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Mr. Chairman, Members of the Committee:

It is an honor to be invited to submit this testimony to this distinguished Committee on the important issue of improving the fuel efficiency of America's vehicle fleet. I currently serve as executive director of the Institute for the Analysis of Global Security (IAGS), an energy security research institution. I'm also representing the Set America Free coalition, a coalition of national security, foreign policy and environmental groups dedicated to promote a blueprint for energy security which focuses on reduction of U.S oil demand in the transportation sector. Among the groups involved in the coalition are IAGS, the National Defense Council Foundation, the Hudson Institute, the Foundation for the Defense of Democracies, the Center for Security Policy, and the Natural Resources Defense Council.

I would like to address the strategic context of our current dependence on imported oil and its implications on national security and offer new approaches to the fuel efficiency debate.

The Strategic Impact of our Oil Dependence

In 2004 oil prices have grown by close to 40%. As a result, the United States spent more than $18 million per hour on foreign oil. In the same period of time, OPEC's oil export revenues grew by 42 percent to $338 billion. According to the US Energy Information Administration (EIA) throughout 2005 oil prices will continue to stay high and OPEC will rake $345 billion in revenue. This transfer of wealth of historical proportions is not only exacting a hidden tax on the American economy but is also undermining our national security and the security of the world at large. It is unfortunate that most major oil producing countries are either politically unstable and/or at odds with the U.S. Some of the world's largest oil producing nations are sponsors of or allied with radical Islamists who foment hatred against the U.S. The petrodollars we provide such nations contribute materially to the terrorist threats we face. In time of war, it is imperative that our national expenditures on energy be redirected away from those who use them against us.

Beyond the underwriting of terror, our present dependency creates unacceptable vulnerabilities. As we have learned from Osama bin Ladin's messages, al Qaeda terrorists know that oil is the Achilles heel of the world economy and disrupting the world's oil supply is central to their efforts to defeat the U.S. and its democratic allies. In Iraq and Saudi Arabia, America's enemies have demonstrated that they can advance their strategic objective by attacking critical oil infrastructure and personnel. In Iraq alone there have

been more than 200 attacks against pipelines and oil installations in the past 20 months. These targets are readily found not only in the Mideast but also in other regions to which Islamists have ready access such as the Caspian Basin and Africa. Over time, these attacks are sure to become more sophisticated and their destructive effects could be difficult, costly and time-consuming to undo.

In the longer run America's national security can be adversely influenced by China's growing demand for oil. Chinese oil consumption is increasing seven times faster than that of the U.S. and its imports have grown by over 35% per year for two consecutive years. All signs indicate that China's appetite for oil will continue to grow in the years to come. According to the International Energy Agency, by 2030 China will import more oil than the U.S. does today. There is no doubt that China's robust economic growth has already been felt on the global energy scene and has been a major contributor to last year's spike in prices. More importantly, China's demand for energy and other raw materials and its hunt for steady oil supplies in areas where the U.S. has strategic interests could undermine Sino-American relations. The U.S.-China Economic and Security Review Commission, a group created by Congress to examine the national security implications of the bilateral trade and economic relationship between the two countries, warned in its 2004 report that China's growing dependence on imported oil is a key driver of its relations with terrorist-sponsoring governments. The report said: "China's approach to securing its imported petroleum supplies through bilateral arrangements is an impetus for non-market reciprocity deals with Iran, Sudan, and other states of concern, including arms sales and WMD-related technology transfers that pose security challenges to the United States." There is growing recognition within the oil industry that the rise of China will bring about a bidding war for Middle East supply between East and West. Dave O'Reilly, chief executive of ChevronTexaco warned recently against alliances formed between Asian countries and Middle East entities, calling for the U.S. government to recognize and understand the implications of such a geopolitical shift. Without a comprehensive strategy designed to prevent China from becoming an oil consumer on par with the U.S., the U.S. might find itself in the future facing aggressive competition from China over access to Middle East oil with grave implications for global security.

U.S. Approach to Oil Dependence

In light of intensifying military involvement in the Middle East, terrorist attacks on oil infrastructure, persistently high global oil prices, and the rise of China, oil dependence has become an insipient national security emergency. To address the problem of our dependence on volatile suppliers, the U.S. has pursued a three-part strategy:

- Diversifying sources;
- Managing inventory in a strategic reserve;
- Increasing the transportation sector's energy-consumption efficiency

The first pillar of our strategy is no more than a stopgap solution. In May 2001, when the Bush administration released its National Energy Policy, it proposed to reduce

dependence on Middle East oil dependence by targeting alternative oil-supplying nations for government investment and closer alliances, including Angola, Azerbaijan, Colombia, Kazakhstan, Nigeria, Russia, and Venezuela. All of these nations are undemocratic, vulnerable to global terrorism and face significant political and social instability. Increasing U.S. reliance on these states would do little to address U.S. security and economic threats stemming from oil dependency. Given the integrated nature of the world economy we accomplish nothing if we merely shift our own purchases of oil from one of the world's regions to another. An oil crisis will affect all our economies, regardless of the source of our own imports. Furthermore, non-OPEC reserves are being depleted almost twice as fast as OPEC's. This will ensure that our dependence on OPEC will only grow as time goes by. With OPEC countries sitting in the driver's seat with respect to the world's oil supply and oil prices, the world's economic and political future will be compromised.

Inventories are a critical element of energy security. But they are limited in scale and only useful to address a short term supply disruption. However, at this moment most major oil consuming nations do not have significant strategic petroleum reserves. This means that a supply disruption will still send international oil prices to the roof regardless of how much stock is kept in the U.S. Though over time it would be advisable to see more countries developing robust strategic petroleum reserves, such action at the point of high oil prices would only create additional demand and hence drive prices up even further.

Since the Arab oil embargo in 1973 several sectors of the economy significantly reduced their dependence on oil. The power sector is a particular example: today, only 2% of U.S. electricity is generated from oil. The transportation sector accounts for 2/3 of U.S. oil consumption, about 2/3 of that being gasoline and most of the rest diesel. Improving fuel efficiency in U.S. vehicles is the only course of action which carries no negative consequences. On the contrary, studies show that by reducing demand for oil in the transportation sector and transitioning the economy into an economy based on next generation fuels and automobiles, the U.S. could generate millions of new jobs and billions of dollars worth of investment opportunities.

New Approach to Fuel Efficiency

In the past three decades the debate on improving fuel efficiency has focused mainly on the tension between auto manufacturers, consumers and the government. Though everybody agrees that the U.S. should reduce its oil bill neither Detroit nor the American consumer is willing to do so for the greater good. The U.S. auto industry shies away from embarking on revolutionary changes in its designs and production lines and by and large resists significant rise in CAFE standards. The American consumer is growingly minded to the need to reduce oil dependence but is still unwilling to accept compromise on cost, comfort, power or performance.
To end the stalemate in the fuel efficiency issue we need to change the terms of the debate. Today when it comes to CAFE the auto industry shoulders the entire burden. But long-term security and economic prosperity depends on technological transformation not

only at the vehicle level but also in the fuel that powers it. In other words, to get people to travel more miles per gallon of gas one need not focus only on redesigning the car, making it lighter or improving its engine. We should think in terms of gallon stretchers—making our fuel more efficient.
For example, a number of commercially available fuel additives can enhance combustion efficiency by up to 20%. Most of these additives are made from organic materials and are environmentally friendly. By reducing the size of the oil droplets they bring to more efficient combustion. Such additives can be blended into gasoline, diesel and bunker fuel.

An even better way of reducing the content of gasoline in the fuel tank can be done by mixing gasoline with alternative fuels and using the blend in **flexible fuel vehicles (FFVs)** that can be readily available at low marginal cost and that require no change in auto design. FFVs are designed to burn on alcohol, gasoline, or any mixture of the two. About four million FFV's have been manufactured since 1996. The only difference between a conventional car and a flexible fuel vehicle is that the latter is equipped with a different control chip and some different fittings in the fuel line to accommodate the characteristics of alcohol. The marginal additional cost associated with such FFV-associated changes is currently under $150 per vehicle. That cost would be reduced further as volume of FFVs increases, particularly if flexible fuel designs were to become the industry standard.

- **Alcohol fuels that can be used in FFVs:**
  - *Ethanol* is currently produced in the U.S. from corn. In 2004, the U.S. produced over 3.2 billion gallons of ethanol, and the market has increased on the average of 25% per year over the past three years. Almost all our ethanol comes from corn and is being used either as an additive to gasoline or as E-85. Upping production of ethanol would be achieved by continuing to advance the corn-based ethanol industry but, more importantly, by commercializing the production of ethanol from agricultural and municipal waste and dedicated energy crops. Progress has been made on a process that produces ethanol from biomass using genetically modified biocatalysts and a Canadian company, Iogen, has just entered commercial production.
  - *P-Series* fuel (approved by the Department of Energy in 1999) is an energy-efficient blend of ethanol, natural gas liquids and ether made from biomass waste. About 20% of the blend is MeTHF, an ether derived from lignocelullosic biomass -- paper sludge, wastepaper, food waste, yard and wood waste, agricultural waste, and so on. P-Series fuels can help solve a problem all municipalities are facing today: waste disposal. Using feedstock with a negative cost - that means waste that municipalities would otherwise pay to have hauled away - allows the fuel's selling price to be about the same as mid-grade gasoline.
  - *Methanol* (also known as wood alcohol) is today for the most part produced from natural gas. Expanding domestic production can be achieved by producing methanol from coal, a resource with which the U.S. is abundantly endowed. The commercial feasibility of coal-to-methanol technology was demonstrated as part of the DOE's "clean coal" technology effort. For almost a decade, a commercial scale demonstration plant in Kingsport, Tennessee has been producing methanol

from coal at under $0.50 a gallon. Methanol can also be produced from biomass using gasification technology.

Alcohol fuels are relatively easy to introduce to the market because of the low infrastructure costs involved. It only costs about $20,000 to enable an existing gasoline or diesel tank at a gas station to accommodate one of the above fuels and about $60,000 to add a new fuel pump to an existing refueling station.
By introducing a fleet of FFVs and actually fueling them with blends of say 20% alcohol and 80% gasoline we can save more oil than through the entire CAFE program. For example, a hybrid car like the Toyota Prius that is also an FFV running on a blend of 85 percent ethanol and 15 percent gasoline can get nearly 300 miles per gallon of gasoline.

Electricity as a fuel

Electricity is seldom referred to as a transportation fuel, but it is. Less than 2% of U.S. electricity is generated from oil, so using electricity as a transportation fuel would greatly reduce dependence on imported petroleum. Tens of thousands of **hybrid electric vehicles** are already on America's roads combining hybrid engines powered in an integrated fashion by liquid fuel-powered motors and battery-powered ones. Such vehicles increase gas-consumption efficiency by 30-40%. While hybrids gather charge to their batteries by capturing breaking energy, their only external source of energy is liquid fuel. **"Plug-in" hybrid electric vehicles** take the concept one step further, by allowing us to draw charge not only from the engine and captured braking energy, but also directly from the electrical grid by being plugged into standard electric outlets when not in use. They have liquid fuel tanks and internal combustion engines, so they do not face the range limitation posed by electric-only cars. Since fifty-percent of cars on the road in the United States are driven 20 miles a day or less, a plug-in with a 20-mile range battery would reduce fuel consumption by, on average, 85%. Plug-in hybrid electric vehicles can reach fuel economy levels of 100 miles per gallon of gasoline consumed.
Overall, plug-ins can reduce gasoline use by 85%. This is so dramatic a reduction that a plug-in SUV actually would consume less gasoline than a standard compact car. Plug-in hybrid vehicles would be charged at night in home garages -- a time-interval during which electric utilities have significant excess capacity. The Electric Power Research Institute estimates that up to 30% of market penetration for plug-in hybrid electric vehicles with 20-mile electric range can be achieved without a need to install additional electricity-generating capacity. Plug-ins will soon make their debut. DaimlerChrysler is currently introducing a plug in version of its Sprinter van. Though a plug-in would be initially more expensive up front than an ordinary car, the total cost over the life of the vehicle would be less due to lower operating costs and gasoline saving. As battery technologies improve the cost of plug-ins will drop further.

If a vehicle combines hybrid technology with a flexible fuel internal combustion engine, the effect of next generation fuels can be multiplied with substantial fuel efficiency gains. A plug-in hybrid vehicle that is also a flexible fuel vehicle can be powered by blends of alcohol fuels, gasoline, and electricity. If fueled by a blend of 80% alcohol, 20% gasoline, and electricity, fuel economy could reach 500 miles per gallon of gasoline.

According to the Set America Free Coalition if by 2025, all cars on the road are hybrids and half are plug-in hybrid vehicles, U.S. oil imports would drop by 8 million barrels per day (mbd). Today, the United States imports 10 mbd and it is projected to import almost 20 mbd by 2025. If all of these cars were also flexible fuel vehicles, U.S. oil imports would drop by as much as 12 mbd.

Recommendations for Congress:

• *Provide incentives to auto manufacturers to produce and consumers to purchase, hybrid vehicles, plug-in hybrid electric vehicles and FFVs across all vehicle models.* Producing fuel-efficient, advanced technology vehicles will requires automakers and their suppliers to retool their factories. Hybrid vehicles rely on advanced equipment such as battery packs, electric motors and generators, and electronic power controllers. Advanced diesel drivetrains require sophisticated fuel injection systems, turbochargers and after treatment systems.

• *Provide incentives for auto manufacturers to increase fuel efficiency of existing, non-FFV auto models.* Many off-the-shelf technologies exist to improve today's cars, including variable valve engine timing, continuously variable transmissions, and lightweight, high strength materials.

• *Call for substantial incorporation of plug-ins hybrids, standard hybrids, and FFVs into federal, state, municipal and covered fleets, and ensure that these FFVs are actually fueled with alcohol blends.*

• *Provide investment tax incentives for corporate fleets and taxi fleets to switch to plug-ins, hybrids and FFVs*.

• *Encourage gasoline distributors to blend combustion enhancers into the fuel*.

• *Provide incentives for existing fueling stations to install alternative fuel pumps* and mandate that all new gas stations be so equipped with such pumps.

• *Encourage new players, such as utilities, to enter the transportation fuel market*. Utility companies have traditionally viewed themselves as providers of "power" for lighting homes or powering computers. Using electricity as a fuel can allow them to become key players in the transportation energy sector and introduce much needed competition in the fuel market.

• *Provide incentives for the construction of commercial scale demonstration plants* to produce non-petroleum based liquid fuels from domestic energy resources, particularly from waste. Two billion dollars in federal funding utilizing public-private cost sharing partnerships could build roughly 25 demonstration plants. Such program would spur innovation, development, and demonstration projects aimed at making non-petroleum fuels cost-effective for consumers while weeding out unfeasible technologies.

• *Apply efficiency standards for heavy-duty trucks.* Most of our effort to improve fuel efficiency is focused on light-duty vehicles. But improving the fuel economy of heavy-duty trucks offers no smaller opportunity for oil savings. The heavy-duty trucks sector is responsible for the consumption of close to 3 million barrels per day of oil. Over two-thirds of this energy is consumed by the heaviest trucks, such as tractor-trailers weighing over 33,000 lbs. Technology assessments by the American Council for an Energy-Efficient Economy (ACEEE) found that conventional technology improvements including enhancements to aerodynamics, weight reduction, improved engine fuel injection and the introduction of hybrid gasoline-electric or diesel-electric drive trains can achieve truck fuel-efficiency advances of 26 to 70 percent at cost-effectiveness. Congress should therefore begin to apply some of the standards for the small cars to the larger vehicle classes especially heavy trucks from 8,500 to 10,000 lbs.
Tremendous amounts of fuel are used by truck drivers during idling. Drivers idle their trucks for days in a row to heat or cool their sleeping cabin and run electrical appliances. This practice is extremely wasteful since large diesel engines are designed to move heavy loads, not run auxiliary systems. Idling can be reduced by installing auxiliary power units and providing electricity in rest areas.

• *Invest in Public Education*. Consumers still rank fuel efficiency way below power, performance, cost and safety in their car buying considerations. As a result the nation's fuel efficiency standards have remained stagnant while our oil dependence continues to grow. Barring a catastrophic oil disruption this could only change if the public is to become more aware of the huge impact oil dependence has on our national security. Reduction of our oil bill should be viewed by consumers as a patriotic duty, not pure economic calculation. There is clear need for public education program to connect the dots between our behavior on the road and our national security, between the number of Hummers on the road and the number of Humvees in the Persian Gulf.
Another issue on which public education is desirable is the true cost of oil.
The most recent estimates suggest that in a non-war year the United States spends $20 to $40 billion in military costs to secure access to Middle East oil supplies, which means that the American taxpayer is paying at least an additional $4 to $5 a barrel for crude oil above market price. These extra dollars are being paid by consumers through their income tax but are not reflected at the price at the gas station. If Americans were more aware of what they pay outside the gas station it would be politically easier to introduce legislative efforts to transfer that tax burden from an indirect mechanism such as income tax to a direct pay-as-you-go tax at the pump.

In sum

America takes pride in offering choice in every aspect of our lives. Yet, when it comes to transportation fuels we are offered nothing but petroleum products. We must embark on an effort to diversify our fuel market by introducing domestically produced fuels that are made from waste products or other resources the U.S. is rich in, and that are clean and affordable. The U.S. is no longer rich in oil or natural gas. It has, however, a wealth of other energy sources from which transportation fuel can be safely, affordably and cleanly

generated. Among them: hundreds of years worth of coal reserves, 25% of the world's total (especially promising with Integrated Gasification and Combined Cycle technologies); billions of tons a year of biomass, and further billions of tons of agricultural and municipal waste. Vehicles that meet consumer needs like “plug-in” hybrids can tap America’s electrical grid to supply energy for transportation, making more efficient use of such clean sources of electricity as solar, wind, geothermal, hydroelectric and nuclear power.

Because of the national security imperative we have no time to wait for commercialization of immature technologies such as fuel cells. I believe that automotive fuel cells hold great potential and should definitely be pursued. But far too much focus is being placed on them at the expense of more quickly available solutions. We should focus on real world solutions and implement technologies that exist today and are ready for widespread use. We also don’t have the time and money to embark on massive infrastructure changes. The focus should be on utilizing competitive technologies that do not require prohibitive or, if possible, even significant investment in changing our transportation sector’s infrastructure. Instead, we should permit the maximum possible use of the existing refueling and automotive infrastructure.
Finally, we need to remember that oil dependence is a global issue which should be addressed internationally. Even if the U.S. was no longer dependent on foreign oil, if the rest of the world still remains beholden to the small club of oil producers the national security problems discussed before will not go away. Only a global effort led by the U.S. to reduce demand for petroleum by distributing the above-mentioned technologies will bring about prosperity and strengthen global security.