Automakers' Corporate Carbon Burdens

UPDATE FOR 1990-2003

EXECUTIVE SUMMARY

ENVIRONMENTAL DEFENSE
finding the ways that work

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ENVIRONMENTAL DEFENSE

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Cover photo: PhotoEdit, Inc. GMC Sierra pickup truck displayed at a car dealership.

Our Mission
Environmental Defense is dedicated to protecting the environmental rights of all people, including the right to clean air, clean water, healthy food and flourishing ecosystems. Guided by science, we work to create practical solutions that win lasting political, economic and social support because thy are nonpartisan, cost-effective and fair.

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Executive summary

Global climate change is one of the gravest environmental threats the world faces. Caused mainly by human activities that release greenhouse gases, global warming poses serious risks to ecosystems, economies and human health. Responding to the threat requires a concerted effort by all parties whose policies shape and drive energy use. Automobiles (cars and light trucks) are of primary importance in efforts to reduce greenhouse gas emissions, since burning motor fuel releases carbon dioxide (CO_2), the main heat-trapping gas. Automobiles account for 20% of the nation's CO_2 emissions and 62% of CO_2 emitted by the U.S. transportation sector, itself the largest source of greenhouse gas emissions in the United States.

Because the United States is the world's largest emitter of greenhouse gases, our automobiles account for a significant portion of the world's heat-trapping pollution—about 5% of the global energy-use related CO_2 emissions. Automotive CO_2 emissions are also linked to the nation's oil dependence, with car and light truck CO_2 emissions corresponding to the single largest portion (40%) of the nation's petroleum consumption.

Updating our 2002 study, *Automakers' Corporate Carbon Burdens: Reframing Public Policy on Automobiles, Oil and Climate,* this report analyzes the automobile's global warming impact in terms of *carbon burden,* a way of measuring the annual average CO_2 emissions over the life of a group of vehicles. Automotive carbon burdens are influenced by many parties, including public officials who finance and shape the transportation system, oil companies that supply motor fuel, automakers and consumers themselves. This report focuses on automakers because their product strategies have a profound influence on CO_2 emissions.

The effectiveness of any corporate action or public policy for cutting CO_2 emissions is ultimately measured by tons of carbon reduced, rather than the type of technology or fuel used. Similarly, the effectiveness of measures to reduce petroleum dependence is measured in terms of barrels of oil consumption avoided. By focusing on these bottom-line metrics of "barrels and tons" (of oil and carbon, respectively), this report provides a framework for assessing strategies to reduce the substantial and growing portion of greenhouse gas emissions and oil demand created by automobiles in the United States.

The report highlights new vehicle CO_2 emissions by automaker for the period 1990–2003. It also reviews the historical trend of total U.S. light vehicle carbon emissions, analyzing the on-road stock of all vehicles, both new and used, during the period 1970–2003. We focus here on the CO_2 emitted when cars are driven. CO_2 and other greenhouse gases are also emitted during the manufacture of cars and components, accounting for about 11% of the total "cradle-to-grave" emissions associated with automobiles. The remaining 89% is essentially proportional to the amount of fuel cars burn, although about 30% of these emissions occur at petroleum refineries and elsewhere in the fuel supply chain.

National trends in automotive carbon emissions

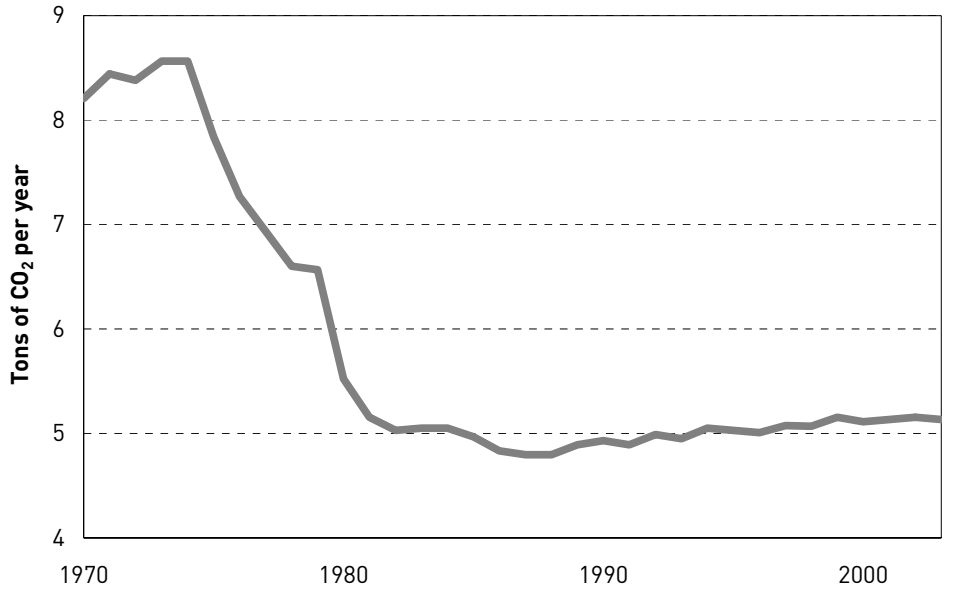
Automobiles are the largest source of U.S. greenhouse gas emissions where we are seeing no improvement. The total quantity of CO_2 emissions, as well as the average emissions rates of all automakers' fleets, continue to rise despite notable changes in factors thought to influence emissions. In particular, the past five years have seen much higher gasoline prices than 1990–98 as well as remarkable progress in automobile technology, highlighted by the introduction of hybrid-electric cars. However, as shown in Figure ES1, these trends have made little difference in new fleet CO_2 emissions rates. In fact, annual sales of even a million hybrids—which some analysts now foresee as soon as 2010—would not suffice to offset even half the increase in CO_2 emissions and oil dependence observed in the auto market between 1990 and 2003.

INCREASING TRAVEL AND STAGNATED CAFE STANDARDS

Total U.S. car and light truck carbon emissions—the sum of emissions for both new and used vehicles—topped 317 million metric tons of carbon (MMTc) in 2003. This CO_2 emissions level is equivalent to 8.6 million barrels of gasoline consumption per day, or 132 billion gallons per year. It represents net growth of 64% from 1970 and a 25% increase from the 1990 level, a common base for climate policies. Nevertheless, the 64% growth in carbon emissions is much less than the 160% jump in vehicle miles of travel from 1970 to 2003 because of the rapid improvement in new vehicle fuel economy between 1974 and 1981.

This effect is also illustrated in Figure ES1, which depicts the changes in

FIGURE ES1
Average new car and light truck CO_2 emissions rate



Source: Derived from Hellman and Heavenrich (2004).

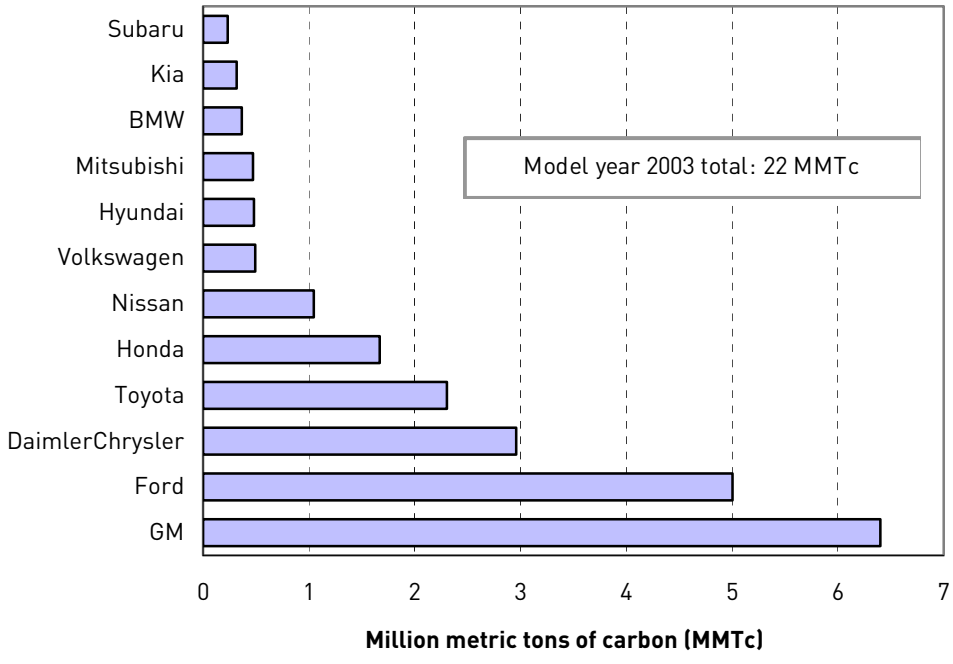
average new vehicle CO_2 emissions rate (an inverse of average fuel economy) from 1970 to 2003. The sharp decline in the average new vehicle emissions rate between 1974 and 1981 reflects the new vehicle fuel economy improvements that were driven by the oil shocks and Corporate Average Fuel Economy (CAFE) standards. From 1988 onwards, the emissions rate has climbed gradually as regulations stagnated while sales shifted from cars to light trucks.

Carbon burdens of major automakers

The six largest automakers in the U.S. market—GM, Ford, DaimlerChrysler (DCX), Toyota, Honda and Nissan—had an 87% market share and accounted for 88% of the new fleet carbon burden in 2003. The next six firms—Volkswagen, Hyundai, Mitsubishi, BMW, Kia, and Subaru—had a combined market share of 12% in 2003 and accounted for nearly all of the remaining new fleet carbon burden. The ranking of new vehicle carbon burdens of these 12 firms follows their market share, with GM accounting for the largest share, and Subaru claiming the smallest part as shown in Figure ES2.

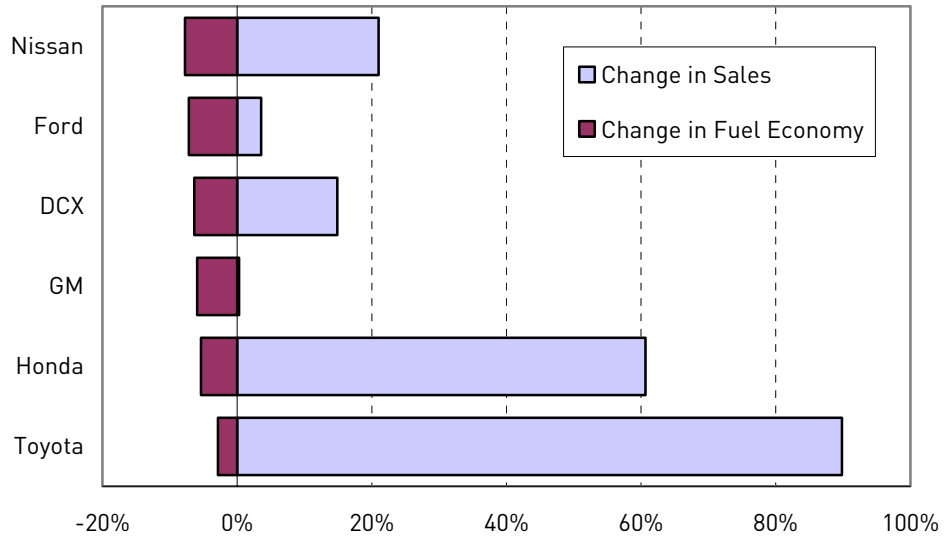
Focusing on the Big Six, Figure ES3 shows each firm's carbon burden growth from 1990 to 2003 broken into its two components, sales increase and fuel economy decrease. The average fuel economy for all Big Six automakers decreased from 1990 to 2003, largely due to each firm's rising truck fraction (proportion of trucks in its total sales), resulting in increased fleet-average CO_2 emissions rates. All automakers significantly expanded their light truck offerings, with the overall light truck fraction growing 21 points over this 14-year period.

FIGURE ES2
Carbon burdens of automakers' U.S. new vehicle sales in 2003



Source: Authors' analysis of NHTSA CAFE data and data from NHTSA (2004) and NHTSA (2005)

FIGURE ES3
Breakdown of growth in Big Six carbon burdens over 1990-2003



Source: Derived from NHTSA CAFE data, NHTSA (2004) and NHTSA (2005).

Nissan had the largest increase in its average CO_2 emissions rate due to the combined effect of rising truck fraction and declining truck fuel economy. Toyota's 95% increase in new vehicle carbon burdens was the greatest among the Big Six, but its fuel economy declined the least; its carbon burden increase was due predominately to its sales success.

Two other trends have been serving to increase oil dependence and CO_2 emissions by U.S. cars and light trucks. One is the Big Three's growing reliance on flex-fuel vehicle (FFV) credits. Federal law gives automakers extra fuel economy credit for selling flexible-fuel vehicles, regardless of whether alternative fuel is actually used. These credits then enable the companies to sell less fuel-efficient vehicles. The use of flex-fuel credits pushed GM's 2003 CO_2 emissions rate 2% higher, Ford's 3% higher, and DCX's 0.2% higher than if they had met CAFE standards without using the credits. None of the Asian or other automakers have exploited this dysfunctional aspect of federal policy.

The other adverse trend is an apparent increase in sales of heavier light trucks (those between 8,500 and 10,000 pounds gross vehicle weight). These vehicles are mainly three-quarter and one-ton pickups, but include a growing number of the largest SUVs, such as the Hummer H2, some models of the Chevy Suburban and Tahoe (and their GMC variants), and the Ford Excursion. Because these vehicles escape CAFE regulation and federal agencies fail to track them, we cannot quantify the additional carbon burdens associated with their sales. In any case, the actual carbon burdens of the Big Three are even larger than what is estimated here using data for only the CAFE-regulated (under 8,500 pound) fleet.

What follows is a summary of the key findings regarding new fleet CO_2 emissions trends for each of the Big Six and notable points for other automakers

during the period of 1990–2003, derived from fuel economy and sales data for their CAFE-regulated fleets.

GENERAL MOTORS

CO_2 emissions rate up 6.3% while market share dropped 6.8 points; still the largest carbon burden overall.

- The 6.4 MMTc carbon burden of GM's model year 2003 fleet accounted for 29% of the total new light-duty fleet carbon burden.
- GM's new car fuel economy improved over each of the past four years, reaching a value 5% higher in 2003 than it was in 1990.
- Light trucks rose from 28% of GM's sales in 1990 to 56% as of 2003 while showing no trend toward fuel economy improvement.
- Increasing reliance on FFV credits pushed GM's 2003 CO_2 emissions rate nearly 2% higher than if the company had met CAFE standards without the credits.
- GM's new fleet-average CO_2 emissions rate was 6.3% higher in 2003 than it was in 1990, as rising light truck share and FFV credits more than offset the recent increase in GM's car fuel economy.

FORD

CO_2 emissions rate up 7.7% while market share dropped 4.4 points; heavy use of flexible fuel vehicle credits contributes a 3% increase in emissions.

- Ford's new fleet carbon burden of 5.0 MMTc accounted for 23% of the market total in 2003.
- Light trucks rose from 35% of Ford's sales to 59% as of 2003 while the average fuel economy of Ford's light trucks dropped by 2% compared to 1990.
- Ford's SUV fuel economy dropped in 2003 after having risen for two years following the company's now-abandoned July 2000 pledge to improve it.
- Ford makes extensive use of FFV credits, inflating its combined CAFE by an estimated 1.1 mpg as of 2003 and making its new fleet-average CO_2 emissions rate 3% higher than if it had met CAFE standards without credits.
- As result of these factors, Ford's new fleet-average CO_2 emissions rate was 7.7% higher in 2003 than it was in 1990.
- To compensate for its 7.7% increase in fleet-average CO_2 emissions rate, Ford would have to sell over 650,000 hybrids (20% of its 2003 sales) with the same average fuel savings as the Escape Hybrid.

DAIMLERCHRYSLER

CO_2 emissions rate up 6.8% while market share declined 1.1 points; greatest dependence on trucks, though revealing recent signs of fuel economy improvement.

- DCX's new fleet carbon burden of 3.0 MMTc accounted for 14% of the total new light-duty fleet carbon burden in 2003.
- DCX's truck share increased by 24 points to reach 74% in 2003, the highest among the Big Six automakers.
- While its car CAFE revealed no obvious trend, DCX's truck fleet fuel economy rose 6% over the past two years but as of 2003 remains down a net 2% from its 1990 level.

- More extensive use of FFV credits inflated DCX's 2003 combined CAFE by 1 mpg, pushing its average CO_2 emissions rate 4.4% higher than it otherwise might have been.
- As a result of higher truck share and lower fuel economy, DCX's new fleet-average CO_2 emissions rate was 6.8% higher in 2003 than it was in 1990.

TOYOTA

CO_2 emissions rate up 2.9% while market share gained 4 points; greatest growth in carbon burden but smallest increase in CO_2 emissions rate among the Big Six.

- Toyota's new fleet carbon burden saw net 95% growth from 1990, reaching 2.3 MMTc in 2003, 11% of the market total.
- The 15-point increase in Toyota's truck share drove its CO_2 emissions rate up by 2.9% over 1990–2003, despite a 4.9% improvement in its car CAFE.
- Toyota's average light truck fuel economy was the same in 2003 as it had been in 1990 despite an extensive expansion of the company's lineup into SUVs and larger and more powerful trucks generally.
- Toyota's sales success accounted for 92% of its 95% increase in carbon burden and its declining overall CAFE accounted for 3% of the increase.
- To compensate for its 2.9% increase in fleet-average CO_2 emissions rate, Toyota would have to sell 150,000 hybrids (8% of its sales) with the same average fuel savings as the Prius and Lexus RX400h.

HONDA

Rapidly growing truck fraction pushed CO_2 emissions rate up 5.7% while market share gained two points, but still the fuel economy leader.

- Honda's 2003 carbon burden reached 1.7 MMTc, attributing to 8% of the total new light-duty fleet carbon burden.
- Since entering the light truck market in 1997, Honda's truck share grew at an average 5.6 points per year, reaching 39% in 2003.
- The company's truck fleet CAFE dropped by 8% since 1997, while its car fleet CAFE rose by 7% over 1990–2003.
- Driven by its growing truck fraction, Honda's CO_2 emissions rate increased by 5.7% from 1990 to 2003, even though its emissions rate is still the lowest among the Big Six.
- To compensate for its 5.7% increase in fleet-average CO_2 emissions rate, Honda would have to sell over 300,000 hybrids (22% of its 2003 sales) with the same average fuel savings as the Civic and Accord Hybrids.

NISSAN

CO_2 emissions rate up 8.4% while market share lost 0.2 points; growing truck reliance and declining truck CAFE.

- The 1.0 MMTc carbon burden of Nissan's 2003 new fleet was responsible for 4.8% of the total new light-duty fleet carbon burden in 2003.
- Notwithstanding great fluctuations in sales over the period, Nissan's market share reached 5% in 2003, about the same as the 1990 level.
- The truck fraction of Nissan's sales grew from 25% to 36% over 1990–2003, while its light truck fuel economy was 13% lower in 2003 than in 1990.

- Falling truck fuel economy and growing truck share pushed Nissan's average CO_2 emissions rate up 8.4% in 2003, the largest increase among the Big Six.

OTHER FIRMS

The "Next Six" automakers, in order of 2003 market share, are Volkswagen, Hyundai, Mitsubishi, BMW, Kia, and Subaru. Their collective sales nearly tripled between 1990 and 2003, when their combined market share reached 12% and they accounted for 11% of the new fleet carbon burden.

- Volkswagen more than doubled its market share 1990–2003 while improving fuel economy and cutting its fleet-average CO_2 emissions rate by 3.3%. Volkswagen's 2003 new fleet average CO_2 emissions rate was the lowest among the 12 automakers examined here.
- Hyundai nearly tripled its market share over 1990–2003 but had the worst increase (16%) in new fleet-average CO_2 emissions rate among major automakers, shifting it from having the lowest new fleet CO_2 emissions rate in 1990 to the 3rd lowest in 2003.
- Mitsubishi's market share generally declined through 1998, but rebounded by 2003; following the truck trend, its CO_2 emissions rate increased 6% over the 1990–2003 period.
- BMW improved its average fuel economy by more than any other firm, reducing its new fleet CO_2 emissions rate by 12.7% over a period in which it achieved a nearly fivefold increase in U.S. sales.
- Kia has steadily gained sales since entering the U.S. market in late 1993, but its new fleet CO_2 emissions rate rose 27% as it increased its truck sales and converged toward the market average.
- Subaru's market share had little net change from 1990 to 2003 and its new fleet-average CO_2 emissions rate increased 3% over the period.

The steady rise of light trucks

As noted above for nearly all automakers, the dominant factor for CO_2 emissions in the new vehicle market has been the steady rise of the light truck fraction of each company's fleet. This phenomenon started in the 1980s and has progressed in several waves. First was the introduction of the minivan in 1984, followed by the modern sport-utility vehicle (SUV) beginning in 1989 and exploding in share throughout the 1990s. Most recently the trend has included a growing popularity of various "crossover" vehicles, with body styles that blend the traits of traditional vehicles. Examples include car-based SUVs—such as "sport wagons" that once simply would have been called station wagons—as well as minivan-SUV and pickup-SUV hybrids (*not* the "hybrid-electrics" of recent fame).

Automakers are classifying nearly all of these new and trendy designs as trucks in order to ease their compliance with CAFE standards. Because light trucks are held to a lower standard—20.7 mpg as of model year 2003, compared to 27.5 mpg for cars—this strategy helps in several ways. Simply moving a vehicle from a car fleet to a truck fleet subjects it to a lower standard. Then, because vehicles that were once cars or derived from cars are generally more fuel-efficient than trucks, the averaging approach on which CAFE is based enables an

automaker to sell more of the large trucks on which profit margins have been so high. Finally, because vehicles shifted into the truck category are typically less efficient than the average car, the company's remaining cars can more easily meet the car standard. Since 1988, when new fleet fuel economy peaked, the market share of vehicles classified as light trucks has climbed from 30% to 51%. It is this car-truck shift that largely accounts for the 7% increase in new fleet-average CO_2 emissions rate over this period.

Given the regulations in effect through 2003, light trucks on average emit 39% more CO_2 per mile traveled than passenger cars. Therefore, light trucks accounted for 59% of the new fleet carbon burden in 2003, disproportionately more than their 51% sales share. If the light trucks that have substituted for passenger cars during the period of market shift had been required to meet the passenger car CAFE standard, U.S. automobiles would consume 536,000 fewer barrels per day of gasoline and would have emitted 20 MMTc per year less carbon in 2003. This would be equivalent to the annual carbon emissions from about thirty 300-megawatt coal-fired electric power plants.

A look at the recent market trends suggests that the car-to-truck classification shift shows no sign of slowing down. All of the Big Six have rising truck fractions. DaimlerChrysler's is the highest, reaching 74% in 2003 as noted above. Honda's has been growing most rapidly because it is playing catch-up in the truck market. The overall truck share has been growing in an essentially linear fashion since 1980, when it was only 17% (it had averaged around 20% through the 1970s). Extrapolating the average gain of 1.5 points per year would put the new light truck share at 60% before the end of the decade.

The National Highway Traffic Safety Administration (NHTSA), which oversees CAFE regulations, is investigating increases in the light truck standard as well as reforms in how vehicles are classified and how the standards are structured. Significantly higher light truck standards would be one important step for slowing the rise in auto sector CO_2 emissions.

Reducing automobile carbon burdens

Many actors are involved in the decisions that determine what kind of cars are built and sold, how much they are driven and how they are fueled. Thus, cutting the carbon burdens of cars is a shared responsibility, though the auto industry is a dominant player.

The past several years have seen shifts in automakers' public positions on global warming. Not long ago, many firms and particularly the Big Three denied the problem and carried out campaigns to undermine U.S. support for climate action. Now, all firms profess a desire to help solve the problem. In 1998, major automakers made voluntary agreements with the European Union to cut their fleet-average CO_2 emissions rates. The recent World Business Council for Sustainable Development's *Mobility 2030* report, endorsed by the Big Six of the U.S. market (plus Renault and Volkswagen), recommended a goal of limiting GHG emissions to sustainable levels. Automakers have started reporting emissions from their fleets and factory operations; they now regularly publicize new technologies and other activities promising emissions reductions.

Nevertheless, as this report shows, automakers have made little progress in cutting CO_2 emissions in the United States, the world's largest auto market. With few exceptions, their product strategies have made emissions worse. What's missing is a constructive stance on public policy, which is essential for resolving the inherent tension between market forces and non-market concerns such as global warming and energy security. In short, automakers need to embrace balanced but meaningful regulation in order to be true to their promises to meet these challenges. There is no other way to break out of the competitive box that binds product strategies and design priorities to offering consumers almost everything imaginable but doing very little to address the huge, non-market problems of global warming and oil dependence.

Automakers rightly point out that lack of customer interest is a barrier to higher fuel economy, in contrast to when CAFE standards were established during the oil crisis. Indeed, an extensive public education effort to make fuel efficiency matter more to consumers is needed as part of a broader public strategy to realign market signals and establish U.S. leadership in addressing oil consumption and global warming. The auto industry's cooperation and expertise could help guide such endeavors, but effective steps seem unlikely until automakers take a more positive approach in the crucial area of regulation. A good-faith effort on the industry's part would open the door to developing more comprehensive policy solutions for the cars vs. climate challenge.