S. HRG. 107–1133

NATIONAL SECURITY, SAFETY, TECHNOLOGY, AND EMPLOYMENT IMPLICATIONS OF INCREASING THE CAFE STANDARDS

HEARING

BEFORE THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION UNITED STATES SENATE

ONE HUNDRED SEVENTH CONGRESS

SECOND SESSION

JANUARY 24, 2002

Printed for the use of the Committee on Commerce, Science, and Transportation

U.S. GOVERNMENT PRINTING OFFICE

94–387 PDF WASHINGTON : 2006

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512–1800; DC area (202) 512–1800
Fax: (202) 512–2250 Mail: Stop SSOP, Washington, DC 20402–0001

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ONE HUNDRED SEVENTH CONGRESS

SECOND SESSION

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NATIONAL SECURITY, SAFETY, TECHNOLOGY, AND EMPLOYMENT IMPLICATIONS OF INCREASING THE CAFE STANDARDS

THURSDAY, JANUARY 24, 2002

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
Washington, DC.

The Committee met, pursuant to notice, at 9:55 a.m. in room SR–253, Russell Senate Office Building, Hon. John F. Kerry, presiding.

OPENING STATEMENT OF HON. JOHN F. KERRY, U.S. SENATOR FROM MASSACHUSETTS

Senator KERRY. The hearing will come to order. I would like to welcome our first panel, Ambassador Eizenstat, Ms. Claybrook, Mr. Lund and Mr. Hoerner. We have a lot of business to cover. I appreciate everybody's patience.

We now are convening the full Committee for a hearing on national security safety technology and employment implications of increasing the CAFE standards. We have had three prior hearings. The most recent one was in December, when we heard from those in the industry and others about their views on aspects of the CAFE standards, and we reserve this final hearing to really analyze the feasibilities and the rationale. Why is this compelling? Is this compelling? Are there reasons for us to consider this as a matter of policy now? The staff has done an extraordinary amount of work in the last few months. We've been talking with literally dozens of different people who are impacted by or have an impact on this particular issue, and I think we have come to have a pretty good understanding of choices not made and choices yet that we face with respect to it, and we will be making some recommendations in the next few days.

One of the dynamics in this issue that makes it complicated is, frankly, the lack of effort in past years by the industry itself to adopt different practices, so we are confronted with one of those Hobson's choices where the industry comes in and says, well, if you force us to do X, Y, or Z, it is going to have the following impact on us, and of course we are put into the quandary of having some impact, but as a consequence of their own lack of having made some wiser choices. Our job is to make good policy choices for the country and to protect our citizens and to make some tough judgments about what we think is feasible, and also to be sensitive. I am not trying to suggest we should do it without sensitivity to what impacts may occur, and we are not going to be insensitive.

I think we are going to do this in a thoughtful way, but at the same time there are some facts that tell different stories. Let me just point one out to everybody as just sort of framing this discussion. Here is a graph. You cannot see it—I regret it is not blown up—but you can see a huge part of the graph here and four components of it.

This is how new technology has been used from 1988 until the year 2001. 53 percent of new technology since 1988 has gone into horsepower, 18 percent has gone into acceleration, 19 percent has gone into weight in one form or another, fuel economy minus 8 percent, so the industry has been pushing horsepower and acceleration while the national urgency with respect to emissions and fuel consumption has been waning, and I could show you another graph where it has just been going down. We are at an all-time low since 1970.

That cannot continue, and I made it clear in my comments on energy on Tuesday that many of us feel we need to do something on the CAFE standard. We will be meeting as a committee, and I am not going to suggest it by myself. We are going to meet in the next days, talk to Senator McCain, to Republican Members of the Committee and to Democratic members and try to see if we can find some consensus, and at that point we will have a markup sometime shortly after we have done the internal work of the Committee Members themselves, so that is where we are in the process today.

We really look forward to examining what is feasible, what can be achieved, what are the realities of the science, what are the compelling considerations here as a matter of national policy, and try to sort our way through those as well as we can.

Let me ask Senator, if anyone else has a statement. Senator McCain.

STATEMENT OF HON. JOHN McCAIN,
U.S. SENATOR FROM ARIZONA

Senator McCAIN. I thank you for convening this hearing, Mr. Chairman, on Corporate Average Fuel Economy (CAFE) standards. This is an important issue for future generations of the country, and I hope today's testimony will assist the Committee as we work together to develop a balanced approach to address this complex issue.

While I applaud the Administration's recent commitment to developing hydrogen-powered fuel cell vehicles, and its "Freedom CAR" partnership with private industry, I do not believe it would be sound policy for the Federal Government to place all of its eggs in the basket of the hydrogen fuel cell program. As we eagerly anticipate the results of that program, we must, at the same time, take necessary steps to improve fuel efficiency without unduly compromising safety.

Last year, the National Academy of Sciences (NAS) report concluded that the benefits resulting from CAFE clearly warrant government intervention to ensure fuel economy levels beyond what may result from market forces alone. The NAS committee found that CAFE has caused marked improvements in reducing greenhouse gas emissions, fuel consumption, and dependence on foreign

oil. The NAS warned, however, that CAFE standards have probably resulted in increased traffic fatalities due to downsizing and downweighting of vehicles by manufacturers in their efforts to comply with the standards. As the Commerce Committee further examines this issue, it is imperative that we account for any unintended consequences. As the NAS committee suggests, we can achieve better fuel economy without having to compromise passenger safety.

The Debate over CAFE is complex, because it requires striking a careful balance among many factors, and this debate is long overdue.

I thank you, Mr. Chairman, and look forward to the testimony.

Senator KERRY. Thank you very much, Senator McCain. Senator Dorgan.

STATEMENT OF HON. BYRON L. DORGAN, U.S. SENATOR FROM NORTH DAKOTA

Senator DORGAN. Mr. Chairman, let me just briefly make a couple of comments. I serve on the Energy Committee, as well as the Commerce Committee. This is an important issue. If you look at energy demand, a substantial increase in demand over a long period of time has come from the transportation sector. You must, it seems to me, with respect to an energy policy, deal with not only increased production but also conservation, increased efficiency, and renewable and limitless resources, so all of this is important.

I would be remiss if I did not say I come from a state that has more miles of roads per person than anyone else in the country. We pay nearly the highest amount of money for fuel tax per person. We drive a substantial number of pickup trucks. It is a rural state with farmers and so on. We need to have a thoughtful and balanced approached with respect to these efficiencies, but I want to make one final point. I have made it before, but it is worth making again.

My first automobile was a car that I bought for $25 when I was a teenager. It was 1924 Model T Ford, and I bought it and restored it at age 14. It was a wonderful experience. I put gasoline in the 1924 Model T Ford the same way I put gasoline in my 1997 car. You just take the hose and stick it in the tank, and you pump gas. Nothing has changed in 77 years. Nothing.

That is why I believe that the fuel cell and other approaches also makes sense. If we do not proceed to deal with technology and begin to wean ourselves from the internal combustion engine and gasoline in the long term, we are simply talking about policies that have serious implications for this country, and so yes, I want to deal with the issue of efficiency in a thoughtful, careful way, but I also want us to be understanding that over 75, 80 years ago we should have been able to develop some new technologies that address some of these issues as well.

And Mr. Chairman, thank you for holding this hearing. We will be holding similar inquiries, in the Energy Committee and talking about these issues as well, but thanks for your leadership.

Senator KERRY. Thank you very much, Senator. I might just comment that interestingly, you were talking about things that have not changed, only 15 percent of the chemical energy in gasoline is used to propel a typical vehicle. 85 percent is gone. I mean, that

is why the industry respondents themselves have agreed by 5 to 1 that the internal combustion engine still has very significant room for increases in overall efficiency, and there are many technologies—we are going to listen to some of them this morning—that could enhance that.

We have a very distinguished panel. I welcome you. Thank you for taking time to be here today. Ambassador, or Deputy Secretary—I am not sure which title he prefers, but he comes with an extraordinary background in these issues and I must say I have personally witnessed his negotiating skills on difficult issues. I think we have been well-served to have his counsel involved in Government for a long period of time. He was President Carter's chief domestic policy advisor at a time when the energy issue first surfaced.

We welcome Ambassador Eizenstat here. Joan Claybrook, a longtime involved in these issues, of Public Citizen, Mr. Adrian Lund, the chief operating officer of the Insurance Institute for Highway Safety, and Andrew Hoerner, the Center for Sustainable Economy, director of research.

Thank you all for being here today. We will start off, Ambassador, with you. Thank you.

STATEMENT OF AMBASSADOR STUART E. EIZENSTAT, PARTNER, COVINGTON & BURLING

Ambassador EIZENSTAT. Thank you, Mr. Chairman, Senator McCain, Senator Dorgan, Senator Breaux. I have been asked to speak primarily about the national security implications of our dependence on foreign oil, and before I begin my formal remarks, Chairman Kerry, let me applaud your alternative energy plan that was unveiled earlier this week.

The lessons of the impact of our dependence on foreign oil supplies were first taught to us back in 1973–1974, with the initial Arab oil embargo, when crude oil prices quadrupled from 1972 to 1974. In large measures spurred by that embargo, Congress in 1975 passed the Energy Policy and Conservation Act, which included provisions for establishing CAFE standards. I was in the middle of that debate as chief domestic policy advisor to President Carter, and remember very well being part of the team that developed CAFE standards and a meeting we had in the Cabinet room with President Carter and the heads of the three big automobile manufacturers. They said that it was impossible to reach the standards that we were considering, starting at 18 miles per gallon in 1978 to 27½ miles per gallon in 1985. The technology did not exist. It was simply impossible and too costly.

And yet, once the CAFE standards were implemented, all three companies met and, indeed, exceeded those standards, so as you embark upon this important process, I feel confident that automobile manufacturers do have the ability to achieve, and even surpass considerably, the standards that have been previously set.

In terms of the national security implications, at present we import about 51 percent of our oil, and that is projected to increase to 64 percent within 20 years. This places us in a precarious national security position. Each year, we import 16 percent of our oil from Saudi Arabia and an additional 9 percent from other States

in the Persian Gulf. Our dependence on oil from the Middle East is fraught with insecurity and danger. These were horrible reminders, of course, on September 11, when terrorist threats both at home and abroad showed linkages, direct or indirect, with oil-producing States in the region.

Our reliance on States that are unstable or in some cases even hostile to the United States presents a very real national security dilemma. Some countries like Iran and Iraq are actively hostile. Others, like Saudi Arabia, have been and remain historically friendly to us, but rest on power bases that might not have broad public support and that have their own internal fundamentalist threats.

While we have a national security interest in the stability of those regions and those regimes, we must remain aware of the possibility that they could fall into hostile hands. I can assure you that we had no anticipation that the Shah of Iran would be toppled so quickly during the Carter years. No one could have forecast the Iranian revolution. The rise to power of Ayatollah Khomeini, the first radical fundamentalist, altered our relationship with Iran and led to one of the most difficult events of the past 25 years, the Iran hostage crisis. At the time of that revolution, oil production from Iran dropped precipitously and oil prices in the U.S. skyrocketed.

The Iranian revolution resulted in the loss of 2 to 2½ million barrels of oil per day from November 1978 to June 1979, and during a 1-year period, from the beginning of 1979 to the beginning of 1980, oil prices rose by 120 percent, delivering a knock-out blow to the U.S. economy.

Another smaller supply interruption occurred during the Iran-Iraq war from 1980 to 1988. The impact was certainly more mild, but still worrisome. Today Iran supports terrorist organizations like Hezbollah, who seek to destroy the Middle East peace process, and is also on a crash course to develop medium-range missiles with potential chemical or nuclear warheads able to reach Israel in a few years. There is no reason to think they will stop there, and we must be concerned by the possibility that they will try to develop long-range missiles that can hit the United States. Clearly, and obviously Iraq is not a reliable partner, either.

Our dependence on oil from the Middle East profoundly influences our economy and our foreign policy. Our decision to take military action against Iraq after the invasion of Kuwait was, at a minimum, heavily influenced by our dependence on oil from the Persian Gulf. It led us to commit more than 500,000 American troops during the gulf war, more than 600 of whom were killed or wounded. At present, we have 4,500 troops in Saudi Arabia and 12,500 naval personnel at sea in the Persian Gulf. The presence of these troops is intended, of course, to protect the governments in the region, but it also leads to resentment, resentment that was at the heart of the September 11 attacks.

The U.S. now finds itself torn between its interests in supporting stable governments in the gulf, and the hostility and danger present to American troops on foreign soil. I for one believe it is critical that we remain, and continue to have a military presence there, but in the end, our dependence on Persian Gulf oil and

Saudi oil, in particular, leaves us vulnerable to attack at home and abroad.

The lessons of the past 25 years in the gulf are clear. Regional instability there is real, with tangible effects here in the United States. If we do not take action at home to reduce our reliance on oil from abroad, we run the risk of falling prey to the very same problems we have lived through in the past. We have remained dependent on a region where, in the past 2 decades, we have fought 2 wars, and the tide of anti-Americanism continues to rise. Tension between modern and radical Islam threatens the ruling elites of the governing regimes and yet, in spite of all of this, we continue to import 25 percent of our daily supply from the gulf. From a national security perspective, this makes no sense.

One further point is that the Persian Gulf is not the only region where our dependence on foreign oil renders us vulnerable. Nigeria, a major supplier of almost a million barrels of oil per day, has regional and religious animosities. The Caspian Sea region is also an area of instability. Getting Caspian oil to international markets will require overcoming enormous hurdles, since it must travel by pipeline through some of the most volatile areas of the world, including Chechnya, Georgia, Armenia, and Iran.

By raising CAFE standards, you will reduce our vulnerability to national and regional instability in oil-producing areas. CAFE standards have already saved 3.9 million barrels a day, and a rise in minimum CAFE standards over time to 40 miles per gallon would represent a savings of almost as much, or more than, the oil we import from Saudi Arabia.

In addition to these national security concerns, a reduction in our dependence on foreign oil would have a substantial effect on our foreign trade deficit. Oil is our biggest natural resource import, and one of the single largest contributors to our trade deficit. Throughout the 1990's, that deficit rose each year, and our reliance on foreign oil was a primary cause of it. Therefore raising CAFE standards, not only would we be reducing our dependence on volatile areas of the world, but also reducting the trade deficit.

As chief U.S. negotiator for the Kyoto Protocol on global warming, I have a particular interest in the environmental effects of our oil dependence. Senator Kerry was in Kyoto during our negotiations. To the extent that we want to reduce the threat of greenhouse gases our reduction of oil consumption is essential. Transportation is responsible for one third of the release of greenhouse gases into the earth's atmosphere, so by raising CAFE standards, we will not only reduce our dependence therefor on volatile markets, but we will be taking steps to reduce our role in the decay of the environment.

With respect to the dependence of consumers on automobiles and costs, I do not believe there is an either-or proposition between conservation and production. We need conservation, we need to increase domestic production, and we need increased research and development on new technologies. I recently test-drove the new Toyota Prius hybrid that gets 52 miles a gallon, and I know that Senator Kerry's alternative energy plan would provide tax incentives for such cars.

I believe that there is a positive impact, in terms of making our industry more competitive, to increasing CAFE standards. For example, Japanese auto makers today are developing technologies at a faster rate than our American counterparts. The Germans are revealing a diesel-powered car that will soon get 35 to 40 miles per gallon. Simply put, U.S. auto makers must be able to compete with their foreign counterparts. Having a fleet that is more fuel-efficient will allow our auto makers to do it.

As you consider the specific numerical targets and timetables, it is important to take into account the findings of the recent National Academy of Sciences report, particularly with regard to the long lead times required for technology changes to be implemented. The report concludes that the widespread penetration of already existing technologies will themselves require 4 to 8 years, and thus, while you should move aggressively in the pursuit of new CAFE standards, it is important to maintain the long-term vision that new technology demands.

Just last week, the Bush administration announced it would not take advantage of congressional action that opened the door to higher fuel efficiency requirements for 2004 model year pickup trucks, minivans, and sport utilities. This is regrettable. I hope the administration will push to review the standards so that, at a minimum, higher requirements can be implemented by the 2005 model year.

With relation to the cost to consumers, I believe these costs will be more than offset by fuel savings. Indeed, it has been estimated that with higher fuel efficiency standards in place, consumers buying cars in 2012 would save a net of $2,200 over the lifetime of their cars.

Let me conclude by reiterating the lessons of the past. In the seventies and eighties, Japanese auto makers gained a foothold in the U.S. by providing higher fuel efficiency cars. The U.S. auto industry continues to suffer from the failure to recognize the trend before it happens. Cars of the future will have higher, much more fuel-efficient systems. You should not wait until the next run-up in oil prices or until Japanese manufacturers have arrived even more fully before we act.

Closing the loophole under which SUV's and minivans are allowed to meet lower standards than other passenger cars would, by early in the decade, save roughly a million barrels of oil a day, and according to a recent study by the National Academy of Sciences, the distinction between cars for person use and trucks for work and cargo has been stretched well beyond its original purpose. We can improve the efficiency of SUV's and minivans with available technology at no cost to consumers over the life of the car.

Last, in considering how to close the SUV loophole, the committee should balance its interests in raising the SUV standard itself against the additional flexibility that the automobile industry would be given if SUV and passenger vehicle standards were to be merged into a single category. I would favor the approach, providing maximum flexibility to the industry. As one who helped champion the creation of tradable emissions credits in the Kyoto Protocol for CO_2 emissions, I would hope the Committee would also consider the National Academy of Sciences' recommendation and

idea of creating tradable fuel economy credits. This can lead to higher standards with more flexibility and less cost to the industry.

To sum up, the national security costs of our petroleum dependence have never been more clear.

Thank you, Mr. Chairman.

[The prepared statement of Ambassador Eizenstat follows:]

PREPARED STATEMENT OF AMBASSADOR STUART E. EIZENSTAT, PARTNER, COVINGTON & BURLING [1]

Chairman Hollings, Chairman Kerry, Senator McCain, and Members of the Committee, good morning. I have been asked to speak today on the national security implications of America's dependence on foreign oil. I am honored that you have asked me to address this issue. The questions that you will be asking this morning and again next Tuesday will have repercussions long beyond our lifetimes. These issues will impact generations to come, in terms of the effects on our national security, our standard of living and our commitment to the environment. Thus, this Committee is engaged in a critical task as it considers what would be the appropriate levels for increased Corporate Average Fuel Economy ("CAFE") standards.

Before I begin my formal remarks, I would like to applaud Senator Kerry for the alternative energy plan that he unveiled earlier this week. I believe that his proposal strikes a healthy balance between the conservation and production concerns that are at the heart of the energy debate.

The lessons of the impact of our dependence on foreign oil supplies were first taught to us back in 1973 and 1974, when the initial Arab oil embargo (the "Arab Embargo") on the United States occurred. At that time, the Federal Government imposed domestic price and allocation controls on petroleum. The results of this policy, as many of you will remember, were widespread gasoline shortages and long gas lines, as well as rapid price increases. The economy as a whole suffered greatly as a result.

In 1975, in large measure spurred by the Arab Embargo, Congress passed the Energy Policy and Conservation Act ("EPCA"). The EPCA included provisions that established the CAFE standards for new passenger cars. Given the oil crisis at that time, it appeared that the CAFE standards would be quickly implemented.

However, in spite of the obvious merits of the standards, the American automobile manufacturers were opposed to the regulations. I remember their opposition well. In my role as Domestic Policy Advisor to President Carter, I was part of the team that developed the first CAFE standards. Those standards set the necessary fuel economy levels for the period from 1977 to 1985, starting at 18 miles per gallon ("MPG") in 1977 and rising to 27.5 MPG in 1985. I specifically remember a meeting in the Cabinet office with President Carter and the heads of the big three automobile manufacturers—Ford, General Motors and Chrysler—in which all three strongly opposed the imposition of fuel economy standards. They claimed that their companies lacked the technology to reach the standards that the Administration had in mind. And yet, once the CAFE standards were implemented, all three companies met and exceeded the standards.

I can imagine the pressure that you are under from those same companies and others as you consider raising the standards. But as you embark on this process, I strongly urge you to recall our experiences in developing the first set of CAFE standards. You should feel confident that the automobile manufacturers do have the ability to achieve and in fact surpass whatever standards you set.

National Security Implications of Reliance on Oil Imports. At present, the United States imports more than 51 percent of its oil. That number is projected to increase to 64 percent by 2020. Such heavy reliance on foreign oil places the United States in a precarious position. Already, oil has played a central role in one recent conflict—the Gulf War—and, over the past quarter century, it has been an influential ingredient of American foreign policy more broadly.

[1] Stuart E. Eizenstat heads the International Trade and Finance Group at Covington & Burling. This testimony reflects his personal views and not those of Covington & Burling or any of its clients. From 1977 to 1981 he served as President Jimmy Carter's Chief Domestic Policy Adviser and Executive Director of the White House Domestic Policy Staff. He has also served as Deputy Secretary of the Treasury, Ambassador to the European Union, Under Secretary of State for Economic, Business and Agricultural Affairs and Under Secretary of Commerce for International Trade. He has had a prominent role in the development of key international initiatives, including the negotiation of the Kyoto Protocol on global warming.

Each year, the United States imports 16 percent of its oil from Saudi Arabia and an additional 9 percent from other States in the Persian Gulf. As you all know, this is a consistently volatile region, and our dependence on oil from the Middle East is fraught with insecurity and danger. As we were so horribly reminded on September 11th, terrorist threats both at home and abroad have links, whether direct or indirect, with the oil-producing States in the Gulf region.

Our reliance on States that unstable or even hostile to the United States, presents a very real national security dilemma, a dilemma that must be addressed immediately. Some States, like Iran and Iraq are actively hostile to the United States. Others, like Saudi Arabia, have historically been friendly to us, but they are often autocratic regimes, which rest on power bases that may not have broad public support, and that have their own internal fundamentalist threats. While we have a national security interest in the stability of these regimes, we must remain aware of the possibility that they will fall into hostile hands. I certainly can say that, given my experience with Iran during the Carter Administration, no one would have forecast that the Iranian Revolution would topple the Shah of Iran, given the military support he appeared to have.

Potential threats in Iran, Iraq, and elsewhere in the region constantly jeopardize the stability of the Persian Gulf. In 1972 the price of crude oil was about $3.00 per barrel and, by the end of 1974, the price of oil had quadrupled to $12.00. The price rise was almost exclusively the result of the embargo by Arab oil-producing states in response to Western support of Israel in the Yom Kippur War. The Yom Kippur War started with an attack on Israel by Syria and Egypt on October 5, 1973. The United States and many countries in the western world showed strong support for Israel. As a result of this support, Arab exporting nations imposed an embargo on any nations supporting Israel in the war. Arab nations curtailed production by 5 million barrels per day. Approximately 1 million barrels per day were recovered by increased production by other countries. The net loss of 4 million barrels per day extended through March of 1974 and represented 7 percent of the free-world production.

Our national security concerns are not restricted to regional action. Since the 1970s, Iran and Iraq have been involved in a number of cataclysmic events that have shaped not only their countries, but ours, as well. Indeed, our reliance on oil from Iran left us vulnerable to that nation's problems at the end of the 1970s. I was serving in the Carter White House at that time and lived through the implications of the Iranian revolution on our economy and, more broadly, our society.

The rise to power of Ayatollah Khomeini altered our relationship with Iran and led to one of the most difficult events of the last 25 years, the Iranian hostage crisis. At the time of the Iranian Revolution, oil production from Iran dropped precipitously and oil prices in the United States skyrocketed. The Iranian revolution resulted in the loss of 2 to 2.5 million barrels of oil per day between November of 1978 and June of 1979. Moreover, after the United States Embassy in Tehran was occupied in November 1979, President Carter halted all oil imports from Iran. During the one year period from the beginning of 1979 until the beginning of 1980, oil prices rose by 120 percent. That increase was a knockout blow to the U.S. economy, aggravating inflationary pressures and increasing unemployment at the same time. In fact, from 1978 to 1981, crude oil prices rose by two and a half times, from $14 per barrel to $35 per barrel.

Another, smaller supply interruption occurred during the Iran-Iraq War from 1980 to 1988. During the Iran-Iraq War, Iraq's crude oil production fell 2.7 millions of barrels per day, and Iran's production dropped by 600,000 barrels per day. The impact of this event was much milder, but still worrisome.

Iran presents a great policy dilemma for the United States, with its Janus-like policy towards us, with one part of the government advocating improved relations with the United States, while the other and more dominant faction supports positions that are inimical to America. In Iran, we are presented with a reformist president, Mohammad Khatami, who is supported by the majority of the people and appears to be sympathetic to some improved relations with the United States. However, he clearly does not have control of the security and defense apparatus in Iran, as well as other sectors of the Iranian government, which support terrorist organizations like Hezbollah, seek to destroy the Middle East Peace Process and are on a crash-course to develop medium-range missiles with potential chemical or nuclear warheads that will be able to reach Israel in a few years. There is no reason to think that the Iranians will stop there, and we must be concerned by the possibility that they will try to develop long-range missiles that can hit the United States. And, clearly, Iraq is not a reliable partner either. At present, we do not import any oil from Iran and, in 2001, we imported approximately 600,000 barrels per day from Iraq. To place these numbers in perspective, Iranian oil production capacity is esti-

mated to amount to 3.9 million barrels per day and Iraqi production capacity is estimated to be 2.8 million barrels per day. In light of our relations with Iran and Iraq, we find ourselves largely dependent on others in the region for our oil.

Our dependence on oil from the Middle East profoundly influences our economy and our foreign policy. In fact, our decision to take military action against Iraq after the invasion of Kuwait was, at a minimum, heavily influenced by our dependence on oil from the Persian Gulf. The threat—not only to Kuwait but to others in the Gulf region—posed by Saddam Hussein's expansionist pretensions led us to commit more that 500,000 American servicemen and women during the Gulf War. More than 600 of our troops were killed or wounded in battle. Many more continue to suffer from a variety of illnesses since their return home.

At present, we have more than 4,500 troops stationed in Saudi Arabia, and more than 12,500 Navy personnel at sea in the Persian Gulf. The presence of these troops is intended to protect the governments in the region, but it also leads to resentment in the region, resentment that was at the heart of the September 11th attacks. The United States now finds itself torn between its interest in supporting stable governments in the Persian Gulf and the hostility and danger attendant to the presence of American troops on foreign soil. In the end, our dependence on Persian Gulf oil in general and Saudi oil in particular leaves us vulnerable to attack, both abroad and at home.

It is also worth mentioning that unconfirmed reports in *The Washington Post* suggest that Saudi Arabia may ask the United States to withdraw its military personnel. Nevertheless, our troops remain deployed there, in large measure to protect the Saudi Government and its primary asset: oil. Moreover, I would note that, while at one level the withdrawal of our troops from Saudi Arabia will reduce the threat posed to our servicemen and women, it also threatens to make Saudi Arabia more unstable.

The lesson of the past 25 years in the Persian Gulf is clear: regional instability there has real, tangible effects here, in the United States. If we do not take action at home to reduce our reliance on oil from abroad, we run the risk of falling prey to the very same problems we have lived through in the past. Indeed, we have seen fit to fight a war in effect to protect our oil interests. And, in placing the lives of American servicemen and women in harm's way in the Gulf War, we have signaled the dangers of our reliance on oil from that region.

Nonetheless, we remain dependent on a region where, in the past decade, we have fought two wars, where the tide of anti-Americanism continues to rise, and where the tension between modern and radical Islam threatens the ruling elites of the governing regimes. In spite of all of these risks—each in itself sufficient to threaten our oil supply from the region—we continue to import 25 percent of our daily supply of oil from the Persian Gulf. Strictly from a national security perspective, this policy does not make sense.

One further point bears mention: I do not mean to single out the Persian Gulf region as the only area where dependence on foreign oil renders the United States vulnerable. Obviously, that region has been, over the past quarter century, the primary source of national security concern with regard to foreign oil production. But other areas engender similar concerns. Nigeria, which boasts Africa's largest population and a wealth of religious and regional animosities, supplies the United States with 900,000 barrels of oil per day. The Caspian Sea region remains a relatively small producer, but its potential reserves make it one of the most anticipated oil resources worldwide. Indeed, the Caspian Sea region is generally considered to represent one of the largest untapped oil resources in the world. And yet, the region itself—and the surrounding areas that would be essential for extraction of the oil—like the Persian Gulf, has an uncertain future.

The Caspian Sea is located in northwest Asia, landlocked between Azerbaijan, Iran, Kazakhstan, Russia and Turkmenistan. Since the breakup of the Soviet Union in 1991, the Caspian Sea—as well as the region surrounding it—has became the focus of much international attention due to its huge oil and gas reserves. The Caspian Sea, which is 700 miles long, contains six separate hydrocarbon basins, and most of the oil and gas reserves in the Caspian region have not been developed yet. Ongoing legal wrangling over rights to the oil continues to stunt the development of the reserves.

To give some sense of the potential importance of the Caspian oil fields, I would note that, in May 2001, oil industry officials reported sizable oil deposits in an area known as East Kashagan, in the Caspian Sea off the Kazakhstan coast. Initial estimates indicate that that field alone could contain as much as 50 billion barrels, and at least 20 billion barrels, of crude oil. By comparison, the United States has known reserves of 21 billion barrels.

Aside from ongoing issues over who retains the rights in the Caspian, U.S. national security is threatened by instability in the areas surrounding the Caspian. Getting the Caspian oil to international markets will require overcoming enormous obstacles since it must travel by pipeline through one of the most politically volatile areas of the world. Because the Caspian Sea is landlocked, oil and natural gas must be transported by pipeline to a terminal on the open sea, where it would be pumped into tankers and shipped to customers. Long distances over often inhospitable mountain and desert terrain, prone to earthquakes, and vulnerable to attack, would make pipeline construction and operation extremely difficult. Proposed pipelines might run through Chechnya, Georgia, Armenia and Iran, among other hot spots. Recent instability in those areas is only one concern. We must also consider the potential for upheaval after the pipeline has been constructed. As our reliance on particular oil deposits grows, our vulnerability to such upheaval grows apace.

By raising the CAFE standards, you will reduce our vulnerability to national and regional instability in oil-producing areas. According to the Union of Concerned Scientists, CAFE has already saved 60 billions of gasoline (3.9 million barrels per day). A rise in the minimum CAFE standards to 40 MPG would save 125 billion gallons of gasoline by 2012. This represents approximately 1.9 million barrels per day, or more than the total amount of oil we import from Saudi Arabia. And, at the end of the day, by reducing our consumption of foreign oil, we will shield ourselves from many of the threats posed by our current level of dependency.

Impact of Oil Dependence on the U.S. Trade Deficit. In addition to the national security concerns that I have just discussed, a reduction on our dependence on foreign oil would have a substantial effect on our foreign trade deficit. Oil is the United States' biggest natural resource import and one of the single largest contributors to our trade deficit. According to the Department of Energy, in 2001, the United States imported an estimated $110 billion in petroleum products. At the same time, our trade deficit last year was an estimated $350 billion. One year earlier, in 2000, our trade deficit reached an all-time high of $375 billion. Indeed, throughout the 1990s, our trade deficit rose each year, and our reliance on foreign oil was a primary cause of the rising deficit.

By way of example, I would point out that, in November 2001, our monthly trade deficit was $1.4 billion lower than our trade deficit one month earlier. The largest single contributor to that drop was a 17 percent reduction in oil imports. Even with that reduction, oil represented more than six percent of U.S. total imports in the month of November.

The volatility of the world oil market leaves the U.S. economy vulnerable to price fluctuations. For example, world oil prices tripled between January 1999 and September 2000 due to strong demand, OPEC production cutbacks, and other factors, including weather and low oil stock levels. Our reliance on foreign oil challenged our economy and increased our trade deficit. Thus, by raising CAFE standards and reducing domestic oil consumption, not only would we be reducing our dependence on volatile areas of the world, but we also would be contributing to the reduction of our trade deficit.

Impact of Oil Dependence on Global Warming and Pollution. As the Chief U.S. Negotiator for the United States for the Kyoto Protocol on Global Warming, I have a particular interest in the environmental effects of our oil dependence. Therefore, I must also mention, at least briefly, the impact of our oil dependence on the environment. To the extent that we want to reduce the threat of greenhouse gases, a reduction in oil consumption is essential. Transportation is responsible for one-third of the release of greenhouse gases into the earth's atmosphere. And, although the United States accounts for three percent of the world's population, we are responsible for over 20 percent of greenhouse gases worldwide. Thus, by raising the CAFE standards, we will not only reduce our dependence on volatile foreign markets but we will be taking steps to reduce America's role in the decay of the environment. As I mentioned at the outset, our responsibility to tackle these difficult issues goes far beyond our own generation. The CAFE standards represent just one of the means by which we can take action.

Impact of Oil Dependence on the American Automobile Industry and on Consumers. I am not one who believes in an either/or proposition between conservation and production. I believe that we need conservation, increased domestic production, and increased research and development on new technologies. On this point, I should mention that I recently test drove the new Toyota Prius hybrid that gets 52 miles per gallon of gas in the city. The engine is part fuel cell and part internal combustion engine. I found the car to be very impressive. I know, Senator Kerry, that your alternative energy plan would provide tax incentives to speed production of hybrid-fuel engines. I firmly agree with this proposal. U.S. automakers must jump on the hybrid-fuel train before it has left the station. Already Japanese auto-

makers have begun developing the technology at a faster rate than their American counterparts. In addition, the Germans have revealed a diesel-powered car that will get 35–40 miles per gallon. Simply put, U.S. automakers must be able to compete with their foreign counterparts. Having a fleet that is more fuel efficient will allow our automakers to do just that.

Just last week, the Bush Administration announced that it will not take advantage of congressional action that opened the door to higher fuel efficiency requirements for 2004-model-year pick-up trucks, minivans and sport-utility vehicles. This is regrettable. Although the National Highway Traffic and Safety Administrator announced that he will continue to consider higher fuel efficiency standards, he added that an April 1, 2002 deadline does not provide sufficient time to review the issue. I would hope that the Administration will push to review the standards so that, at a minimum, higher requirements can be implemented for 2005-model-year vehicles. The NHTSA's recent action also places an additional burden on you to move expeditiously in setting higher CAFE standards, so that they can be implemented as soon as possible.

In the meantime, President Bush's proposed energy plan would include controversial drilling in the Arctic National Wildlife Refuge ("ANWR") in Alaska. While the President's proposal would not provide for drilling of the entire region, it is noteworthy that, even if drilling took place in the entire ANWR reserve, according to the Department of Energy, there is a 95 percent probability that at least 5.7 billion barrels of oil are technically recoverable. At the other end, there is only a 5 percent probability that there are more than 16 billion barrels of oil that are recoverable. The mean estimate is that 10.3 billion barrels of oil are recoverable. To place those numbers in perspective, the United States consumes about 19.4 million barrels of oil per day, meaning that the ANWR reserves would only be able to supply full consumption for less than a year-and-a-half. Of course, the reserves would not be used to supply full consumption, but the fact is that ANWR would only add 0.3 percent to the world oil supply. Thus, the Administration's Plan with regard to ANWR simply does not itself relieve our dependence on foreign oil supplies.

With relation to the costs to consumers that would come from rising car prices to accommodate new technology, I believe that those costs will be more than offset by fuel savings. Indeed, it has been estimated that, with higher fuel efficiency standards in place, consumers buying cars in 2012 would save a net of $2,200 over the lifetime of their car.

I would reiterate that we must learn the lessons of the past. In the 1970s and 80s, Japanese automakers succeeded in gaining a foothold in the U.S. auto market by providing a benefit to consumers that American auto manufacturers had simply overlooked. Starting in the 1970s, while American automakers stood on the sidelines, Japanese manufacturers introduced smaller, more economical vehicles to the U.S. market. By the time American manufacturers entered that market, the Japanese makers had already cornered it. The U.S. auto industry continues to suffer from the failure of American manufacturers to recognize the trend in the market before it happened. Cars that require less gas are the wave of the future. We must ride that wave. We should not wait until the next run-up in oil prices or until Japanese manufacturers have arrived before we take action. There is no lack of technology to meet higher standards. The issue is whether the will to implement change exists.

Simple steps to improve automotive fuel efficiency would pay enormous dividends. Closing the loophole under which SUVs are allowed to meet lower standards than other passenger cars would, by early in the next decade, save roughly one million barrels of oil per day, helping to provide clean air and protecting Americans from disruptions in oil supply. According to a recent study by the National Academy of Sciences, this advance could be accomplished with available technology and at no cost to consumers over the life of a car.

Conclusion. To sum up: America's reliance on foreign oil imports presents an ongoing threat to the stability of our economy and continues to exert undue influence our foreign policy. The national security costs of our petroleum dependence have never been more clear. As you probably know, I am by no means an advocate of protectionist trade policies. What I do advocate, however, is a reduced dependence on foreign oil, both for its effects on our economy and on our national security. By raising the CAFE standards, you will reduce our dependence on foreign oil. The benefits of a reduced dependence will be felt not only by us but also by future generations. I urge you to fight the resistance of the automobile industry and others who fear the potential short-term costs of increased fuel efficiency. The benefits of fuel economy are simply too great to ignore. Enactment of the Kerry energy proposal would be a good step forward and would be in the interests of our national security, our trade deficit, and the environment.

Thank you very much. It is a pleasure to be here and to contribute to the Committee's work. I would be happy to answer your questions.

Senator KERRY. Thank you very much, Mr. Ambassador, for that important testimony.

Ms. Claybrook.

STATEMENT OF JOAN CLAYBROOK, PRESIDENT OF PUBLIC CITIZEN

Ms. CLAYBROOK. Thank you, Mr. Chairman. I am Joan Claybrook, president of Public Citizen, a national consumer organization, and the former administrator of the National Highway Traffic Safety Administration. I issued the first fuel economy standards in 1977.

As reported by Keith Bradsher in the New York Times, Ford Motor Company admitted in its corporate citizenship report in May of 2000 that SUVs, which generate much of the company's profit, "contributed more than cars to global warming, emitted more smog-causing pollution, and endangered other motorists, and that the company faced an awkward situation, because its most profitable products do not meet its goals for social responsibility." However, Bradsher reported that Ford still has no plans to halt or reduce production of their massive SUV, the Ford Excursion, which gets 10 miles per gallon in the city, 13 on the highway, and weighs as much as two Jeep Grand Cherokees.

Congress must require manufacturers to change the fuel economy performance of their vehicles because in the 17 years that have passed since 1985 they have failed to do so on their own—in fact, they have gone backward—and if they do not, America will continue to suffer the consequences of short-term industry thinking and long-term damage to this country.

Americans support, with their pocketbook if necessary, strong fuel economy standards, according to a Harris poll and other polls that have been done, as a way of reducing our economic dependence on the vagaries of foreign oil and protecting our environment by cutting emissions of greenhouse gases. Congress must now limit U.S. oil consumption. Raising fuel economy standards is the most reasonable and the most cost-effective way to accomplish this goal.

The CAFE standard that was devised by the Congress in 1975 has been a smashing success, but it is now outdated due to inactivity at the congressional and NHTSA level, and improvements are needed. NHTSA is charged by statute with administering both the highway safety and the fuel economy program and, in view of this dual mission, I would like to help debunk the industry canard that fuel economy and safety are a tradeoff. That has never been the position of the agency among its technical staff, at least, and it is incorrect.

The argument has been made by the auto industry so many times it is now a cliche, but fortunately, it is not true. First, historically, weight reductions in the smallest vehicles did not occur with the 1978–1985 CAFE standards and it is not likely to happen in the future, and the reason why not is that it is not cost-effective for the industry. When they remove weight, they take it out of the behemoths, they do not take it out of the little guys, because that

is what is worthwhile in terms of saving fuel and the investments they have to make.

In 1974, Ford claimed that fuel economy standards, "would require a Ford product line consisting of either all sub–Pinto-sized vehicles or some mix of vehicles ranging from a subcompact to a Maverick." That prediction was wrong, and their predictions today about safety and fuel economy, are wrong as well.

In fact, what happens is that after the CAFE standards were issued, the lightest vehicles, those under 2,500 pounds, were pretty much eliminated, and they comprise a smaller percentage of the fleet than they did earlier.

The original passage of CAFE standards did not result in the lighter cars becoming lighter or less safe. For example, the Honda Civic gained 800 pounds, and went from failing the NHTSA crash test to receiving five stars, so it shows that through technology these companies were able to improve their vehicles and also achieve their fuel efficiency.

In addition, the Department of Energy study of the original CAFE standards shows that 85 percent of the gains in fuel economy came from technological advances, not weight changes, so most of it is through technology, and to the extent that weight is taken out, it is taken out of the big vehicles, and what does that do? It makes the fleet more compatible, and so these big vehicles are less likely to do damage to the smaller cars because it is a more compatible fleet, and that is actually what happened for a short period of time, until the auto industry started taking advantage of the light truck loophole which allowed SUVs to become very prominent in our fleet.

Some of the analyses that have been done on the results of the CAFE standards have been done based on averages, for example, Charles Kahane at the NHTSA did an analysis that looked at taking 100 pounds out of vehicles across the fleet. When you do that, and it is inherently in the auto industry's argument, you ignore the fact that it is the bigger cars or the bigger vehicles that lose weight and go on a diet, and not the small ones.

In addition, of course, Dr. Kahane's study is only based on 1993 data and before, and ignores many of the important improvements in standards, some of which have been mandated by this committee, including side impact protection and head injury protection, as well as dual airbags.

If you hold crashworthiness improvements constant, then you undermine, of course, the safety improvements that are available to be done, and there are two major ones that are really important for this Committee to consider. Kahane's study focused on the fact that from small vehicle crashes in roll-overs there would be an increase in deaths, but roll-overs are one of the most achievable types of crashes in which you can improve safety, and I believe that the Committee in your legislation should require two important changes in safety to accompany your fuel economy requirements, and they are (1) a roll-over crash worthiness standard. That would mean stronger roofs, padding, pre-tensioned belts that hold you in your seats, the seat structure, and side-impact head airbags. Virtually you could have survival of a majority of roll-over crashes if this was done.

The second is an anti aggressive standard, so that these larger vehicles cannot roll over the smaller vehicles. There are always going to be smaller vehicles, because the manufacturers are going to make smaller, cheaper vehicles for some portion of the population that cannot afford the unimogs and the other huge Excursions which are their cash cows.

The NHTSA in 1974 began building something called a research safety vehicle. It was a car about the size of a Pinto, weighed 2,500 pounds, and when you crash-tested it in a frontal crash there was no injury virtually at 50-mile-an-hour crash test and side and rollover at 40 miles an hour. I would like your indulgence, when I finish in just a second, to show a 1-minute clip of what this vehicle looked like and what it was able to do.

The recommendations that we have for improvement in fuel economy are the following, very quickly. One is to close the light truck loophole so that all vehicles are measured under the same standard, second to set an appropriate goal for improvement of 40 miles per gallon beginning in 2005 for 10 years, third is to adjust the gas guzzler tax to cover trucks and cars, and have it apply when it is 5 miles per gallon or more below the average, fleet-wide, for that year.

We must require truth in testing, because there is a big differential between testing and actual highway use, get rid of bogus credits like the dual fuel vehicles, tighten the requirement for credits on carry-back and get rid of them, and eliminate the preemption clause, in current CAFE law, to allow states to have a feedbate program.

And finally, and very importantly, the reason that Mr. Eizenstat said that the NHTSA did not increase the fuel economy standard, there is a very good reason why it did not. It does not have any money and any staff working on this because of the prohibition in the appropriations bills for the last 6 years; zero, it has zero. NHTSA has no capacity, and I would urge that in the supplemental appropriations bill that is coming up, that you put $5 million and 10 staff positions at least, which is very modest in the scheme of this government, so that they can get started on evaluating fuel economy and have the capacity to issue those standards.

I would now like to show the clip. It is a 1-minute clip of the research safety vehicle. It is 1977 technology that crashes safe at 50 miles an hour, and it would get 50 miles per gallon.

[A videotape was shown.]

Ms. CLAYBROOK. Do not call the 800 number today because this was made in the Carter administration. That number is no longer available, and neither is the car, but it is the model of what can be achieved by this industry.

Thank you, Mr. Chairman.

[The prepared statement of Ms. Claybrook follows:]

PREPARED STATEMENT OF JOAN CLAYBROOK, PRESIDENT OF PUBLIC CITIZEN

Thank you, Mr. Chairman and Members of the Senate Committee on Commerce, Science and Transportation, for the opportunity to testify before you today on the safety implications of raising fuel economy standards for the United States vehicle fleet. My name is Joan Claybrook and I am the President of Public Citizen, a national non-profit public interest organization with 150,000 members nationwide that represents consumer interests through lobbying, litigation, regulatory oversight, re-

search and public education. Public Citizen has a long and successful history of working to improve consumer health and safety. I am also the former Administrator of the National Highway Traffic Safety Administration, where I issued the first U.S. fuel economy standards in 1977.

I. Introduction

Increasing consumption of fuel and industry manipulation of the CAFE system threaten our safety, security, and the environment

The Corporate Average Fuel Economy (CAFE) system that was instituted in 1975 is sorely in need of a Congressional upgrade. CAFE, which was crafted in view of the vehicles and technology available at the time, was a smashing success, raising average fuel economy performance for the entire fleet in the U.S. 82 percent between 1978 and 1985.[1] Its primary feature is a 27.5 miles per gallon (mpg) standard for passenger automobiles, set by statute. There is no minimum standard for light trucks, but the National Highway Traffic Safety Administration (NHTSA) is instructed by law to set a standard every year according to what is "maximally feasible."

CAFE currently saves us 118 million gallons of gasoline every day and 913 million barrels of oil each year, or about the total imported annually from the Persian Gulf.[2] It was a major factor in breaking the stranglehold of the Organization of the Petroleum Exporting Countries (OPEC) on oil prices and cutting rampant U.S. inflation in the early 1980s. Since 1985, no major congressional initiative or agency action has been taken to update CAFE standards to reflect current technology, shifting vehicle use, or the need to address global warming and foreign oil dependency. As SUVs have come to dominate our highways, the American public has recognized that the program is outdated.

One obvious deficiency with the current CAFE system is that it holds so-called "light trucks"—such as minivans, pickups, and SUVs—to a lower fuel economy standard than passenger cars. This distinction may have been valid in 1975, as light trucks were a small portion of the vehicle fleet and were generally used for farming and commercial purposes. However, automakers have since turned this into a loophole in CAFE, shifting their marketing and production of passenger vehicles to push light trucks. At present, nearly 50 percent of personal vehicles sold qualify as light trucks under the present system.[3] The bifurcation of the standard has created huge problems with vehicle compatibility, resulting in countless lost lives and injuries as not-so-light trucks crash with smaller vehicles. This is also a problem that Congress must address.

The problem of global warming is a key reason to improve fuel economy. Human emissions of carbon dioxide through power plants and motor vehicles are the primary sources of this problem, with U.S. motor vehicles generating 5 percent of total global carbon dioxide emissions.[4] The American public recognizes that the future of the earth is at stake when we discuss solutions to this problem, and wants Congress to act to preserve the delicate balance of life on earth for our grandchildren and beyond.

A consensus for change

Americans do want Congress to require improvements in fuel economy, and consumers are willing to pay for such improvements. A poll conducted in July 2001 for Public Citizen by Lou Harris asked Americans whether they would be willing to pay 3 percent (or about $900 on a $30,000-vehicle) more for their sport utility vehicles in order to solve emissions problems stemming from their use, and 63 percent of respondents answered yes.[5] In a separate Gallup poll a decade ago, 61 percent of Americans favored increasing the fuel efficiency requirements to 40 miles per gallon (mpg), even if it increased the price of cars.[6] Other Gallup polls conducted over the years support this result. Ninety-three percent of Americans believe the United States should require cars to get better gas mileage to reduce our dependence on foreign oil,[7] and 61 percent believe that greater conservation of energy supplies is an important piece of the solution to our energy problems.[8] In the face of such strong and consistent public opinion over the years favoring significant improvements in fuel economy, it would be irresponsible for Congress not to act.

The automakers will not solve the problem on their own. Recent statements, such as the promise by Ford to improve the fuel economy of its SUVs by 25 percent, or the copycat claims made by Daimler-Chrysler and General Motors, should not be interpreted as an industry solution. Despite long being in the best position to improve the efficiency of the vehicle fleet, automakers have long taken the opposite tack. Manufacturers chose to spend dollars and earn profits in the SUV market segment, which lowers safety for all Americans and reduces overall fuel economy, and to ad-

vertise these vehicles' powerful engines and speed, making their claims of social consciousness not credible.

The problems with SUVs are no secret to their manufacturers. As reported by Keith Bradsher of *The New York Times,* Ford Motor Company admitted in its "corporate citizenship" report in May 2000 that sports utility vehicles, which generate much of the company's profits, "contributed more than cars to global warming, emitted more smog-causing pollution and endangered other motorists" and that the company faced an "awkward situation" because "its most profitable products do not meet its goals for social responsibility."[9] However, Ford still has no plans to halt or reduce production of its massive SUV, the Ford Excursion, which gets just 10 mpg in the city and 13 mpg on the highway and weighs as much as two Jeep Grand Cherokees. Congress must set fuel economy goals to be achieved and require manufacturers to change the fuel economy performance of vehicles, or America will continue to suffer the consequences of short-term industry thinking and actions.

Missed opportunities

Twelve years ago, Senator Richard Bryan of Nevada introduced legislation, the Motor Vehicle Fuel Efficiency Act of 1990, that would have raised average fuel economy for the overall vehicle fleet by 40 percent. That legislation accrued 57 votes, not quite enough to defeat a filibuster, and its failure has resulted in a downward trend in fleet fuel economy performance. Had the bill passed, Americans would have saved billions of dollars and today we would have a safer, more environmentally sustainable and less costly vehicle fleet. Congress should seize the opportunity for action now, and enact strong fuel economy standards.

II. What Should Be Done on Fuel Economy

- **Close the "light truck loophole":** Count all passenger vehicles under a single fuel economy standard. Phase light trucks into the CAFE program over time, by requiring that manufacturers include an increasing percentage of their manufactured vehicles when calculating their fleet average for passenger cars. Increase the maximum weight covered under the standard to 10,000 lbs.
- **Set realistic but appropriate goals for improvement:** Raise total fleet fuel economy to 40 mpg over ten years beginning with model year 2005, and setting targets to be met every other year thereafter.
- **Tax the major offenders:** Adjust the Gas Guzzler tax with each increase in CAFE so that it affects all vehicles sold with fuel economies 5 mpg or more below that model year's fleet-wide CAFE standard.
- **Require truth in testing:** Require the Environmental Protection Agency (EPA) to adjust its testing procedures in order to narrow the gap between real-world fuel economy performance and tested performance to below a 10 percent margin of error within 5 years of initiation of new CAFE standards and below a 5 percent margin of error by completion of the CAFE program in 2015. Testing accuracy has eroded from 3 percent at the program's inception to 17 percent today.
- **Get rid of bogus credits:** Eliminate the dual-fuel credit program, which extends CAFE credits for the production of dual-fuel vehicles, even though gasoline is almost always used to power these vehicles.
- **Tighten enforcement:** Eliminate the "carryback" provisions in the CAFE credit system, which encourages manipulation and missed targets by manufacturers.
- **Allow states to reward leaders:** Clarify the preemption clause in current CAFE law to allow states to enact "feebate" programs, which reward manufacturers and consumers for fuel economy performance exceeding federal standards.
- **Allocate meaningful funding for NHTSA research:** Congress should immediately appropriate a $5 million supplemental appropriation for NHTSA and 10 staff positions for research, evaluation and rulemaking for fuel economy standards on cars and light trucks, in order to allow the agency to prepared for the issuance of new standards. In its rulemaking, NHTSA made it clear that it did not have the staff or funds to issue new light truck standards, as required by law, this spring.
- **Solve safety problems by addressing safety:** Require NHTSA to set new safety standards in the areas of rollover crashworthiness protection and limits on aggressivity. On rollover, Congress should require:
  - A dynamic roof crush standard;
  - Roof energy absorbing protection to reduce injuries from contact with the roof;

- Safety belt pretensioners that are triggered in a rollover crash;
- Improved seat structure to keep occupants in position during a roll;
- Side impact head protection air bags that are triggered in a rollover crash.

On vehicle aggressivity, Congress should require a crash safety standard to reduce the damage caused by light truck-type vehicles in crashes with smaller vehicles by 30 percent compared with model year 2000 vehicles.

III. The Real Safety Problem

A. The Myth of the Safety Tradeoff

Industry's claims that fuel economy measures reduce safety are wrong

The auto industry has argued, time and again, that raising fuel economy standards will adversely impact safety by causing the increased production of smaller vehicles or by reducing vehicle weight. In fact, there is no evidence that establishes a clear correlation between vehicle weight and increased fatalities—some heavier cars are far more dangerous to both their occupants, and to others on the highway, than are lighter ones. Across many measures of crashworthiness, the newest fuel guzzlers—the SUVs—are the worst performers. What matters most for safety are the crashworthiness protections and the compatibility that is designed and built into vehicles, and these must be enhanced as critical parts of any comprehensive highway safety and fuel economy program.

The use of the time-worn safety canard by industry is a cynical attempt to frighten consumers and Congress in an attempt to deflect new requirements, and appears most appallingly hypocritical when we consider that industry has acted to obstruct safety improvements whenever possible. Industry deploys a misleading safety "red herring" only because it hopes that it will offer a modicum of political cover for its unwillingness to act responsibly.

Public Citizen has a long record of working for safer cars—most often in opposition to the powerful efforts of the auto industry to squelch or resist them—the analysis we present today shows that raising fuel economy standards, if accompanied by appropriate and reasonable safety measures, will not hurt highway safety and in fact will even save lives by creating a more compatible vehicle fleet. It is important to note that NHTSA administers both the safety and fuel economy programs, so it can coordinate this work, as I did as NHTSA Administrator in the 1970s.

The following points will, I believe, put the industry's hypocritical arguments to rest at last.

Historically, the auto industry and the National Academy of Sciences (NAS) are wrong that CAFE standards reduced vehicle weight and endangered motorists

> *"[CAFE standards] would require a Ford product line consisting of either all sub-Pinto sized vehicles or some mix of vehicles ranging from a sub-sub-compact to perhaps a Maverick."—Ford Motor Company, 1974* [10]

Some members of the panel that published the July 2001 NAS report on fuel economy contend that raising CAFE standards would increase the occupant fatalities in crashes due to a connection between vehicle weight and fatality crash rates. As a strong NAS panel dissent by David Greene and Maryann Keller and other critics have pointed out, this conclusion is problematic because the panel was:

- Using outmoded data on crashworthiness: The data used by NAS is from 1993 and before, and therefore fails to account for recent advances in occupant protection from new government standards, such as dynamic side impact protections, dual air bags, and head injury protections. In holding crashworthiness constant, the panel overlooked crucial, compensating safety improvements that are possible in the areas of rollover and aggressivity, thus overstating the negative safety effects. This oversight is particularly troubling given the high survivability of rollover crashes and the panel's reliance on data from the study for NHTSA by Kahane. Kahan hypothesized that the largest increase in fatalities by CAFE would come from deaths in small vehicle rollover crashes, deaths which would be avoidable with proper crash protections;
- **Perpetuating cause-correlation confusion in vehicle size and weight as factors:** The changes in fuel economy standards will not result in a fleetwide, uniform reduction of vehicle weights; postulating that a possible weight-fatality correlation is not the same as demonstrating that improving the average fuel economy of vehicles will actually cause increased fatalities. In fact, history shows that weight reductions will occur only in the largest vehicles, where it is most cost-effective. Also, there was no attempt by the majority panel to account for confounding factors such as vehicle size and driver characteristics;

- **Overlooking harm from the light truck loophole:** The panel ignored some implications of the main study by Kahane that it prominently cited, which suggested that *proportional changes in both cars and trucks causing the downweighting of the entire vehicle fleet would have zero safety impact*, because relative weight, rather than absolute weight, is the crucial factor. Kahane's figures actually bear this out, although in drawing his conclusions Kahane changed the weight of cars while keeping weights for light trucks and other vehicles unaltered, and vice versa, producing confused results;
- **Understating the risks of incompatibility:** The panel overlooked the results from several studies which suggest that *disparities* among vehicle weight are the cause of devastating crashes, thus suggesting that instead of causing harm, any convergence effect on vehicle weights from CAFE standards would actually yield safety benefits.

In fact, the link between CAFE standards and reductions in vehicle weight at the low end of the vehicle weight range simply does not exist: while the heaviest vehicles were put on a diet and lost a thousand pounds, the lightest vehicles today are considerably heavier than their pre-CAFE counterparts. As was pointed out in the December 6, 2001, testimony of Clarence Ditlow of the Center for Auto Safety, the original passage of CAFE standards did not result in light cars becoming lighter or less safe. In fact, the Honda Civic gained 800 pounds and went from failing NHTSA crash tests to receiving the best possible rating for crashworthiness—5 stars. Moreover, the Ford Pinto and Chevrolet Chevette, notably unsafe vehicles, were replaced by the safer models of the Ford Escort and Chevrolet Nova. [11]

Looking at the CAFE-weight relationship more broadly, as fleet fuel economy increased over time, vehicle weights did not move in any one direction. In 1975, cars weighing less than 2,500 pounds made up 10.8 percent of the new-car fleet, but only 2.6 percent in 2000. By contrast, cars in the over 4,500 pound weight class made up 50 percent of the new-car fleet in 1975 but only 0.9 percent in 2000. These data show that CAFE standards did not cause a uniform reduction in vehicle weight at the light vehicle level (although CAFE may have caused a reduction in average weight, as more cars were built in the 2,500–4,500 pound category). [12] Because automakers could get proportionally more fuel savings from reducing the weight of the heaviest class of cars, those were the first targets for fuel economy improvements, and production numbers for cars in the lightest class actually decreased.

Any improvement in the CAFE standards made today will likely have a similarly small impact on the weight or production levels of the smallest cars. It is not cost-effective to reduce their weights by very much, given the limited fuel economy improvement from doing so and the relatively higher cost of vehicle redesign.

Major improvements in fuel economy are possible using currently available technology without any reduction in safety protection

A Department of Energy (DOE) study found that 85 percent of the fuel economy gains made following the 1975 CAFE law were from improvements in vehicle technology rather than weight reduction. [13] The evidence strongly suggests that similar technological leaps are currently available or just around the corner, and that the recent stagnation and even backsliding in overall fuel economy is a trend that must be stopped.

The Union of Concerned Scientists (UCS) pointed out in a report released in 2001 that today's vehicles could become more fuel efficient at a price that would easily be made up in savings on fuel costs, and the necessary changes would have no negative impact on safety. Technologies currently used in portions of today's fleet, if adopted fleetwide, could make vehicles more streamlined, less fuel intensive, and more efficient. A partial list of these technologies includes the following:

- **Aerodynamic improvements**—reducing vehicle drag by reducing their profiles;
- **Rolling resistance improvements**—changing tread designs and rubber quality on tires;
- **Safety enhancing mass reduction**—increasing the use of plastics, aluminum and high strength steel;
- **Accessory load reduction**—using more energy efficient electric accessories that draw less power from the battery;
- **Variable valve control engines**—used in Honda VTEC engine, allowing valves to be adjusted for better engine performance;
- **Stoichiometric burn gasoline direct injection engines**—introducing fuel directly to the engine cylinder;

- **Integrated starter generators**—allowing engines to turn off rather than idling when the car is not in use;
- **5- and 6- speed automatic transmissions**—increasing opportunities for engines to run at their efficiency "sweet spot;"
- **5-speed motorized gearshift transmissions**—mimics the performance of a manual with the ease of an automatic;
- **Optimized shift schedules**—using electronics and sensors to improve automatic transmission performance;
- **Continuously variable transmissions**—providing complete control over the relationship between engine speed and vehicle speed. [14]

The UCS has not limited their research to the hypothetical realm. With technologies currently used in mass production by at least one company, and basing their design on the current Ford Explorer, the UCS designed a new vehicle that increased the real world fuel economy of the Explorer by 50 percent while improving zero to sixty performance by 1.7 seconds and saving 4 percent ($1,577 in gasoline costs) over the lifetime cost of the unimproved vehicle (See Table 1). Adding technologies currently entering the market to their design, they were able to improve fuel economy by 75 percent, creating a vehicle that would test at 34.1 mpg and save 6 percent ($2,163) over the lifetime cost. [15]

Table 1: Union of Concerned Scientists' Greener SUV

	Ford Explorer	UCS Exemplar	UCS Exemplar Plus
Curb Weight (lbs)	4146	3525	3525
0–60 Performance (secs)	12.4	10.7	12.2
Fuel Economy (mpg)	19.3	28.4	34.1
Vehicle Price	$28,830	$29,545	$29,765
Lifetime Fuel Costs	$7,253	$4,961	$4,155
Total Cost	$36,083	$34,506	$33,920

Ford's Explorer currently fails to meet the very modest 20.7 mpg CAFE standard for light trucks, getting just 19 mpg. With the improvements implemented by the UCS using currently available technology, the same vehicle surpassed the current 27 mpg CAFE standard for passenger cars. Given the challenge of a higher CAFE standard to meet, auto manufacturers, with their considerably larger resources, could certainly far surpass the 34.1 mpg performance achieved by UCS within a ten year time-frame.

As a final point, it is clear both historically and legally that the Motor Vehicle Information and Cost Savings Act, like the National Traffic and Motor Vehicle Safety Act, is technology-forcing. It requires the Secretary of DOT to set the "maximum feasible" standard while considering, among other factors, the energy needs of the nation. [16] Any sensitive consideration of our energy needs would lead one to conclude that reducing our dependency on foreign oil is a high national priority.

B. The Real Story on Safety

Vehicle size and design, not weight, are the critical factors for safety

None of the research that attempts to establish the industry argument has thus far sufficiently isolated the confounded effects of vehicle size and vehicle weight in terms of safety implications for occupants or other motorists. Even the landmark study by Charles Kahane for NHTSA did not isolate the different implications of shifts in vehicle size and weight, [17] a problem which the recent NAS study literally glosses over in their attribution of overblown fatality figures to CAFE.

However, vehicle size, design and relative crashworthiness are the crucial factors in safety outcomes, for several reasons. While increases in weight irrefutably export an externality of threat to other motorists, increases in size and improvements in design and crashworthiness have the potential to save lives, both as net impacts and for the drivers of larger vehicles. Vehicle size, as distinct from weight, is pertinent to safety, and confounds the analysis of fuel economy effects for several reasons. Larger vehicles provide additional room for occupants' torsos and limbs to avoid contact with the area of crash impact, and there is space to design the vehicle frames of large vehicles to better absorb crash forces, so that occupants' bodies do not.

The real solution to CAFE may be to emphasize the use of innovative and lightweight crash materials, such as those employed in the Research Safety Vehicle designed by Don Friedman of Minicars for NHTSA in the 1970s. For another example, while the UCS in the above experiment involving the retrofitted Explorer did remove weight from the vehicle to improve fuel economy, the size of the vehicle and all of its safety features were left intact.

Honda has emphasized this point in a letter sent December 19, 2001, to the Committee, which I urge Members to closely read. In the letter, Honda demonstrates that many of its most fuel efficient vehicles are extremely good performers on safety as well, thereby answering the misleading arguments put forward by Ford at a prior hearing December 6.

C. The SUV Safety Myth

Many factors affect safety, creating hazards for drivers of SUVs

The prevailing concept of the connection between light trucks and safety is wrong. Light trucks are more dangerous to other drivers than their passenger car counterparts, but are not necessarily any more safe for their own occupants. The Chevrolet Blazer, for example, has a per million vehicle year driver death rate that is more than three times higher than the Honda Civic's death rate.[18] The chart of driver death rates compiled by the Insurance Institute for Highway Safety is proof that crashworthiness and crash survival vary widely within vehicle classes. Other research by David Greene, a dissenter on the NAS panel, has pointed out that there is no correlation between vehicle weight for passenger cars, for example, and a car's crashworthiness crash test ratings in the New Car Assessment Program administered by NHTSA.[19]

Another insight from Greene is that SUVs and heavier vehicles may face particular safety obstacles, including longer braking distances on both wet and dry pavement.[20] Ford has admitted that many drivers of SUVs alarm company engineers by failing to adjust their driving habits to the different handling characteristics of SUVs, including a propensity to rollover in emergency maneuvers. Ford has thus begun contracting with a national driving school to teach special safety skills to drivers of their SUVs.[21] Because Ford's own marketing data show that drivers behind the wheel of an SUV operate under a false impression of enhanced safety and drive more aggressively than they otherwise would, accounting for such differences in the safety data used to study the implications of fuel economy is crucial. The NAS majority and Kahane were unable to do so.

SUVs have a high propensity to roll over and poor crashworthiness for rollovers

The 2001 Blazer received only one star on NHTSA's rollover resistance rating system, while the 2001 Toyota Corrola, a small car, received a high score of four stars, and the midsized Chrysler Sebring received five stars.[22] Based on these ratings, the Blazer is four times or more as likely to roll over in an emergency maneuver than is the Sebring. Sixty percent of deaths in light trucks (vans, pick-ups and sports utility vehicles) occur in rollover crashes.[23] The good news is that rollover crashes are among the most survivable type of crash.

The Ford Explorer is a case in point for lessons in the importance of crashworthiness.[24] Post-hoc accounting showed that while tread separations for the Firestone tire used on Explorers were extraordinarily common, most of the fatalities which occurred following a tread separation were directly attributable to a rollover of the vehicle. Subsequent tests of the Explorer's rollover crashworthiness undertaken in preparation for litigation by safety expert and engineer Don Friedman show that the Explorer was equipped with an extremely flimsy roof which is incapable of bearing up under the weight of the rolling vehicle after the windshield is broken. Because a vehicle's windshield typically shatters after one roll, the Explorer's occupants were basically left unprotected from roof crush injuries, which are often devastating or fatal.

To address this safety problem, then, improvements are needed not only to the vehicle's tire and rollover propensity, but also to its roof strength and rollover crashworthiness in general. The point is that the human suffering caused by a failure to design a safe vehicle was entirely unnecessary given the survivability of rollover crashes. The high cost to Ford's economic well-being and reputation for safety that were caused by over 200 fatalities and 700 serious injuries appears particularly unfortunate when we consider that most of them could have been avoided by a safer design.

The NAS majority reached its conclusion by holding vehicle fatalities constant, ignoring the lifesaving possibility contained in measures such as rollover protections. But the main data relied on by the NAS, the 1997 Kahane study, found that single vehicle rollover crashes involving the greater number of small cars predicted to

enter the highway under CAFE were the swing factor in producing net increases in fatalities. As we argue below, however, to fix this problem we should, as a policy matter, address rollover crashworthiness first, last and foremost. In so doing, we can wipe out the auto industry argument that fuel economy threatens safety.

D. Solving the Rollover Problem

The need for rollover crashworthiness standards

The auto industry should begin their campaign for safety by addressing vehicle rollover. Rollovers now kill more than 10,000 people each year, a sum that is fully one-third of all vehicle deaths, yet the causes of death in such a crash are largely preventable. The forces exerted in a rollover crash are small, less than 10 mph in many cases. Like professional race car drivers that survive such crashes, if vehicle occupants are sufficiently protected from the hazards of a rollover crash they can escape death or serious injury.

The auto industry has been so laggard over the years, causing thousands of needless deaths and injuries, that federal motor vehicle crashworthiness standards are needed. One of the primary elements of protecting occupants in a rollover crash is a roof that is resistant to crushing as the vehicle rolls. Currently, roof crush standards do not adequately measure the way a roof is likely to respond in a real world rollover crash because:

- The test used by NHTSA is static rather than dynamic;
- The force measured for passage is less than that actually experienced in a rollover; and
- The windshield, which breaks on the first roll in an actual crash, is left in place for the test and supplies about one-third of the measured strength of the roof in the test NHTSA uses.

With protections, rollovers are highly survivable crashes with low gravitational forces. The following measures will provide basic occupant protection:

- A dynamic roof crush standard, which measures roof crush without the windshield in place;
- Safety belt pretensioners which trigger in a rollover crash;
- Improved seat structure to keep occupants in position during a roll, including seat belt anchors on the seat structure;
- Side impact head protection air bags which are triggered in a rollover crash and reduce the ejection of occupants;
- Roof injury protection to protect occupants in the event of contact with the roof structure; and
- Improved door locks and hinges to keep doors from becoming ejection portals in a rollover.

E. Improving Compatibility and Reducing Fatalities from Aggressive Vehicles

Fixing CAFE to reduce fatalities

The current structure of CAFE contributes to highway deaths not because vehicles are too light, but because of the dual standard created for cars and light trucks, including SUVs. The current system of CAFE standards pretends that there are two vehicle fleets: cars, which must meet a statutorily required 27.5 mpg standard, and "light trucks" and their progeny which meet the 20.7 mpg standard set by NHTSA. The safety consequences of the bifurcation of the standard have been disastrous as manufacturers have marketed heavier and heavier SUVs as family vehicles.

The erosion of CAFE will continue as manufacturers keep ramping up SUV size to produce truly massive passenger vehicles in the absence of new fuel economy standards. For just the latest example, in February 2001, DaimlerChrysler announced that the company would be marketing a new mega-vehicle, named the "Unimog," that will be 20 feet long and nearly two feet wider than a typical car, weigh 12,500 lbs., and get 10 mpg on diesel fuel.[25]

Light trucks, particularly SUVs, are very dangerous for other drivers on the highway

Study after study shows that heavier vehicles, and especially SUVs, are a threat to other drivers in vehicles they hit, especially in their heaviest and most aggressive versions. A 1998 report by Hans Joksch for the Department of Transportation (DOT) showed: (1) that the risks imposed by heavier cars on lighter car occupants *outweigh the safety benefits to the heavier car occupant across the entire vehicle fleet on the highway* and (2) that greater variability in the distribution of weights increases fatalities.[26] A paper by Alexandra Kuchar of the DOT's Volpe Institute concluded that

shifting the fleet from cars to light trucks—at each increment of the shift—increases serious injuries and fatalities, partly because of the greater stiffness of light trucks.[27]

Despite the perception that light trucks are safer for the occupant, total highway safety is made worse by the presence and weight of these vehicles. Over 11,000 light truck-type vehicle occupants were killed in crashes in 1999, and crashes involving light trucks killed another 4,896 people, for a ratio of .44 non-truck occupant fatalities for every 1 occupant fatality. This should be contrasted with passenger cars, which killed just .08 non-occupants in crashes for each passenger car occupant killed.[28] The NAS report last year concluded that a reduction in the mass of the light truck fleet would result in a net reduction in the number of fatalities on our highways, because the reduced-mass light trucks would kill fewer of the occupants of the vehicles into which they crash.[29]

All the research points to conclusions that are precisely the opposite of the myths promoted by manufacturers about CAFE and safety. As David Greene has argued, the risk to other drivers posed by SUVs and other larger vehicles is a way of "exporting" risk as a market externality that should be corrected by government action. Given the high societal costs of automobile crashes, the increased fatalities and injuries that result are costs that all of us bear. Closing the light truck loophole and new requirements under CAFE would likely have the happy consequence, as did those passed in 1975, of increasing the number of mid-sized vehicles in the fleet and bringing about greater convergence in vehicle weight across the fleet.

F. The Need for Aggressivity Standards

Sports utility vehicles now constitute 50 percent of new vehicle sales, yet SUVs are almost three times as likely as cars to kill the other driver in a collision. The scope of the problem is well-known. Even some manufacturers, such as Toyota, Nissan and Renault, have called for regulations to make all passenger vehicles more compatible in crashes.[30] In a corporate report, Ford has admitted that SUVs are an anti-social vehicle type, and this is certainly the case from a vehicle dynamics standpoint.

Light trucks tend to have higher bumpers and structures, which can override the body of a smaller car and fail to engage the crash protections built into both vehicles. Light trucks are also typically built with stiffer frames that fail to absorb crash forces, causing damage to other vehicles as well as their own occupants. Finally, most light trucks are substantially heavier than passenger cars, thus exerting more mass in a crash with a lighter vehicle.

NHTSA has begun studying the problem of vehicle aggressivity, and their results have suggested some major areas for improvement. Vehicle aggressivity, as presently understood, relates generally to three factors: vehicle weight, structural stiffness of the vehicle, and height of center of force. This last factor shows the importance of vehicle design factors—the height of a vehicle's "center of force" reflects the design distribution of its mass and is a primary indicator of the amount of damage that will be inflicted on another vehicle during a collision.[31]

All things being equal, a heavy vehicle will be more aggressive than a lighter one. When weight is controlled for, however, other factors relating to vehicle design become important. Small pick-ups and mid-sized cars have approximately the same curb weight (3,000 lbs.), yet a NHTSA study found that small pick-ups caused roughly 50 percent more fatalities to occupants of other vehicles than did mid-sized cars on a per-vehicle basis.[32]

NHTSA should be directed to issue an aggressivity reduction standard as a top priority given the rapidly increasing population of light trucks mixing with cars on our highways.[33] By raising CAFE standards, Congress would encourage automakers to take weight out of the aggressive vehicles at the high end of the fleet weight range—saving both fuel and human life. By requiring NHTSA to issue standards that reduce the likelihood of struck driver death in an accident, Congress can dramatically reduce the harm caused by our largest vehicles.

G. Believe What Industry Does, Not What It Says

The industry's solicitude for safety in the context of the fuel economy debate is disingenuous and should not mislead Congress or the public

The concern for safety expressed by automakers in the fuel economy debate is a red herring. Historically, the auto industry has protested one safety requirement after another for 35 years, using Congress, the courts and its administrative access to avoid costs associated with vehicle redesign while the safety of the public suffers. Among many other battles over safety measures, the industry:

- Fought efforts to place seat belts and shoulder harnesses in all vehicles;

- Remained silent in the debate over raising the speed limit—increased speeds in states which raised their speed limits cause over 500 deaths per year;[34]
- Fought mandatory air bags on cost grounds;
- Fought side impact and fuel system standards;
- Currently is battling to prevent effective dynamic rollover tests and an improved roof crush standard;
- And now are also fighting new requirements for a dashboard tire pressure monitoring system on cost grounds, which saves fuel economy and improves safety.

In addition, it is well documented that the industry resisted any attempt by NHTSA to publish rollover resistance ratings for years, until the Ford/Firestone disaster forced them to back away from their public opposition to ratings.[35] The cumulative death toll from these delays and the continuing battles far exceeds even the industry's claims about the so-called risks resulting from fuel economy standards.

As another one example of industry relentlessness in pursuit of profit, I cite the epic struggle over air bags. With the exception of General Motors in the early 1970's under its president Ed Cole and Mercedes in the 1980's, the manufacturers generally opposed a federal standard requiring air bags from 1969 until it finally took effect in 1988. In 1983, the Supreme Court ruled that the Reagan administration had improperly revoked the rule. Justice White, writing for the Court, stated that the industry had waged "war" on air bag regulation and that NHTSA's regulatory actions under the Safety Act could be "technology forcing:"

> The automobile industry has opted for the passive belt over the airbag, but surely it is not enough that the regulated industry has eschewed a given safety device. *For nearly a decade, the automobile industry waged the regulatory equivalent of war against the airbag and lost*—the inflatable restraint was proven sufficiently effective. Now the automobile industry has decided to employ a seatbelt system which will not meet the safety objectives of Standard 208. This hardly constitutes cause to revoke the standard itself. *Indeed, the Motor Vehicle Safety Act was necessary because the industry was not sufficiently responsive to safety concerns. The Act intended that safety standards not depend on current technology and could be "technology-forcing" in the sense of inducing the development of superior safety design.*[36]

Industry advertising sells speed and demonstrates a lack of concern for safety

Fuel economy levels, like our larger economy, are in recession. Despite their potential for tremendous impact on our environment and safety, more fuel efficient vehicles may never come to market unless Congress acts. Why? Because automakers have chosen to focus on the production of generation after generation of larger and powerful, faster vehicles, despite their knowledge that these are just the vehicle features which increase fatalities.

Recent motor vehicle television ads have begun to once again resemble the "speed ads" of the early 1990s, which persisted until safety advocates shamed the auto industry into a temporary ceasefire. The Insurance Institute for Highway Safety has pointed out the marketing strategy that accompanies this approach, citing commercials that "either ignore safety or undermine it by obscuring the fact that driving fast or aggressively increases motorists' crash risk."[37] While automakers build ever faster and more powerful vehicles, they waste the opportunity and resources to make passenger vehicles that are safe and socially responsible.

IV. Fixing the CAFE System Will Save Both Lives and Fuel

A. The existing structure of the CAFE system should be used to produce more fuel economy gains

Despite the manufacturers' outcry about technological limitations when CAFE was initially introduced as part of the Energy Policy and Conservation Act in 1975, fuel economy performance rose substantially in the seven years after the legislation took effect. Manufacturers retooled their engines and drivetrains, adjusted the mixture of their fleets, took advantage of unused technological advances, and resized or eliminated their most fuel-thirsty vehicles to produce cars that were more socially responsible. This period of change, and the exciting directions in which it took the auto industry, were summed up in a 1977 speech made by Robert B. Alexander, then Vice President of the Car Product Development Group at Ford. His response to the challenges of posed by the new fuel economy standards and emissions standards of that period was to declare the era "the age of the engineer—and I, for one, couldn't be happier."[38]

Even some in the auto industry agree that the CAFE system has been effective in meeting its goals. In his testimony of December 6, 2001, Bernard Robertson, Sen-

ior Vice President of Engineering Technologies and Regulatory Affairs for DaimlerChrysler stated that "the industry achieved significant gains during the past twenty-five years" and said that alternatives to the CAFE system are "either politically unacceptable or have significant 'unknowns' or problems." Jaime Auffenberg, chairman of the American International Auto Dealers Association recently said that "we are going to have to find ways to improve fuel efficiency . . . I think there's opportunity to improve CAFE numbers, and we need to be responsible and address them."[39] While some in the industry may quibble about the specifics of the CAFE system, none of them has advocated a viable replacement.

Because of CAFE requirements, the United States has saved 3 billion barrels of oil a day and saved consumers more than $20 billion each year. At the same time, we have avoided sending billions of dollars overseas to pay for oil, and prevented the release of tons of greenhouse carbon dioxide into the atmosphere. The program, however, has stagnated and must be updated to account for technological changes, energy concerns and environmental imperatives. While Public Citizen does not recommend significant changes in the overall structure of the system, a few critical modifications must be made.

B. Close the light truck loophole

As currently structured, the CAFE system has separate targets for cars and light trucks. The standard for cars, set by statute, is 27.5 mpg. The standard for light trucks, which NHTSA is responsible for adjusting each year to account for improvements in what is the maximum feasible, is set at 20.7 mpg and has not been adjusted for 7 years. Since 1994, appropriations riders have prevented NHTSA from expending any funds to adjust of the standard, a provision secured by the auto industry that has detrimentally affected safety, gasoline expenditures, and our environment.

As a result, NHTSA has had no money for staff research on CAFE. Moreover, the Gas Guzzler tax, which penalizes manufacturers for selling vehicles that fall extremely far below the CAFE standard, shockingly only applies to cars as it is currently drafted, and provides a weak penalty that today is out-of-date. One CAFE standard and one Gas Guzzler tax system should be applied to all light duty passenger vehicles in a manufacturer's fleet.

In 1975, when the distinction between light trucks and passenger cars was adopted and favored by the auto industry, light trucks accounted for just 20 percent of the vehicle fleet, and were largely used for off-road and commercial purposes.[40] Light trucks were also not redesigned as frequently and often used older technologies. Thus, Congress felt it could not anticipate the minimum mpg numbers for these vehicles and asked NHTSA to set the standard by regulation.

However, a separate standard makes no sense in a world where SUVs carry millions of Americans back and forth to work each day. SUVs and other light trucks are simply not used as Congress anticipated in 1975, and there is no basis for maintaining their status as a special part of the vehicle fleet. Moreover, many manufacturers have introduced crossover models built on a car chassis but have a truck body or other features, and are therefore counted under the truck CAFE standard. One particularly egregious example of this is Chrysler's PT Cruiser, which is counted as a truck for CAFE purposes simply because the back seats are removable and it has a hatchback trunk. The PT Cruiser cannot be used off-road due to its low (6.5″) ground clearance, has a towing capacity of only 1,000 lbs., and lacks 4-wheel drive. Yet the current CAFE system counts it as a light truck, raising Chrysler's overall truck fleet fuel economy average and enabling the production of other extremely inefficient vehicles. The ability of manufacturers to play this game of "light truck" qualification makes the higher CAFE standard for cars far less meaningful.

In addition, the safety implications of the two fleet split are obvious to anyone who has ever stared up at the massive grill, high bumper, and heavy, stiff body of one of the largest SUVs. Two standards means two fleets—one of which is hazardous to the other. By closing the "light truck loophole," which has become big enough to drive the 19-foot Ford Excursion through, Congress would force manufacturers to reduce the size and aggressivity of their largest vehicles, rendering them less of a hazard to other drivers and improving fleetwide fuel economy.

NHTSA just issued its rulemaking on the light truck standard (Docket No. NHTSA–2001–11048) for 2004 and announced their plans to leave the 20.7 mpg standard unchanged. The agency explains in its rulemaking that the Congressional appropriations riders which froze adjustment of this standard from 1995 to 2001 left NHTSA unable "to lay the factual or analytical foundation necessary to develop a proposed standard other than the one at 20.7 mpg."[41] This embarrassing situation must be corrected by the same Congress that imposed it on NHTSA every year since 1994.

Closing the light-truck loophole will require a phase-in of some sort, so as not to cause undue disruption in the auto industry by allowing adequate planning lead time for design adjustments. Manufacturers should be required to count an additional 20 percent of their vehicles under a combined standard every two years, until all of their vehicle fleet is counted under a single standard after 10 years.

C. Other Important Changes to CAFE Are Justified and Necessary

Fleet fuel economy should be raised to 40 mpg over ten years, starting in model year (MY) 2005

At the same time as light trucks are being phased into the vehicle fleet, Congress should set targets to increase overall fleet fuel economy. Model year 2001 total fleet fuel economy is just 24.5 mpg, a 6.5 percent decline from the high of 26.2 mpg achieved in 1987. Manufacturers were able to improve fleet fuel economy by 80 percent from 1978 to 1987, and they have had 15 years to develop new technologies that could achieve a similar improvement given enough lead time and appropriate penalties for failing to comply with the standard. While manufacturers may argue that the opportunities for technological improvement are exhausted, the work of the UCS explained above and the emergence of the hybrid engine prove these arguments wrong.

The NAS report did not advocate any fleetwide fuel economy number as the appropriate one, but its Path 2 and 3 calculations and assumptions suggest that a fleetwide fuel economy of 37 mpg by 2015 is achievable using only conventional gas engines.[42] Their original report estimated much higher achievable mileages, but they revised these estimates downward after receiving pressure from the auto industry in two waves, once before the official publication of the report, and in another round after the auto industry privately appealed to the NAS and a subsequent public hearing.[43] The NAS also failed to account in their estimates for the potential of hybrid engines to raise fleetwide fuel economy.

Moreover, the NAS analysis did not project what was possible over the long run or cost-effective from an environmental or societal viewpoint, and instead focused only on what was next-dollar "efficient" in narrow, consumer-defined economic terms. Many vehicles that were considerably more fuel efficient than those considered optimal by the NAS panel would still be cheaper, over the life of the vehicle, than the vehicles in today's fleet they would replace.[44] Phasing in a new fleet fuel economy of 40 mpg would save an estimated 2 million barrels a day by 2012, or more oil than we currently import from both Saudi Arabia and Kuwait. America would take a giant step toward untying our hands on foreign policy and enriching our environmental future by implementing this standard.

Testing procedures must be made more accurate

When CAFE was first implemented in 1978, the testing procedures used by the Environmental Protection Agency (EPA) predicted real world fuel economy performance within a margin of 3 percent. Currently, the tests predict performance within a 17 percent margin of error.[45] This is unacceptable. The overstated values that emerge from these tests are used to calculate a manufacturer's fleetwide fuel economy to determine whether or not they are meeting the CAFE target. Congress should require the EPA to issue a rulemaking that adjusts its testing procedures in order to narrow the gap between real-world fuel economy performance and tested performance to below a 10 percent margin of error within 5 years after the initiation of new CAFE standards, and below a 5 percent margin of error after 10 years. Adjusting these procedures would improve real world fuel economy, because companies would be performing to the standard, rather than to 83 percent of the requirement. It would also give Americans an accurate yardstick by which to judge our progress against our fuel reduction goals.

End the dual-fuel credit program

The duel fuel credit program is an embarrassing waste of taxpayer dollars and is a prime example of corporate welfare. It should be eliminated. Under this program, manufacturers are rewarded for not limited to, ethanol and other alcohol-based fuels), though only 1 percent of the miles driven in these vehicles are ever powered by such a fuel.[46] Consequently, manufacturers are able to build vehicles that emit more carbon dioxide than they otherwise would, simply by making cheap modifications to their engines that subsequently go unutilized. The result: U.S. gasoline consumption *increased* by 473 million gallons in 2000 because of this program.[47] The cost of building an infrastructure to support alternative fuels would far outstrip the tiny benefits in emissions reduction we could achieve through its use.

Tellingly, H.R. 4, introduced by Billy Tauzin (R–LA), which extends the dual-fuel credit program, also extends by four years the deadline by which the Secretary of

Transportation must report on the effectiveness of the program.[48] No manufacturer even attempted to offer a reasonable defense of this program in their testimony of December 6th, 2001, suggesting that even its beneficiaries understand they are getting something for nothing. The NAS condemned the program as having had "a negative effect on fuel economy."[49]

Eliminate the carryback provision in the CAFE credits system

Today, if a manufacturer fails to meet its CAFE requirement, it can submit a plan for improving vehicle fleet efficiency in three future years and then earn credits in those years that will negate the earlier year's delinquency. This loophole, the so-called "carryback" provision, invites abuse and dishonesty by the manufacturers by effectively delaying the deadline by which they must meet their fuel economy targets. Consequently, domestic manufacturers never pay any fines, and it is difficult to tell from year to year which companies are actually in compliance. In fact, no member of the Big Three domestic manufacturer group has ever paid a fine under the CAFE system, though foreign manufacturers have paid fines of as much as $26 million.[50]

In order to simplify this system, Congress should amend 49 U.S.C. 32903(a)(1) to eliminate the carryback provisions. Retaining the "carryforward" provisions at 49 U.S.C. 32903(a)(2) is desirable. These provisions allow manufacturers to apply credits earned in the present year to any of the three following years, rewarding them for exceeding their mandated CAFE performance.

The preemption provision in the CAFE regulations should be clarified so it does not preclude state-run "feebate" programs

There is some evidence, as expressed in the NAS report, that a feebate program, wherein manufacturers (and consumers) are rewarded for selling cars that are more fuel efficient than CAFE requires, would produce benefits beyond a straightforward CAFE system. While Public Citizen does not advocate implementing this program on a national level due to the large number of unknowns involved, we believe there is enough potential merit in such a system that states should be allowed to experiment with it. Currently, the preemption clause at 49 U.S.C. 32919 rules out this possibility, thereby preventing useful experimentation. Congress should pass language that specifically excludes these programs from preemption, so long as the program only rewards manufacturers for selling vehicles with tested fuel economies at or above the applicable CAFE standard in the year they are manufactured.

V. Reaping the Benefits of Solid Energy, Safety and Environmental Planning

Improving fuel economy benefits the American economy in both the short and long run

Automobile manufacturers have argued that improving fuel economy will cripple their ability to do business by preventing them from giving the customer what she wants. They argue, further, that because the automobile industry is so critical to the health of the American economy it would be destructive to the economy as a whole if Congress were to prescribe new fuel economy standards. Their conclusion shortchanges their own talented engineers and runs contrary to economic history.

Reducing dependence on oil will protect our economic stability and growth

Unstable oil and gas prices destabilize the American economy. Each of the three major oil price spikes of the last 30 years (1973–74, 1979–80, and 1990–91) was followed by an economic recession in the United States. Because so much of our oil must be imported, we are at the mercy of OPEC and foreign governments should they choose to act to rapidly raise oil prices as they did two years ago. Our economy, as it is currently structured, requires the importation of over $100 billion dollars of crude oil and petroleum products each year, which accounts for 29 percent of our trade deficit and totals $378 for every man, woman, and child in the U.S.[51] American spending on gasoline consumption—$186 billion dollars in 2000—renders consumers vulnerable to sudden price spikes over which they have no control.[52]

The economic cost of U.S. oil dependence over the past 30 years has been estimated at $7 trillion dollars of present value[53]—an amount approximately equal to the combined 2000 Gross Domestic Product (GDP) of France, the United Kingdom, Germany and India.[54] If we were to reduce our use of oil substantially, this wealth would remain within the United States and we would have greater control over economic growth.

Economic health and environmental health are closely linked

The long-run economic health of the United States depends on the stability of our climate. Our contributions to global warming through vehicle use are substantial.

Vehicle carbon dioxide emissions account for nearly a quarter of total U.S. emissions, and are a whopping 5 percent of the global total. The catastrophic environmental effects of continued warming have been well documented—I will cite just a few. If our carbon dioxide use continues unabated, we can expect:

- Epidemics of tropical diseases like malaria and encephalitis in the United States;
- Extreme heat waves that will kill hundreds and devastate agriculture;
- Uncontrolled flooding of our coastal cities;
- Extreme weather patterns, resulting in massive property damage and insurance costs.[55]

We must treat global warming as a threat to our long-term security and wealth. The actions we can take now to reduce emissions will have positive impacts for generations to come.

Weak fuel economy standards hamper U.S. competitiveness

While some foreign auto manufacturers invested considerable money and human capital and built safe, affordable, fuel-efficient vehicles of all sizes, domestic auto manufacturers secured appropriations riders barring increases in fuel economy for the last seven years. By stifling fuel economy improvements, U.S. manufacturers looked to Congress to protect them from competing, rather than using their resources to build socially responsible vehicles.

Each year that goes by without an increase in CAFE standards represents another year of backsliding by the Big Three. As just one manifestation of this trend, Honda and Toyota released vehicles powered by hybrid engines in the United States in 1999 and 2000 respectively, while Detroit (led by Ford) will not release its first hybrid vehicle until 2003.[56] If U.S. auto companies are to remain competitive, they must have the blinders of environmental and economic reality removed and join the rest of the globe in producing fuel efficient and safe vehicles.

Beware the auto industry tactic of promoting future "SuperCars" to avoid new CAFE standards now

The Bush Administration recently announced that it plans to abandon the Clinton-initiated Partnership for a New Generation of Vehicles (PNGV) program, on which $1.5 billion was spent over 8 years. This program was the excuse for failing to increase fuel economy in the early Clinton years. Now, in league with the auto industry, President Bush is vowing to commit large sums of federal money, spaced out over a decade, to research fuel-cell powered automobiles, for another long-term project that will, it is hoped by industry, supplant feasible fuel economy standards today.

Fuel cell cars would theoretically produce no carbon dioxide emissions from the exhaust system of the car (though manufacturing their fuel would still require upstream emissions).[57] While fuel cells hold tremendous potential for improving the environmental impact of America's vehicle fleet, the timing and political impact of this recent announcement should be understood as yet another industry delay tactic.

Although the PNGV program was flawed, there is little evidence that these flaws are being corrected in the proposed design for the proposed Bush administration fuel cell program, so this new program may also have limited impact on advances in the vehicle fleet. Similar risks attend this new program as plagued the old: the PNGV program was overly controlled by the auto industry itself; it shut innovative suppliers out of the process; it focused on long-term goals rather than achievable improvements; it relied on competitors sharing research with one another, inherently limiting its usefulness; and it failed to set any mid-point goals so that the program could be evaluated. It is not coincidental that President Bush is scuttling the program just two years before its only goal (an 80-mpg passenger vehicle) was to have been achieved.

The recently announced program to fund fuel cell research is based on the same premises as the PNGV program. The proposed program will do nothing to improve fuel economy in the short run, and may do very little to improve it in the long run. Mass production of fuel cell powered vehicles is many years away.[58] There are a number of technical hurdles that must be cleared before fuel cells are powerful, safe, and compact enough to be used in passenger vehicles. There is also a strong possibility that this program will be dominated by the manufacturers and their interests in the way that the PNGV program was, and therefore fail to make much material progress. Most importantly, without a federal mandate for the auto industry to improve fuel economy, there is no guarantee that manufacturers will implement any of the developed technology. This program is clearly not a substitute for raising

CAFE requirements, although its long-term research potential is certainly important.

In many ways, the car of the future was built in 1978

If automakers truly cared about producing socially responsible vehicles they need look no further than the Research Safety Vehicle (RSV), designed and assembled between 1975 and 1978, for ideas on how to improve both safety and fuel economy. The RSV was built in the late 1970s under a NHTSA contract with Don Friedman, a former GM engineer who won a competition for the contract against much larger companies. The finished vehicle weighed 2,450 lbs., got 32 miles to the gallon in 1978, and safely protected its occupant in crash tests.[59] The vehicle was able to protect its occupants in a full frontal barrier impact at 50 miles per hour (mph), and in side impact and rollover crashes at 40 mph, without significant risk of occupant injury. Current statements from Friedman indicate that, if equipped with the hybrid engine technology currently being used in the Honda Insight, this vehicle would achieve a fuel economy today of between 50 and 60 mpg.

VI. Conclusion: Upgrading Fuel Economy is A Win-Win for Congress, Public Safety and the Economy

At this moment, Congress has an historic opportunity to require a more socially responsible vehicle. Public opinion strongly supports higher fuel efficiency, and our environment, national, and economic security demand it. Improvements in fuel economy, vehicle rollover crashworthiness, and reductions in vehicle aggressivity will save both gas and human life. Congress should jump at this win-win opportunity with a definitive schedule for the phase-in of vehicle fuel economy standards up to 40 mpg for a combined fleet of cars and trucks.

Thank you so much for the opportunity to speak with you today. I look forward answering any questions you may have.

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Washington, DC. Vehicles where an additional dollar spent on the sticker price did not result in an additional dollar of gasoline savings were excluded from consideration by the NAS. The UCS rejects this approach in favor of one which includes all vehicles that are cheaper over their lifetimes than the vehicles they replace.

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[47] Keith Bradsher, "Ethanol Plan Fails to Reduce Use of Gasoline," *New York Times*, June 21, 2001, A1.

[48] HR 4, "Securing America's Future Energy Act of 2001," Section 203.

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[52] Union of Concerned Scientists, *Drilling in Detroit,* Table 1.

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Senator KERRY. Who did that car?

Ms. CLAYBROOK. The Department of Transportation. We did it with a gentleman named Donald Friedman, who is a former General Motors engineer, at a small company named Minicars. There was a big competition for doing this in 1974, and he won the competition and produced it in 1977, and that was one of the models on which we based the 1977 fuel economy standards.

Senator KERRY. Did they attach a retail consumer available price to it?

Ms. CLAYBROOK. We did. We had it evaluated by Budd Company, and it was about the same price as a car of that era like a Pinto, for example. It was in mass production.

Senator KERRY. Mr. Lund, why don't we go to you.

STATEMENT OF ADRIAN K. LUND, CHIEF OPERATING OFFICER, INSURANCE INSTITUTE FOR HIGHWAY SAFETY

Mr. LUND. Thank you, Senator. As chief operating officer of the Insurance Institute for Highway Safety, I welcome this opportunity to discuss the important relationship between vehicle fuel economy and safety.

Ms. Shelly Martin, the Institute of Government Affairs' representative, will assist me with my presentation. Also, note that my oral remarks are abbreviated from the text provided separately to the Committee, finally, note also that I am a member of the National Academy of Sciences Committee that reviewed CAFE this past year, and though I am not speaking as a representative of that committee today, I have borrowed liberally from our report.

The institute is concerned that mandatory increases in fuel economy under current CAFE structure could increase the risk of serious injury in crashes. We are concerned because reductions in vehi-

cle size and weight are obvious means to improve fuel economy, but at the same time, smaller, lighter vehicles do not protect occupants as well in crashes.

Future improvements in safety technology, driven by safety standards and consumer testing, may hide or offset the safety cost of future downweighting, but those lighter vehicles would afford less protection than heavier vehicles with the same technology. This concern does not mean that enhanced fuel economy and safety are inherently incompatible. Some downweighting of the heaviest vehicles in the fleet could reduce injury risk when all road users are considered, and there is developing fuel efficiency technology that for a price could increase fuel economy without downweighting of vehicles.

However, the evidence is clear that any regulatory action that increases the sale of smaller, lightweight cars, or light-duty trucks, for that matter, will increase injury risk in crashes. Moreover, CAFE as currently structured provides an incentive for the sale of the smallest, lightest vehicles, thus, an alternative structure, perhaps one that indexes fuel economy to vehicle weight, is necessary to avoid negative consequences.

The institute's concern about a potential increase in small car sales is illustrated in Figure 1 here. We see that the risk of occupant crash fatality per vehicle on the road increases as vehicle weight decreases, going from right to left across this figure. For example, the risk of fatal injury per registered vehicle is about twice as high for the lightest car as compared with the heaviest ones.

Now, the protective factor of vehicle weight is not the full story. Vehicle weight can also increase the risk of injury to other road users. Figure 2, for example, shows that as the weight of the vehicles increases, the fatality risk increases in other vehicles that collide with them. These two effects of weight; greater protection for the vehicle's own occupants plus increased risk to other road users, are combined in Figure 3, which shows the total number of crash tests involving these vehicles, including pedestrians and cyclists. We see increasing vehicle weight to about 3,500 or 4,000 pounds reduces total fatality risk.

However, beyond 4,000 pounds, increasing vehicle weight results in a net increase in fatalities as the risk to other road users more than offsets the increased occupant protection of the additional weight. Note that any decrease in weight below 4,000 pounds results in an increase in fatality risk, whether we are talking about cars, or SUV's, or pick-ups, but above 4,000 pounds, decreases in vehicle weight can reduce total fatality risks.

To put this another way, Figure 3 illustrates that some vehicle downweighting could occur without a net safety cost to society as a whole, if it involved only the heaviest vehicles. There are other ways to increase fuel economy without negative safety consequences. For example, there is developing technology that could increase fuel efficiency and achieve large increases in fuel economy without reducing vehicle weight or altering current vehicle performance. However, this brings us to the problem of the current CAFE structure. Nothing about it encourages manufacturers to achieve fuel economy by reducing the weight of only their largest vehicles, or by installing expensive developing technology.

Senator Kerry, you mentioned all of the fuel efficiency technology that has gone into horsepower vehicle weight, instead of fuel economy. However, CAFE is structured so an increase in the sales of small, lightweight, and fuel-economical vehicles is an obvious way to offset the low fuel economy of large, heavy vehicles.

Figure 4 illustrates this by showing the distribution of 1999 model cars by weight and fuel consumption in gallons per 100 miles traveled. Figure 4 also shows the mandated CAFE standard, but as the horizontal line at 3.64 gallons per 100 miles. As car weight increases, fuel consumption also increases, and many heavier cars consume more than the CAFE target. This is allowable with corporate averaging, because any manufacturer with a heavy model that consumes fuel much above the required level, like vehicle A here, can still satisfy CAFE by also producing lightweight and fuel-economical models like vehicle B, because usually there is much more profit to be made from larger, feature-laden vehicles. Lowering the allowable fuel consumption further may not result in downweighting or improved fuel economy of the heavier vehicle A, but rather, in increased sales of the less profitable and less safe vehicle B.

CAFE need not be structured this way. The standard could promote fuel economy and safety if the fuel economy requirements were indexed to vehicle weight. Figure 5 shows the fuel economy of all passenger vehicles in 1999, and a single alternative CAFE requirement is plotted for light cars and trucks, the solid line that increases until about 4,000 pounds and then flattens out. The idea is that allowable fuel consumption would decrease for vehicles lighter than 4,000 pounds, so their higher fuel economy would no longer provide an offset for lower fuel economy of heavier vehicles. Thus, there is no incentive to down-weight lighter vehicles.

Ending the sliding fuel economy requirement at around 4,000 pounds further enhances the potential safety benefits by holding all vehicles above this weight to a common value. There would be an incentive for manufacturers to reduce the weights, and therefore the aggressivness of the heaviest vehicles. The better fuel economy of lighter vehicles could not be used to offset that high fuel consumption. NHTSA, we believe, should investigate this enhanced CAFE structure and, if its promise is confirmed, it should be seriously considered as an alternative to the current structure.

In summary, improved fuel economy and safety are not inherently incompatible, but there is a problem. The current CAFE structure allows, and market economics encourage, the sale of small, lightweight, and less protective vehicles in order to offset the fuel consumption of large, heavy, and profitable ones. Simply ratcheting up current CAFE requirements for cars or light duty trucks will increase motor vehicle fatality risk by increasing the sales of lightweight cars and trucks.

Based on the best evidence available, the NAS CAFE Committee concluded that the vehicle weight reductions that occurred between 1976 and 1993, at least partially in response to the initial fuel economy standards resulted in about 2,000 additional fatalities in 1993. Congress should be guided by this history. World events and environmental concerns may well require improved fuel economy as part of our U.S. response. If so, I urge Congress to direct NHTSA

to consider new CAFE structuring that could improve both fuel economy and safety. We must ensure that the fuel economy improvements that might save lives in the far future do not result in avoidable crash fatalities in the very near future.

Thank you.

[The prepared statement of Mr. Lund follows:]

PREPARED STATEMENT OF ADRIAN K. LUND, CHIEF OPERATING OFFICER, INSURANCE INSTITUTE FOR HIGHWAY SAFETY

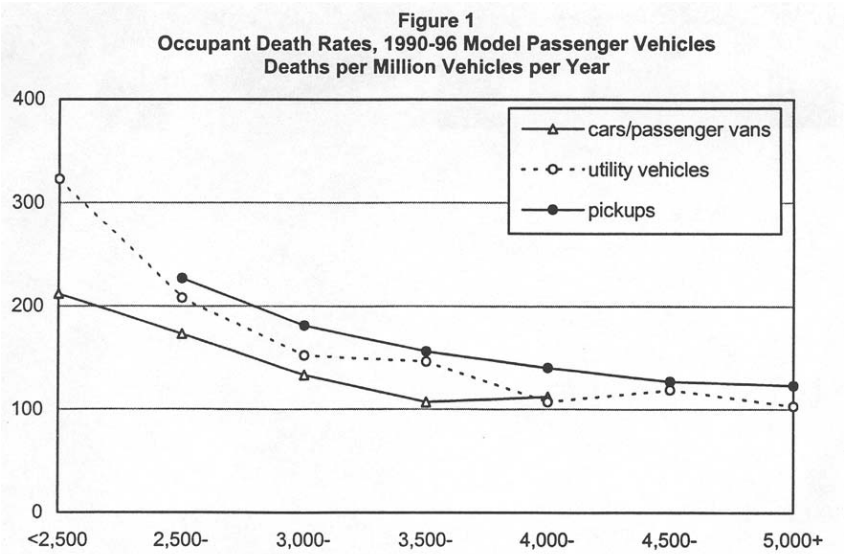
The Insurance Institute for Highway Safety is a nonprofit research and communications organization that identifies ways to reduce motor vehicle crashes and crash losses. I am the Institute's chief operating officer, and I am here to discuss the important relationships between vehicle fuel economy and safety. The Institute is particularly concerned that mandatory increases in fuel economy could increase the risk of serious injury in crashes or, at the very least, reduce the societal benefits of future vehicle safety improvements.

This concern is based on the inherent physical relationships between vehicle mass, fuel consumption, and safety. Larger, heavier vehicles consume more fuel to travel the same distance as smaller, lighter cars. At the same time the larger, heavier vehicles protect their occupants better in the event of a crash. This is true in both single- and multiple-vehicle crashes. Reductions in vehicle size and weight can improve fuel economy but only at the cost of reduced occupant protection. Simultaneous improvements in safety technology to protect occupants can hide or offset the safety costs of downweighting, but the basic fact remains that, for a given level of safety technology, heavier vehicles afford greater protection than lighter vehicles. No safety technology can be added to lighter vehicles that will offset their inherent disadvantages in protecting occupants in crashes. The protective effects of mass are independent of, and additive to, other safety factors.

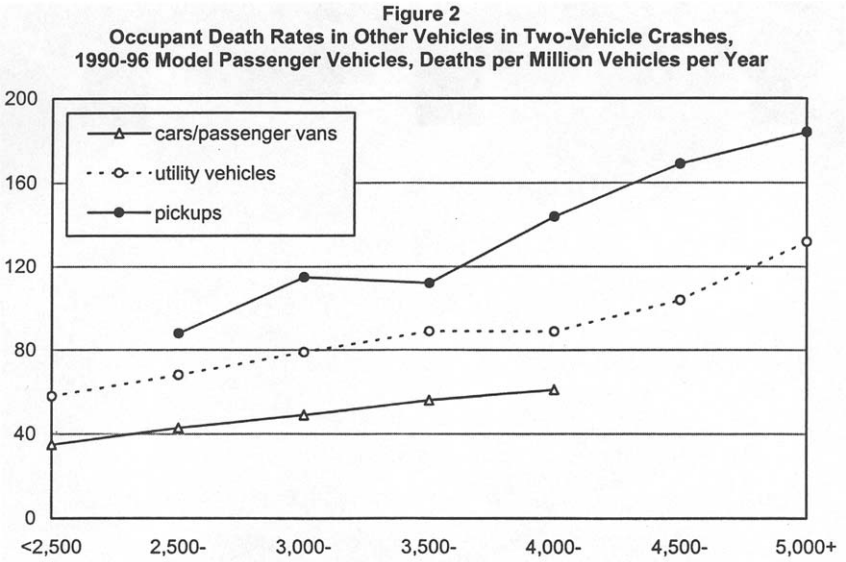
This relationship is described in much greater detail in the recent report by the National Academy of Sciences (NAS) Committee to Review the Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards, July 31, 2001. I was a member of that committee, and the Institute largely agrees with the report's majority position on safety, so I will not repeat the details. I will instead focus on the primary implications of the report:

- Any regulatory action that increases the sale of small, lightweight vehicles, whether cars or light-duty trucks, will increase injury risk in crashes.
- This inherent relationship does not preclude the improvement of fuel economy without adverse safety consequences.
- As currently structured, CAFE standards provide an incentive for the sale of the smallest, lightest vehicles.
- Alternative CAFE structures that index fuel economy requirements to vehicle weight can mitigate or even reverse the negative safety implications of increased fuel economy requirements.

Before elaborating on these points, we first need to review the relationship between vehicle mass and motor vehicle crash injury risk. In Figure 1, we see the risk of occupant crash fatality per vehicle on the road for 1990–96 model cars, sport utility vehicles (SUVs), and pickups during 1991–97, the most recent year for which the Institute has conducted these analyses. (Note: In contrast to the National Highway Traffic Safety Administration (NHTSA), the Institute classifies minivans, which typically are built on modified car platforms, as cars rather than trucks.) For each of these vehicle types, the risk of occupant death increases as vehicle weight decreases. The risk of fatal injury per registered vehicle is about twice as high for the lightest cars com-pared with the heaviest ones. Similar relationships occur for SUVs and pickups, although the typical SUV or pickup has a higher fatality risk than the typical car of similar weight. This is largely due to the increased risk of single-vehicle crashes, particularly rollover crashes, among light-duty trucks. So what we see from this figure is the basic protective effect of vehicle size and weight. We also see a diminishing protective effect as vehicle weight approaches 3,500 to 4,000 pounds.



This protective effect of vehicle weight is not the full story. Many crashes involve more than one vehicle, and in multiple-vehicle crashes vehicle weight can increase the risk of injury in other vehicles at the same time it limits the risk to its own occupants. Figure 2 shows the number of occupant fatalities that occurred in other vehicles that collided with 1990–96 models during 1991–97, per registered 1990–96 vehicle. What we see from this figure is that the risk of fatality in other vehicles increases with increasing vehicle weight.

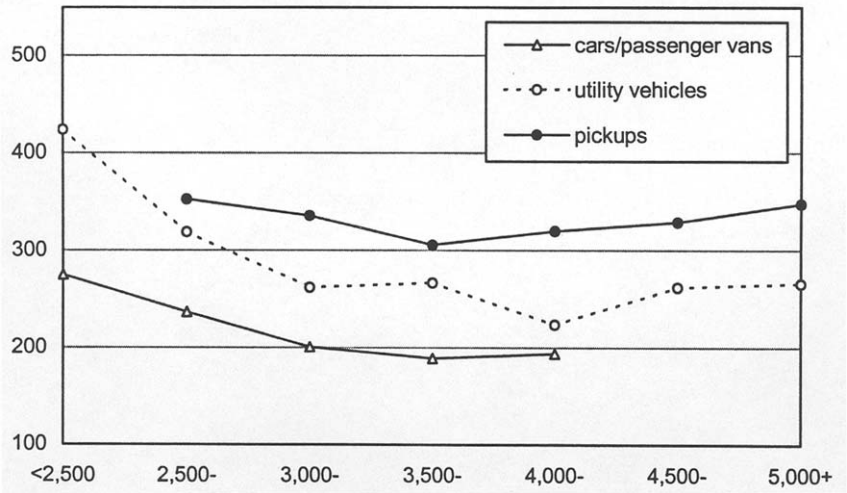


From a societal perspective, the effect of vehicle weight includes both of these effects—the protective benefits for a vehicle's own occupants plus the increased risk to other road users. In Figure 3, the total number of crash deaths involving 1990–96 models during 1991–97 is shown by vehicle weight. These fatality counts include pedestrians and cyclists but exclude deaths in crashes involving three or more vehicles, which are relatively few and in which the implications of vehicle weight would

be difficult to isolate. This figure illustrates that, from a societal view, increasing vehicle weight to about 3,500 or 4,000 pounds reduces total fatality risk. Beyond about 4,000 pounds, increasing vehicle weight results in a net increase in fatalities, as the risk to other road users more than offsets the increased occupant protection afforded by the additional weight.

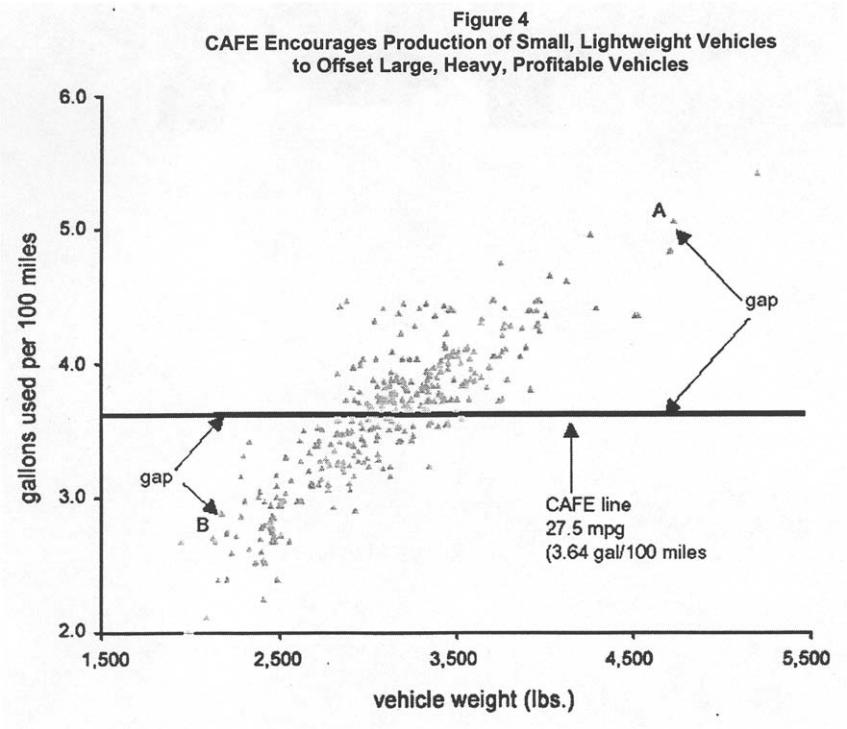
To put this another way, Figure 3 illustrates that reducing the weight of midsize cars or small SUVs will increase the total fatality risk. However, reducing the weight of the heaviest SUVs and pickups could result in a net societal safety benefit. So some vehicle downweighting need not result in a net safety cost if it involves the heaviest vehicles.

Figure 3
Occupant and Other Road User Death Rates in Crashes, 1990-96 Model Passenger Vehicles, Deaths per Million Vehicles per Year

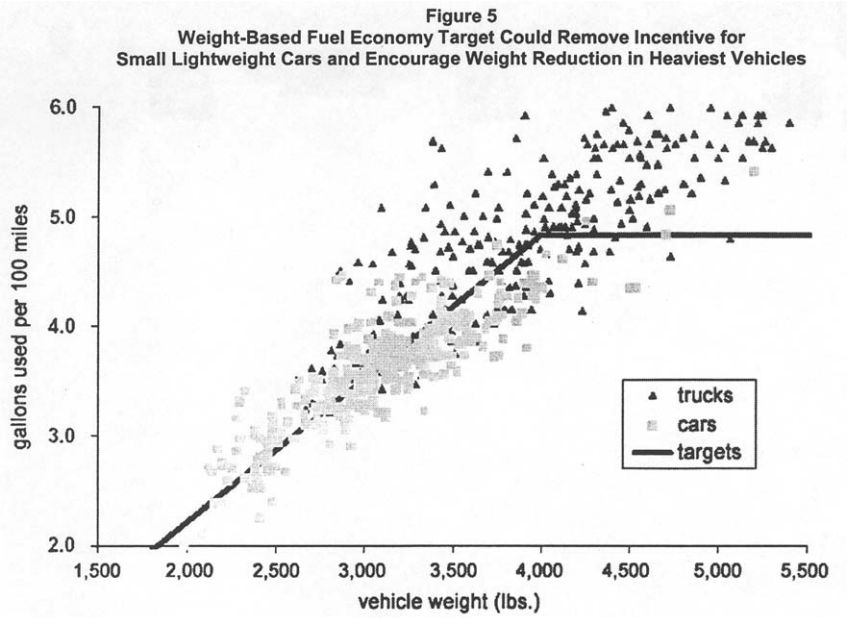


Besides downweighting the heaviest vehicles, there are other ways to increase fuel economy without negative safety consequences. The NAS committee's report notes the existence of technology that could increase fuel efficiency and achieve large increases in fuel economy with-out reducing vehicle weights or altering current vehicle performance. However, nothing about the current CAFE structure encourages manufacturers to achieve fuel economy by reducing the weight of their largest vehicles or by installing expensive technology. In fact, CAFE is structured so that increasing the production of small, lightweight, and fuel economical—but less safe—vehicles can offset the production of large, heavy vehicles, which offer manufacturers much greater opportunity for profit.

Figure 4 illustrates this. It shows the distribution of 1999 model cars by weight and fuel economy (in gallons per 100 miles traveled). It also shows the mandated CAFE standard of 27.5 miles per gallon (the horizontal line at 3.64 gallons per 100 miles). For a manufacturer, CAFE is computed by taking the difference between each vehicle's fuel economy and the required level and aver-aging across the various vehicles. Note that any manufacturer with a heavy model that consumes fuel much above the required level (vehicle A in Figure 4, for example) can satisfy CAFE by also producing small, lightweight, and fuel economical models (like vehicle B). Because there usually is much more profit to be made from larger, heavier, feature-laden vehicles, this aspect of CAFE can be detrimental to safety by providing an incentive to develop and sell small, less protective vehicles. The danger is twofold—the number of small, lightweight vehicles on the road increases and, because those vehicles permit manufacturers to increase production of large, heavy vehicles, the overall incompatibility of the passenger vehicle fleet increases. Essentially, the sale of the lightweight vehicles permits the sale of the heavy vehicles that pose the greatest danger to the occupants in the lightweight vehicles.



As the NAS committee reported, CAFE need not be structured in this manner. The standards could promote fuel economy and safety, if the fuel economy requirements were indexed to vehicle weight. Figure 5, which appears in the NAS report labeled "Enhanced CAFE Targets," shows the fuel economy of all passenger vehicles in 1999, and a single CAFE requirement is plotted for cars and light trucks. The idea is that fuel economy requirements would increase as vehicles become lighter. Thus, there would be no incentive to downweight the lightest vehicles because their fuel economy requirements would simply increase. Increased sales of such lightweight vehicles could not be used to offset the fuel requirements of heavier vehicles.



To further enhance the safety effect of modifying the current CAFE structure, the NAS committee considered that the sliding fuel economy requirement could end at around 4,000 pounds. Above this, the societal consequence of increasing vehicle weight appears to be negative as vehicle aggressivity effects outweigh occupant protection effects. By holding all vehicles above this weight to a common value (shown here as the current fuel economy level for light trucks), there would be an incentive for manufacturers to reduce the weights, and therefore the aggressivity, of the heaviest vehicles. The Institute believes strongly that NHTSA should investigate this enhanced CAFE structure and, if its initial promise is confirmed, it should be seriously considered as an alternative to the current CAFE structure.

The Institute is concerned that current efforts to increase the fuel economy of the U.S. vehicle fleet could result in more deaths and injuries in crashes. However, the Institute does not view improved fuel economy and safety as inherently incompatible goals. The chief problem is that the current CAFE structure encourages the sale of small, lightweight, and less protective vehicles in order to permit the sale of large, heavy vehicles. Although the heavy vehicles are more protective of their occupants, the additional protective effect of weight diminishes at greater weights while the aggressive effect increases. Thus, simply ratcheting up current CAFE requirements for cars or light-duty trucks would be expected to increase motor vehicle fatality risk by increasing the sales of lightweight cars and trucks.

The NAS committee identified a number of vehicle and engine technologies that could increase fuel economy without downweighting or losing vehicle performance characteristics. But these technologies come at a cost, and nothing in the current CAFE structure encourages manufacturers to adopt fuel efficiency strategies as opposed to the potentially cheaper and less safe strategy of downweighting. In contrast, incentives do exist to add weight-increasing features to large, profitable vehicles while subtracting features and weight from small, cheap vehicles. The risk is compounded by the likelihood that younger, riskier drivers who cannot afford the protection of the heavier vehicles will drive the small, cheap vehicles.

Congress should be guided by history as it considers this issue. The first fuel economy standards were imposed in the 1970s after the oil crisis. In response, new technologies were introduced, but a large proportion of the resulting improvements in fuel economy came from vehicle weight reductions. Cars in 1993 were, on average, 700 pounds lighter and light-duty trucks were 300 pounds lighter than in 1976. NHTSA has estimated that in 1993 each 100-pound decrease in car weight was associated with a 1.13 percent increase in fatality risk in crashes. This suggests, as the NAS report concludes, that if car drivers in 1993 had chosen vehicles as heavy as those in 1976, there would have been fewer sales of the lightest vehicles and

more sales of the heavier ones. This would have meant 2,100 fewer fatalities in crashes. The NHTSA analysis also indicates that, because light-duty trucks were 300 pounds lighter in 1993, there were 100 fewer fatalities in truck crashes. This effect of truck weight reduction occurs because light-duty trucks, on average, are heavier than most other passenger vehicles and the aggressive effect of additional mass outweighs the protective effect.

Simply ratcheting up fuel economy requirements within the current CAFE structure could cause a repeat of this negative effect. Although the technology exists to improve fuel economy without downweighting the smallest, lightest vehicles, economic forces may argue against the adoption of such technology. Certainly, the current CAFE structure does nothing to prevent the increased sale of small, lightweight, and less safe cars and light trucks. The Institute understands that Congress may decide that current world events as well as environmental concerns require improved fuel economy as part of the U.S. response. However, we urge Congress to direct NHTSA to consider new CAFE structuring that could improve both fuel economy and safety. Such consideration is necessary to ensure that the fuel economy improvements that might save lives in the distant future do not result in vehicle downsizing and downweighting that surely will result in needless fatalities in the near future.

Senator KERRY. Thank you very much, Mr. Lund. Mr. Hoerner.

STATEMENT OF J. ANDREW HOERNER, DIRECTOR, RESEARCH CENTER FOR A SUSTAINABLE ECONOMY

Mr. HOERNER. Good morning, Mr. Chairman and Members of the Committee. I want to thank the Committee for inviting me to testify this morning on the economics of increasing CAFE standards. I am Andrew Hoerner, director of research for the Center for a Sustainable Economy. The center is a nonprofit research institute.

My testimony today focuses on the consequences of increased CAFE standards on employment. It is based on a series of economic simulations we did jointly with the Economic Policy Institute. Our findings are rooted in one simple observation, every dollar of the cost of producing a car is paid to somebody. The reason cars are more expensive when you increase efficiency standards is because you are using more labor or more expensive materials, or both. We find that higher CAFE standards, which increase the price of automobiles, would also increase employment in the U.S. auto industry.

My testimony will be based on a reference scenario in which the car and light truck fleets are combined, and the combined CAFE is increased from its current level of 24 miles per gallon to 50 miles per gallon over 20 years. This is a realistic scenario, in that the rate of improvement in CAFE is roughly 80 percent of the rate that was maintained in the previous period of CAFE increases. Our costs and technology assumptions are taken from estimates by the U.S. Department of Energy National Labs.

In our scenario the average cost of passenger cars and light trucks increases relative to the baseline approximately 1 percent per year, starting in year five. These cost estimates were then used to estimate employment, trade, and other economic consequences, using a University of Maryland macroeconomic model, the lift model.

How would such standards affect employment in the auto industry? Employment is the product of two factors, first, the number of domestically produced automobiles and, second, the number of workers needed to produce each car. We estimate that the increase in the cost of vehicles caused by a higher CAFE standard would decrease the output of the U.S. auto industry by an average of 1.4

percent in the first decade and 5.5 percent in the second decade. The bulk of this decrease, more than 90 percent in both decades, is due to increased imports of foreign cars. On the other hand, we estimate increased labor requirements per vehicle to average 2.2 percent in the first decade and 6.1 percent in the second decade.

The combined effect of the decrease in output and the increase in labor requirements per car is a small net employment increase averaging about 0.8 percent in the first decade and 0.6 percent in the second decade. These job gains could be more than tripled if policies could be devised to avoid the loss of market share to imports.

One approach to reducing the negative impact of increased CAFE standards on market share is to provide production tax credits for U.S. producers of superefficient vehicles. If properly designed, production tax credits could offer several benefits. They would provide incentives to accelerate the introduction of new technologies, they would increase the stock of vehicles exceeding the CAFE standard, thus providing slack to reduce the cost of CAFE for other new vehicles, and they would mitigate the increase in vehicle price and thereby maintain market share for the U.S. industry.

We believe that such credits are appropriate to the extent that CAFE offers benefits such as reduced global warming and reduced exposure of the economy to global oil price shocks that flow to the public at large.

We note that in order to offset competitive burdens on U.S. producers, these tax credits must be on production rather than purchase or consumption. Purchase credits would reduce the cost of higher efficiency autos to consumers, but would not help to preserve U.S. market share. Most economists would agree that such tax credits, whether on production or purchase, are best financed through either increased fees on low efficiency vehicles, or a small increase in gasoline taxes.

The estimated real rate of return to the consumer investment in auto efficiency averages more than 10 percent per year. This is more than a third higher than the long-term average real rate of return on corporate stocks. Returns of this magnitude imply that consumers have more money to spend, increasing personal income.

In summary, we have found that increased CAFE standards would increase employment in the U.S. auto industry, but erode the market share of U.S. producers. The negative effects of CAFE on output can be reduced or eliminated and the positive effects greatly enhanced if tax credits are used to share the increased cost of superefficient vehicles between the purchaser and the public.

Finally, increased CAFE standards provide a high rate of return to the consumer investment and energy efficiency, and increase personal income.

Thank you. I would be happy to take any questions.

[The prepared statement of Mr. Hoerner follows:]

PREPARED STATEMENT OF J. ANDREW HOERNER, DIRECTOR, RESEARCH CENTER FOR A SUSTAINABLE ECONOMY

Good morning Mr. Chairman and Members of the Committee. I want to thank the Committee on Commerce, Science and Transportation for inviting me to testify this morning on the economics of increasing Corporate Average Fuel Economy (CAFE) standards.

I am Andrew Hoerner, Director of Research for the Center for a Sustainable Economy. The Center is a non-profit, non-partisan research and policy organization devoted to promoting innovative, market-based approaches to achieving an economy that combines long-term economic prosperity, environmental quality, and social fairness.

The issue of CAFE is a complex one. It involves policy issues in national security, environmental quality, consumer safety, trade and competitiveness, and the economic health of an important industry. My testimony today focuses primarily on the consequences of increased CAFE standards on employment. It is based on a series of economic simulations that we did jointly with the Economic Policy Institute as part of an effort to model labor impacts of a comprehensive climate and energy policy.

Our findings are rooted in one simple observation: every dollar of the cost of producing a car is paid to somebody. The reason cars are more expensive when you increase efficiency standards is because you are using more labor or more expensive materials or both. We find that higher CAFE standards, which increase the price of automobiles, would also increase employment in the U.S. auto industry by a modest amount, despite significantly increased imports of foreign cars and lower purchases of cars by U.S. consumers.

My testimony will be based on a reference scenario in which the car and light truck fleets are combined, and the combined CAFE is increased from its current level of approximately 24 MPG to 34 MPG after 10 years and 50 MPG in 20 years. This increase is phased in over a 15-year period, starting in 5 years. These fleet average numbers are approximately equivalent to auto standards of 48 mpg in 2010 rising to 68 mpg in 2020 and light truck standards of 30 mpg in 2010 and 42 mpg in 2020.

We do not allege that this scenario is in any sense optimal. It is a realistic scenario in that the rate of improvement in CAFE is roughly 80 percent of the rate that was maintained in the previous period of CAFE increases, 1978 to 1985. The specifics of our results depend on the exact scenario that we analyze. However, we believe that the qualitative features described below would be maintained over quite a wide range of CAFE increases, including any increases smaller than those we examine. These qualitative features include increased auto cost, reduced fuel consumption and expenditures, consumer impacts that are positive over the life of the car at auto-financing discount rates, a decrease in the number of domestically produced autos sold together with an increase in the total value of those autos, and an increase in domestic auto industry employment.

Our cost and technology assumptions are taken from estimates by the U.S. Department of Energy national labs.[1] They are similar to those used in the recent National Academy of Sciences assessment of CAFE,[2] though the policy package we analyze is more aggressive in some other dimensions, such as public funding of energy research.

These cost estimates were then used to estimate employment, trade, and other economic consequences of the scenario using the LIFT (Long-term Interindustry Forecasting Tool) model of the Inforum academic research and consulting group at the University of Maryland. Inforum has a well-respected, 20-year track record performing macroeconomic modeling. The LIFT model is a 97-sector inter-industry macroeconomic model. It tracks more than 800 macroeconomic variables, and is unique in the extent to which it builds up aggregate demand from individual industry demands at a high level of industrial detail.

It is generally agreed that substantial increases in CAFE will increase the cost of motor vehicles, all other things held constant. In our scenario, the average cost of passenger cars and light trucks increases relative to the base price by 1 percent in year five, rising steadily to 15 percent in year 20. This increase in auto price and fuel efficiency has a number of effects.

For consumers, the estimated fuel savings offset the increase in cost of the vehicles. All of the increased cost, however, occurs up front when the consumer purchases the vehicle; while the fuel savings occur over the vehicle's life. Thus, whether the net result is positive or negative depends on the rate at which you discount the

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[1] Specifically, from the CAFE sensitivity case in chapter six of Interlaboratory Working Group. 2000. *Scenarios for a Clean Energy Future.* LBNL–44029 and ORNL/CON–476. Washington DC: U.S. Government Printing Office. <http://www.ornl.gov/ORNL/Energy__Eff/CEF.htm>

[2] National Academy of Sciences, Committee on the Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards, Board on Energy and Environmental Systems, Transportation Research Board, National Research Council, *Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards*, Washington DC: National Academy Press (2002), <http://www.nap.edu/catalog/10172.html?onpi__newsdoc073001>.

fuel savings. For reasons that are not well understood, but which may relate to imperfect information in the auto market, consumers appear to discount energy efficiency savings at a higher rate than most other credit transactions. At a 15 percent discount rate, similar to the rate consumers appear to employ for these transactions, the result is a net benefit for car purchasers in 2010 and a small net burden for car purchasers in 2020. On the other hand, it would appear to be more rational to use a rate similar to the typical automobile financing rate. If such a rate (roughly 9 percent for bank-financed car loans [3]) is used, the reference CAFE scenario would provide a net benefit to consumers in every year.

How would such standards affect domestic employment in the auto industry? Employment is the product of 2 factors, the number of domestically produced automobiles and the number of workers per car.

We estimate that the increase in the cost of vehicles meeting a higher CAFE standard will slightly decrease the output of the U.S. auto industry. Over the first decade, the average decrease relative to the baseline is 1.4 percent (not 1.4 percent per year). In the second decade, this average decrease rises to 5.5 percent. A small portion of this decrease is due to consumer responses to higher prices. However, the bulk of the decrease—more than 90 percent in both decades—is due to increased imports of foreign cars.

We assume that foreign producers have the lead on U.S. producers in the manufacture of high-efficiency vehicles. To capture this in our modeling framework, we assume that foreign producers are able to supply vehicles meeting the higher CAFE standards at half the incremental cost of U.S. producers. The cost advantage assumed here is probably at the high end of what most industry experts would estimate. If the cost advantage of foreign producers in producing highly-efficient vehicles is assumed to be lower, the negative impact on output would be lower and the employment benefit would be higher.

According to the Department of Energy estimates we used, the cost of achieving our reference CAFE standards would amount to 15 percent of vehicle cost in year 20. This cost is divided between increased labor and increased materials costs, and is born partly by consumers and partly by producers. Increased materials costs provide employment benefits to other industries, but not to the auto industry itself. We estimate increased labor requirements per vehicle to average 2.2 percent in the first decade and 6.1 percent in the second decade.

The combined effect of the decrease in domestic output and the increase in domestic labor requirements per car is a small net employment increase, averaging about 0.8 percent (5500 jobs) in the first decade and 0.6 percent (4400 jobs) in the second decade. These job gains could be improved by a factor of approximately 2 in the first decade and 10 in the second decade if policies could be devised to avoid the loss of market share to imports. I will suggest one such policy in a moment.

We did not model the effect of an increase in CAFE standards on exports of U.S.-made vehicles. The rest of the industrialized world is moving rapidly to adopt increasingly tight auto efficiency standards. It seems clear that if the U.S. is alone or nearly alone in maintaining lower efficiency standards, U.S. manufacturers will find it increasingly difficult to sell their cars in foreign markets. Thus it appears reasonable to assume that increased CAFE standards in the U.S. will increase exports of U.S.-made autos. However, we were not able to quantify this effect. If this effect could be estimated, it would mitigate the loss of auto industry output and further increase the auto industry job gain.

One possible approach to reducing the negative impact of increased CAFE standards on market share is to provide production tax credits for U.S. producers of super-efficient vehicles that exceed the CAFE standard. Assuming that the CAFE standards are binding, such credits would not further improve auto efficiency (unless vehicles receiving the credit are excluded from CAFE calculations). This is because, for each vehicle that exceeds the CAFE standard, manufacturers can produce offsetting vehicles below the standard. However, if properly designed, production tax credits could offer several other benefits. They could:

- provide incentives to accelerate the introduction of new technologies; [4]
- increase the stock of vehicles exceeding the CAFE standard, thus providing "slack" to reduce the cost of CAFE for other new vehicles not receiving the credit;

[3] See, e.g., <http://www.bankrate.com/brm/news/fed/fedchart.asp>.

[4] For an estimate of the magnitude of this effect, see Hoerner, J. Andrew and Avery Gilbert, *Assessing Tax Incentives for Clean Energy Technologies: A Survey of Experts Approach*, Washington DC: Center for a Sustainable Economy (April 2000) <http://www.sustainableeconomy.org/abstract.htm>.

- mitigate the increase in vehicle price and help maintain market share for the U.S. industry; and
- share the incremental cost of super-efficient vehicles between the purchaser and the public.

We believe that cost-sharing with the public is appropriate to the extent that CAFE offers benefits—such as reduced air pollution, reduced global warming, and reduced macroeconomic exposure to global oil price shocks—that flow to the public at large.

Note that in order to offset competitive burdens on U.S. producers, these must be production, rather than purchase or consumption, tax credits. Purchase tax credits go to U.S. consumers of high-efficiency vehicles, regardless of where those vehicles are produced. Production tax credits go to U.S. producers of high-efficiency vehicles, regardless of where those vehicles are purchased. Purchase credits would reduce the cost of higher-efficiency autos to consumers, but would not help to preserve U.S. market share. Production credits are particularly appropriate to the extent that CAFE standards are intended to reduce global warming, as super-efficient vehicles produce an equivalent reduction in CO_2 emissions whether they are purchased domestically or abroad. Most economists would agree that such tax credits, whether on production or purchase, are best financed through either increased fees on low-efficiency vehicles or a small increase in gasoline taxes.

For the economy as a whole, the impact on personal income of the CAFE program we studied is unambiguously positive. Increased CAFE standards essentially constitute a program of forced investment in auto efficiency. The return comes in the form of energy savings. The estimated real rate of return to this consumer investment in auto efficiency in our reference scenario varies with the period and vehicle type. But the return averages more than ten percent over the entire period and vehicle stock. This is more than a third higher than the long-term average real rate of return on corporate stocks.[5] It is even higher when compared to the average consumer's investment portfolio, which typically includes securities such as bonds and bank accounts with lower risks and returns. Returns of this magnitude imply that consumers will have more money to spend, increasing personal income.[6]

In summary, we have found that increased CAFE standards raise the price of domestically produced autos and the labor requirements per car. The net effect of this is to increase employment in the U.S. auto industry slightly, but erode the market share of U.S. producers. The latter effect would be smaller if the foreign cost of energy efficiency improvements were more similar to the U.S. cost, or if increased CAFE standards cause an increase in exports. We recommend that further research in these areas be undertaken.

The negative effect of CAFE increases on output can be reduced, and the positive effect on employment increased, if tax credits are used to share the increased cost of super-efficient vehicles between the purchaser and the public. These must be production credits to be effective. They are best financed with charges on low-efficiency vehicles or a small increase in motor fuels taxes. Finally, increased CAFE standards provide a high rate of return to consumer investment and increase personal income.

Thank you. I would be happy to take any questions.

Senator KERRY. Thank you very much, Mr. Hoerner. Thank you all for your testimony.

Let me begin, if I may. Ambassador, do you see some parallels, or is there a distinction between the national security imperatives of the period when you all confronted this and what we see today?

Ambassador EIZENSTAT. No. I think, if anything, the national security imperative has become heightened. The instability in the gulf, the threat to moderate Arab regimes from Islamic fundamentalism in the very regions on which we are increasingly dependent for imports, all to me heighten the national security concerns that we faced in the seventies, rather than diminish them.

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[5] Roger Ibbotson, *Stocks, Bonds, Bills, and Inflation: Classic Edition Yearbook* Chicago: Ibbotson Associates (2002).

[6] Some of this benefit may be offset in terms of economic welfare (but not in terms of personal income) if high-efficiency vehicles have lower performance on other dimensions important to consumers, such as performance or carrying capacity.

Senator KERRY. What do you say to somebody in the industry who might say to you, well, wait a minute now, we are going to go from 51 percent to 64. You are going to make some savings in CAFE. I do not know what you are going to do to the industry as a whole, but even when you finish doing whatever you do to us, we are still going to be pretty dependent on foreign oil, including the Middle East.

Ambassador EIZENSTAT. That is absolutely true. President Nixon talked about energy independence in the early 1970's, and that is a chimera. It is not going to happen, we are going to continue to be dependent. The question is, how much, and what we want to do as rapidly as possible is reduce that dependence, so instead of having a curve in which we go from 51 to 64 percent, we begin to take that curve downward and keep it flat at least initially and then have it go downward, but Senator, you are quite right, for a very long time we are going to be dependent on oil from very volatile regions.

Senator KERRY. I assume that your strategy in adopting the notion that you want to try to hold it down and sort of reduce your exposure would also predicate that you would want a very serious effort to be moving down the road toward complete, sort of independence from that kind of constraint, or do you see that, or is that simply pie in the sky?

Ambassador EIZENSTAT. I think it is pie in the sky in any reasonable timeframe. I do not think it is pie in the sky to suggest that we can level off that dependence and begin to reduce it by an aggressive program which includes CAFE standards, increased production and, in particular, the kind of research and development incentives you have championed. That is not at all pie in the sky. If we look out 10 to 15 years, there is no reason why, with a very aggressive research program, strong CAFE standards, and as much increase in production as we can get domestically, and that obviously is fairly limited because we simply do not have the kind of reserves other countries do, that we can begin to reduce that dependence.

Senator KERRY. When you struggled with the three chief, the big three sort of sitting in front of you in the White House, and there you are being told, impossible, cannot do it, we are going to lose jobs, and so forth. Maybe you might share with us how you saw through that cloud of negativity so as to take the step with a conviction that, in fact, you were not going to be doing harm to the economy and buying into the political maelstrom?

Ambassador EIZENSTAT. Well, frankly, I remember that meeting as if it were yesterday. Tom Murphy was the chairman of GM. He was the chief spokesman, because GM was by far the largest of the big three, and he was the most aggressive in simply saying to the President, Mr. President, we do not have the technology to make this possible.

There was from our perspective a certain leap of faith. We believed at that time that the CAFE standards would themselves drive that technology. We also saw that the Japanese were beginning to develop cars that were more fuel-efficient, and that in the end it would be beneficial for the industry to be more competitive.

I shudder to think where we would be had we not taken that leap of faith.

We also had from Jones Agency studies that did indicate that the technology could be done, but there was obviously to some extent a leap of faith, and it was one that was fully justified, because once the standards were set and industry shifted its investments, as you suggested, from the increase in horsepower and other items to fuel efficiency, in fact we came a long way and met those standards.

Now we have the possibility of going forward. I mentioned that I myself test-drove just a few months ago this Toyota Prius that gets 52 miles a gallon in the city. It is a hybrid car. The State of Maryland provides a tax incentive for that. It costs $30,000 to make but Toyota, to try to establish a market, is selling them for $20,000 a car. With the kinds of credits that you are suggesting and that were just suggested here, those kinds of technologies will be improved.

So we had some data from NHTSA, but we also believed in a leap of faith, that with a mandate, the industry would, in fact, make—to some extent the analogy, build a stadium and they will come was our philosophy.

Ms. CLAYBROOK. Mr. Chairman, can I comment on that one? One of the things that was available to the Department of Transportation and to the White House was a very substantial amount of work that was done over a 2-year period to document all of the engine plants, the transmission plants to make an evaluation of the capacity of the industry, and $10 million was spent doing this and also subpoenas were sent to the companies to demand that they supply certain kinds of information that would make it possible to do the analysis that allowed us to do this. That was one point.

The second is, there were 40 people working on it, and the third issue is, there was a statutory mandate, and that statutory mandate meant the agency had to act. It was just a matter of how we spaced out those standards, and that gives a great deal of confidence, because Congress has made adjustments. This was a national priority.

Senator KERRY. When you describe it as a leap of faith, it was a leap of faith based upon the judgment that Ms. Claybrook has just described that you had a certain amount of technology there, you had a certain trend being evidence din the Japanese, you knew what was achievable. The leap of faith was when you put American ingenuity to work it was going to respond, I assume.

Ambassador EIZENSTAT. Exactly, and again we did not throw a dart at a dartboard and come up with a number. The agency provided us data which gave us confidence that that 27½ miles per gallon by 1985 was technologically achievable, and again, by setting it, it drove the incentives, and because oil prices did decline during the early to mid-eighties. Again, had we not had that in effect, we would have been even more dependent on oil from volatile regions.

Senator KERRY. Ms. Claybrook, you heard Mr. Lund describe the balance here between sort of 4,000 pounds and light vehicles versus high. I mean, I assume it stands to reason that a lighter vehicle crashing into a heavier vehicle by and large, people in the lighter vehicle are going to be at risk. It is one of the reasons people are

running out to buy cars. It is a defensive measure. I have heard countless families tell me, well, somebody else has a behemoth, I have to get one. It is sort of a defense when saying it is their preference.

But do you disagree with this? You have a feeling, I think, there is a divergence here as to where the cut may be, whether there will be an automatic reduction in weight that comes with the standard, or do you think you have to make a standard that in fact excludes, as Mr. Lund has suggested, the lighter vehicle so that they do not get factored in and, in effect, you make it harder, I suppose, to reach it. I mean, it is a more dramatic change.

Ms. CLAYBROOK. There are a number of different ways of structuring the fuel economy program. The fact is that in 1977, when the auto industry saw these new standards they had to meet, what they did, and what I described, is they took the weight out of the larger vehicles. They did this, because that was the only thing that was cost-effective. It is not cost-effective for the industry to save weight by redesigning a smaller car to be 100 pounds lighter, so they take the weight out because that is what makes sense to this industry. And they used mostly technology. 85 percent of the improvement came from technology, so I thought it was a very sensible approach that they took in order to achieve these goals.

The reason that we have gone downhill is because, starting in 1986, 1987, the industry started putting faster engines, bigger engines, and designing larger vehicles.

Senator KERRY. They would respond as they did—I mean, I have been through this with them, and we have sat privately and we have listened here. The response is, well, that is what the consumer wants. We provide what the consumer wants, and the consumer wants to buy those vehicles.

Ms. CLAYBROOK. The larger vehicles, yes, but they buy a lot of small cars, too. The consumer buys a lot of small cars. That is part of the answer. Part is that you can design safety into a vehicle far superior to what it is today. But the increase in deaths alleged by the manufacturers and the Insurance Institute for Highway Safety because of CAFE in fact would be mostly in roll-over crashes, and you can virtually stop deaths and injuries in roll-over crashes if you have properly designed cars.

There is a huge unused bank account of safety technology that the manufacturers still have not put in their cars despite 35 years since the passage of the auto safety law, and I remember, for example, in 1977, when we issued the fuel economy standards we also issued the passive restraint airbag requirements simultaneously, within 3 weeks of each other, and the reason was, we wanted to see safer cars as they went to put the fuel efficiency provisions into effect.

The manufacturers fought the airbags, delayed them another 7 years, so they are crying wolf, in my view, when they say, "Well, the problem with fuel efficiency is, it hurts safety." If you have a roll-over crash worthiness standard that really protects people in roll-over crashes, which are not high force crashes—a high force crash is 60 miles an hour into a barrier—the roll-over crashes are in the 10 to 20 mile an hour speed, so if you have a well-padded, well-controlled vehicle with a proper roof and so on, you do not

have much injury in a roll-over crash. Today 10,000 out of 40,000 deaths, or one-third of all occupant deaths today, occur in roll-over crashes.

Ambassador EIZENSTAT. Senator, on the notion of making cars consumers want, this is where government policy comes into effect, because you have externalities, as economists would call it, that consumers do not take into account. They cannot, when they make a purchase, take into account the national security implications of being dependent on oil from volatile regions, potential threats. They cannot take into account the implications of greenhouse gases. That is not what a consumer thinks about when he or she buys a car. That is where government policy and CAFE standards come in to take those externalities into account.

Ms. CLAYBROOK. And also the aggressivness of these vehicles, the larger vehicles, that is where there should be a government policy to reduce the aggressivness of these behemoths so that they do not do harm to the lighter weight vehicle.

The research safety vehicle you saw crashes safer than any car on the road today. It is a 2,500 pound car, and that is entirely feasible to make. The way they made it lightweight was that they took the steel and they had it hollowed, and poured a styrofoam-like liquid material in that hardens so that when it crashes, it collapses evenly like an accordion, but it does not weigh very much.

There are all sorts of technologies that are unused in the industry today, and the only way they are going to put their ingenuity into it is to have government requirements. In 1978, a speech was given by a Ford vice president that said, "This is the age of the engineer." Fuel economy, emissions and safety standards all had to be met simultaneously by this industry, and he viewed it as a fabulous challenge.

That is the way the industry should look at the requirements that we are talking about, and that is one of the reasons why I hope that in your fuel economy bill you will put several safety provisions that will completely obliterate any likelihood that there would be increased injuries.

Senator KERRY. Some of the recommendations I heard you say seemed to smack when you spoke of a lighter vehicle in this test vehicle—when you started talking a moment ago about roll-over capacity and other things, are you adding weight? I mean, are all of those going to involve weight which then runs counter to any quick gains, easy, low-picking fruit gains from fuel efficiency?

Ms. CLAYBROOK. A small amount of weight. It will add a small amount of weight.

Senator KERRY. Does that put greater pressure on the industry with respect to what technologies they have to come up with to get their fuel savings, if they are adding the others?

Ms. CLAYBROOK. A little bit, a very minor amount. It is a very minor amount. They took out 1,500 pounds, Senator, out of the large cars in 1977 to 1985. We are talking about maybe 50 pounds or 100 pounds that we are going to add back in.

Senator KERRY. Their argument would come back to you to say, yes, we did, we took it out because we had not done anything, and now we have done a lot, and therefore you can only make these

gains at the margins. You cannot grab as much or as easily, because we have done so much.

Ms. CLAYBROOK. Much of what they did was use fuel efficient technologies as opposed to weight change. Eighty-five percent of the improvement came from technologies. That was 1977 to 1980. That was 20 years ago. The advancements that have occurred since then are enormous in terms of those technologies.

Second, yes, they did take the weight out. Now they have put it back in, because now they have gotten an even better improvement from technology, they just put that weight back in, and particularly with the SUVs and these larger vehicles, so there is tons of weight to be taken out of these vehicles, and it should be, as Mr. Lund has now said, and this is a new position of the institute.

Senator KERRY. What are the economics of doing that with respect to foreign competition? The industry again would say to you, well, most of our profits at this point are coming from those larger vehicles, and if all of a sudden we become noncompetitive, then the industry is hurt. I mean, I can think of 10 answers, but I would like to hear them from you.

Ms. CLAYBROOK. Well, first of all the—I think others on the panel should answer, too, but the foreign industry, of course, has made their larger cars as well, their larger vehicles, and so it is not as though they do not have any work to do, but it is true that they have spent the last 20 years doing more work in fuel efficiency technologies that they are offering for sale than our manufacturers have, and they are going to have to do some catch-up, and that is really most unfortunate, because they should not have let that time pass.

Ambassador EIZENSTAT. One of the positive things positive things from the original CAFE standard, 1975 to 1985, Senator, was the fact that our industry actually became more competitive relative to the Japanese than they otherwise would have been had they gone on a business-as-usual cycle, and the same will be true here, as I mentioned.

The Germans, for example, are coming up with a 35-to-40 mile per gallon passenger car diesel. The Japanese are developing much more energy-efficient cars, and so to be competitive over time it will be essential for the U.S. industry to produce cars that can match that kind of foreign competition.

Ms. CLAYBROOK. I would like to say one more thing, and that is that oil crises are devastating for the U.S. auto industry. They are totally devastating, and if the industry does not understand its own self-interest here in trying to reduce our dependence on foreign oil so that we do not have gas lines and higher interest rates and all the other things that come along with higher gas prices and cutoff of oil, then they are making a tremendous mistake not looking at the long term. They are looking at the very, very short-term in the policy recommendations they make.

Senator KERRY. The car companies say that consumers do not care about fuel economy. I have found, in fact, that consumers are somewhat contradicted by what Ford has decided to do, because increasingly the dealers reported to them that the people were concerned about SUV economy and therefore they have set a goal of increasing their fuel economy by 25 percent by the year 20005. It

seems to be a kind of blatant contradiction. Do consumers care about fuel economy? Would more people buy? Is that a marketing point? Is that something you could actually market to Americans?

Ms. CLAYBROOK. I think that it does depend upon the price of oil, there is no question about it, and when prices are very high, people think about it more, when prices are lower, they go with the flow, but if you look at public opinion polls and you say, what should be the policy of this country, 63 percent in the Harris poll said that they wanted more fuel-efficient vehicles even if they had to pay up to 3 percent more to buy that vehicle, so they understand it costs something. They understand it gets paid back over time, and that they do want it.

There is another issue, which is that the industry does not market fuel-efficient vehicles. This is an industry that knows how to market, and if it really wanted to do the marketing of fuel-efficient vehicles and other reasons why you should have them, the public would be much more responsive, but they have never really done that.

The automobile industry finally started selling safety in the early eighties when the public was exposed to things like the RSV in crash tests and all of those issues on television and they could all understand why it was important, the public started to shift, and the industry then started to sell, and they continue to this day to try and sell safety, but they have never really sold fuel efficiency.

Senator KERRY. I do have a few more questions, but let me turn to Senator Allen, who has been very patient over here.

STATEMENT OF HON. GEORGE ALLEN, U.S. SENATOR FROM VIRGINIA

Senator ALLEN. Thank you, Mr. Chairman.

If I could use some of this time to give my perspective and then ask a question—I am sorry I was not here for the beginning. I have been listening to our distinguished panel, and Dr. Lund, who I remember from our previous panel back in August. I have been listening to the testimony of this very well-educated and distinguished panel, and it strikes me that there is little faith in free people.

I am one who philosophically puts a great deal of trust in free people, free markets, and free enterprise, and allowing people to make their own free choices. Especially in a very competitive motor vehicle manufacturing market, which is international in scope, I think that the marketplace can meet the demands of consumers, as there is a wide variety of consumers who demand things such as fuel economy. They care about the size of the cargo capacity, the towing capacity, the seat arrangements, and the style of a vehicle.

Now, today I think we are the beneficiaries of many innovations in passenger vehicle technology, all talk about technology, which is good, and our engineers in this country have been in competition with others, whether they are from Sweden, Japan, Korea, Germany, France or elsewhere in the world, and they have made some unbelievable and very good advances in automobiles as far as increasing horsepower—I always have to convert these liters, multiply it by 61 to get it to the cubic inches to understand the size of an engine. It is amazing how smaller engines can give you the

horsepower that back in the seventies took longer, whether it is 25 percent or 33 percent more size in an engine, and increasing the overall performance.

We have seen an increase in fuel efficiency through technology. We have seen fuel injection, increased air flow, and also improved exhaust systems and transmissions that helped provide these advances. The modern engines are burning fuel more efficiently. They are burning it cleaner, and it results in an overall reduction in tail pipe emissions. I think the auto manufacturers have responded to the desires of consumers here in this country by providing more choices in the form of new designs for cars and trucks, and there has been the advent of the minivan and the sport utility vehicle or the SUV, which seems to be a dirty word around here today.

But let us just use some common sense. Vehicle manufacturers have two choices to improve fuel mileage. One, use technological innovation, and certainly we have seen that in the past several decades, and there is no reason why that would not continue.

The second choice is to decrease the weight of their vehicles, which is an easier and more cost-effective way to ensure increasing fuel mileage in the future.

Now, this boils down to the concept that to me is simple physics. It takes less energy and therefore less fuel to propel a lighter and also smaller, less safe vehicle. Our engineers have certainly applied this scientific principle to conform to the mandates of CAFE. It is no surprise that most of the increase in fuel mileage is attributed to the declining weight of vehicles.

Now, the proposals that are being put forth here say implicitly that government policy should be designed to take choices away from consumers. It restricts the ability of auto manufacturers to respond to market forces and consumer demand. Most important, it forces mothers and fathers to compromise the safety of their families and put their children at risk.

Ms. Claybrook, who is highly respected, talked about safety and advertising for safety. Volvo led the way, and people were wanting safety. My general view is, as people saw the value of airbags, they demanded airbags, and I remember someone crashed off a road in Virginia, hit a tree going 65 miles an hour, had an airbag, was not wearing a seat belt but had an airbag, and survived. That will be the best advertising for airbags anybody would ever want, and people demanded airbags, and not just for the driver, they wanted them for the passenger. They wanted them regardless of what government required. Those would have been accessories that consumers wanted for themselves and their passengers.

Now, through all of this, the average vehicle weight over the years has declined approximately 23 percent since the adoption of the CAFE standard in 1975. This is a direct result of the government-imposed fuel economy standard. the studies from the National Academy of Sciences concluded as a result somewhere between 1,326 additional traffic fatalities occur each year.

Now, back in August, August 2, I remember asking Dr. Lund about this issue from the insurance point of view, because they take into account all these facts, and I will requote from that testimony. "There are many studies which have looked at the relationship between car-size, car weight, and the risk of serious injury or

fatality. Without exception, those studies find that, as you decrease the size of a vehicle, you increase the risk of injury. This is one of the best-known facts in highway safety."

So let us understand this, and the studies have shown that approximately—and I am off your quote—the studies show that approximately 46,000 people have lost their lives due to the imposition of the CAFE standard on vehicles sold in the United States.

Dr. Leonard Evans, president of the Science Serving Society in Michigan, has performed numerous studies on the effects of CAFE on safety, and illustrates this phenomenon through his study that showed that adding the weight of that one passenger will reduce the driver fatality risk by 7½ percent.

Now, it does not take a scientist to understand that passengers in, say, a Chevrolet Suburban crashing with a Geo or a Geo Metro, that the Suburban is more likely to survive, or if passengers in a Suburban versus a Geo Metro crash into a tree off the road, or a fire hydrant, or whatever they may run into, they are more likely to survive and have less injury if they are in the larger vehicle. That makes sense.

Now, this government proposal is intended to limit consumer choices, and especially eliminate the size of pick-up trucks, vans, and SUV's. Doing this not only increases the likelihood of death or injury in a traffic accident, but it can also cost jobs to hard-working people, and these are good-paying jobs over the years. Virginia is not like Michigan, but nevertheless, we have some good facilities, the Ford pick-up plant in Norfolk, where there are over 2,300 people working and the Fredericksburg area—I was just down there a few weeks ago. They have a power train facility that employs 300 people. They make the torque converter clutches for the General Motors vans and trucks and cars, and they were saying they would lose about 25 to 30 of their employees out of that 300.

Now, that is not a big facility, but if you extrapolate all of that, that is 25 people who would lose their jobs, and they are good-paying jobs, and they said that would be if they just increased the CAFE standard by 1 mile per gallon, if that were imposed on the industry.

Now, if you took this into consideration, let us say you all wanted to go down there to the Ford assembly plant for pick-up trucks in Norfolk, you bring all the folks out there and you say, well, the government wants to do something here. Yes, we know mothers and fathers and other individuals like to buy your SUV's or your pick-up trucks, or your minivans, but the government says they cannot buy them any longer, so we are going to have to decimate this workforce. Everyone stand up and one of every 10 of you step forward and lose your job.

I certainly would not want to do something to take away their jobs, and I do not think you would, either, so there needs to be some sense as to what this will do to our economy.

Now, here is where I think we can find some philosophical agreements as to what we ought to do, rather than being punitive and officious in preventing individual choice. Now, the solutions to the problems I think are fairly logical. If the goal is to decrease dependence on foreign oil, I think we need to increase our domestic supply. I agree with you all that the demand-side approaches are

very important. However, we should not impose harmful policies that harm people or punish people by increasing the cost of their cars, lowering the safety of their vehicles, and ultimately cause them to lose their jobs.

The philosophical compatibility I think, Mr. Chairman, at least with me and these panelists, and I think with the Chairman as well, is that Congress should be in the business of providing incentives to manufacturers for innovations that do not compromise safety and do not cost the loss of jobs or diminished choice on the part of the American consumer.

I think we should establish policies that enable consumers to choose alternative-fuel vehicles that reward industry for their production, whether they are hybrids, electric-powered vehicles, natural gas, or fuel cells. I think they are absolutely exciting for the future. They should be a part of the solution, also, new technologies for direct injected gasoline and the integrated starter-generator and the variable displacement engine may also prove very valuable.

Unfortunately, I think once again we are facing the possibility that the free market and the natural evolution of business and consumer choice will be hindered by the officious hand of government, so the consequences of whatever policy we adopt are very significant to our economy, the people, and their safety.

I think with some of these ideas it is very clear on what the harm would be, and I very much look forward, Mr. Chairman, to finding some common ground on some of these incentives and continue this discussion as we go forward on energy security legislation. What we need is balance. We need to have common sense, and I will advocate that we should be trusting free people to make the right choices for themselves and for their families, and I thank you, Mr. Chairman, for bringing these panelists once again on this very important subject. I just want you all to know what base I am coming from philosophically on it, and I would conclude, if I may, by asking a question to Ms. Claybrook.

Senator KERRY. Sure. Let me just say to the Senator that I really appreciate the comments he has made, because I think it is helpful to us to kind of lay out here publicly and to give the panel an opportunity to respond to some of the things you said. I mean, I think there is this balance, and the Senator is sincere, I understand, and committed in his feelings about the free market choices.

At the same time, we have a long history—and I am sure the Senator, even while he was Governor, enforced some of those limitations. We put a speed limit on the roads. You enforce that as a Governor.

Senator ALLEN. I would have liked them to be higher.

[Laughter.]

Senator KERRY. We have seat belts in the cars, and everyone in America has come to accept that seat belts save lives. The fact is, when Ralph Nader showed us the problems with the Corvair he made cars safer, and it was a government response that made them safer. Nobody would argue that today. Children sit in car seats today, and children's lives are saved. Government intervened.

I do not think you would have voted against any of those things today, so I think there is a balance here, and the Senator himself, who talked about limiting choice, turns around and suggests we

ought to have the government create behavior by having a series of tax credits that I happen to agree with completely, but that is a limiting choice. It is limiting the choice of somebody to go out and buy a car that is completely the antithesis of that, and there is a reason you are limiting that choice, so I think there is a marginal contradiction in where you are drawing the line here.

I would like to hear from the panel, though, because I think the Senator has raised some genuinely felt ideological and in some cases practical reservations that some people on both sides of the aisle may have about how we approach this, and I would like particularly those who have been involved in this policy (because you have heard these arguments before) to address the concerns of the Senator with respect to his opening, and then we will go to the question.

Senator ALLEN. Before you answer, just so you know, there are certain policies that I think the government has taken that are good policies. Some of them come from consumer choice on safe vehicles. People will not buy them, whether it was the Corvair or the Pinto, and some of it was litigation. I am not saying that policy should always be by litigation, but that is also a concern, and I am not going to argue all of those others. Just for the record, on the speed limits I was one in the legislature who was trying to get it to 65, and as Governor I would have liked to see 70 on the interstates, but the legislature disagreed. That is the balance of power, so to speak, but in a place such as Europe, where they artificially increase the cost of gasoline by high taxes, you would think these sort of ideas obviously propel manufacturers for the European market, and obviously there is—Volvo and Peugeot and Fiat and BMW and Volkswagen, of course, sell in this country as well.

My field commander for Southside Virginia is so proud of his Volkswagen Jetta diesel and the great gas mileage he gets in that vehicle.

So wouldn't a lot of these ideas and innovation come from Europe just because, I think, of their punishing policies as far as gas taxes, but why wouldn't those vehicles be sold in this country?

Ms. CLAYBROOK. Well, first of all you have raised a whole lot of issues. You mentioned the Pinto. In the era when the Pinto was in the United States in the 1970's, Ford was selling a car in Europe that had a far superior fuel tank design for safety than the Pinto, and finally out of disgust with the problems with the fuel tanks here in the United States the government set a safety standard to require the better fuel tanks they were then selling in Europe. They did not sell them here.

You mentioned airbags. You could not buy an airbag until the Government standard came into effect, except for Mercedes Benz, so essentially what you had was a very, very high end of the vehicle population. You could buy an airbag beginning in 1982, but until the standard was issued you could not buy an airbag in an American car except for a very brief period in 1974 to 1976, when General Motors, under Ed Cole, the president, who was a great safety advocate who loved airbags, offered them for sale. When he retired, they stopped making them.

So there are reasons for government standards, and they are performance standards, at least on the safety side they are perform-

ance standards, so that the companies have a lot of choice about how they go about achieving that level, but they are minimum standards. They set a minimum below which you cannot go when you sell that particular vehicle.

In terms of the fuel economy standards, the corporate average fuel economy system was designed by the auto companies. They did not want any standards, but when the government said, we have to have some standards, we cannot deal with this variability in gas prices and the heavy importation of fuel, the companies said, we would like the corporate average fuel economy because it allows us a great deal of flexibility. We can sell larger vehicles, smaller vehicles, and we can put technology in different ones, and we will decide how we are going to do that.

What they did decide was to install technology for most of their fuel-efficiency achievement, not weight reduction. You had mentioned most of it came from weight. That is not true. Eighty-five percent of the improvement in fuel efficiency came from technology. That is, engines, transmissions, aerodynamics, tires and the rest of it. Fifteen percent came from weight reduction, and almost all of it, came out of the larger behemoths. It came out of the 5,000 pound vehicles that were reduced to 3,700 pounds, so that is where they did the weight reduction, and they did it that way because that was what was cost-effective for them.

Weight reduction is very expensive. You have to use new materials, and you have to redesign the whole vehicle. It is complicated. So it was very expensive, and they decided to do it only for about 15 percent of their savings.

So that is what happened in meeting the government standard. I agree with you, regulation is a blunt instrument, there is no question about that. But what happens is, regulation emerges when you have a long period of time when the companies do not do it voluntarily, in whatever field that you are talking about.

Senator ALLEN. Why wouldn't consumers demand it? There are small cars available, are there not?

Ms. CLAYBROOK. Lots of them are sold. Lots of consumers buy small cars, partly for price, partly for efficiency.

Senator ALLEN. Then why do people, in your view, buy minivans and SUV's?

Ms. CLAYBROOK. They buy them because of the false belief that they are safer. An SUV is a very stiff vehicle, and when you crash what you want that vehicle to do is to absorb the energy of the crash so that less of that force is transmitted to you. The SUV is a very, very stiff vehicle.

Senator ALLEN. It is larger, though.

Ms. CLAYBROOK. It is larger, and there is an advantage to that, but I will tell you on the statistics that a four-wheel-drive Suburban has a higher death rate than the Honda Civic, and I will tell you that a Ford Expedition crashed in exactly the same way as a GM Saturn, the Saturn did better, so it depends upon how you design the car for safety, and it is not necessarily so that a larger vehicle or heavier vehicle, per se, is better. Larger is better, but heavier is not necessarily better. It depends upon how you design the protection.

SUV's roll over. 66 percent of the deaths, or 65 percent of the deaths in SUVs are from roll-over. Roll-over is a bad type of crash today, because the roofs crush in and crush your brain. They could make better roofs, they could have pre-tension seat belts, they could have side-impact airbags and padding on the roof, and a roll-over crash is one which you would survive easily, but the companies do not do that.

Senator KERRY. Can I just intervene in the question, just for a moment. Ms. Claybrook, I assume you would concede that that is not the only reason people buy SUVs and minivans. People buy minivans because they have got to pile a family in the car.

Ms. CLAYBROOK. Absolutely.

Senator KERRY. And people buy SUVs because of this in many cases—not all. I mean there is an absurdity in a lot of the SUVs that go 20 miles from work to home in urban settings, except for the degree to which they choose them to also sometimes perform some other needs, but an awful lot of people in this country,particularly in rural areas, et cetera, have real needs for the large vehicle that has four-wheel capacity, whether it takes them hunting or whether it takes them up into outlying areas, or on a farm, or whatever. Those are very practical vehicles. I assume you allow for that kind of variation within the marketplace.

Ms. CLAYBROOK. Oh yes, of course, and I am not saying the corporate average fuel economy system is the only way to design a fuel economy standard program, but that program does allow for a great deal of variability and choice by the manufacturers in what they offer to the consumers.

One of the problems is, when you talk about the marketplace, consumers are relatively uninformed, because there is a lack of information there for them about what is the safest vehicle, and what is the least-safe vehicle. There is information available, but it is hard to find and put together, so only the most industrious consumer will put a whole package of information together to figure out what makes the most sense for their needs, measuring fuel efficiency and safety and all of those things, so it is a hard job to buy a new vehicle, and it is not just something where you can walk in and you can ask the dealer, is this the best vehicle to buy. He is going to say yeah, yeah. You know that.

So it is hard to be a good consumer, and we do not have a sticker on the windshield, which I believe we should have, which says, when this vehicle rolls over, what is the result, and when this vehicle crashes at 50 miles an hour, what is the result?

You also cannot buy—you know, you mentioned child restraints. You cannot buy, except in very limited vehicles, a built-in child restraint. Now, why don't manufacturers make cars safe for kids? Why don't they build a car restraint like the Volvo does? You mentioned Volvo, which has an arm rest that pulls down and there is a child restraint. Those are the kind of things that really frustrate the consumer and frustrate safety advocates like myself, who, by the way, do not believe in 70-miles-an-hour driving because it is bad for fuel efficiency, and it is bad for safety, even in an SUV.

But those are the problems that we face in the marketplace, unless we ask the government to make these things available to us, often they will not be there.

Senator ALLEN. Mr. Chairman, I would say to Ms. Claybrook, number one, the interstates are engineered and designed and constructed for 80 miles an hour.

Ms. CLAYBROOK. No, no, no, no, 70 maximum.

Senator ALLEN. No, 80, but you set the speed limit at 70 or 75 because folks will instinctively not like limits, which I think is healthy. I have a libertarian streak in me, as you might guess.

At any rate, in purchasing vehicles over the years personally, and this is nothing scientific. I suppose we have not had a study on it, but in purchasing vehicles, everything from a Volkswagen diesel Rabbit to pick-up trucks to SUV's and vans and all the rest years ago, I think for consumers, all you had was Consumer Reports, and you would have to order those Consumer Reports and get all the details, and if you are trying to compare vehicles it was even more costly. Now you get on Yahoo Cars and put them side by side.

I had a Ford Explorer, now I have a Durango, and the reason is, I think that I do not like the gas mileage, and generally you go south of Bull Run or the Occoquan and gas prices are less than in Northern Virginia, and I know where all the least-expensive gas stations are everywhere in Virginia, and I go to them and fill up before I get to Northern Virginia or DC.

Regardless, you can compare all of that, and there are reports on safety for people who care about safety. Those are published in the newspapers. You can get them over the Internet as well, so I think there is even more access to information now for people. Actually I think it is tough on the car dealers when you can figure out what the cost is of every accessory to them, so you can determine how much of a percentage they are marking up, obviously, for them to stay in business, so I think consumers have a great deal of ability to decide things.

And again, you talk about the roll-over on SUV's. I like the wider track on the Durango. It holds the road better on turns, I thought. I very much like the comfort of the seats on the Explorer, and you compare all the cargo for our three children that the chairman talked about, my wife likes the minivan. It is easier to keep the kids from hitting one another than in the SUV.

But regardless of all of these demands, again back to Europe, Europe where they have high gas prices, why would not those people in Europe, where they have the high gas prices, why would they not be demanding the type of vehicles you would have people in this country driving and restricting their choices in this country to buy the vans or the SUV's or pick-up trucks they so desire?

Ms. CLAYBROOK. I do not think there is a restriction in choice. One of the problems is, you can only get an SUV that in most cases in the larger ones are fuel-inefficient. Why can't you buy, as the Union of Concerned Scientists showed in their report—which I believe is a part of this committee's record, and if it is not, it should be—showed that you can take the Ford Explorer, the car you like, and you can make it far more fuel-efficient than it is today. Why hasn't the industry done that?

Why have they made these large vehicles so that you have to go to every gas station in Southern Virginia? In order to save fuel, why didn't they make you a Ford Explorer that is fuel-efficient, be-

cause they could have, and it would not have increased the prices very much at all, and if it did, you are going to get that back in your fuel savings.

So that is our concern, is that in fact there is not consumer choice, often, in our marketplace, and you cannot buy a Ford Explorer that has a safe roof for crushing. In fact, in most SUVs you cannot, so that is the concern that we have, that these government requirements come after long periods of time when the industry does not take advantage of technology that is available to them and does not really offer a wide consumer choice in the marketplace for the kinds of things that most people want, which is fuel-efficient vehicles that serve their purposes.

Senator ALLEN. I guess that is just a basic disagreement. I think there is more vehicle choice than ever. I look at what Toyota has out in SUVs. They must have three or four different types of SUVs, from the Land Cruiser to the Fourrunner, to whatever these other ones are that are smaller, and that have better fuel-efficiency.

Ms. CLAYBROOK. They are smaller, but they do not necessarily have to be to have the fuel efficiency.

Senator ALLEN. But they are—the point is, if you have to carry more weight, it is not going to be as fuel-efficient. That is just basic physics. My general view is that we do not have restrictions on cars coming in here from Japan and from Korea and all over the world, and it seems to me——

Senator KERRY. Sure they do. They have to live up to our standards. Absolutely they have to have restrictions.

Senator ALLEN. Yes, they do. Yes, they do, they have to meet our standards, you are right, our safety standards. However, look at the variety of choices, and I guess that is just the basic difference is, I think consumers have a lot of choices now, and they are not just restricted to the big three auto makers of the United States and, indeed, because of that competition from the Japanese, even if you did have CAFE standards, people, especially when fuel prices went up, clearly they had to react to it because people did not want to be driving around in those things that look like yachts and get 8 miles a gallon.

Senator KERRY. Mr. Ambassador, you are waiting to say something I think.

Ambassador EIZENSTAT. I was waiting, yes. I am glad Joan came up for breath.

[Laughter.]

Ambassador EIZENSTAT. Just a couple of points. First of all, the National Academy of Science report, which was an exhaustive report, indicated that improved CAFE standards and fuel economy standards can be achieved without job loss, without compromising safety, and without increasing consumer cost. Indeed, they indicate that the consumer in 2012 buying a more efficient car will save over $2,000 over the lifetime of the car.

Second, I lived in Europe, Senator, for 2 years as Ambassador to the European Union. I was privileged to be confirmed by the Senate for that position in 1993, and the fuel efficiency in Europe comes at a very significant price, because gasoline is 4 times more expensive than it is here, which no one would, I think, want for the American consumer.

That has driven, to use a euphemism, Europeans into purchasing very tiny cars that would have no market here, so when you ask, why don't those cars sell here, and those small cars—and in part they are small because of the huge cost of gasoline, but also because Europe is very compact, and with people not going across national borders, there is simply not the demand for the kinds of cars we want to drive long distances.

Third, you are quite right that consumer choice is a tremendously important item on any national agenda. The fact is, in a low gasoline price, low oil price environment, people generally will not demand fuel-efficient cars. It is not their priority, and that is where I believe government policy comes into effect. It is not a question of denying consumers a choice, because they will always have that choice. It is looking at what is good for the Nation as a whole and, as I mentioned earlier, when a consumer makes a choice, the consumer does not look at, as the Congress and the President must, the national security implications of being more and more dependent on foreign oil.

The National Academy found, for example, that had we not had the original CAFE standards, we would be importing 2.8 million barrels of oil per day more than we are now. We would be even more dependent. The consumer does not look at the impact that greater fuel efficiency would have on reducing greenhouse gases, and the consumer does not look at the impact that more and more imports have not only on national security and greenhouse gases, but on our trade deficit. The largest single component of our trade deficit in terms of natural resource imports is oil.

So those are, again, using an economic term, externalities which have to be factored in when one considers what is best for the country.

And last, if I may also say, I think market incentives are tremendously important. I strongly support your concept of greater, and Senator Kerry's, greater tax incentives for these technologies, but the technologies will not be driven fast enough without additional things besides the incentives.

And may I say again that I think we should look, and the Committee should look at the National Academy of Sciences' recommendation of providing, as an alternative regulatory system, the concept of fuel economy credits we again attempted to put into the Kyoto Accords. This would give you more market-driven choices and less of a heavy regulatory burden.

I am not prepared to say that that, in and of itself, should substitute for CAFE standards, but it is certainly something that over time one should look at.

Senator ALLEN. Thank you, Mr. Ambassador.

On your point—this is where I think there is, Mr. Chairman, some common ground. There is a national interest, first of all, in the long run, and as quickly as possible, of use of other methods of propulsion, other than the internal combustion engine. One, they are cleaner, and obviously we do not have sufficient petroleum supplies in this country to not import from elsewhere.

So the point is, though, that you are saying the incentives are not enough. You have to put in the restrictions. I would just like to use carrots rather than sticks, and I think people can make deci-

sions, especially when making major purchases of an automobile, which is probably the second largest purchase they will ever make in their life, second only to their home, and I do think there is an interest in getting more domestic supply for petroleum in this country, which is a whole other issue we do not need to get into here.

But again, I think if we can find some common ground on the proper incentives for fuel cell technology, electric vehicles and so forth, I think that is where we could do a good service to the country, and then expand the choices, or maybe those incentives, rather than taking away the freedom of an individual to choose for their family or for themselves what size or kind of vehicle they want to drive.

But thank you, Mr. Ambassador.

Senator KERRY. I need to turn this back a little bit. The weight and size component of this is an important component, but it is really not the whole story at all, and there are other significant technological ways in which some of these gains can be made.

Second, let me just emphasize, in whatever this Committee proposes, we are not going to take any choice away from the American people, and I made it very clear in the comments I made on Tuesday, nobody is going to mandate that you cannot have variation. All of the choices available today, you can drive a big car, you can drive an SUV, but they can be more efficient. There is no question of that.

The National Academy of Sciences, and I want to ask you, Mr. Lund—you guys have been very patient over there—page 414, this is the conclusion of the National Academy, it is technically feasible and potentially economical to improve fuel economy without reducing vehicle weight or size and therefore without significantly affecting the safety of motor vehicle travel. Is that correct, Mr. Lund?

Mr. LUND. That is correct.

Senator KERRY. So let us keep in mind what we are talking about here. You can have all the choice in the world. You can buy every single different kind of SUV that is on the road today. It just can be configured differently, and every family that needs to pile in six kids and five dogs, or whatever, to drive 15 miles can do it, but you do not have to do it with the consumption levels we have today.

Mr. LUND. That is correct, Senator Kerry. I would just, again, reiterate the remarks I made in my opening, that we are concerned about the structure of CAFE. Simply increasing CAFE standards, if we just do it with the current structure, there is a danger of repeating the negative experience we had in terms of safety from the 1970's.

Senator KERRY. Now, let us stay focused on that for a minute. Ms. Claybrook, would you respond to the notion, if you can, and Ambassador Eizenstat or anybody on the panel, are you coming back to this 4,000 concept? Is that where your——

Mr. LUND. The 4,000-pound concept is what I am talking about in terms of restructuring. What you can see from looking at the fatality experience of cars on the road is that there is a tradeoff. Occupant protection always increases with heavier vehicles. Joan, it is simply not correct that a family is as safe transporting their chil-

dren in a Civic as they are in a Suburban. Increased size is protective.

But at around 4,000 pounds, we see there is an offsetting effect. Joan talked about how the aggressiveness of vehicles is also an issue. Above that, you start seeing there are more fatalities being caused by vehicles in this weight range than are being saved, that is being caused among other road users, other vehicle occupants, pedestrians, cyclists, than are being saved by the additional mass of the vehicle, so there is a complex relationship between vehicle weight and safety.

Ms. CLAYBROOK. I would agree, compatibility of the size of vehicles generally, the weight of vehicles generally on the highway is advantageous, and that is actually what started to emerge with the CAFE standards that were issued in the 1970's.

Senator KERRY. Because it began to bring more vehicles down?

Ms. CLAYBROOK. They brought the smaller ones up from about 2,000 to about 2,300, 2,400, and they got rid of the great big ones, and then they started introducing SUVs and we had this great differential again, so I agree that compatibility is highly advantageous. The GAO did a study and showed this, and so on.

But the fact is that when you look at the statistics on the highway today, you are not looking at what safety can be built into these vehicles. Roll-overs are one-third of all occupant fatalities. If you substantially increase the roll-over protection, the crashworthiness in a roll-over, which is not a horrendously high velocity type of crash, you could save huge numbers of lives.

Senator KERRY. Let me come to another point if I can for a moment. I do not disagree with that, but what really happened was, you had a compatibility that was being created within all the vehicles that are on the road, and then people stopped focusing and enforcing.

We had a downward trend for the last 12 years or so, which reflects the sort of—I hate to say it, but it is a reflection of what Senator Allen is talking about that has taken place, where people have been left completely to their own devices, with the result that the compatibility that we had achieved with the sort of reasonableness of consumption has now gone backward, and the very policy imperatives that drove us in the first place to adopt this standard, which has resulted in lower costs to consumers, ultimately, and safer cars, which reduces insurance costs, which reduces a whole bunch of other things or a lot of other ways consumers benefit, not to mention hospital cost and long-term recovery cost, and all of that, that we have in fact had enormous gains societally from that.

Now, what is really important here as we think about what we may do is that the recommendations of the National Academy of Science saying, we could gain somewhere up to—well, they had one standard for light trucks and one standard for passenger vehicles, but I think the upper limits were about 37.2 over 10 years, 12 years. Is that right?

Mr. LUND. It is over an extended timeframe.

Senator KERRY. I am going to the back end. I am not trying to force the envelope, but if you go to the back end it was 37.2, or it was a 10 to 15 variation. 15 was the upper end, and that was 37.2, but that standard, when they arrived at that scientifically, tech-

nically feasible standard, it did not factor in hybrids, and other potential savings that could come, so I do not disagree with the Senator from Virginia.

I think that what we may or may not be able to do here with respect to credits and market incentives at the same time as we also consider what is a reasonable standard may be a good combination, and could facilitate this significantly for the industry.

Ms. CLAYBROOK. I just wanted to mention, though, the issue of the 4,000 pounds.

Senator KERRY. We need to wrap up, because we have another panel.

Ms. CLAYBROOK. Fine, but the issue is that you can make cars much safer than they are today. The National Academy did focus on that piece of it, so if you look at what the statistics are today, you have to adjust that for what you can do in terms of the way you design and improve vehicles, so that is the only point I wanted to make, so you do not have to have 4,000 pounds to have that same level of safety. It is the design of the vehicle that matters for safety.

Senator KERRY. I understand. Let me just ask Mr. Hoerner something quickly, if I can. I read through your analysis, and appreciate it very much, and you saw a downturn momentarily, but that would then be made up in terms of foreign competition, is that correct?

Mr. HOERNER. We saw that a CAFE standard alone, a fairly aggressive CAFE standard would increase employment in every year.

Senator KERRY. Increase employment in every year?

Mr. HOERNER. In every year, modestly. It would have increased employment substantially, except that increase in employment was somewhat offset by the increased penetration of foreign cars.

Senator KERRY. And that is because there is an adjustment taking place in the marketplace by virtue of choices people are making?

Mr. HOERNER. It is basically because we think that right now, foreign producers have an advantage over U.S. producers in producing these high-efficiency cars. We think they have a lead.

Now, we assumed, and I think this was a pessimistic assumption, we assumed that they would maintain that lead over the entire 20-year period. If you do not make that assumption, we get a much larger employment benefit than we saw.

Senator KERRY. In point of fact, the history of the CAFE implementation negated that pessimistic assumption. It in fact showed that we became more competitive more rapidly and moved to compete against the cars that Europe at that time also had an advantage on.

Mr. HOERNER. Well, I think it is true that the increased CAFE improved the competitiveness of U.S. cars in world markets. However, foreign cars were also improving their energy efficiency over the same period. We recommended that further research be done in the relative cost benefit, cost advantage of foreign and U.S. producers in producing more efficient cars, but I think the important conclusion from our study is that even if you make these very pessimistic assumptions about foreign advantage, it is still the case

that there would be a net employment gain every year throughout the forecast period.

Senator KERRY. I appreciate it. Thank you all very much.

Senator ALLEN. If I could ask a followup question, Mr. Chairman, that is all very interesting, but let us be realistic here on the folks who are actually in the business.

It seems like every manufacturer in this country, as well as those who are headquartered in other countries, are opposed to some of these proposals, and it is not just management, it is not just the sales force, it is United Auto Workers as well, and these are the folks whose jobs are on the line, or their business, and they all are opposed to this, and they all say it is going to be harmful to their jobs, and obviously I was talking more on the consumer approach, but regardless, it is nice to talk about theory, but how do you answer the fact that all of these people, these workers, whether they are union or management, say this is going to be harmful for their jobs, notwithstanding whatever theories you may have? Are they all wrong?

Mr. HOERNER. Sir, we have been talking to the United Auto Workers about this question, and we are in ongoing discussion with them about the research they have been looking at and the research that we have been looking at.

Certainly there are concerns there, but it is worth recognizing that the United Auto Workers have a resolution which is still in place that states that increased auto efficiency standards are good, provided they can be done in a way which does not reduce jobs in net, and I think that what we are looking at here is a careful economic analysis that asks, can we achieve those efficiency standards in a way that does not reduce jobs in net, and I think the answer to that is certainly yes.

It is true with CAFE standards alone, but it is more true with the combination of CAFE standards and energy efficiency credits. That combination can guarantee that no net jobs would be lost to the increased efficiency standards.

Senator KERRY. Mr. Ambassador, you had to confront that same issue.

Well, thank you very much on this panel. We appreciate it. If we could shift to the next panel, I would appreciate it.

We have Professor Marc Ross of the Physics Department at the University of Michigan, Mr. John German, American Honda Motor Corporation, manager of environmental and energy analysis, Mr. Allen Schaeffer, executive director of the Diesel Technology Forum, and Gregory Dana, vice president of environmental affairs, Alliance of Automobile Manufacturers.

[Pause.]

Senator KERRY. Thank you all very, very much for your patience. I am going to try if I can hold—the statements to 5 minutes, if you can sort of watch the lights.

Mr. Schaeffer, why don't you lead off.

STATEMENT OF ALLEN SCHAEFFER, EXECUTIVE DIRECTOR, DIESEL TECHNOLOGY FORUM

Mr. SCHAEFFER. Good morning. I want to thank the Committee and Senator Kerry for this opportunity to appear today. My name

is Allen Schaeffer. I am the executive director of the Diesel Technology Forum, and my remarks will be abbreviated from those the Committee has in their hands.

First, a word about the Forum. We are a unique organization of leaders in the diesel technology industry. Our members include diesel engine and vehicle manufacturers, diesel refiners, manufacturers of emissions treatment systems, and key suppliers in the diesel industry. We appreciate the opportunity to be here this morning.

I would like to cover three main areas with the Committee: First, the nature, importance, and inherent benefits of diesel technology, second, the important role of light duty diesel engines in meeting energy refinement goals in Europe, and third, how diesel engines can play a major role in meeting U.S. energy goals.

First of all, the nature of the diesel engine. Diesel engines are the most inherent efficient internal combustion engine, converting more of the chemical energy that is fuel into chemical energy with less energy wasted. The combination of unique compression ignition cycle, and the fact that the fuel contains more power, more BTU's per gallon, as it were, makes the diesel a highly efficient power system. The inherent performance advantages include more power at lower engine speeds, better fuel efficiency, more durability, and more power from a given engine size, and lower greenhouse gas emissions.

Today's diesel technology is perhaps best known as the technology source that powers over 90 percent of all commercial trucks, nearly all fire and rescue equipment, two-thirds of all farm equipment, 100 percent of all railroads and commercial barges and boats. Diesel power also plays an important role in the economy, and as an industry it contributes $85 billion each year, more than the iron and steel industries.

I am here today to explain to you why diesel technology is an untapped potential for helping the Nation achieve greater energy security and meeting its energy and environmental goals. First of all, we can learn a lot from the experience in Europe, which has been covered here this morning, and the U.S. and Europe are taking very different approaches to the use of clean diesel technology to improve fuel economy. Diesel automobiles are extremely popular in Europe, and demand continues to grow. One in every three cars sold in Europe today is powered by a diesel engine. In some countries, it exceeds 40 percent. Experts predict that diesels will soon gain about 40 percent of the entire European market.

Why is it, that Europeans favor diesel engines? There are a series of reasons, including better fuel efficiency, durability, and lower greenhouse gas emissions, along with the performance advantages. This information is covered at length in the study that we have provided for the Committee and the record here. It is clear, then, that the Europeans are able to reap the environmental and energy benefits of clean diesel technology.

I would also like to point out to you why diesel engines can play a key role in the U.S. by reducing consumption in our transportation sector, and there are several key indicators of why that is.

First of all, the July 2001 National Academy of Sciences report that evaluated fuel economy standards noted the possibilities of reducing petroleum consumption with the use of clean diesel tech-

nologies, and I quote, "direct injection diesel engines are among engine technologies with high potential with improved fuel consumption, and the application of small turbo-charged direct injection diesel engines has seen tremendous expansion in passenger cars and light duty trucks in Europe."

A second indicator of the importance of diesel technology. Last October, as every October, the Department of Energy releases its annual fuel economy rankings, ranking the cars and light duty trucks from the most fuel efficient to the least fuel efficient. This year again diesel-powered vehicles garnered three of the top five rankings, with only the gasoline electric hybrids beating those three diesel engines.

I would point out for the Committee's consideration that advanced European diesel technology vehicles exceed those U.S. hybrid models that are at the top of the list today by over 60 percent.

One of the greatest opportunities for clean diesels is in the light duty truck and sport utility vehicle categories, and now those categories exceed 50 percent of annual sales, as the Committee is aware, we believe that the use of advanced clean diesel engines in these vehicle categories offers a cost-effective and efficient near-term alternative that can reduce fuel consumption by 30 to 60 percent. Coupled with the tremendous advances in exhaust emissions controls and after-treatment technology, today's clean diesel's also have significantly lower emissions.

According to the Department of Energy, diesel is a proven and readily available technology. The power and efficiency of diesels can also be used to reduce Nation-wide fuel consumption without the safety compromises associated with building lighter vehicles. Because diesel engines are more powerful and more fuel-efficient at the same time, the use of diesel allows these fuel economy improvements to be realized without building lighter and less safe vehicles.

And finally, according to the U.S. Department of Energy, if diesel engines were to penetrate the light duty market to 30 percent by the year 2020, the U.S. would have a savings of 700,000 barrels a day of crude oil, and that is equivalent to cutting in half the total energy consumption used each day in California.

In conclusion, we believe there are significant opportunities for advanced clean diesel technology engines to play a much larger role in boosting the fuel efficiency of popular sport utility vehicles and light trucks. In the State of California right now, the California Energy Commission and Air Resources Board are preparing a report to the legislature that identifies clean diesel technology in light duty applications as one of the 26 strategies that can help that state reduce its petroleum consumption.

In May of this year, the Diesel Technology Forum and the U.S. Council for Automotive Research, USCAR, will bring advanced clean diesel technology cars, trucks, and sport utility vehicles here to the U.S. Capitol for you to have an opportunity to experience the technology first-hand. We hope that you will join us.

In conclusion, members of the Diesel Technology Forum, while not taking a position on specific aspects of corporate average fuel economy ratings, believe that clean diesel technology can and should play a greater role in reducing energy consumption in personal transportation.

Thank you, and we would be happy to answer any questions.
[The prepared statement of Mr. Schaeffer follows:]

PREPARED STATEMENT OF ALLEN SCHAEFFER, EXECUTIVE DIRECTOR, DIESEL TECHNOLOGY FORUM

Good morning. My name is Allen Schaeffer and I am the Executive Director of the Diesel Technology Forum.

The Forum is a unique organization of leaders in the clean diesel technology industry. Our members include diesel engine and vehicle manufacturers, diesel fuel refiners, manufacturers of emissions treatment systems, and key suppliers to the diesel industry.

We appreciate the opportunity to appear before the Committee today on the important issue of energy consumption in the transportation sector, and would like to make three key points:

(1) the nature, importance and inherent benefits of diesel technology;

(2) the role of light-duty diesel engines in meeting energy and environmental goals in Europe, and

(3) how diesel engines can play a greater role in meeting U.S. energy goals.

I. Nature and Importance of Diesel Engines

Diesel engines are the most efficient internal combustion engine, converting more of the chemical energy (or fuel) to mechanical energy, with less energy wasted. The combination of the unique compression-ignition cycle, and the use of diesel fuel, which packs more energy per unit volume than gasoline results in a highly efficient power system.

Diesel's inherent performance advantages include more power at lower engine speeds; better fuel efficiency; greater safety; more durability; and more power from a given size engine.

Today's clean diesel technology is perhaps best known as the technology source that powers over 90 percent of all commercial trucks, nearly all fire and rescue equipment, two-thirds of all farm equipment, 100 percent of all railroads and commercial barges and boats. Diesel power plays an important role in the economy, and as an industry it contributes $85 billion each year—more than the iron and steel industries.

Diesel technology also has untapped potential for helping the nation achieve greater energy security and energy efficiency in the transportation sector.

II. U.S. Falls Behind Europe In Use of Clean Diesel Cars

The United States and Europe are taking very different approaches to the use of clean diesel technology to improve fuel economy in passenger cars and light-duty trucks. Diesel automobiles are extremely popular in Europe, and demand continues to grow. One in every three cars sold in Europe today is powered by a diesel engine. Experts predict that diesels will soon gain about 40 percent of the European market. There are several reasons why diesel cars have won such approval in Europe. These include:

- Inherent Performance Advantages of Diesel. Europeans have found that light-duty diesel vehicles—cars and small trucks—offer significant inherent performance advantages over gasoline-powered vehicles. These include:

  - *Better Fuel Efficiency*. Light-duty diesels use 30–60 percent less fuel than gasoline engines of similar power. Some of the most advanced models are attaining astonishing fuel efficiency, such as the European-market Audi A2 that achieves 87 mpg on the highway.

  - *More Power*. Diesels produce more drive force at lower engine speeds than gasoline engines.

  - *More Durability*. A typical light-duty diesel engine is built to last well over 200,000 miles. Diesel engines also require less maintenance and have longer recommended service intervals than gasoline engines.

  - *Fewer Greenhouse Gas Emissions*. Because diesels burn less fuel than gasoline vehicles, they also produce significantly lower emissions of greenhouse gases such as carbon dioxide.

  - *Clean and Quiet Technology*. Use of the latest diesel technology has nearly eliminated the noise and smoke that many Americans remember from early diesel cars. With the application of advanced technologies such as direct injection

lean-burn combustion, particulate traps and catalytic converters, diesel vehicles are now a clean and quiet alternative to less efficient gasoline powered cars.

These and other findings came out of our study entitled "*Demand for Diesels: The European Experience*", * that highlights the dramatic differences in clean diesel technology use and consumer acceptance of light-duty automotive applications between the two continents. The Europeans are able to reap the efficiency and environmental rewards of clean diesel technology.

The contrast in diesel usage between the U.S. and Europe is stark: In Europe—one of every three new cars sold today is powered by clean diesel technology and in the premium and luxury categories, over 70 percent are clean diesels. But in the U.S.—light-duty diesels account for only about 0.26 percent of all new cars sold, with only slightly higher figures in the light-duty truck markets.

III. Diesel Engines Can Play a Key Role in the U.S. By reducing energy Consumption in the Transportation Sector

Given the inherent energy and efficiency benefits and the existing fueling infrastructure, clean diesel technology can help the U.S. meet its energy and environmental goals.

The July 2001 report by the **National Academy of Sciences** evaluating fuel economy standards noted the possibilities for reducing petroleum consumption with the use of clean diesel technologies

> "direct-injection diesel engines are among engine technologies with high-potential for improved fuel consumption and "the application of small, turbocharged direct injection diesel engines has seen tremendous expansion in passenger cars and light-duty trucks in Europe." [1]

There are other more direct indications of the role that diesel engines can play in reducing energy consumption here in the U.S.. Last October, the Department of Energy issued its annual fuel efficiency ratings of new vehicles. This year like previous years, diesel-powered vehicles captured three of the top 5 ratings, exceeded only by the gasoline-electric hybrid vehicles. Advanced European diesel technology passenger vehicles exceed today's U.S. hybrid fuel efficiency by over 60 percent.

One of the greatest opportunities for clean diesel technology is in the light-duty trucks and sport utility vehicle categories. In 2001, light-duty truck and SUV sales exceeded 50 percent for the first time ever. The use of advanced clean diesel engines in these vehicle categories offer a cost-effective and efficient near-term alternative that can reduce fuel consumption by 30 to 60 percent. Coupled with the tremendous advances in exhaust emissions controls and after-treatment technology, today's clean diesels also have significantly lower emissions.

According to the U.S. Department of Energy, diesel is a proven and readily available technology. The diesel has been tested and refined for more than a century and its versatility and reliability are legendary.

While technology is constantly evolving, the few models of diesels available to American consumers today demonstrate that light-duty diesel vehicles can have economic benefits for consumers through reduced fuel costs over current technology gasoline vehicles. For example:

> A 2001 turbo-diesel Volkswagen Jetta GLS costs $500 dollars less than the turbocharged gasoline powered Jetta GLS [2] and the owner of a diesel Jetta can expect to save over $2300 in fuel costs over a 100,000-mile vehicle life at year 2000 fuel prices. [3]

Fuel cost savings with diesel are proportionally greater for larger vehicles handling heavier loads. The owner of a 1999 diesel Ford F–250 Super-duty pickup truck would pay $1,650 more for a diesel powered version, but because the diesel gets 46 percent better mileage under towing conditions, the diesel owner would save over $8,000 in fuel costs over the course of 100,000 miles. [4]

It is important to note that both of these examples for illustration only and are a snapshot in time. As technologies improve and strategies for regulatory compli-

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* The information referred to has been retained in Committee files.

[1] Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) standards; National Academy of Sciences, Washington DC July 2001, pp 3–11.

[2] Based on Manufacturer's Suggested Retail Prices available at http://www.vw.com/jetta/engspec.htm

[3] Based on U.S. Dept. of Energy's weekly Petroleum Status Reports average U.S. retail fuel prices for August, 2000 (Diesel $1.46/Gasoline $1.50) and MY 2001 U.S. EPA Fuel Economy Ratings.

[4] "Diesel Technology and the American Economy," Charles River Assoc. (Oct. 2000)

ance evolve for both gasoline and diesel engines, these comparisons will necessarily change.

The proportional effect of these fuel savings is particularly significant in the context of the U.S. auto market where now over half of all new vehicles sold are SUVs, vans or pickups.[5]

Because diesel engines are more powerful than gasoline engines, producing more torque at lower engine speeds, they are perfectly suited for improving the fuel economy of this burgeoning U.S. light truck/SUV market. Nearly all of the growth in U.S. vehicle sales over the past 25 years has been in light trucks. Since 1975, light trucks, which include SUVs, pick-ups and vans, have seen annual sales growth from 2 million to nearly 7.5 million. The average new SUV/light truck currently gets 20.7 mpg compared to 28.1 for the average new car. Application of diesel technology in the SUV market could immediately increase the nation's average fuel economy by targeting a large market share of vehicles that currently achieve lower fuel economy ratings due to their size.

The power and efficiency of diesels can also be used to reduce nationwide fuel consumption without the safety compromises associated with building lighter vehicles. Numerous studies by the National Highway Traffic Safety Administration, the National Academy of Sciences, the Harvard Center for Risk Assessment, and the Insurance Institute for Highway Safety have found that vehicle weight reductions in the early 1980's tended to reduce vehicle safety and led to thousands of additional vehicle fatalities.[6] Because diesel engines are more powerful and more fuel efficient at the same time, the use of diesel allows fuel economy improvements to be realized without building lighter, less safe vehicles.

Because of the size of vehicles driven in the United States and the popularity of automobile transportation, the United States has the potential to reap substantially greater fuel and emissions savings than the less automobile-oriented European countries. In 1992, automobile miles-per-capita in the U.S. were nearly four times the per-capita automobile miles traveled in France, Italy, the former West Germany and Great Britain combined.[7] The number of vehicle miles traveled in the U.S. has doubled since 1970 and is expected to rise by an additional 50 percent by 2020. The average fuel economy for all passenger vehicles on the road in the U.S. is 20.6 mpg. Thus, American drivers on average use many more gallons of gas than their European counterparts. Because Americans burn more fuel, the potential for fuel savings and corresponding CO_2 emissions savings from increased use of diesel is much greater than the savings experienced in Europe.

More specifically, the U.S. Department of Energy has estimated that increasing the market share of light-duty diesel technology to 30 percent would reduce net crude oil imports by 700,000 barrels per day by 2020—an amount equivalent to cutting in half the total energy used each day in the state of California.[8]

Conclusions

We believe there are significant opportunities for advanced technology clean diesel engines to play a much larger role in boosting the fuel efficiency of popular sport-utility vehicles and light-trucks.

In May of this year, the Diesel Technology Forum and the U.S. Council for Automotive Research (USCAR) will bring advanced clean diesel technology cars, trucks and SUVs here to the U.S. Capitol for you to have an opportunity to experience the technology first hand. We hope that you will join us.

In conclusion, members of the Diesel Technology Forum—while not taking a position on the specific aspects of Corporate Average Fuel Economy Ratings, believe that clean diesel technology can and should play a greater role in reducing energy consumption in personal transportation.

Thank you and I would like to ask that our written statement be included in the record, and would be happy to answer any questions.

Forum members are the nation's most progressive manufacturers and suppliers of diesel fuels, engines, and components, along with their partners in finance and business. Members include Caterpillar, General Motors, Cummins, Robert Bosch, Detroit Diesel, BP, ExxonMobil, Eaton, Delco-Remy, Honeywell-Garrett and the

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[5] "Drilling in Detroit: Tapping Automaker Ingenuity to Build Safe and Efficient Automobiles," Union of Concerned Scientists & Center for Auto Safety (June 2001)

[6] http://www.vehiclechoice.org/safety/size.html

[7] Schipper, L. "Determinants of Automobile Use and Energy Consumption in OECD Countries," Annu. Rev. Energy Environ. (1995)

[8] "The Impacts of Increased Diesel Penetration in the Transportation Sector," Office of Integrated Analysis and Forecasting, Energy Information Administration, U.S. Department of Energy (Aug. 1998); "Diesel Technology and the American Economy," Charles River Assoc. (Oct. 2000)

Donaldson Company. For more information, contact the forum at 703–234–4411 or visit our website at www.dieselforum.org.

Senator Kerry: Thank you very much. Mr. Ross.

STATEMENT OF MARC ROSS, PROFESSOR OF PHYSICS, UNIVERSITY OF MICHIGAN

Mr. ROSS. Yes, Mr. Chairman. I would also like to thank you for the opportunity to discuss improving automotive fuel economy. It is a very important topic. There are actually many different technologies that could increase automotive fuel economy by 50 percent or more without changing the size and performance of cars and light trucks. What I present in my printed testimony is an existence proof. It shows one way to do it.

Senator KERRY. When you say many, how many?

Mr. ROSS. Well, I would say half-a-dozen different possibilities. Diesels is one. Another is hybrids. I am not going to talk about hybrids, nor will I talk about diesels or remote things like fuel cell cars.

If the manufacturers were motivated to increase feul economy they would choose the technologies and the technologies would undoubtedly, in my opinion, be different from most of the specific things that will be suggested to you, because there are so many possibilities. I am presenting one way to do it, by making modest changes in the existing engine and system, primarily using smaller engines, sophisticated controls, and reducing the weight of the heaviest vehicles along the lines of some of the discussion we had a few minutes ago. The primary reason for reducing the weight of the heaviest vehicles is safety, and detailed suggestions, maybe too many details for most people's taste, are in my printed testimony.

The advantage of the approach I will discuss is that it is based on today's conventional vehicles, it can be applied to all cars and light trucks, and although there would be development costs to refine the control systems to make a satisfactory product for all customers, the incremental manufacturing costs would be small. So once refined, this approach is inexpensive and can be applied to all cars and light trucks. The problem with something like alternative fuels is that it applies to a tiny group of cars and light trucks, and although it is exciting and challenging, glamorous, it is not the way to make progress with our oil and greenhouse gas problems in a foreseeable timeframe.

Why aren't more conventional technologies already being adopted? We had a lot of discussion about that with the first panel. Of course, they are being adopted to a degree, but at the same time, mass and power are being increased. It seems like the CAFE standard has become a ceiling for most manufacturers.

I think, as a variation on some of the discussion we had this morning, that while buyers have some interest in fuel economy, they are interested in many characteristics of an automobile and, in that kind of a market, manufacturers have found they do not have to go to the trouble of improving fuel economy. They can focus on other aspects of marketing, and there are many aspects, as has been mentioned. The result has been that we do not have middle of the market vehicles with high fuel economy. With a couple of ex-

ceptions, we only have small cars, cheap cars with high fuel economy.

I have asked people from General Motors about that. They say they assume the only people who care enough about fuel economy want a really cheap car.

I am not a policy person, but I have three general remarks about policy. I do agree with people who see some difficulties with CAFE as a number that you would just increase. First of all, we care about fuel, and so we should be regulating gallons per mile, in analogy with what the Europeans do, instead of miles per gallon. A large increase in fuel economy in miles per gallon corresponds to a smaller percentage decrease in gallons per mile, and we should talk about what is really relevant.

Second, we care about safety as well as fuel, so we should be motivating, through our policies, technologies that reduce the weight of the heavier light trucks. I have a study with a collaborator from Lawrence Berkeley Laboratory on "losing weight to save lives", along those lines.

Third, coming from Michigan, I care about our domestic industries, as I am sure that many people do. And I care about the UAW. We want to help the big three remain competitive, but they are not going to innovate on fuel economy unless they are pushed, and pushed hard. So it is an awkward situation. My own thought here is not detailed. It is simply to set ambitious goals, but to be generous about the amount of time that is allowed for the progress.

Senator KERRY. Which means?

Mr. ROSS. Well, it means that you need 10 to 15 years to go to 40 miles per gallon, in my view. It takes a lot of time to develop and introduce new engines. You can do some things in shorter time, and so I think a progression is very sensible, but to get all the way there would take a lot of time.

And finally, I would suggest that we should incorporate the occasional review of technological progress, as we do with the appliance standards. It should be a formal requirement to do so, and that might help avoid the bind we are in now.

Let me finish by saying for the last dozen years I have been going to the Society of Automotive Engineers Annual Congress. It is just overwhelming how much technology has changed during that period, and yet we do not have a higher expectation for our automotive fuel economy. I recommend to the staff, look at the current (January) Automotive Engineering Magazine. There is an article on gasoline engines and new technologies, including astonishing progress, for example, at Honda. It is an entirely different world out there, and yet we are still talking about the same standards that we had in the mid-eighties.

Thank you.

[The prepared statement of Professor Ross follows:]

PREPARED STATEMENT OF MARC ROSS, PROFESSOR OF PHYSICS, UNIVERSITY OF MICHIGAN

Efficient Automotive Propulsion

I want to thank the Committee for giving me this opportunity to discuss improving automotive fuel economy.

Developmental Concept

I am not going to discuss revolutionary technologies like fuel-cell propulsion or high-voltage hybrid propulsion (although there are two outstanding hybrid cars sold in the U.S.). The proposed improvements are based on evolution, not revolution, and have two advantages:

- *The technologies can be implemented in all new light-duty vehicles; and*
- *the incremental manufacturing cost would be low, less than the value of the fuel savings.*

Although more than a decade would be needed to *fully* achieve these changes in a way satisfactory to all customers, substantial improvements in fuel economy could be made sooner.

Technological Goal

The goal of the proposed propulsion technologies is:

- high efficiency in typical low-power operation, while retaining the capability for high power.

Present automotive propulsion systems have high-power capability, but are inefficient in ordinary driving. High power driving is rare (mainly high-speed hill climbing and acceleration at high speed); almost all fuel is consumed in low-power driving. For example, high speed driving on a level road does not involve high power compared to today's engine capabilities.

Physical Concept

Today, friction is used to control the use of energy in automobiles. It is used to smoothly shift gears in automatic transmissions (with a torque converter), to regulate the flow of air into the engine (with a throttle), and to adjust the output of the air conditioner. It's analogous to dimming lights with a variable resistor. The way that was done, the energy used in the light was reduced with the resistor, i.e. by heating it. Now we dim lights by controlling the system electronically, rapidly switching the electricity on and off such that the on-time yields the desired amount of lighting. Very little energy is wasted.

There are two advantages to sophisticated control of automotive propulsion: Friction is reduced. And the improved controls enable efficient technologies to be designed so they are satisfactory to customers.

Technologies

1) The basic change is to smaller higher-speed engines coupled with sophisticated transmission.

A smaller engine has less internal friction. In today's typical engines, while the work done on the pistons by the hot combustion gases is about 38 percent efficient (thermodynamic efficiency), the work done overcoming internal friction introduces, on average, another 50 percent efficiency factor in the Urban Driving Cycle, for an overall engine efficiency of only 0.38*0.50 = 19 percent. Smaller engines are more efficient because they involve less friction, while, if they have high-speed capability, they can provide the same maximum power. An excellent example of such an engine is the 1.7 liter engine of the Honda Civic EX. Scaled to 2.0 liters, it would have the same power capability as a typical 3.0 liter engine with two-thirds as much friction.

Either continuously variable transmission or motor driven gear shifting can enable rapid and controlled changes in engine speed. These technologies are now available on a few production cars. With good design, the torque converter can be eliminated, so that engine speed and vehicle acceleration are smoothly controlled through intelligence rather than friction. In this way, a smaller engine can be made fully satisfactory to customers even though it involves more gear shifting and higher engine speeds. Further work is needed in this area, but it is engineering of the kind the industry regularly does, and does very well.

After development, such propulsion systems would cost less than what they replace.

2) Sophisticated controls and high-efficiency accessories enable turning the engine on-and-off.

With modern controls the engine can be turned off and on with almost no noise or vibration. However, enhanced electrical capability and high efficiency accessories, like air conditioning, are needed to enable turning the engine off for most of the time when the vehicle is stopped or in braking. The industry move to 42 Volts instead of 12 Volts will help engine on-and-off capability happen as a by-product. For air conditioning, what is needed is high efficiency in normal low-demand situations,

combined with the capability to handle extreme situations. Air conditioning for electric vehicles has provided some experience in this area. This improvement would increase costs, but the increase would not be large in the overall picture.

3) Weight reduction can be used to make heavier vehicles lighter to enhance safety.

Traffic safety can be greatly enhanced by systematic changes in design. One part of this safety strategy is to redesign the heaviest vehicles, decreasing their weight, while maintaining the weight of the lightest vehicles. The smaller engine and simpler transmission discussed here would enlarge the design opportunities. To make a definite projection, the weight reduction in the calculation that follows is taken to be 10 percent. More than this reduction could be accomplished with increased use of high-strength steels or other materials, and with the smaller engine and simpler transmission. It would be wise to make larger weight reductions for typical light trucks and no reductions among the lightest cars. A 10 percent reduction in aerodynamic and tire loads is also assumed, perhaps less than might be expected normally over the next decade.

4) Sophisticated engine controls offer engine efficiency benefits

Valve controls enable decreased frictional loss in air management by substituting valve action for the throttle. (The action is closely analogous to light dimming.) This has been fully implemented in a BMW production engine. Less-ambitious variable valve timing, already implemented in several engines, improves efficiency at low and high engine speeds.

The above technologies have been grouped so they address different energy opportunities. The first involves reducing engine and transmission friction; the second, turning off the engine; the third, load reduction; and the fourth, residual engine efficiency opportunities.

Potential Gains in Fuel Economy

Consider a recent midsize sedan similar to Ford Taurus with its standard engine. First I establish a reasonable limit: the fuel economy that could be achieved strictly through propulsion system efficiency improvement—without reducing mass or tire and aerodynamic loads (Table 1). For this exercise, I assume that all engine and transmission friction is eliminated (certainly not practical), while, conservatively, I assume that the engine's "thermodynamic efficiency" is at today's optimal of 38 percent and that the accessory load is reduced by one-third.

Table 1. "Test" Fuel Economies of a Recent Car, & a Very Efficient Car with the Same Load

	Urban Driving Cycle (mpg)	Highway Driving Cycle (mpg)	Composite Cycle (mpg)
late 1990s base car	22.2	35.3	27.0
"limit", car w/ same load	56.3	64.2	59.6

Now consider implementing the four types of technologies sequentially. (See Table 2.)

Table 2. Projected Fuel Economies from Implementing the Four Types of Technologies

	Urban Driving Cycle (mpg)	Highway Driving Cycle (mpg)	Composite Cycle (mpg)
base car plus step (1)	29.6	42.9	34.4
w/ steps (1) and (2)	33.3	42.9	37.0
w/ steps (1), (2) and (4)	35.0	43.9	38.5
include 10% lower load	37.7	48.5	41.9

Summary of the Fuel Economy Projections

The fuel economy gain projected here is 41.9/27.0 or 55 percent. This corresponds to a fuel saving at the same number of miles of 27.0/41.9 of 35 percent. Our study of light-truck fuel economy shows larger gains than I have projected here. The major point is that savings on this scale could apply to all new light-duty vehicles, albeit more for heavier light trucks and less for lighter cars.

Why aren't such technologies being adopted?

Some speculations: (1) All the manufacturers are adopting some of these measures, but they tend to simultaneously increase vehicle mass and engine power. (2) Most manufacturers prefer to sell vehicles like those they already produce, emphasizing changes in style rather than technology. (3) The manufacturers know that buyers are interested in many vehicle attributes, and they know it's hard for buyers to select for fuel economy in those circumstances. (4) Large, heavy and expensive vehicles are the most profitable (because the market is moving to higher income buyers, and because competitors are more numerous among smaller, lower-priced vehicles).

Finally, while these fuel economy technologies offer the same maximum-speed and acceleration-times, they have subtle disadvantages, somewhat uneven acceleration and somewhat more noise. Unless engineering efforts are made to moderate these disadvantages, the changes would not be satisfactory for some customers.

Policy.

I am not a policy specialist, but I have three general suggestions: (a) We care about fuel. Let's regulate gallons per mile instead of miles per gallon. (b) Motivate reducing the weight of the heavier light trucks. That's also justified by safety. (c) Strive to enable the old "Big-Three" to remain competitive. This requires pushing them strongly to be innovative, but not too hard. I think a good combination is to set ambitious goals, but to be generous with the rate of progress.

Citations to Our Recent Work in This Area

DeCicco, J, F An & M Ross, 2001. Technical Options for Improving the Fuel Economy of Cars and Light Trucks by 2010–2015, American Council for an Energy-Efficient Economy.

An, F, J DeCicco, & M Ross, 2001. Assessing the Fuel Economy Potential of Light-Duty Vehicles, Society of Automotive Engineers Paper No. 2001–01–2482.

An F, D Friedman & M Ross, 2002. Fuel Economy Potential for Light-Duty Trucks, Society of Automotive Engineers 2002–01–xxxx (to be published).

M Ross & T Wenzel, 2001. Losing Weight to Save Lives: A Review of the Role of Automobile Weight & Size in Traffic Fatalities, American Council for an Energy-Efficient Economy.

Senator KERRY. Thank you very much, professor. We appreciate it. Mr. German.

STATEMENT OF JOHN GERMAN, MANAGER, ENVIRONMENT AND ENERGY ANALYSES, AMERICAN HONDA MOTOR CORPORATION, INC.

Mr. GERMAN. Thank you. I am the manager for environment and energy analyses, in the Product Regulatory Office for American Honda Motor. I testified before this Committee on July 10, and I am pleased to be invited back to further discuss technology feasibility. I will summarize my prepared statement and ask the full statement be printed in the hearing record.

Even though car and light truck CAFE have remained constant for the last 15 years, there was a substantial amount of efficiency technology introduced during this period. However, this new technology was usually introduced to respond to vehicle attributes demanded by the marketplace, rather than to increase fuel economy.

For the past two decades, consumers have insisted on such features as enhanced performance, luxury, safety, and greater utility. As reflected in my prepared statement, vehicle weight increased 12 percent from 1987 to 2000, zero to 60 acceleration time improved by 22 percent from 1981 to 2000, and average horsepower increased by more than 70 percent, all while maintaining the same CAFE level.

The bottom line is it is these other attributes, not fuel economy, which influence customer decisions in the marketplace. Given the

low price of gasoline in the United States, this should come as no surprise. Since 1987, technology has gone into the fleet that could have improved fuel economy by almost 1½ percent per year if it had not gone to other attributes demanded by the market. Thus, while fuel economy did not increase, the fuel efficiency of these vehicles did.

We see four pathways to improve fuel efficiency. First, in the near term, we believe that the 1.5 percent annual efficiency improvements from conventional technology introduction could continue into the future. There are a number of technologies that are just beginning to penetrate the market, including 5-speed automatic and 6-speed manual transmissions, continuously variable transmissions, cylinder cutoff during light load operation, direct injection gasoline engines, and idle-off features.

In addition, many existing technologies have not yet spread to all vehicles, such as four-speed automatic transmissions, four valves per cylinder, variable valve timing, and reduced friction. The challenge is applying these new technologies toward fuel economy instead of vehicle attributes more highly valued by the customer.

Second, vehicle loads can be reduced. This can be effective in both the short term and the long term. Examples include use of materials for weight and strength optimization, measures to reduce friction and accessory losses, and aerodynamic designs. Honda's superior fuel economy performance is a direct result of our decision to aggressively incorporate advanced technology across our product line. Just a few examples; Honda pioneered variable valve timing in the early 1990's and now use it on over 80 percent of our vehicles. Virtually all of our engines are aluminum block with overhead cam shafts and four valves per cylinder, and all of our automatic transmissions have at least four speeds.

Third, over the next 5 to 15 years, the most promising opportunities will come through hybrid technology, vehicles which employ two power sources. Two such vehicles are sold in the U.S. today, the Honda Insight, and the Toyota Prius. Honda will also sell a hybrid version of our five-passenger Honda Civic sedan this spring.

Hybrid technology can markedly reduce fuel consumption in three ways. First, by using an electric motor to provide a power boost when needed, a smaller, more fuel-efficient gasoline engine can be used. Second, the electric motor can recharge the battery by capturing the energy that would normally be lost during deceleration and braking. Third, the electric motor can rapidly restart the engine, facilitating engine shut-off at idle.

Hybrids do not require a new refueling infrastructure, and do not need to be plugged in for recharging. However, hybrids currently cost at least several thousand dollars more than the equivalent conventional gasoline vehicle, with the cost increasing proportionately for larger vehicles. With fuel costs so inexpensive in the U.S., absent incentives, hybrid costs must dramatically decrease before hybrids will be accepted in the mass market.

In the long term, fuel cells are extremely promising. Honda and other manufacturers are actively working on both direct hydrogen fuel cell vehicles and on reformers, which convert fuel to hydrogen on board the vehicle. However, major hurdles remain. Reformers are expensive, take up valuable space in the vehicle, are slow to

warm up and respond to transient driving conditions, and reduce the efficiency of the vehicle. There are significant technological challenges with on-board hydrogen storage, in addition to the formidable challenge of developing an entirely new refueling infrastructure. It is highly unlikely that a consumer market will develop for fuel cells within the timeframes currently being evaluated by Congress.

The NAS report did a good job in laying out the different technology options and it presented a reasonable framework for assessing the cost and feasible fuel economy gains available from the application of new technology. Congress should follow the NAS analyses and recommendations when balancing the Nation's need to conserve energy with market acceptance.

A related issue is the safety impact of increasing fuel economy requirements, which was talked about extensively earlier. With respect to safety, Honda supports the dissenting opinion expressed by NAS committee members David Greene and Maryann Keller that existing data is insufficient to conclude that overall safety is compromised by smaller vehicles. Honda recently retained a contractor, Dynamic Research, Incorporated, to update NHTSA's 1997 analysis of the safety effects of reducing weight by using more recent accident data and newer vehicles with updated safety technology.

The preliminary conclusion is that the effect of a 100-pound weight reduction on the traffic fatalities of the combined car and light truck fleet is very small, and is statistically insignificant. Earlier this year, DRI presented an extensive overview of the analysis to NHTSA. NHTSA indicated that DRI appeared to have done a credible job of replicating their statistical techniques and updating their earlier analyses.

Although additional research is needed, the updated analysis indicates that weight reduction across the entire vehicle fleet may not have a negative safety impact. Honda will submit the completed DRI report to NHTSA shortly.

Mr. Chairman, there is much that technology can do to achieve enhanced fuel efficiency, but we must be realistic about the pace of technology and the hurdles that we will encounter. Manufacturers can only sell what customers are willing to buy. Absent programs or marketplace conditions that stimulate demand or provide incentives, the manufacturer's challenge would be to increase fuel efficiency without sacrificing the performance, safety, convenience, and comfort that customers demand.

Thank you. I would be happy to answer any questions.

[The prepared statement of Mr. German follows:]

PREPARED STATEMENT OF JOHN GERMAN, MANAGER, ENVIRONMENT AND ENERGY ANALYSES, AMERICAN HONDA MOTOR CO., INC.

Good morning, my name is John German, Manager, Environment and Energy Analyses, Product Regulatory Office, American Honda Motor Co., Inc. Honda appreciates the opportunity to appear before the Senate Commerce, Science and Transportation Committee to discuss automotive fuel efficiency with a focus on technology.

Honda products have always focused on the most efficient use of resources. It has been a part of Honda's culture from the beginning. To quote our founder, Mr. Honda, in 1974, "I cannot overstress the importance of continuing to cope with the pollution problem." We believe we must think about more than just the products we make. We think about the people who use them and the world in which we live.

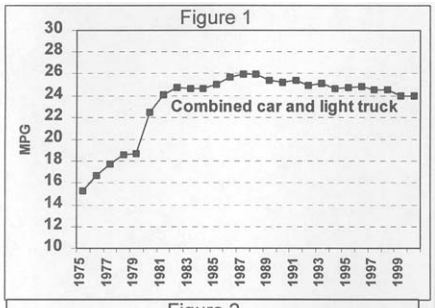
We believe that it is our responsibility, as a manufacturer of these products, to do all we can to reduce the pollutants that are created from the use of products that we produce.

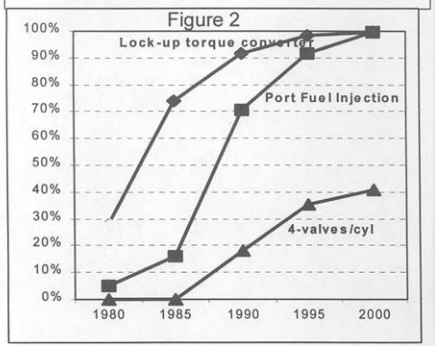
Conventional Technology

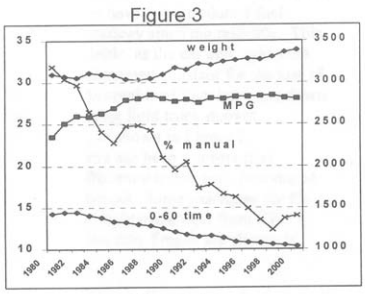
There is a popular misconception that vehicle manufacturers have not introduced fuel efficient technology since the mid-80s. This is understandable, as the car and light truck CAFE have remained constant for the last 15 years (and the combined fleet has gone down due to increasing light truck market penetration), as shown in Figure 1. However, there has been a substantial amount of efficiency technology introduced in this time period. Some examples for the entire car and light truck fleet from EPA's 2000 Fuel Economy Trends are shown in Figure 2.

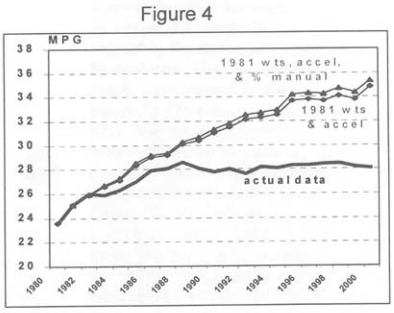
However, this new technology has been employed more to respond to vehicle attributes demanded by the marketplace than to increase fuel economy. Over the past two decades consumers have insisted on such features as enhanced performance, luxury, utility, and safety, without decreasing fuel economy. Figure 3 shows the changes in vehicle weight, performance, and proportion of automatic transmissions since 1980 in the passenger car fleet. Even though weight increased by 12 percent from 1987 to 2000, the 0–60 time decreased by 22 percent from 1981 to 2000. This is because average horsepower increased by over 70 percent from 1982 (99 hp) to 2000 (170 hp). In addition, the proportion of manual transmissions, which are much more fuel efficient than automatic transmissions, decreased from 32 percent in 1980 to 14 percent in 2000.

It is clear that technology has been used for vehicle attributes which consumers have demanded or value more highly than fuel economy. Figure 4 compares the actual fuel economy for cars to what the fuel economy would have been if the technology were used solely for fuel economy instead of performance and other attributes. If the current car fleet were still at 1981 performance, weight, and transmission levels, the passenger car CAFE would be almost 36 mpg instead of the current level of 28.1 mpg. The trend is particularly pronounced since 1987. From 1987 to 2000, technology has gone into the fleet at a rate that could have improved fuel economy by about 1.5 percent per year, if it had not gone to other attributes demanded by the marketplace.









There is no reason why this technology trend of improved efficiency (as opposed to fuel economy) should not continue. Many of the technologies in the 2000 fleet, such as 4-valve per cylinder, have not yet spread throughout the entire fleet (although Honda vehicles have been virtually 100 percent 4-valve per cylinder since

1988). In addition, several new technologies that will have significant efficiency benefits are just beginning to penetrate the fleet. One technology pioneered by Honda is variable valve timing. While Honda used variable valve timing in almost 60 percent of our 2000 vehicles, penetration in the other manufacturers' fleets is only a percent or two. Other technologies that have recently been introduced or for which at least one manufacturer has announced plans to introduce include:

- Direct injection gasoline engines (only announced for Europe and Japan to date)
- 5-speed automatic and 6-speed manual transmissions
- Continuously variable transmissions (works like an automatic, but more efficient)
- Lightweight materials
- Low rolling resistance tires
- Improved aerodynamics
- Cylinder cut-off during light-load operation (for example, an 8-cylinder engine shuts off 4 cylinders during cruise conditions)
- Idle-off (the engine stops at idle)

Technologies are continuously being incorporated into vehicles. However, consumer's sense of value usually puts fuel efficiency near the bottom of their list. The dilemma facing manufacturers is that customers may not value putting in these technologies just to improve fuel economy.

Gasoline-Electric Hybrids

The most promising technology on the mid-term horizon (5–15 years) are hybrid vehicles—vehicles which employ two power sources. The two hybrid vehicles recently introduced in the U.S., the Honda Insight and the Toyota Prius, both use innovative hybrid techniques. In addition, Honda will introduce a hybrid version of our Civic sedan this spring.

There are some basic operating characteristics that help shape the design of any hybrid system. The greatest demands on horsepower and torque occur while accelerating and climbing grades. Minimal power is needed to maintain a vehicle's speed while cruising on a level road. By using an electric motor to provide a power boost to the engine when appropriate, a smaller, more fuel-efficient gasoline engine can be used. In addition, the motor can be used to capture energy that would normally be lost during deceleration and braking and use this energy to recharge the battery. This process is referred to as "regenerative braking". These vehicles do not need to be plugged in. Finally, the powerful electric motor can restart the engine far quicker than a conventional starter motor and with minimal emission impact, allowing the engine to be shut off at idle.

Honda's Integrated Motor Assist (IMA) relies primarily on a small gasoline motor and is supplemented by a high torque, high efficiency DC brushless motor located between the engine and the transmission.[1] This 10 kW motor is only 60 mm (2.4″) thick and is connected directly to the engine's crankshaft. It supplies up to 36 ft-lb. of torque during acceleration and acts as a generator during deceleration to recharge the battery pack. This is a simple, elegant method to package a parallel hybrid system and minimizes the weight increase.

Toyota's hybrid system combines both series and parallel systems.[2] The Prius powertrain is based on the parallel type. However, to optimize the engine's operation point, it allows series-like operation with a separate generator.

Both models use relatively small battery packs. The Insight's NiMH battery pack is rated at about 1 kW-hr of storage and only weighs about 22 kg (48 pounds). The battery pack on the Prius is larger, but is still no more than twice the size of the Insight's. These lightweight battery packs help to maintain in-use performance and efficiency while maintaining most of the hybrid system benefits. The larger motor and battery on the Prius also allow limited acceleration and cruise at light loads on electricity only.

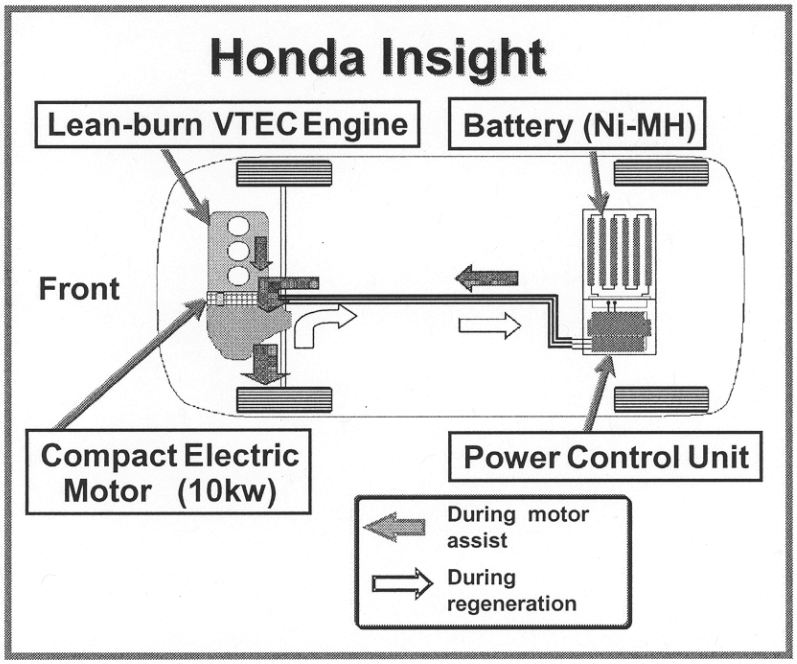
Both the Insight and the Prius incorporate substantial engine efficiency improvements, in addition to the downsizing allowed by the hybrid system. The Prius uses a low friction, Atkinson cycle 1.5L engine. The Atkinson cycle uses a longer expansion stroke to extract more energy from the combustion process.

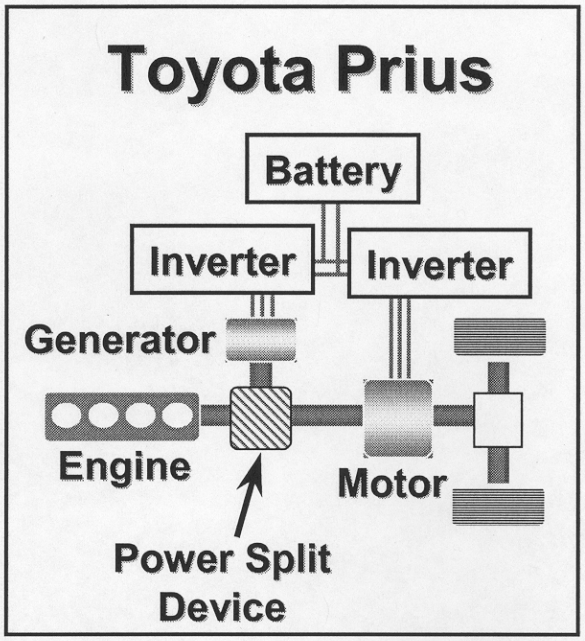
The Insight engine incorporates a number of different strategies to improve efficiency. The engine has Honda's variable valve technology, which boosts peak horsepower and allows even more engine downsizing. The 1.0L, 3-cylinder engine also in-

[1] "Development of Integrated Motor Assist Hybrid System", K. Aoki et al, Honda, June, 2000, SAE # 2000–01–2059.

[2] Prius information is based upon October, 1999 Presentation by Dave Hermance of Toyota, "Toyota Hybrid System Concept and Technologies."

corporates lean-burn operation, low friction, and lightweight technologies to maximize fuel efficiency. Despite the small engine size, the Insight can sustain good performance with a depleted battery, due to the high power/weight from the VTEC engine.


Honda Insight
Lean-burn VTEC Engine
Battery (Ni-MH)
Front
Compact Electric Motor (10kw)
Power Control Unit
During motor assist
During regeneration


Toyota Prius
Battery
Inverter
Inverter
Generator
Engine
Motor
Power Split Device

What is especially interesting about the Insight and Prius comparison is that very different powertrain technologies were used to achieve similar efficiency goals. One important lesson is that the different types of hybrid systems have reasonably similar environmental performance. The new continuously variable transmission (CVT) Insight is rated as a SULEV. There are an infinite number of ways to combine hybrid components to create a practical hybrid electric vehicle.

Both the Insight and the Prius have achieved impressive fuel economy improvements. The manual transmission Insight has the highest fuel economy label values ever for a gasoline vehicle, 61 mpg city and 68 highway. The CVT Insight is rated at a slightly lower level. While much of the high fuel efficiency is attributable to the hybrid engine, other fuel efficient technologies, such as aerodynamic design and strategic use of lightweight materials were incorporated into the Insight as well. The Prius values are 52 mpg city and 45 highway. The label values on the Civic hybird will be about 50 mpg city and highway.

Projections have also been made for prototype or future hybrid designs. Table 1 compares the manufacturer claims for the prototype vehicles to the production values for the Insight, Civic, and Prius. It should be noted that Table 1 presents CAFE values, instead of fuel economy label values.[3]

Table 1: Hybrid Vehicle Comparison

		CAFE mpg	% improvement**
Commercial	Honda Insight	76	91%
Commercial	Toyota Prius	58	50%
Commercial	Honda Civic sedan	High 50s	35%
Prototype	Ford Escape SUV	40	40-70%
Prototype	Dodge Durango SUV	19	20%
Prototype	GM SUV	35	20%
Prototype	GM full-size pickup	20	15%

* Gasoline-equivalent mpg

** Baseline for Escape is 24 mpg (V6) to 29 mpg (4-cyl)
Baseline for PNGV is 28 mpg (based on typical midsize car)

While it is easy to overlook because of the large efficiency benefits, hybrids also offer some potential emission reductions. The lower fuel consumption directly reduces upstream emissions from gasoline production and distribution. If the higher efficiency is used to increase range, evaporative emissions from refueling are reduced.

Future potential for hybrid powerplant applications and volume sales

Hybrids have a number of positive features that are desired by customers. They use gasoline (or diesel fuel); thus there are no concerns about creating a new infrastructure to support fueling. The customer benefits from lower fuel costs, extended range, and fewer trips to the gas station. Hybrids have good synergy with other fuel economy technologies and even help reduce emissions. Equally important, there is little impact on how the vehicle operates. The vehicles drive and operate similar to conventional vehicles.

Recent announcements from a number of manufacturers indicate that hybrid systems are being considered across a very broad vehicle spectrum. Toyota has announced production of a hybrid electric minivan for the Japanese market.[4] Ford has announced plans to put a hybrid system into a 2003 model year Escape, a small SUV.[5] DaimlerChrysler will offer a hybrid in its Durango SUV sometime in 2003.[6] General Motors is already selling hybrid bus systems and plans to sell hybrid versions of its full-size pickup truck and the forthcoming Saturn VUE SUV in 2004.[7] There appears to be no inherent limitation on the use of hybrid systems, as long as packaging, weight, and cost issues can be managed.

While there have been tremendous strides in hybrid technology, there remain some packaging issues such as finding space for the motor, battery pack, and power

[3] EPA discounts the city test by 10 percent and the highway by 22 percent when calculating fuel economy values, so the combined FE based upon the label values discussed in the last paragragh is about 15 percent lower than the CAFE values in Table 1.

[4] "Toyota sees a hybrid future", Autoweek, October 30, 2000.

[5] Ford Motor Co. press releases, January 10, 2000 and April 7, 2000.

[6] Associated Press article by Justin Hyde, October 25, 2000.

[7] General Motors Co. press release, January 9, 2001.

electronics, as well as some additional weight. However, these issues are secondary compared to the cost issue.

Unfortunately, hybrid systems are not cheap. Initially, hybrids also have high development costs spread over relatively low sales. Manufacturers are understandably reluctant to discuss the cost of their hybrid systems, so it is difficult to determine a realistic cost. Still, it is clear that hybrids currently cost at least several thousand dollars more than the equivalent conventional gasoline vehicle, with the cost increasing proportionally for larger vehicles.

To put the cost issue into context, one must examine what customers might be willing to pay in exchange for the fuel savings, both in the U.S. and overseas using several assumptions. The most critical is customer discounting of fuel savings. It is generally understood that most customers in the U.S. only consider the first 4 years of fuel savings, plus they heavily discount even these 4 years. This is roughly equivalent to assuming that customers only value the fuel savings from the first 50,000 miles. For lack of information, the same 50,000 mile assumption is used for overseas customers (who drive less per year but may value the fuel savings more).

Estimates were made for three different size vehicles, small cars, midsize cars, and large trucks. Three estimates were also made for the hybrid benefits, as the improvements listed in Table 1 range from 15 percent to 91 percent. Of course, some of the vehicles in Table 1 include factors that go well beyond the impact of the hybrid system itself, such as weight and load reduction and engine efficiency improvements. A reasonable factor for just the hybrid system and corresponding engine size reduction is probably about 30–40 percent over combined cycles. Sensitivity cases of 20 percent (for very mild hybrids) and 80 percent (for hybrids combined with moderate engine and load improvements) are also shown in Table 2.

The final factor is fuel cost. Table 2 lists two cases: $1.50/gallon (U.S.) and $4.00/gallon (Europe and Japan). The formula used to calculate the fuel savings in Table 2 is:

$$\left[\frac{50{,}000 \text{ miles}}{\text{baseline mpg}} - \frac{50{,}000 \text{ miles}}{\text{base mpg}*(1+\text{FE inc.})} \right] * \text{ Fuel cost}$$

Table 2: Customer Value of Hybrid Fuel Savings (savings for the first 50,000 miles)

		Small car	Midsize car	Large truck
Hybrid FE increase	Fuel cost	40 mpg baseline	27 mpg baseline	16 mpg baseline
+ 20%	$1.50/gal	$313	$463	$781
	$4.00/gal	$833	$1,235	$2,083
+ 40%	**$1.50/gal**	**$536**	**$794**	**$1,339**
	$4.00/gal	**$1,429**	**$2,116**	**$3,571**
+ 80%	$1.50/gal	$833	$1,235	$2.083
	$4.00/gal	$2,222	$3,292	$5,556

The results are sobering. From a societal view, the fuel savings over the full life of the vehicle (which are about three times the values in Table 2), would likely justify the approximately $3000 cost of hybrid systems. However, the typical customer would not make up the incremental cost of $3000 by the fuel savings, especially in the U.S.. In Japan and Europe, there may be a substantial market for hybrids even at a cost of $3000, due to the higher fuel prices. If the hybrid cost could be reduced to $1500 or $2000, the majority of customers in Japan and Europe might be willing to purchase a hybrid vehicle.

Even in the U.S., there are customers who, because they drive a lot or value the benefits more highly, will be willing to pay a $3000 premium for a hybrid vehicle. However, it is clear that hybrids will not break into the mainstream market in the U.S. unless the cost of hybrid systems comes down and/or some sort of market assistance or incentive program is adopted.

Over the next 5 to 10 years, we are likely to see a gradual increase in hybrid sales in the U.S. While the approximately $3000 cost increment in 2003 is too high for the mass market in the U.S., enough customers will desire the features to keep the market growing. In addition, hybrid sales are likely to increase much faster in Europe and Japan, due to their much higher fuel costs. This will lead to higher volume production and further development, both of which will reduce cost worldwide. Sales in the U.S. will continue to increase as the costs come down.

But there is a broader message here for U.S. policymakers. All of the technology improvements that can be made are incremental and have a financial cost. Absent marketplace signals as well, progress on achieving higher fuel efficiency in the marketplace may be slower than we may desire.

Fuel Cells

Fuel cells are the most promising mid- to long-term option. Hydrogen fuel cells have virtually no emissions and are extremely efficient. Large-scale production of hydrogen would probably use natural gas, which would reduce our dependence on fossil fuels. Even longer term, we may be able to produce hydrogen using solar energy or biomass fuels.

However, there are many issues to resolve before fuel cell vehicles become commercially viable. Cost and size must be drastically reduced and on-board hydrogen storage density must be significantly improved. Durability must also be proved. Even after all these problems are solved, there are still infrastructure and fueling system issues to resolve. Thus, fuel cells will be a long time in development.

There also are serious concerns about on-board reformers for creating hydrogen. Reformers are the hardware that converts fuel like natural gas or methane, to hydrogen. These reformers are expensive, take up valuable space in the vehicle, and are slow to warm up and respond to transient driving conditions. In addition, they reduce the efficiency of the vehicle, both because of the energy needed for the reforming process and because the resulting fuel stream is not pure hydrogen. The dilution of the fuel stream requires a larger fuel cell stack to maintain the same performance, increasing weight, size, and cost of the system. In fact, recent research has concluded that fuel cells with on-board reformers may not be more efficient than a good gasoline hybrid.[8]

Honda's current research efforts are focused on direct hydrogen fuel cell vehicles. These are not yet ready for the public, not ready for "numbers", and not ready to help fill requirements for zero emission vehicles. But even if all of the technological and infrastructure obstacles can be overcome, we are still one to two decades away from serious commercial introduction. However Honda is serious about this technology because it holds promise for environmentally sound transportation.

NAS CAFE Study

The recent report of the National Academy of Sciences (NAS) entitled "Effectiveness and Impact of Corporate Average Fuel Economy Standards" provides the Committee with a good point of departure for considering this complex technological, economic and public policy issue. We commend the NAS on its report on fuel economy. While we do not agree with all the findings and recommendations, the Panel had a formidable task, which it completed on an extremely tight time frame.

A number of the recommendations of the NAS on any future increase in CAFE parallel our thinking. The report recognizes the importance of providing adequate lead-time to design and introduce new technology to meet future standards. The report focuses on a 15-year timeframe. Certainly, the more significant the increase in the standard, the longer the lead-time needed. We also note the NAS Report is not unanimous on its position with regard to safety. We have more to say about this critical issue later, but we concur that more research is warranted.

The pace of technology improvement is significant in the context of the NAS finding that "[t]echnology changes require very long lead times to be introduced into the manufacturers' product lines." Accelerated mandates that are met through piecemeal modifications to existing vehicle designs, rather than through integration of fuel-efficient technologies from the inception of a new vehicle design, can have disruptive and undesirable effects. The NAS notes that the downweighting and downsizing that occurred in the late 1970s and early 1980s, may have had negative safety ramifications. But the ability to "design in" fuel economy from the beginning—through the use of aerodynamic styling, enhanced use of lightweight materials, and incorporation of the newest drivetrain technologies—can produce significant fuel savings with little sacrifice of other vehicle attributes that consumers desire. We can say unequivocally that this has been Honda's experience.

As long as adequate leadtime is provided, the technology analyses in the NAS report are reasonable. Similar to Honda's position, the NAS found that there are significant amounts of conventional technology that can be applied to the vehicle fleet, but that hybrids may cost too much for mass market acceptance and fuel cells are not ready for the consumer market. The minor corrections in the NAS Letter Report of January 16, 2002 and the committee's stated desire for readers to focus on the

[8] "On the Road in 2020", M. Weiss, J. Heywood, E. Drake, A. Schafer, and F. AuYeung, Massachusetts Institute of Technology, October 2000.

average results, instead of the upper and lower bounds, are also reasonable. The fuel efficiency and cost estimates in the NAS report are in the ballpark and can be used to help Congress balance the nation's need to conserve energy with consumer acceptance of the costs and impacts on other consumer attributes.

Safety Issues

It is significant that safety considerations are the only issue that produced a dissenting opinion in the NAS Report. Honda concurs with that dissenting opinion expressed by committee members David Greene and Maryann Keller, that the data is insufficient to conclude that safety is compromised by smaller vehicles. The level of uncertainty about fuel economy related safety issues is much higher than stated in the majority report. Significantly, existing studies do not address the safety impact of using lightweight materials without reducing size, especially for vehicles with advanced safety technology.

As the dissenters state, "[t]he relationship between vehicle weight and safety are complex and not measurable with any degree of certainty at present." We believe it is important to understand the differences between size and weight. We have demonstrated through the use of sophisticated engineering and advanced lightweight materials that smaller cars can be made increasingly safer. For example, Honda's 2001 Civic Coupe, with a curb weight of 2502 pounds, was the first compact car to receive a five star safety rating in the NHTSA crash results for the driver *and* all passenger seating positions in frontal and side crashes. The fuel economy of the Civic HX coupe with a continuously variable automatic transmission (CVT) and a gasoline engine is 40 mpg (highway) and 35 mpg (city). In addition, there are many ways to increase fuel efficiency that do not affect weight including power train technology and the efficient use of space.

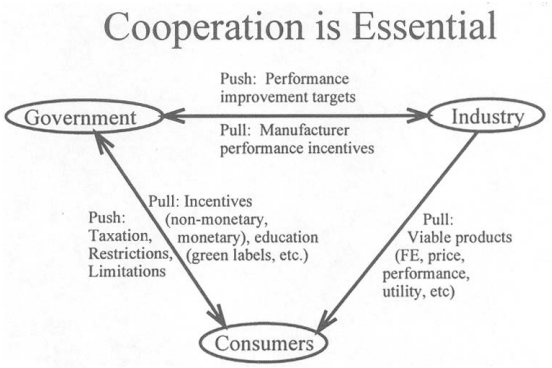
Thus, vehicle design and size, and not just vehicle mass, must be considered when studying the relationship between fuel economy and safety. There are accident scenarios where less weight may actually be an advantage in some vehicle accidents. In others, it is a disadvantage. But, there is much we do not know. For example, to what extent can advanced crash avoidance technologies, such as forward collision warning/avoidance, lane keeping and road departure prevention, and lane change collision warning/avoidance systems, be employed to make weight considerations less relevant? To what extent can new, lightweight materials and sophisticated engineering provide a level of crash protection comparable or even superior to vehicles with traditional materials and designs?

Honda supports the NAS recommendation that NHTSA undertake additional research to clarify the relationship of weight and size in the context of newly evolving advanced materials and engineering techniques in the array of accident scenarios that are encountered on American roads. Honda recently retained a contractor, Dynamic Research, Inc. (DRI), to update NHTSA's 1997 analysis of the safety effects of reducing weight by using more recent accident data with newer vehicles. The preliminary conclusion is that the effect on traffic fatalities of a 100 pound weight reduction on the combined car and light truck fleet is very small and not statistically significant. On January 15, 2002, DRI presented an extensive overview of the analysis to NHTSA staff. They indicated that DRI appeared to have done a credible job of replicating their statistical techniques and updating their earlier analysis. The updated analysis indicates that weight reduction across the entire vehicle fleet may not have a negative safety effect. Honda will submit the complete DRI study report to NHTSA in the very near future. Honda supports the NAS recommendation that NHTSA undertake additional research to clarify the relationship of weight and size in the context of newly evolving advanced materials and engineering techniques in the array of accident scenarios that are encountered on American roads.

Customer Preference

Honda believes it has a duty to be a responsible member of society and to help preserve the global environment. Honda is committed to contributing to mitigation of greenhouse gas emissions through technological progress. We believe it is our responsibility to develop and offer efficient products in the market. We have been an industry leader in introducing such products and will continue to do so.

However, unless the customer becomes an integral participant in the process of reducing greenhouse gases, market acceptance of these products will be limited. Programs will be far more effective if they include government and customers, not just industry. The industry can provide a "pull" by providing products desired by the consumer. But, we cannot push customers into buying vehicles they do not want. Government programs to stimulate demand, provide incentives, and educate the customer could dramatically affect acceptance of new technologies and market penetration.



Thank you for this opportunity to testify. I would be happy to answer your questions.

Senator KERRY. Thank you very much. Mr. Dana.

STATEMENT OF GREG DANA, VICE PRESIDENT, ENVIRONMENTAL AFFAIRS, ALLIANCE OF AUTOMOBILE MANUFACTURERS

Mr. DANA. Mr. Chairman, thank you for the opportunity to testify before the Committee today regarding CAFE standards. I will summarize my written report.

Senator KERRY. All of the statements will be placed in the record as if read in full.

Mr. DANA. First, the alliance supports efforts to create an effective energy policy based on broad, market-oriented principles. Policies that promote research, development, and employment of advanced technologies and provide customer-based incentives to accelerate demand of these advanced technologies set the foundation.

Second, the alliance believes that Congress does not need to set new standards or change the structure of the CAFE program. Current law requires the Department of Transportation to promulgate new light truck standards at a maximum feasible level, taking into consideration technology feasibility, economic practicability, the effect of other motor vehicle standards on fuel economy, and the need of the United States to conserve energy. These are the same issues that are the focus of today's hearing.

In fact, the National Highway Traffic Safety Administration has issued a proposal to set standards for the 2004 model year, and we expect the agency will soon issue a rulemaking notice to address the proper level of light truck CAFE standards for the 2005 model year and beyond. Auto makers will be working cooperatively with the agency in these rulemakings.

Setting future CAFE standards requires knowledge of auto makers future product plans, their technology roll-out, and their financial situation. This requires NHTSA to gather and analyze a vast amount of data, along with propriety information from manufacturers and suppliers. Given the many variables and uncertainties in the marketplace, auto makers believe that NHTSA is the appropriate forum to consider CAFE standards. NHTSA is the best to

judge the complexities of the program and the need to balance public policy goals.

In discussions involving future CAFE standards on auto makers, consumers cannot be left out of the equation, for their decisions drive today's sales and influence future research and product planning. According to the Environmental Protection Agency, vehicle fuel efficiency, as measured on a pound for pound basis, has increased nearly 2 percent per year since 1975. Fuel economy has marginally declined, however, representing consumers' increasing preference for safety, utility, and performance.

When considering what kind of vehicle to buy, consumers evaluate all the different uses they will demand of their new car or light truck. Most customers select vehicles that best serve their peak uses, whether carrying kids, car-pooling adults, towing trailers, or handling adverse terrain or weather. Auto manufacturers are working on future technologies such as hybrid and fuel cell vehicles that may lead to substantial improvements in efficiency and emissions performance without sacrificing safety, utility, and performance.

Successful introduction of these new and emerging technologies all share the need for cooperative efforts that bring all the key stakeholders together, including the auto makers, energy providers, Government policymakers and, most importantly, the customers.

Auto makers have also been developing a new generation of highly fuel-efficient clean diesel vehicles as a way to significantly increase fuel economy and reduce greenhouse gas emissions. Low sulfur diesel fuel is necessary to enable the new clean diesel technology to be used in future cars and light trucks. Cleaner fuels will also provide emission benefits for the existing on-road fleet of vehicles. We know that advanced technologies with a potential for major fuel economy gains are on the horizon, and as a Nation we need to get these technologies developed and on the road as soon as possible in an effort to reach the national energy goals as fast and as safely and as efficiently as we can.

What can Congress do to assist in this process? We urge that the Senate consider new approaches for the 21st Century which accelerates the consumer's acceptance of advanced technologies. The alliance and its 13 member companies believe the best approach for improved fuel efficiency is to aggressively promote the development of technologies through cooperative public-private research programs and competitive development and incentives to pull the technologies into the marketplace as rapidly as possible.

In closing, let me comment we are in general support of the concepts in Senate bill 760, the CLEAR act, which you, Mr. Chairman, and other members of this Committee have cosponsored, and this bill would provide consumer tax credits for the purchase of fuel-efficient vehicles, and we appreciate your help in that area.

I would be happy to answer any questions, Mr. Chairman.

[The prepared statement of Mr. Dana follows:]

PREPARED STATEMENT OF GREG DANA, VICE PRESIDENT, ENVIRONMENTAL AFFAIRS, ALLIANCE OF AUTOMOBILE MANUFACTURERS

Mr. Chairman,

Thank you for the opportunity to testify before the Committee regarding energy issues. My name is Greg Dana and I represent the Alliance of Automobile Manufacturers (Alliance), a trade association of 13 car and light-truck manufacturers. Our member companies include BMW Group, DaimlerChrysler Corporation, Fiat, Ford Motor Company, General Motors Corporation, Isuzu Motors of America, Mazda, Mitsubishi, Nissan North America, Porsche, Toyota Motor North America, Volkswagen of America, and Volvo.

Alliance member companies have more than 620,000 employees in the United States, with more than 250 manufacturing facilities in 35 states. Overall, a recent University of Michigan study found that the entire automobile industry creates more than 6.6 million direct and spin-off jobs in all 50 states and produces almost $243 billion in payroll compensation annually.

The automobile industry has played an integral role in the economic and job growth of the nation. 2001 was the second best year for new vehicle sales and this was certainly helped by the zero-percent financing offered by many companies in response to the September terrorist attacks. However, the current economic recession has affected many in our country and the automobile industry is no exception.

The economic downturn in the industry offers many challenges for our industry in 2002. In recent months, many companies have announced restructuring plans to address changing business conditions and consumer demands and ensure long-term financial health. The overriding goal has not changed and that is to provide American consumers with a wide of range of vehicle choices to meet their needs and desires. However, policies that are at odds with the market add a real cost to manufacturers and their customers. Higher Corporate Average Fuel Economy (CAFE) standards beyond the maximum feasible level threatens our ability to provide customers with the vehicles they want and/or price increases that reduce demand for new automobiles. Both of these have the potential to undermine the growth of the auto industry and their contribution to U.S. economic growth.

As automakers research, design and build cars and light trucks, a number of factors are taken into consideration including some which are the subject of today's hearing. Technology, safety, utility requirements, and cost are key components for any vehicle and companies are constantly striving to balance these issues in manufacturing vehicles and meeting government regulatory standards. We welcome the opportunity to discuss the Alliance views on our nation's energy policy and, specifically, the benefits of advanced technology vehicles for consumers and its role in domestic policy.

The Alliance supports efforts to create an effective energy policy based on broad, market-oriented principles. Policies that promote research, development and deployment of advanced technologies and provide customer based incentives to accelerate demand of these advanced technologies set the foundation. This focus on bringing advanced technologies to market leverages the intense competition of the automobile manufacturers worldwide. Incentives will help consumers overcome the initial cost barriers of advanced technologies during early market introduction and increase demand, bringing more energy efficient vehicles into the marketplace.

Over the past year, there has been increased attention on vehicles and their fuel economy levels with particular discussion of the CAFE program. The Alliance believes, however, that Congress does not need to set new standards or change the structure of the program. Current law requires the Department of Transportation (DOT) to promulgate new light truck standards (pickups, SUVs, minivans and vans) at the "maximum feasible level" taking into consideration technological feasibility, economic practicability, the effect of other motor vehicle standards on fuel economy, and the need of the U.S. to conserve energy. These are the same issues that are the focus of today's hearing. In fact, the National Highway Traffic Safety Administration (NHTSA) has issued a proposal to set standards for the 2004 model year and we expect the agency will soon issue a rulemaking notice to address the proper levels of light truck CAFE standards for the 2005 model year and beyond.

Automakers will be working cooperatively with the agency in these rulemakings. Setting future CAFE standards requires knowledge of automakers' future product plans, their technology rollout, and their financial situation. This requires NHTSA to gather and analyze a vast amount of data along with proprietary information from manufacturers and suppliers. Given the many variables and uncertainties in the marketplace, automakers believe that NHSTA is the appropriate forum to consider CAFE standards given the complexities of the program and the need to balance public policy goals.

What can Congress do to assist in this process? We urge that the Senate consider new approaches for the 21st century which accelerate the consumers' acceptance of advanced technologies. The Alliance and its 13 member companies believe that the best approach for improved fuel efficiency is to aggressively promote the development of advanced technologies—through cooperative, public/private research programs and competitive development—and incentives to help pull the technologies into the marketplace as rapidly as possible. We know that advanced technologies with the potential for major fuel economy gains are on the horizon. As a nation, we need to get these technologies developed and on the road as soon as possible in an effort to reach the national energy goals as fast and as safely and efficiently as we can.

In discussions involving energy policy and automakers, consumers cannot be left out of the equation, for their decisions drive today's sales and influence future research and product planning. According to the Environmental Protection Agency, vehicle fuel efficiency, as measured on a pound for pound basis, has increased nearly 2 percent per year since 1975. The fleet fuel economy has marginally declined, however, representing consumers' increasing priority for safety, utility and performance. When considering what kind of vehicle to buy, consumers evaluate all the different uses they will demand of their new car or light truck. Most customers select vehicles that best serve their peak uses, whether carrying kids, carpooling adults, towing trailers or handling adverse terrain or weather.

Another important consideration is that technologies that produced significant car fuel economy improvements, such as front wheel drive and aerodynamic styling, are not always possible to a great extent on light duty trucks. The majority of light duty truck buyers have specific performance requirements related to their use of pickups and vans for cargo capacity, towing, and utility. Manufacturers are developing engine technologies that will increase fuel efficiency and incorporate these performance requirements without impacting those attributes.

R&D Focus

The University of Michigan study also found that the total R&D spending by the industry is approximately $18.4 billion per year, with much of it in the high tech sector. In fact, the study stated the following: "The level of automotive R&D spending and the relatively high employment of research scientists and engineers in the U.S. auto industry has traditionally earned it a place in any U.S. Government listing of high technology industries generally thought to be central to the long-term performance of the U.S. economy." A number of other industries are affected by the decisions, actions and economic health of the automakers. For instance, automobile companies are the rail industry's 3rd largest customer. Other affected industries include: steel, aluminum, plastics, tires, trucking, glass, iron, carpeting and semiconductor manufacturers.

As we begin the 21st century, the auto industry is committed to developing and utilizing emerging technologies to produce safer, cleaner, more fuel-efficient cars and light trucks. The National Academy of Sciences (NAS), in its July, 2001 report to Congress on CAFE, introduced their discussion of promising technologies by stating that the 1992 NAS report outlined various automotive technologies that were either entering production at the time, or were considered "emerging" based upon their potential and production intent. Automotive technology has continued to advance, especially in microelectronics, mechatronics, sensors, control systems, and manufacturing processes. Most of the technologies identified in the 1992 report as "proven" or "emerging" have already entered production.

The 2001 NAS report also demonstrates the complexity of the CAFE program and the impact on a number of fronts including one of this Committee's key concerns: safety. Following are key excerpts:

> "The majority of this committee believes that the evidence is clear that past downweighting and downsizing of the light-duty vehicle fleet, while resulting in significant fuel savings, has also resulted in a safety penalty. In 1993, it would appear that the safety penalty included between 1300 and 2600 motor vehicle crash deaths that would not have occurred had vehicles been as large and heavy as in 1976." (page 2–26)

> "If an increase in fuel economy is effected by a system that encourages either downweighting or the production and sale of more small cars, some additional traffic fatalities would be expected." (page 6–5)

The Alliance believes NHTSA, as the nation's highway safety agency, is best situated to issue new fuel economy standards that do not result in a degradation of safety.

Auto manufacturers are working on future technologies such as hybrid and fuel cell vehicles that may lead to substantial improvements in efficiency and emissions performance without sacrificing safety, utility, and performance. Fuel cell technology also serves as a potential vehicle to move away from a petroleum dependent transportation sector. Successful introduction of these new and emerging technologies all share the need for cooperative efforts that bring all the key stakeholders together . . . including the automakers, energy providers, government policy makers and most importantly, the customers.

Key Energy Policy Initiatives

1) Promoting Market-Driven Principles

The focus on bringing advanced technologies to market leverages the intense competition of the automobile manufacturers worldwide. This competition drives automakers to develop and introduce breakthrough technologies to meet a variety of demands and customer needs in the marketplace.

The National Academy of Sciences summarized this diversity of demand and priorities in the marketplace when it stated that "automotive manufacturers must optimize the vehicle and its powertrain to meet the sometimes-conflicting demands of customer-desired performance, fuel economy goals, emissions standards, safety requirements and vehicle cost within the broad range of operating conditions under which the vehicle will be used." This necessitates a vehicle systems analysis. Vehicle designs trade off styling features, passenger value, trunk space and utility. These trade-offs will likewise influence vehicle weight, frontal area, drag coefficients and powertrain packaging, for example. These features together with the engine performance, torque curve, transmission characteristics, control system calibration, noise control measures, suspension characteristics and many other factors, will define the drivability, customer acceptance and marketability of the vehicle.

This is a long, but necessary, way of saying that in the end, the customer is in the driver's seat. Market based incentives and approaches ultimately will help consumers overcome the initial cost barriers of advanced technologies during early market introduction and increase demand, bringing more energy efficient vehicles into the marketplace. This will also accelerate cost reduction as economies of scale are achieved in a timelier fashion.

The Alliance supports enactment of consumer tax credits during early market introduction to help offset the initial higher costs of advanced technology and alternative fuel vehicles until more advancements and greater volumes make them less expensive to produce and purchase. These types of tax incentives would ensure that advanced technology is used to improve fuel economy and energy savings. Performance incentives would be tied to improved fuel economy in order for a vehicle to be eligible for the tax credits. These performance incentives would be added to a base credit that is provided for introducing the technologies into the marketplace.

2) Maintaining Technology Focus

The Alliance and its 13 member companies believe that the best approach for improved energy security and fuel efficiency gains is to aggressively promote the development of advanced technologies—through cooperative, public/private research programs and competitive development—and incentives to help pull the technologies into the marketplace as rapidly as possible.

The automobile companies are convinced that advanced technologies with the potential for major fuel economy gains are on the horizon which will allow automakers to continue offering products that consumers demand without sacrificing safety, performance or cargo features. Increased costs during early market penetration for those new technologies, however, create a critical hurdle for customer acceptance and demand. As a nation, we need to get these technologies on the road as soon as possible and tax credits will help spur consumer acceptance so we can reach the national energy goals as fast and as efficiently as we can.

New Technologies—Promises and Challenges

Focus on Powertrain and Vehicle Technologies

Automobile companies around the globe have dedicated substantial resources to bringing cutting-edge technologies—electric, fuel cell, and hybrid electric vehicles as well as alternative fuels and powertrain improvements—to the marketplace. Each of these technologies bring a set of unique advantages to the marketplace. At the same time, each technology has a unique set of challenges that inhibit widespread commercialization and acceptance. The internal combustion engine, fueled by relatively inexpensive gasoline, has been and continues to be, a formidable competitor against which all new technologies must compete.

For consumers sensitive to cost, fuel economy gains must be compared to the increased investment costs and risks in their new vehicle purchase decision. Assuming today's gasoline price per gallon, a 20 percent increase in vehicle fuel efficiency offers an annual fuel savings of about $100. This savings must be weighed against the increased vehicle price to provide this 20 percent as well as the convenience, utility and performance tradeoffs. As automakers, we are keenly aware of the importance of consumer choices and the challenges we have to deliver new technologies that meet their affordability, performance and utility needs.

Fuel Cell Vehicles

The most promising long-term technology offers breakthrough fuel economy improvements, zero emissions and a shift away from petroleum-based fuels. From a vehicle perspective, hydrogen-fueled fuel cells offer the biggest improvement in efficiency and emissions but at high cost and with major infrastructure challenges. Onboard hydrogen storage also presents some difficulty. Gasoline infrastructure is well established, but gasoline reformers are the least developed and the most costly of reformer technology. Current sulfur content in gasoline will most likely need further reduction to zero or near zero levels.

A robust fuel cell commercialization plan incorporates breakthroughs and complementary research in stationary power units. A primary challenge in the introduction of fuel cells into America's light vehicle passenger and truck fleet are the packaging restrictions of size and weight. Experience and commercial expansion of stationary power units, relatively unconstrained by size and weight will be helpful gaining the experience necessary to meet the cost targets for commercialization in the vehicle sector.

Hybrid-Electric Vehicles

Hybrid-electric vehicles can offer a significant improvement in fuel economy. These products capture power through regenerative braking. When decelerating an internal combustion vehicle, the brakes convert the vehicle's kinetic energy into heat, which is lost to the air. By contrast, a decelerating hybrid vehicle can convert kinetic energy into stored energy that can be reused during the next acceleration. Hybrid vehicles do not require additional investments in fuel infrastructure which helps reflect their potential for near term acceptance.

Battery Electric Vehicles

Vehicles that utilize stored energy from "plug-in" rechargeable batteries offer zero emissions. Battery electric vehicles continue to face weight, energy density, and cost challenges that limit their customer range and affordability.

Advanced Lean Burn Technology Vehicles

Vehicles that are powered by direct injection diesels are faced with a significant challenge in meeting the new California and Federal exhaust emission standard. If the technology challenges can be overcome, these types of vehicles could provide fuel economy gains in excess of 25 percent above comparable conventional vehicles.

Focus on Fuels and Infrastructure

Much of the discussion regarding fuel economy centers on the vehicles of the automobile manufacturers and their role in a national energy policy. But it is important not to forget about a vital component for any vehicle—the fuel upon which it operates. As automakers look at the competing regulatory challenges for our products—fuel efficiency, safety and emissions—and attempt to move forward with advanced technologies, we must have the best possible and cleanest fuels. EPA has begun to address gasoline quality but fuel needs to get even cleaner. This is important because gasoline will remain the prevalent fuel for years to come and may eventually be used for fuel cell technology.

Low Sulfur Gasoline

In 1999, new EPA rules were issued which direct oil refiners to reduce the amount of sulfur in gasoline to an average of 30 parts per million, a reduction of 90 percent over current levels. Low sulfur gasoline is vital to ensuring that vehicle pollution control devices, such as catalytic converters, work more efficiently. This is especially important as automakers phase-in more stringent Tier II emission standards beginning in the 2004 model year. Further improvements will be needed especially if gasoline is to be used in fuel cells.

Low Sulfur Diesel

In addition to alternative fuels, companies are constantly evaluating fuel-efficient technologies used in other countries to see if they can be made to comply with regulatory requirements in the United States. One such technology is diesel engines,

using lean-burn technology, which has gained wide acceptance in Europe and other countries. Automakers have been developing a new generation of highly fuel-efficient clean diesel vehicles—using turbocharged direct injection engines—as a way to significantly increase fuel economy and reduce greenhouse gas emissions. However, their use in the U.S. must be enabled by significantly cleaner diesel fuel which provides the best opportunity to achieve the more stringent emission standards in this country.

Last year, EPA promulgated its heavy-duty diesel rule that the Alliance supports, as far as it goes. The rule reduces the amount of sulfur in the fuel. Low sulfur diesel fuel is necessary to enable the new clean diesel technology to be used in future cars and light trucks. Providing cleaner fuels, including lowering sulfur levels in gasoline and diesel fuel, will provide emission benefits in existing on-road vehicles. Unless there are assurances that such fuels will be available, companies will not invest in new clean diesel technologies. Efforts to reduce sulfur content will provide environmental benefits and allow vehicles to operate more efficiently.

As you can tell, the automobile companies—from the top executives to the lab engineers—are constantly competing for the next breakthrough innovation. If I can leave one message with the Committee today, it is to stress that all manufacturers have advanced technology programs to improve vehicle fuel efficiency, lower emissions and increase motor vehicle safety. These are not "pie in the sky" concepts on a drawing board. In fact, many companies have advanced technology vehicles in the marketplace right now or have announced production plans for the near future. That's why now is the perfect time for the enactment of tax credits to help spur consumers to purchase these new vehicles which years of research and development have made possible.

The Alliance and its member companies would urge that public policy decisions focus on the steps that will achieve real reductions in fuel consumption and which support our national energy goals. The advanced technology fuel-efficient vehicles are typically more expensive than their gasoline counterparts because of the new technologies. Therefore, market penetration is a challenge. As a result, the Alliance supports personal and business tax incentives for the purchase of qualifying advanced technology hybrid and fuel cell powered vehicles as well as alternative fueled vehicles and infrastructure development. These tax incentives should help "jump start" the market penetration of these highly fuel efficient vehicles leading to increased sales and volumes so that the cost will come down in the long-term with positive implications for energy security.

Thank you for the opportunity to testify before the Committee today. I would be happy to answer any questions you may have.

Senator KERRY. Thank you, Mr. Dana.

In your written testimony you state that the CAFE standards should not be set, "beyond the maximum feasible level." What is that level?

Mr. DANA. That level is something that we think has to be determined by NHTSA as part of their rulemaking.

Senator KERRY. Well, you guys know what your industry is capable of. What is the level?

Mr. DANA. I do not know what my manufacturers' confidential product plans are 4 or 5 years out That is the kind of data they share with NHTSA to help them determine what the maximum feasible level can be, based upon advances in technology and also the product plans of the manufacturers.

Senator KERRY. So the industry is sort of unwilling publicly, as an industry, to even suggest a range?

Mr. DANA. I cannot suggest a range, as I said, not knowing what the future product plans the members are. That is confidential information.

Senator KERRY. We are not asking for the product plan. We are asking for a range within which you think you could provide greater efficiency. I mean, is it 1 mile per gallon over 10 years? Do you think the industry could do 1 mile per gallon over 10 years?

Mr. DANA. I think that is something NHTSA has to decide based upon its rulemaking, Senator.

Senator KERRY. So you are not even prepared to say you would give 1 mile per gallon over 10 years. Don't you think that renders you sort of silly?

Mr. DANA. No, sir, I do not.

Senator KERRY. I beg your pardon?

Mr. DANA. No, sir, I do not.

Senator KERRY. You do not think it is kind of strange that Andrew Card in 1995 would suggest that Congress ought to make the decision, not NHTSA? Now that NHTSA is in different hands, and Congress is, you are reversing that choice, sort of forum-shopping your way? It does not mean anything to you?

Mr. DANA. I am a technical person, Senator. I do not deal with policies like that.

Senator KERRY. Well, technically, can you tell me technically is it feasible to have a gain in fuel efficiency along the lines suggested by the National Academy of Sciences? Do you technically agree with the National Academy of Sciences?

Mr. DANA. We think what the National Academy of Sciences' report points out is the complexity and the difficulty of arriving at what fuel economy levels might be achievable, given all the demands on those levels by the consumers and by the other technologies.

We do believe that technological progress has been made in the past. We think there are chances for improvements in technology in the future. We are the largest industry in the country, and we have the most R&D money spent in this country, and we are very proud of the technology we have been able to develop, and what we hope to develop in the future.

Senator KERRY. Well, that is not my question. My question is, "NAS, is it technically—and you said you are technical—is it technically feasible and potentially economical to improve fuel economy without reducing vehicle weight or size, and therefore without significantly affecting the safety of motor vehicle travel. Do you agree with their technical conclusion?"

Mr. DANA. I would cite the fact that the NAS said the numbers in their report are not intended to be CAFE standards per se. You can discuss technology improvements and you can discuss fuel economy improvements, but again, the NAS made it very clear that those should not be considered as part of CAFE.

Senator KERRY. Well, within the industry there is sort of a variance, I guess. I mean, again, I am not asking you—I am not trying to trap you into accepting the figures they put out. I am asking you to accept the principle that it is technically feasible. I mean, do you see what I am saying? I did not ask you to adopt 37.2 as a goal in 15 years. I am asking whether it is technically feasible to achieve in the equation they have set forward.

Mr. DANA. We think it is technically feasible to achieve improvements in fuel economy technology based upon technological developments.

Senator KERRY. Without affecting the safety of motor vehicle travel?

Mr. DANA. I have not worked on automotive vehicle safety for 5 years. I am not sure I can address that.

Senator KERRY. Mr. German, can you share with me a sense—you have sort of worn a couple of hats. You have been with EPA previously, now with the industry. Obviously, we need to give time to the industry to incorporate economy improvements into new fleets, and I understand that, and we want to try to be sensible about how we do that. In your judgment, what is a reasonable timeframe for that? I mean, I understand the model cycles and so forth. What do you think is a reasonable timeframe for improvements, leaving out what might or might not be a figure?

Mr. GERMAN. The real issue is the amount of time it takes to design and tool, and you have natural product cycles which are 5, 6 years before you can roll it out to the entire fleet, so something in the range of 12 to 15 years is probably reasonable.

Senator KERRY. So the academy's range is 10 to 15. That is a fair range.

Mr. GERMAN. Honda is completely supportive of the academy's assessments of lead time.

Senator KERRY. And that did not reflect, obviously, the potential of hybrid or other—I mean, I assume it did not even reflect diesel injection, did it?

Mr. GERMAN. Well, the National Academy report considered them, but what they concluded is that conventional technology is available at much lower cost.

Senator KERRY. If we were to make allowance as we have talked about here, and Mr. Dana, maybe you could answer this, too, for the CLEAR act components, the tax credit, and perhaps even some kind of a framework for credit trading of some notion, would that then make the academy goals which on their own, freestanding, they said are achievable, even more palatable and more achievable to the industry?

Mr. GERMAN. The CLEAR act would be very helpful if you are trying to make hybrid vehicles commercial. Right now, their costs are just too high. There are two ways you can reduce cost. One is economics of scale, increase the sales volumes, and the other is further development, and the CLEAR act will help with both of those. It will help bring the cost down. The hybrids do have a ways to go before they are going to be accepted by most consumers.

Senator KERRY. What is the restraint on that? You said before it is accepted.

Mr. GERMAN. It is cost.

Senator KERRY. But the cost, as we heard earlier, they have lowered the cost down at least into the marketplace now, to try to gain a foothold.

Mr. GERMAN. There is a lot of different types of consumers out there. There is a small group which are very much into technology and innovation, and like those kinds of characteristics, and value them fairly highly, so there is an niche market right now, even at current prices.

Senator KERRY. And what does it take to get it beyond niche, lowering the cost even further?

Mr. GERMAN. The cost has to come down.

Senator KERRY. Below 20?

Mr. GERMAN. The incremental cost of the hybrid technology probably has to come down under $1,500 before most customers will accept it.

Senator KERRY. What is the incremental cost today?

Mr. GERMAN. It is over $3,000. How much over, it is hard to determine, because manufacturers do not really reveal that information.

Senator KERRY. What happens when you factor in the CLEAR act?

Mr. GERMAN. Absolutely, at that stage it does become acceptable to a much, much larger audience of people. That is one of the advantages of the CLEAR act, we will be able to significantly increase volumes with that.

Senator KERRY. What happens to the overall—I mean, pricing, is there an efficiency that begins to cut in here with larger consumption, more production, or not? In other words, if you are selling a lot more, do you suddenly—do you bring your cost down?

Mr. GERMAN. Usually, yes, and the problem is that the higher production volumes allow you to do things more efficiently, and sometimes it has a huge impact, sometimes it has a small impact. We expect that. For example, on hybrids you have three primary costs. You have the motor, the power controls, and the batteries. We do expect to see dramatic decreases in the electronics, maybe dramatic decreases in the motor, hard to say, but the battery pack is a tough one. So how the overall thing is going to work out at this stage is very unclear, but having incentives is helpful for establishing this and helping us progress to the next stage.

Senator KERRY. You will, acknowledge, I assume, that the academy did not contemplate the hybrid component when they came up with their feasibility. I mean, their feasibility does not have the cushion of the hybrid in it.

Mr. GERMAN. Right.

Senator KERRY. Mr. Dana, the chair of the NAS panel said it might cost about $800 to substantially increase fuel economy of the new car, or sport utility. Is that a cost that the industry cannot work with to create an affordable package fort the consumer?

Mr. DANA. As Mr. German said, we are in a very competitive marketplace, and we would like to keep costs from going up much at all. We have already done a lot of that with emissions and safety standards. I think it is safe to say that any kind of cost increment is difficult in the marketplace. We would like to see an ability to get that cost down so that we can more effectively compete.

The CLEAR act also represents things like hybrids and advanced diesels which have a larger incremental cost to them, and that is why the CLEAR act is clearly necessary for them. I think over time, as manufacturers improve technology, I think you have to look at the NAS numbers, too, as a cumulative overtime number. I mean, we have improved fuel efficiency of models 2 percent per year over a long period of time, and those costs have been incorporated in vehicles over time as well, so it has been a gradual change in price.

Senator KERRY. Well, the National Academy again said that just existing technologies—I mean, you have to go out and spend a lot of money on the R&D and push the technology curve, but existing

technologies, from variable valve timing to integrated starter generators and so forth, would significantly reduce fuel consumption and could improve fuel economy by 20 to 40 percent.

Notwithstanding that, I saw the chart earlier which shows that you folks have put most of your technological money into horsepower and acceleration. Can't the auto industry just take the existing technologies and begin to reverse that a little bit in order to improve fuel economy?

Mr. DANA. As I said in my statement, we have continued to improve fuel efficiency of models.

Senator KERRY. But efficiency is different from economy. I understand the distinction. I am talking about economy.

Mr. DANA. Well, economy, and talking about CAFE standards in particular requires consumers' input in terms of that demand equation, and you said how the industry has taken technology and improved performance. Well, part of that is what I said and what Mr. German said, is that we are driven by market demands, and consumers want performance, they want safety, they want other things they value more than fuel economy, so what we have had to do is do a balancing act with the technology we put on the vehicles, trying to meet all those competing demands as well as trying to use it to improve fuel efficiency of that vehicle model.

Senator KERRY. Well, with all due respect, again you come back to fuel efficiency. There is a distinction between fuel efficiency and fuel economy, and I know you have improved fuel efficiency, but what we are concerned about here is the economy side of it.

Second, a huge amount of that increase—I have bought enough cars in my lifetime, in the last few years, to be pretty familiar, as we all are as consumers, with the marketing process. A huge amount of that increase in what you call performance, which is in horsepower and acceleration, is almost unused by most Americans. They like it when you go in, the salesman can pitch it, but it is almost nonessential.

I mean, how much faster you get between red lights is not all that in the end, important relative to some of these other choices, and the speed limits on these cars, or the speed capacity of these cars and acceleration is so far in excess of performance needs that the question is whether the industry when you measure that against where we are with this need to try to get economy, where there cannot be some sort of better balance of that.

Ms. Claybrook earlier talked about how at one point we began to ratchet down the weights. Now, the weights have all been added back, and that is one of the reasons why the efficiencies of the economy has gone down. What do you say to that?

Mr. DANA. Well, again, we are driven by the consumers in the marketplace.

Senator KERRY. You do not think you drive the consumers at all? You think there is no, which comes first here?

Mr. DANA. All of the surveys we have show that fuel economy is very low on the list of what consumers value, and so we do our best to balance that along with other demands that consumers have in the models we make.

Senator KERRY. So what about Mr. Eizenstat's comments about security and national need, the externalities. Does that not compel

us to sort of change the externalities as we did in 1975 so you respond differently?

Mr. DANA. What we said is NHTSA should take its role under current law and look at the maximum feasible levels based upon the considerations they have to look at to make the standards effective.

Senator KERRY. But we may have to set the standard. What if we just set the standard and let them decide how it is going to be achieved? But you are again setting the standard.

Mr. DANA. We think that NHTSA is better equipped to do that. They can review the confidential plans together. They have to be considered like that.

Senator KERRY. Mr. German, with respect to the hybrid and the balance of these other technologies that are available now, help us to understand what would the balance be if Congress raises the standard? Do you know at this time whether you would look mostly to the hybrids to try and meet that, or would you adopt some of these available standards, available technologies that are there now, or would it be a mix?

Mr. GERMAN. Assuming you are talking about standards in the range of what NAS considered, we would definitely look forward toward conventional technology, incremental technology. There is a lot—Marc is right, I read this article in Automotive Engineering on the plane on the way in yesterday. It is a good summary of just some of these things that are being worked on right now. There is a lot happening in conventional engine technology, and most of those, not all of them, are more cost-effective at this stage than hybrids are, so they would come first.

Senator KERRY. Professor Ross, you have done a lot of work on this, and a lot of it with the industry itself. The average percentage of energy and fuel converted by an internal combustion engine to the mechanical energy is now—what is it now?

Mr. ROSS. Well, I think you mentioned 15 percent. If we consider the accessories it might be a bit more.

Senator KERRY. 18 to 20 percent?

Mr. ROSS. More like 17 or 18.

Senator KERRY. What is the maximum percentage of energy that could be converted by an internal combustion engine into mechanical energy?

Mr. ROSS. Well, we know what percentage is converted into work by the pistons, and that is followed by all kinds of frictional losses before you get to the 17 percent. The initial percentage is 38 percent with today's conventional gasoline engines, and somewhere in the low 40's, up to 44 percent maybe, with the diesel engine.

Senator KERRY. So if you were able to—and is one able to, incidentally—is there a technically feasible way to get between that roughly 19 percent today, 18, 19 percent, and then 38 percent?

Mr. ROSS. Not all the way. If you went halfway there you would get beyond what the National Academy was projecting. Getting rid of all the friction is too hard. You know, we have bearings at electric power plants, and those machines can be efficient in the upper nineties in terms of frictional losses, but an internal combustion engine is a much cruder device, a much, much cheaper device.

Senator KERRY. What is not pushing the curve, in your judgment? I mean, if you were to—and I am sort of trying to reach for reasonableness here. What is a reasonable expectation of the engine efficiency you could gain just in the thermodynamic efficiency component?

Mr. ROSS. Well, half again better would be reasonable, about 25 percent.

Senator KERRY. Where does that take you in terms of the academy?

Mr. ROSS. You could go somewhat further than the academy, maybe to 40 miles per gallon.

Senator KERRY. That could take you there at roughly what you sort of deem the reasonable medium, and that is without measuring, that is just on the internal combustion engine. That is without measuring what you could get through hybrid or other kinds of combinations here?

Mr. ROSS. That is right. It is based on the engine and transmission. The transmission is also very important, the gearing and the management of it.

Senator KERRY. Is there room for improvement, from your knowledge, with respect to hybrids themselves at this point? Could we have greater gains there? I mean, it is a very new——

Mr. ROSS. There is room, but the two high voltage hybrids that are being offered for sale now are very ambitious, and they recover quite a lot of breaking energy, which is one of their really special features, and they have relatively efficient internal combustion engines. They have done a good job. Of course, they could go further, but not much further.

Senator KERRY. But the gain that you have described that comes just in the internal combustion engine through the more efficiency of the fuel component is also augmented, would it not be, by other potential existing technologies that are there if you wanted to also grab them?

Mr. ROSS. Well, it depends on what you are talking about. If you are turning the engine on and off, which is part of what the hybrid vehicles do, that could also be done at much lower cost in a conventional vehicle. So I would lump that together with engine efficiency as a part of the engine efficiency improvement.

Senator KERRY. What about the 5–4–3 valves per cylinder, the variable valve timing? You just mentioned idle-stop-start cylinder, deactivation, variable compression ratio, variable displacement, and then, of course, the advanced IC engines that we were hearing about earlier. Are those a legitimate part of the mix?

I mean, as we are sitting here—and incidentally, I am not talking about choosing between them or anything like that. That is not our role. I am happy to say NHTSA or somebody else ought to make that decision. I just want to understand from a policy point of view, as Mr. Eizenstat mentioned earlier when they sat there, they had a sense of what the feasibilities were so they were not just whistling in the dark. Are these legitimate? Are they real potentials? Are they within reach? How do we make a judgment about these?

Mr. ROSS. You know, most of them are legitimate. Most of them cover some of the same ground. You do not have to do all those

things. They are covering the same ground. There are different ways of reducing the friction within an engine, for example, so the fact that we see different ways, whether they are putting in more air into the cylinder with one technology or reducing friction in the engine, or turning the engine off when it is not needed, there are all kinds of different things which have become practical in the last 15 years. They were thought of much earlier. In fact, Rudolph Diesel himself thought of some of these things back in the 19th Century, but they were entirely impractical until we had the control systems that are now practical.

Let me just say, one of the reasons why 10 or 15 years is needed is that these technologies, when you apply them, have to be refined. The programming has to be refined, so time is needed even though the technology in principle is available.

Senator KERRY. Fair enough. Just a couple more questions, and then we will wrap it up.

Is it possible to have—and I do not know the answer. Is it possible, is there any reason you could not have a diesel hybrid?

Mr. ROSS. None at all. That is certainly one of the possibilities.

Senator KERRY. So if you had a diesel hybrid, you have a much more significant gain than you augment, don't you?

Mr. ROSS. It is another factor.

Mr. GERMAN. I think that the hybrid certainly improves the overall diesel efficiency, but I think I would suggest that by not quite as high a percentage as on gasoline. It is just a function of the fact that the diesel has lower pumping losses under light load conditions to begin with, and the light load condition is where the hybrid really helps most.

Senator KERRY. Mr. Schaeffer, what is the reason that the diesel is not more successful here? Can it be, are there barriers and restraints to its introduction?

Mr. SCHAEFFER. There are a number of issues, Senator, one of those being consumer familiarity. Right now, diesels in the U.S. make up less than one third of 1 percent of all light-duty vehicles, so 0.26 percent of all the fleet that is out there today are diesel-powered, so there is not a strong familiarity with the technology.

The second issue, obviously, had been talked about before. That is, the petroleum prices right now, gasoline prices being very low, relatively speaking. I think the third thing is there are still some technological issues that are working to be overcome. Just last year the Environmental Protection Agency promulgated new standards that include requirements for cleaner diesel fuel, and people are working to figure this new system out of how these advanced technology diesel engines can meet the lower NO_X and particulate matter standard and still provide their inherent benefits of efficiency and lower greenhouse gases.

So it is a number of factors that lead there to be not a high presence of diesels in the marketplace today.

Now, having said that, I think there is a significant amount of research underway not just here in the U.S. but around the world, including companies like Honda and Toyota have significant diesel operations in Asia and really around the globe. Diesels are very predominant global technology, and I think the U.S. can reap the benefits from those, especially sport utilities, those kinds of vehi-

cles, and the three leading diesel manufacturers in the U.S. today, Caterpillar, Cummins, and Detroit Diesel, are all working on the kinds of diesel engines that would make the SUVs have higher fuel economy, so there is lots of work underway. We are just a little bit before the market.

Mr. ROSS. If I could interject just for a moment, there still is an issue with the health effects of particulates, and research is still needed. The Europeans have gone into quite deliberately to diesels, nevertheless the smallest particles are not regulated by EPA or anybody else. We still need more research in that area before we wholeheartedly embrace the light duty vehicle diesel. That research can be done and I am optimistic about it, but we still need that work.

Mr. GERMAN. There is one other factor that I think does tend to get overlooked, and that is that diesels are not cheap. The four-cylinder diesel Volkswagen uses is an $1,100 price increment over the comparable gasoline engine. The kinds of diesels that are used in the large sport utilities and pick-up trucks are over $3,000 price increments. It is not a complete barrier, of course, but it is a factor that needs to be considered.

Mr. SCHAEFFER. If I might respond to that, those numbers are correct, but for folks that own that vehicle for 5 or 10 years, or have a need for a vehicle of that type, those cost differentials are returned in their fuel savings in a fairly short amount of time, especially because here in the U.S. we travel a lot more than in Europe.

Also a comment about the particulate issue. Light duty diesels right now, the EPA inventory suggest they make up one-half of 1 percent of all the particulate that is in the inventory today, and on the heavy duty side, the particulate emissions have been reduced by over 80 percent today, and there is going to be another 90-percent reduction in just a few years, so with the new traps and filter technology diesels will be very clean, and the differential between diesel performance and, for example, natural gas has narrowed to a point now where there is very little difference in some applications.

Senator KERRY. Well, that is exciting and interesting, and I have heard that actually. I know that people in Europe are extraordinarily excited about the DI capacity, which is—and I know there have been some sort of environmental constraints here that people have been concerned about it, but they are obviously ironing that out in a way that offers some terrific possibilities, there is no doubt about it.

Well, I appreciate everybody's patience and participation in this today. Thank you very, very much. I think we hope to move forward. We are going to have some meetings in the Committee and see where we go from here.

Thank you. We stand adjourned.

[Whereupon, at 12:50 p.m., the Committee adjourned.]

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