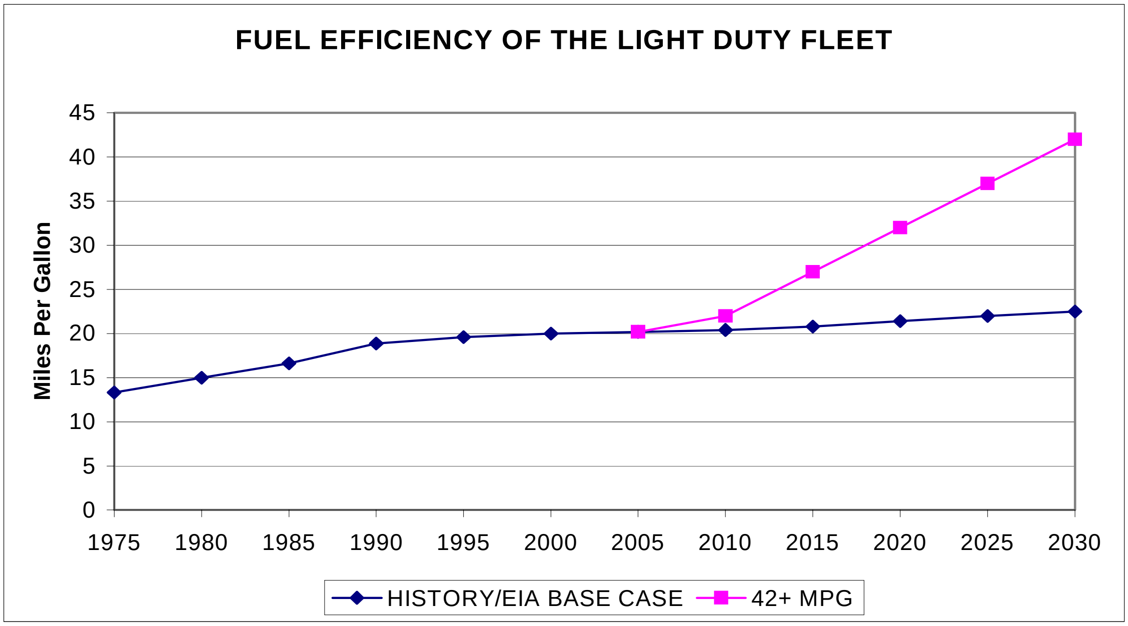


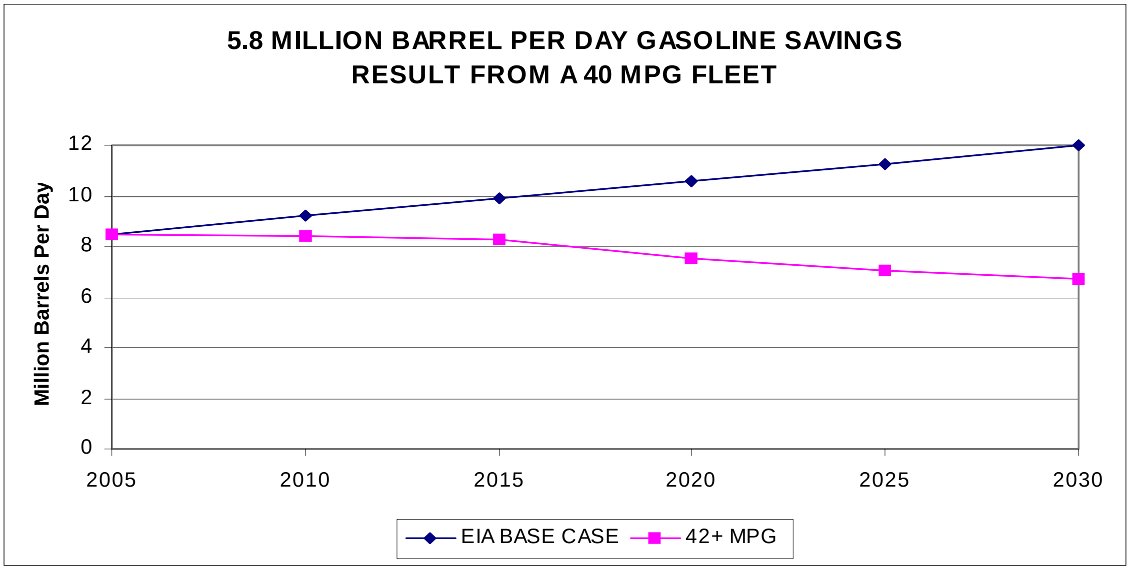
Source: Calculated by author. See Text.

The impact of achieving this level of improvement in fuel efficiency would be substantial. Exhibit IV-3 compares the analyzed program with the most recent EIA projection of the average fuel efficiency of the light duty fleet and the resulting level of gasoline consumption. Fuel economy doubles and consumption declines by over five million barrels a day.

This is a reduction of just under 20 percent of total consumption and over 30 percent of imports.

EXHIBIT IV-3
THE IMPACT OF MOVING AVERAGE FLEET EFFICIENCY TO 42+ MPG





Source: Energy Information Administration, *Annual Energy Outlook 2006 with Projections to 2030* (Washington: February 2006), 42+ mpg goal calculated by author.

V. CONCLUSION AND A REALITY CHECK

Having considered the consumer economics and the dynamics of fleet replacement, we suggest a target of ***50 by 2030***. This would anticipate a modest acceleration of technology over a quarter of a century. Since we show that the consumer is very likely to break even by buying more efficiency, the large societal benefits argue strongly for a vigorous effort to move new vehicles to 50 miles per gallon by 2030. This will pull the fleet average to in excess of 42 miles per gallon. With this added kicker, the program works out to one mile per year for 25 years.

There is no doubt that ***50 by 2030*** is an aggressive goal, but, given the dramatic increase in gasoline prices and the growing concern about the externalities associated with oil consumption, it is not overly ambitious.

For example, if we go back and reconsider the NRC analysis of increases in CAFÉ standards under the assumption of $3.00 oil we find a dramatic shift in the economics of fuel efficiency (see Exhibit V-1). The NRC analysis was constrained by economics, not technology. The NRC scenarios were modeled at an assumed price of gasoline of $1.50 per gallon (in 1999 dollars). Under that constraint, in none of its scenarios did it invest more than $1500. More than half the technologies that were identified were left on the shelf. The current price of $3.00 per gallon is about $2.50 in 1999 dollars. With the benefits of fuel efficiency increased by two-thirds, the economic analysis pulls those technologies off the shelf and into the fleet. We have examined investments costing up to $5,000 and found them cash flow neutral.[19] Also, the NRC did not consider hybrids. The shift in the value of savings has a dramatic impact on the investment that is justified.

NRC’s most aggressive case has been rendered as a “Push the Envelope” proposal by Hirsh, Bezdek and Wendling in their study of peak oil production.[20] It increases fuel efficiency by 45 percent. Hirsh puts short time frames on the scenario see (Exhibit V-2).

EXHIBIT V-1:
INCREASING GASOLINE COST DRAMATICALLY RAISE JUSTIFIED INVESTMENT IN FUEL EFFICIENCY

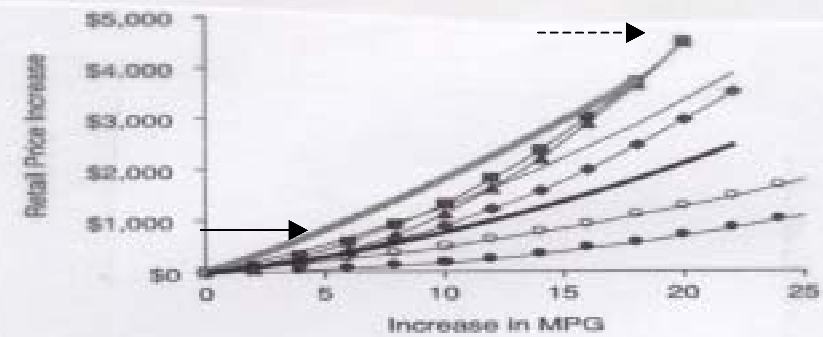


FIGURE 4-5 Passenger car fuel economy cost curves from selected studies.

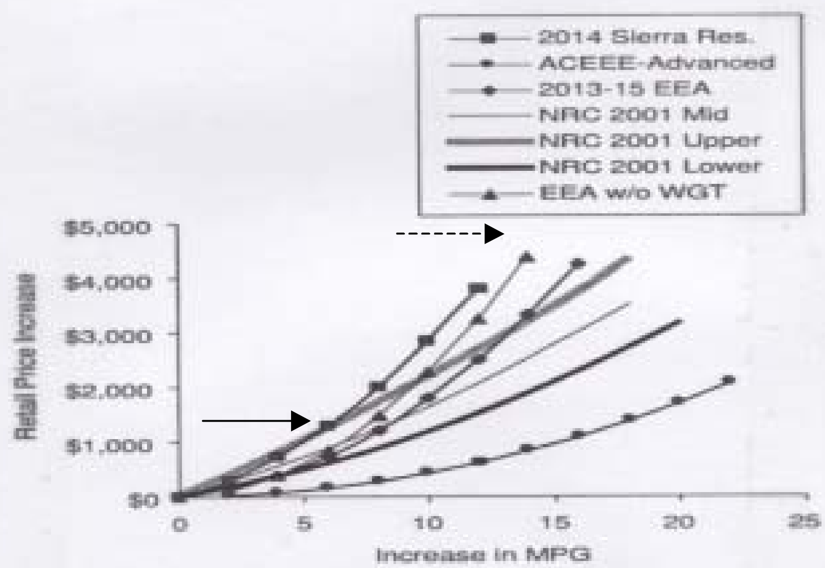
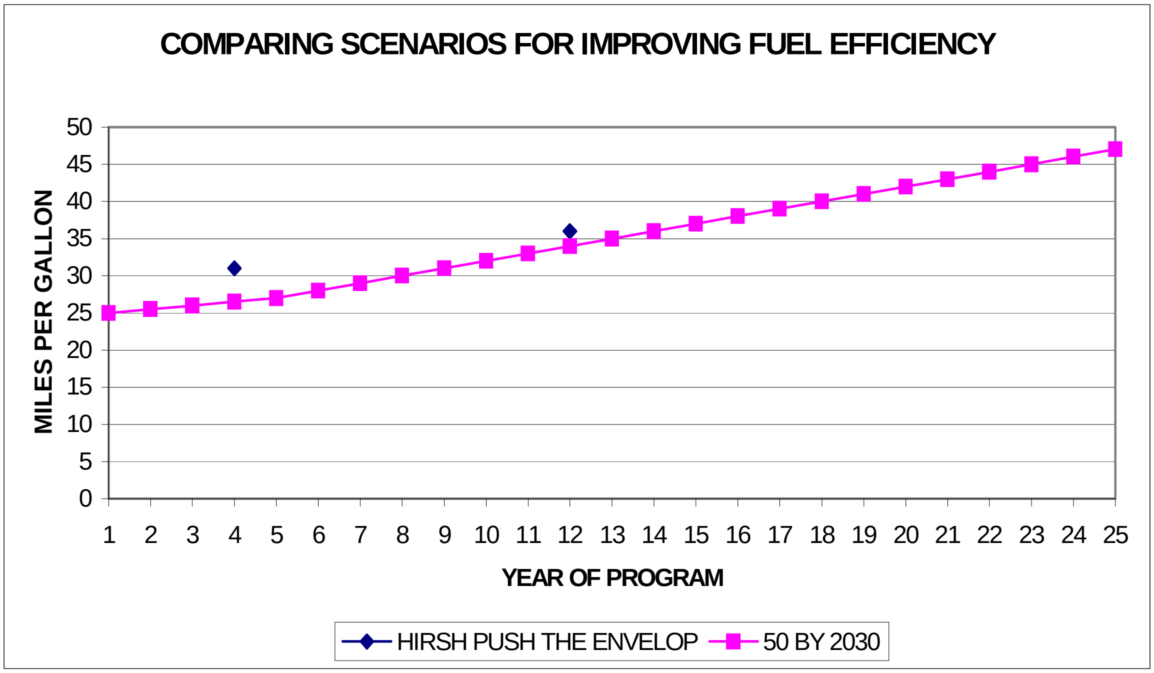


FIGURE 4-6 Light-truck fuel economy cost curves from selected studies.

Source: National Research Council

⟶ = NRC max; -------▶ Max at $3.00/gallon

EXHIBIT V-2:



Source: ***50 by 2030*** calculated by author. Hirsh, Robert L., Roger Bezdek and Robert Wendling, *Peaking of World Oil Production: Impact, Mitigation & Risk Management,* February 2005, p. 77.

Our proposal is to stay on course for a full quarter of a century. The challenge comes in the second half of the program, when technological progress can play a larger part. The examples and analyses presented in this paper involve many simplifying assumptions, but we believe they demonstrate a fundamentally correct point. The current gasoline situation, with prices at $3.00 per gallon and growing recognition of severe societal costs, requires a shift in thinking about the public policy challenges the nation faces in dealing with its “oil addiction.”

All analyses such as this are plagued by the question “what happens if gasoline prices fall?” Given that consumers have been up and down this roller coaster so many times,[21] we think the smart thing to do would be remind ourselves of the huge external benefits, applaud the temporary relief, but not be fooled into thinking the problem is solved, and redouble our efforts to reduce our dependence on oil.

ENDNOTES

[1] Needless to say, opinions abound. The Energy Information Administration, *Annual Energy Outlook 2006 with Projections to 2030* (Washington: February 2006), projects a real price in 2006 dollars of approximately $3.00 per gallon from 2010 to 2030.

[2] Mufson, Steven, “Profits, Prices Spur Oil Outrage,” *Washington Post,* April 28, 2006, p. A1; Fialka, Johmn J., Laura Meckler and Steve LeVine, “Gas-Price Uproar is Likely to Shift U.S. Energy Policy,” *Wall Street Journal,* April 29-30, 2006, p. P1.

[3] EIA, Annual Energy Outlook, p. 145, estimates 2004 average fuel efficiency for new light duty vehicles are 24.9 mpg.

[4] For example, the Lending Tree web site uses a 5 year loan as a default value.

[5] National Research Council, *Effectiveness and Impact of Corporate Average Fuel Economy (CAFÉ) Standards* (Washington: National Academy Press, 2002).

[6] The Consumer Federation of America conducted two polls over the course of 2005 that showed major and growing concern about Middle East imports, available at http://www.consumerfed.org/pdfs/GasPricesRelease090105.pdf

[7] NRC, CAFÉ study.

[8] NRC, CAFÉ study.

[9] Energy Information Administration, *Annual Energy Outlook 2006 with Projections to 2030* (Washington: February 2006), p. 137.

[10] The NRC used a 15600 miles driven starting point declining by 4.5% per year for fourteen years. The total miles driven by the vehicle is 10 percent higher in the NRC analysis. Discounted miles driven is 5 percent higher.

[11] NRC, p. 67. These are routinely used in governmental an academic studies. For example, see “Canada’s Motor Vehicle Fuel Efficiency Initiative,” and Roger H. Dezdek and Robert M. Wendling, “Fuel Efficiency and the Economy,” *American Behavioral Scientist,* 23 (2005).

[12] We have two cost estimates for conventional engines. The low cost conventional estimate is from “Canada’s Motor Vehicle Fuel Efficiency Initiative.” The high cost estimate is from Roger H. Dezdek and Robert M. Wendling, “Fuel Efficiency and the Economy,”American Scientist, 23 (2005).

[13] (Union of Concerned Scientists, January 2003).

[14] The NRC presented its two perspectives in essentially this manner. The consumer perspective was modeled as a short payback view (3 years) with no discount rate. The societal perspective was presented as a long, life to the vehicle perspective with a high discount rate (14 years at 12%).

[15] The author provides a fundamentally incorrect economic analysis because he is distracted by discount on old, fuel inefficient models offered by manufacturers to clear out inventory, which is not a permanent economic feature of the market, he is fixated on hybrids, when, as we have shown, improvement in vehicles up to forty miles per gallon are achievable in conventional engines, and he fails to take resale value into account.

[16] Greene, David L., and Sanjana Ahmad, *Costs of U.S. Oil Dependence: 2005 Update* (Oak Ridge National Laboratory: Tennessee, February 2005).

[17] International Center for Technology Assessment, The Real Price of Gasoline, 1997, Gasoline Cost Externalities Associated with Global Climate Change, September 29, 2004; Gasoline Cost Externalities: Security and Protection Services, January 25, 2005; Lovins, Amory, et al., Winning the Oil Endgame (Rocky Mountain Institute, 2004).

[18] Hirsh, Robert L., Roger Bezdek and Robert Wendling, *Peaking of World Oil Production: Impact, Mitigation & Risk Management,* February 2005, p. 77, allow three years for an aggressive program. Hirsh allows three years.

[19] The NRC also used a more severe economic criterion – three year payback – than our five year cash flow criterion. The three year payback vastly exceeds the investment opportunities available to most consumers. The implicit, or revealed preference on which the 3 year payback period rests does not suggest rational behavior on the part of consumers.   We suspect that the "revealed" preference is being misinterpreted. It may involve many factors, like imperfect information, an inability to project prices and do life cycle cost calculations, marketing by auto manufacturers, etc.

[20] Hirsh, Robert L., Roger Bezdek and Robert Wendling, *Peaking of World Oil Production: Impact, Mitigation & Risk Management,* February 2005.

[21] Consumer Federation of America, *Ending the Oil Price Spiral: Market Fundamental for Consumer-Friendly Policies to Stop the Wild Ride* (Washington, D.C.: July 2001); *Record Prices, Record Prices, Record Oil Company Profits: The Failure of Antitrust Enforcement to Protect American Energy Consumers* (Washington, D.C.: September 2004); *Debunking Oil Industry Myths and Deception: The $100 Billion Consumer Rip-Off: A Report on Rising Gas Prices and Industry Profits* (Washington, D.C.: May 3, 2006).