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ENDING OIL DEPENDENCE

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EXECUTIVE SUMMARY

Plug-in hybrid engines, biofuels and other technologies can help end the United States' oil dependence in a generation. Doing so would provide important national security, environmental and economic benefits. A broad political consensus and game-changing technological advances create the conditions for dramatic change.

Yet bold leadership will be needed. There are no simple or short-term solutions. Solving the problems created by oil dependence will require a far-reaching transformation so that drivers can choose between oil, electricity and biofuels to move their vehicles. Working together, the President and Congress should:

- **Transform the auto fleet,** with federal purchases of plug-in hybrid vehicles, tax incentives for the purchase plug-in hybrids paid for with the federal gasoline tax, a fund to help automakers pay for retiree health care costs and invest in fuel-saving technologies, and automatic annual increases in fuel economy standards
- **Transform the fuel supply,** by requiring oil companies to retrofit gas station pumps for ethanol, increasing support for cellulosic ethanol, adjusting the ethanol subsidy as oil prices rise and fall, phasing out the ethanol import tariff for producers that meet social and environmental standards, and supporting lower prices for off-peak electricity
- **Protect the climate** with federal cap-and-trade legislation
- **Invest in research** on advanced energy technologies
- **Transform oil diplomacy** by focusing on fuel efficiency in consuming nations, not just on additional supply, and
- **Establish an "Oil Addiction Index"** to stimulate and track progress.

Previous efforts to address oil dependence have failed for lack of ambition. The widespread focus on oil imports has obscured a more fundamental problem – the near-total reliance of our transportation sector on oil. Today several technologies offer the promise of disrupting oil's deeply entrenched hold on the transportation fuels market, while lowering driving costs and improving environmental quality. Promoting the rapid adoption of these technologies should be a top national priority. To solve the problems created by oil dependence, drivers must have a choice between oil and other fuels.

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I. INTRODUCTION

Seldom in American politics has consensus produced such little action.

The United States is a divided nation. Deep disagreements dominate our political dialogue. Consensus eludes us on countless topics.

Yet on oil dependence, an astonishing array of voices agree. National security hawks raise alarms about the vast sums of money sent each year to the Persian Gulf. Environmentalists warn about global warming. Farmers see new fortunes in the transition to ethanol. Consumers cry out when oil prices rise.

Politicians as different as President George W. Bush, Senator Richard Lugar (R-IN), Senator Tom Harkin (D-IA) and Democratic National Committee Chair Howard Dean all call for an end to the United States' oil "addiction." In doing so, they echo the words of Presidents of both parties, who have been decrying our dependence on foreign oil for more than three decades.

Yet today oil provides more than 97% of the fuel for our transportation fleets, barely different than a generation ago. Few experts expect that figure to change by more than a few percentage points during the next several years. Oil use continues to grow steadily in the United States and around the world.

The consensus on this topic is not complete, of course. Disagreements and different emphases arise on some aspects of the problem. And, though more than 85% of Americans say oil dependence is a serious problem, a roughly equal percentage oppose any increase in the gasoline tax. Complications and contradictions will bedevil any leader who addresses this issue.

Still, a confluence of factors – including a broad political consensus, game-changing technological advances and strong interest from private investors – create the conditions for transformational change. These conditions offer the prospect of a lasting legacy to the leaders who make oil dependence a priority. But it will take just that – making the issue a priority. Easy rhetoric and small initiatives will not be enough.

With sustained commitment, we can end the United States' debilitating dependence on oil. This paper explains how.

II. THE OIL PARADOX

First, a question: how did a product so widely used become so widely resented? After all, oil is a high-energy content, easily transportable fuel. Trillions of dollars of infrastructure is already in place to convert it into services people want around the world.

Oddly perhaps, this extraordinary success lies at the heart of the problem. Oil's dominance as a transportation fuel is so total, it shapes relations among nation-states. Oil's reward is so rich, it shapes entire economies. Oil's emissions are growing so rapidly, they are warming the planet.

Call it the Oil Paradox. Oil is a spectacularly successful product, used by billions of people daily. Yet oil's enormous success creates epic problems. Because we depend so completely on oil, we devote extraordinary political and military resources to securing it, at staggering cost. We empower oil-exporting nations that wish us ill. We pour vast quantities of heat-trapping gases into the atmosphere each year.

In one sense, the solution to these problems is straightforward -- develop substitutes for oil and use less of it. Give drivers a choice between oil and other fuels. Invest in promising technologies – such as plug-in hybrid engines and cellulosic ethanol -- which would do just that.

Yet the challenge is immense. Oil's near-total dominance as a transportation fuel is the result not only of its inherent properties, but a century of favorable government policies and deeply ingrained cultural patterns. Furthermore, much of the oil infrastructure (pipelines, service stations, conventional vehicle manufacturing facilities) has already been built and paid for, while much of the infrastructure for alternative fuels must be built and financed.

Three facts underscore the challenge:

- First, modern vehicles depend almost completely on oil.

  This fact is so basic – so utterly taken for granted – it's worth pausing for a moment to consider. If you're thirsty and don't feel like a soda, you can drink water or orange juice. If you'd like to relax and don't feel like a movie, you can watch television or read a book. But if you want to travel more than a few miles and don't want to use oil, you're almost certainly out of luck. Perhaps you can buy 85% ethanol fuel (sold at less than 1% of U.S. gas stations) or biodiesel (even less available). Perhaps you can bike or ride an electric train. In most situations, though, you'll almost certainly need oil.

- Second, oil's dominance is deeply entrenched, in part because capital stock turns over slowly.

  In the United States, new car sales account for roughly 6.5% of the total auto fleet every year.[1] That means it takes roughly 15 years for the fleet as a whole to turn over. Designing and testing new oil-saving technologies, and then re-tooling production facilities, can take several years at least.

[1] "Automobile and Truck Statistics," Plunkett Research (http://www.plunkettresearch.com/Industries/AutomobilesTrucks/AutomobilesandTrucksStatistics/tabid/90/Default.aspx)

In short, new oil-saving technologies will take many years to permeate the fleet and have big impacts on total demand. For those eager to see dramatic reductions in oil consumption in a short time -- say, within the term of an elected official -- the pace of change can be frustratingly slow.

- Third, oil's dominance reflects a century of favorable government policies.

  For more than a century, eminent domain authority has been used to help build a network of pipelines for moving oil at low cost. Favorable tax treatment has promoted domestic oil drilling. Federal highway funds have vastly exceeded federal support for mass transit.

  Perhaps most significant, the U.S. military protects the flow of oil at key locations around the world, providing incalculable benefits to oil markets.[2] Since 1980, every President has embraced the Carter Doctrine, declaring that "an attempt by any outside force to gain control of the Persian Gulf region will be regarded as an assault on the vital interests of the United States of America, and such an assault will be repelled by any means necessary, including military force." Securing diverse and reliable supplies of oil has been a priority of Presidents and top government officials for generations.

Previous efforts to address oil dependence have failed for lack of ambition. Solving the problems created by oil dependence will require substantial change in our stock of vehicles (approximately 260 million cars and trucks)[3] and fuel delivery infrastructure. It will require not just minor improvements in fuel efficiency (which are desirable), but a more far-reaching transformation so that drivers can choose between oil, electricity and biofuels to move their vehicles. It may require steps by other oil-consuming nations as well.[4] We cannot meaningfully address the problems created by oil dependence by tinkering at the margins.

These changes will not happen overnight. They will not happen at all without substantial and sustained bipartisan cooperation.

Yet we ignore these problems at our peril.

III. PROBLEMS WITH OIL DEPENDENCE

A. National Security Threats

The United States is in a long war. Islamic fundamentalists struck our shores and are determined to do so again. Like the Cold War, this struggle has many causes and will last for generations. Unlike the Cold War, oil dependence plays a central role in the struggle.

[2] See "As Threats to Oil Supply Grow, A General Says U.S. Isn't Ready," The Wall Street Journal, December 19, 2006 (http://www.wsj.com)
[3] "Automobile and Truck Statistics," Plunkett Research, supra note #1
[4] See discussion of "Transforming Oil Diplomacy" at p. 19 below

Oil dependence lies behind the jihadist threat – not as the only cause, but as an important one. For example, according to Brent Scowcroft, National Security Adviser at the time of the first Gulf War, "…what gave enormous urgency to [Saddam's invasion of Kuwait] was the issue of oil."[5] After removing Saddam from Kuwait in 1991, U.S. troops remained in Saudi Arabia where their presence bred great resentment. Osama bin Laden's first fatwa, in 1996, was titled "Declaration of War against the Americans Occupying the Land of the Two Holy Places."

Today, deep resentment of the U.S. role in the Persian Gulf remains a powerful recruitment tool for jihadists. That resentment grows not just from the war in Iraq, but from the U.S. relationship with the House of Saud, the presence of U.S. forces throughout the region and more. Yet the United States faces severe constraints in responding to this resentment. With half the world's proven oil reserves, the world's cheapest oil and the world's only spare production capacity, the Persian Gulf will remain the indispensable region for the global economy so long as modern vehicles run only on oil. To protect oil flows, the U.S. policymakers will feel compelled to maintain relationships and exert power in the region in ways likely to fuel the jihadist movement.

Compounding this problem, the huge money flows into the region from oil purchases help finance terrorist networks. Saudi money provides critical support for madrassas with virulent anti-American views. Still worse, diplomatic efforts to enlist Saudi government help in choking off such funding, or even to investigate terrorist attacks, are hampered by the priority we attach to preserving Saudi cooperation in managing world oil markets.

This points to a broader problem -- oil dependence reduces the leverage of the world community in responding to threats from oil-exporting nations. Today, the most prominent threat comes from Iran, whose nuclear ambitions could further destabilize the Persian Gulf and put terrifying new weapons into the hands of terrorists. Yet efforts to respond to this threat with multilateral sanctions have foundered on fears that Iran would retaliate by withholding oil from world markets. Experts predict this would drive prices above $100 per barrel – a risk many governments are unwilling to accept. In short, three decades after the first oil shocks -- and a quarter-century after the humiliating capture of U.S. diplomats in Tehran – we remain hostage to our continuing dependence on oil.

Other oil-exporting nations pose problems as well. President Hugo Chavez of Venezuela – the world's fifth largest exporter -- fans anti-American sentiments throughout Latin America. Oil revenues not only help maintain his grip on power, they allow him to finance policies that put U.S. assets at risk in countries such as Bolivia and Argentina.[6] Russia recently cutoff oil flows to five European nations in a dispute with Belarus over natural gas prices and transit fees.

[5] As quoted in Amy Myers Jaffe, *US and the Middle East*, report prepared for the National Commission on Energy (http://www.energycommission.org/files/contentFiles/I.1.b_-_US_and_the_Middle_East_44ce6a5bcf7b9.pdf)

[6] National Security Consequences of U.S. Oil Dependency, Independent Task Force Report No. 58, p. 26. John Deutch and James R. Schlesinger, co-chairs (Council on Foreign Relations Press 2006)

Oil wealth also corrodes democratic institutions. This dynamic is not inevitable, but it is widespread. A growing body of scholarly work explores this topic, concluding that oil wealth is strongly associated with corruption and authoritarian rule.[7]

A few examples underscore this trend. Bahrain, the Persian Gulf country with the smallest oil reserves, was also the first to hold free elections.[8] As oil prices climbed in recent years, both Vladmir Putin and Hugo Chavez moved away from democratic institutions and toward more authoritarian rule. In Nigeria, oil abundance contributes to widespread corruption.

A final point – oil dependence jeopardizes the safety of our men and women in uniform. Fuel convoys are often highly vulnerable to ambush. Diesel generators display a heat signature easily detected by some enemies. In many Army deployments, oil makes up a staggering 70% of the tonnage transported to the front lines.[9]

In June 2006, Major General Richard Zilmer, head of the Multi-National Force in Al-Anbar Province, made a "Priority 1" request for renewable energy technologies on the front lines. Zilmer wrote "[w]ithout a self-sustainable energy solution, the U.S. Army will continue to accrue preventable serious and grave casualties."[10]

B. Environmental Threats

Oil is one of Earth's principal reservoirs of carbon. When oil is burned, this carbon is transformed into carbon dioxide, which stays in atmosphere -- trapping heat -- for more than a century.

Today, oil accounts for 42% of the world's energy-related carbon dioxide emissions (more than coal).[11] The average car in the U.S. puts more than 1.5 tons of carbon into the air every year. Total emissions from oil use are climbing sharply, both in the United States and around the world.

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[7] See Michael L. Ross, "Does oil hinder democracy?" *World Politics 53* (2001), pp. 325-61; Kevin Tsui, "More Oil, Less Discoveries" (Nov 2005) (http://home.uchicago.edu/~ktsui/OilDemocracy.pdf); Jeffrey D. Sachs and Andrew M. Warner, "The Big Rush, Natural Resource Booms and Growth," *Journal of Development Economics*, June 1999, 43-76. Leading Issues in Economic Development, Oxford University Press, 2000; Paul Collier, *Natural Resources, Development and Conflict: Channels of Causation and Policy Interventions*, report prepared for Oxford University and the World Bank (http://wbln0018.worldbank.org/eurvp/web.nsf/Pages/Paper+by+Collier/$File/PAUL+COLLIER.PDF)

[8] See Tsui, Ibid. at p. 21, Thomas L. Friedman, "First Law of Petropolitics," *Foreign Policy*, May/June 2006

[9] Amory Lovins, *Winning the Oil Endgame: Innovation for Profit, Jobs and Security* (Rocky Mountain Institute, 2005), p.85.

[10] See Mark Clayton, "In the Iraqi war zone, US Army calls for 'green' power" *Christian Science Monitor*, 9/7/06. Available online at http://www.csmonitor.com/2006/0907/p01s04-usmi.html

[11] See http://www.eia.doe.gov/overview_hd.html; http://www.eia.doe.gov/oiaf/1605/ggccebro/chapter1.html; and http://www.eia.doe.gov/oiaf/ieo/emissions.html

In June 2005, the U.S. National Academy of Science joined with ten other national academies from around the world in declaring that

> "The scientific understanding of climate change is now sufficiently clear to justify nations taking prompt action. It is vital that all nations identify cost-effective steps that they can take now, to contribute to substantial and long-term reductions in net global greenhouse gas emissions."[12]

When it comes to fighting global warming, not all ways of reducing oil dependence are created equal.

- Technologies that improve fuel efficiency are best, since all existing fuels produce at least some heat-trapping gases.

- Biofuels are an improvement over oil, since the carbon released when biofuels burn is simply being returned to the atmosphere after briefly being sequestered in plants through photosynthesis. (Burning oil, in contrast, adds to the atmosphere carbon stored underground for millions of years.) Among biofuels, ethanol from cellulose or sugar is best, since making ethanol from these feedstocks requires relatively little fossil energy. Corn-based ethanol also helps, though only slightly, since growing corn typically involves substantial fossil energy and fertilizer. Life-cycle emissions of corn-based ethanol are slightly lower than those from oil.

- Replacing oil with electricity using plug-in hybrid vehicles is also an improvement. The extent of the improvement depends on how the electricity is generated. Significantly, however, even when a plug-in vehicle runs on electricity from a conventional pulverized coal plant, emissions of heat-trapping gases are less than when a similar vehicle runs on oil in an internal combustion engine.[13]

- The worst fuel from a global warming standpoint – considerably worse than oil – is liquefied coal. Although the global warming impacts of liquefied coal can be partially mitigated if carbon is sequestered at production facilities, the resulting fuel is still rich in carbon. At present there is no way to use liquid coal in a way that produces fewer heat-trapping gases on a life-cycle basis than oil. This fact has important implications for the nation's oil dependence policies. Policymakers should make sure that such policies play an important role in helping – and certainly do not hinder – the fight against global warming.

Oil is also a major cause of urban smog and, as a result, of asthma and heart disease. Oil spills have damaged marine ecosystems around the world.

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[12] Joint Science Academies Statement: Global Response to Climate Change (June 7, 2005) http://nationalacademies.org/onpi/06072005.pdf

[13] See discussion at p. 9 below.

C. Economic Threats

Oil dependence exposes the United States' economy to the volatility of world oil markets. Because oil price increases can occur suddenly, consumers and businesses may be unable to adjust behavior and forced to incur higher expenses when prices rise. The impacts on low-income families and oil-intensive businesses may be especially severe.[14]

The oil price spikes of the 1970s have often been blamed for the recessions that followed.[15] However, this view has been challenged by Ben Bernanke and others who argue that restrictive monetary played a larger role in those downturns.[16] Significantly, the oil price increases of 2005-2006 did not produce a recession. Possible reasons include sound management of monetary policy and a lower ratio of oil use to GDP than during prior price spikes.

Nevertheless, the climb in oil prices during the past few years imposed considerable costs. In 2006, U.S. payments abroad for oil were more than $250 billion.[17] Between summer 2003 and summer 2006, world oil prices rose from roughly $25 per barrel to more than $78 per barrel. For several African countries, increased oil costs during this period substantially exceeded amounts saved through debt relief. For the United States, each $10/barrel increase results in roughly $50 billion of additional foreign payments annually (approximately 0.4% of GDP).[18]

IV. SOLUTIONS

Recall the Oil Paradox. Oil's enormous success creates epic problems.

To solve these problems, we must end the near-total dependence of our vehicles on oil. This means creating a transportation infrastructure in which drivers have a choice between oil and other fuels.

Since the 1970's, "ending dependence on foreign oil" has been a regular applause line in U.S. politics. However the challenge is more fundamental. Several problems often associated with dependence on *foreign* oil are in fact caused by dependence on oil more broadly.

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[14] The price elasticity of demand for oil is very low, due to lack of substitutes and other factors. See John C.B. Cooper, "Price Elasticity of Demand for Crude Oil: Estimates for 23 Countries," *OPEC Review*, Vol. 27, pp. 1-8, March 2003 (http://ssrn.com/abstract=416815)

[15] See James Hamilton, "This Is What Happened to the Oil Price-Macroeconomy Relationship," *Journal of Monetary Economics* 38 (1996), pp. 215-220, and James Hamilton, "What Is an Oil Shock?" *Journal of Econometrics* 113 (2003), pp. 363-398.

[16] Benjamin Bernanke, Mark Gertler and Mark Watson, "Systematic Monetary Policy and the Effects of Oil Price Shocks," *Brookings Papers on Economic Activity* (1997), pp. 91-116.

[17] "Exhibit 9: Exports, Imports, and Balance of Goods, Petroleum and Non-Petroleum End-Use Category Totals" (http://www.census.gov/foreign-trade/Press-Release/current_press_release/exh9.pdf)

[18] See John Fernald, Fed Reserve Bank of SF Economic Letter 2005-31 (Nov 18, 2005) (http://www.frbsf.org/publications/economics/letter/2005/el2005-31.html)

- Unfortunately, many national security vulnerabilities created by oil would remain even if U.S. oil imports fell. The United States hasn't purchased a drop of oil from Iran in 25 years, but that fact doesn't prevent Iran from playing its oil card to advance its nuclear ambitions. In an interdependent global economy, in which our prosperity depends on the economic well-being of allies and trading partners, the U.S. will retain a vital interest in the Persian Gulf so long as global transportation fleets run almost entirely on oil.

- Unfortunately, the global warming impacts of imported and domestic oil are almost exactly the same.

- Unfortunately, American families would remain vulnerable to swings in gasoline prices even if U.S. oil imports dropped dramatically. Oil is a fungible product, traded globally, with prices set on a world market. The percentage of imports has little impact on prices paid by U.S. consumers. (In the United Kingdom in 2000, truck drivers went on strike over rising gas prices. The U.K. was a net oil *exporter* at the time, but that didn't protect British truckers from rising world oil prices.)

Cutting oil imports can help with some problems, such as the trade deficit. But many of the most important national security, environmental and economic problems created by oil cannot be solved by cutting imports alone. To solve these problems, we must end oil's near-total dominance of the transportation fuels market. We must give drivers a choice between oil and other fuels.

Today several technologies offer the promise of doing just that.

A. Plug-in Hybrids

To reduce oil dependence, nothing would do more good more quickly than making cars that could connect to the electric grid.

The United States has a vast infrastructure for generating electric power. However, that infrastructure is essentially useless in trying to cut oil dependence, because modern cars can't connect to it. If we could build cars that ran on electricity and plugged into the grid, the potential for displacing oil would be enormous.

Fortunately, we can. Several small companies are already doing this, with a first generation of "plug-in hybrid" engines designed to run both on gasoline and electricity from the grid.[19] General Motors recently announced plans to produce light duty plug-ins.

Historically, electric cars have been limited by several factors, including a short driving range (think golf carts), battery weight and cost. The driving range problem is solved by hybrid engines, which draw energy first from the battery packs and then from the gas tank when batteries are depleted. The weight problem is being addressed with new kinds of batteries made

[19] For general background on plug-in hybrid vehicles, see the CalCars website (http://www.calcars.com). See also Sherry Boschert, Plug-in Hybrids: The Cars that Will Recharge America (New Society Publishers 2006)

with nickel or lithium. Upfront costs are still high – roughly $5,000-$6,000 more than a standard internal combustion engine – but well within range of commercial acceptability. (Conventional hybrids cost $2,000-$3,000 more than a standard internal combustion engine and have demonstrated strong consumer appeal.) Purchase costs are expected to drop sharply once plug-in hybrid electric vehicles (PHEVs) are in mass production.[20]

The potential benefits are enormous. Electric utilities typically have substantial unused capacity each night, when electricity demand is low. Furthermore, utilities maintain reserve generating capacity – known as "peaking power" – for days of unusually high demand. This unused and excess capacity could provide an important cushion for vehicles in case of a sudden disruption in oil supplies or steep rise in oil prices. Furthermore, driving on electricity is cheap. Even a first-generation plug-in hybrid car would travel about 3-4 miles per KwH -- equivalent to about 75 cents per gallon.[21]

Plug-in hybrids would dramatically cut local air pollutants and would even be better from a global warming standpoint than a standard internal combustion engine. True, the energy to recharge a plug-in vehicle needs to come from somewhere, and in much of the United States that somewhere would be a coal-fired power plant. However, the thermal efficiency of even an old-fashioned pulverized coal plant is roughly 33-34%, while the thermal efficiency of an internal combustion engine is roughly 20%.[22] In terms of heat-trapping gases emitted, plugging a car directly into a coal plant is better than running it on oil in an internal combustion engine. Plugging a car into the average U.S. grid (50% coal) -- or, better yet, the much cleaner grids of some states such as California – would generate substantial greenhouse gas savings.

How much oil could plug-in hybrids displace how quickly? A lot – although the data available on U.S. driving habits only allows a rough estimate. According to the Department of Transportation, 40% of Americans travel 20 miles or less per day and 60% of Americans travel 30 miles or less each day.[23] Table 1 below sets forth one possible scenario, in which plug-ins hybrids replace one-third of the oil in U.S. light duty vehicles by 2025. This assumes strong policies supporting early deployment of plug-ins and steady penetration in the vehicle fleet thereafter.

Finally, tens of millions of PHEVs could be added to the fleet without the need for new electric generating capacity, since PHEVs could recharge at night when electric loads are low. According

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[20] See Plug-in Partners website http://www.pluginpartners.org/plugInHybrids/frequentlyAskedQuestions.cfm

[21] 75 cent figure reflects national average electricity prices. See "All About Plug-in Hybrids" at the CalCars site -- http://www.calcars.org/vehicles.html

[22] Thermal efficiency is a measure of the efficiency of converting fuel to work. See National Academy of Sciences, "Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards" (2002) at p. 31. "Only about 12 to 20 percent of the original energy contained in the fuel is actually used to propel the vehicle… The average fraction of the fuel converted to work to propel the vehicle over typical load-varying operation is about 20% of the fuel energy" (http://www.nap.edu/catalog/10172.html)

[23] Amy Raskin and Saurin Shah, "The Emergence of Hybrid Vehicles: Ending Oil's Stranglehold on Transportation and the Economy," AllianceBernstein (available on-line at http://www.calcars.org/alliance-bernstein-hybrids-june06.pdf)

to one estimate, even with PHEVs making up 50% of the vehicle fleet, electricity demand would increase by only 4-7%.[24]

B. Biofuels

Over the next several decades, biofuels have the potential to replace a significant fraction of the United States' oil use. Estimates range from 25 to 100 billion gallons per year by 2025 (roughly 20%-70% of 2005 consumption).[25] Ethanol imported from the Caribbean, Latin America or Brazil could add to these totals.

In 2006, the U.S. industry produced roughly 5 billion gallons of ethanol – more than 3% of U.S. liquid fuels.[26] Almost all ethanol in the U.S. is blended into gasoline. A small but growing number of U.S. gas stations are selling E85, a fuel made up of 85% ethanol and 15% gasoline.

The U.S. ethanol industry is growing rapidly, with double digit growth rates and at least 73 plants under construction. (At a recent conference, former CIA Director Jim Woolsey quipped that "You can't stand on a street corner in the Silicon Valley today without some venture capitalist throwing money at you for an ethanol plant.") When plants currently under construction are complete – projected for 2008-2009 -- total capacity of the U.S. industry will exceed 11 billion gallons per year.[27] Many experts think 15 billion gallons per year is the capacity for corn-based ethanol production in the U.S.

Almost all ethanol in the United States today is made with corn. Last year, 20% of the corn crop was used for ethanol production – a percentage expected to grow in the next few years.

Beyond this, there are two sources. The first is ethanol from cellulosic sources, such as switchgrass, farm waste such as corn stalks, and fast-growing trees. There is tremendous interest in cellulosic ethanol among politicians and the investment community. However, the cost of making ethanol from cellulose remains high and, at present, there are no commercial plants producing ethanol from cellulose in the United States.

The other potential source is sugar. Brazil currently makes ethanol from sugar and there is considerable potential for Caribbean and Central American nations to do the same. In 2005, imports from Brazil and the Caribbean totaled 212 million gallons.

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[24] PHEVs could even sell power back to the grid during the day to reduce peak load. See "Electric Drive Vehicles as Distributed Power Generation Systems" (http://www.acpropulsion.com/Veh_Grid_Power/Veh_grid_power.htm)

[25] Total U.S. gasoline consumption in 2005 was roughly 140 billion gallons. For the 100 billion gallon by 2025 estimate, see A High Growth Strategy for Ethanol, Report of an Aspen Institute Policy Dialogue, Thomas W. Ewing and R. James Woolsey, co-chairs (2006) (adopting this figure as a "very ambitious" goal for domestically produced ethanol) (http://www.aspeninstitute.org/atf/cf/{DEB6F227-659B-4EC8-8F84-8DF23CA704F5}/EEEethanol1.pdf). See, also, Vinod Khosla, "Imagining the Future of Gasoline" (September 2006, draft) (http://www.khoslaventures.com/presentations/ImaginingTomorrowSept2006a.doc)

[26] Renewable Fuels Association news release (December 20, 2006) (http://www.ethanolrfa.org/objects/documents/919/yearend2006.pdf)

[27] "Testimony of Keith J. Collins, Senate Agriculture Committee, Jan. 10, 2007" (http://www.usda.gov/oce/newsroom/congressional_testimony/Collins_011007.pdf)

Fuel blenders currently receive a 51 cent exemption from the federal excise tax for every gallon of ethanol purchased. This credit is set to expire in 2010. Imported ethanol is subject to a 54 cent per gallon tariff, intended to prevent foreign producers from benefiting from the excise tax exemption. The tariff expires in 2007.

C. Conventional Efficiency Technologies

Many existing technologies can improve fuel efficiency. Most important is the "conventional" hybrid engine.

The fact that hybrid engines can now be considered "conventional" reflects the technology's remarkable success in the past few years. The first hybrid engines were introduced into the U.S. market several years ago amidst some skepticism they would find a market. Since then consumers have regularly sought more hybrids than are available on the market, and the technology is rapidly moving into new models. Analysts at Alliance Bernstein state that:

> "The world is on the cusp of a major transition to hybrid-power vehicles…This is a game-changing technology that promises to increase energy efficiency substantially, make a broad range of fuels available for powering vehicles, and meaningfully reduce demand for oil from the transportation sector." [28]

These analysts see a long-term decline in global oil demand as a result of the rapid penetration of conventional hybrid engines (noting that the advent of plug-in hybrids would accelerate this trend).

Beyond hybrid engines, there are many existing or emerging technologies that can substantially reduce fuel consumption without sacrificing performance, safety or comfort. The National Academy of Sciences released a comprehensive assessment of these technologies in 2002, concluding that

> "Technologies exist that, if applied to passenger cars and light-duty trucks, would significantly reduce fuel consumption within 15 years. Auto manufacturers are already offering or introducing many of these technologies in other markets (Europe and Japan, for example)..." [29]

According to the National Academies, options include low-friction lubricants (estimated savings of 1%), variable valve timing (2-3%), cylinder deactivation (3-6%), five-speed automatic transmissions (2-3%), continuously variable transmissions (4-8%), and many more.[30] Based on this data, the Union of Concerned Scientists found that raising the average fuel economy of new passenger cars and light trucks from today's level of 24 miles per gallon to 37 miles per gallon

[28] Raskin and Shah supra note 23
[29] NAS CAFE report supra note 22 at p. 3
[30] NAS CAFE report supra note 22 at chapter 3

within 10 to 15 years would be technically feasible and cost effective for the consumer with gasoline at $2.50 a gallon.[31]

D. Smart Growth

Americans are driving more and enjoying it less. Between 1993 and 2003, vehicle miles traveled in the U.S. increased 26%. Drivers report spending more time in their cars each day – up from 49 minute average in 1990 to 62 minutes today. Traffic congestion is a growing frustration for millions. [32]

More sensible growth patterns could help improve quality of life while reducing oil dependence. "Transit-oriented development" – building mixed-use communities around transit stations – is one increasingly popular approach. A recent study found that doubling ridership on mass transit nationally could save 1.4 billion gallons of gasoline per year.[33]

Longstanding federal subsidies for urban highway construction have contributed to the current mix of traffic congestion, driver unhappiness and oil consumption. Ironically, repeated experiences in major U.S. cities demonstrate that building more roads fails to solve traffic congestion. One expert summed it up by saying: "Trying to cure traffic congestion by building more roads is like trying to cure obesity by loosening your belt."[34] The most recent federal highway bill, passed in August 2005, provides four times more funding for highways than mass transit.[35]

E. Liquefied Coal

The United States has abundant coal resources, which could be converted to liquid fuels with existing technology. This "coal-to-liquids" (CTL) technology was used by the Germans during World War II and has been used in South Africa since the 1980s (when the country was subject to an international embargo).

However, there are two principal barriers: cost and global warming impacts. The capital costs of new plants are very high – many billions of dollars – and the product could not compete today with oil, corn-based ethanol or electricity from the grid.

In addition, coal's carbon content is higher than that of oil, so substituting liquid coal for oil would in almost all situations make the global warming problem *worse*. In theory, life cycle

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[31] Union of Concerned Scientists, "Clean Vehicles" (http://www.ucsusa.org/clean_vehicles/cars_pickups_suvs/nas-report-cafe-effectiveness-and-impact.html)

[32] Bruce Katz and Robert Puentes, "Remaking Transportation Policy for the New Century," speech to *Institute of Transportation Engineers*, January 23, 2006 http://www.brookings.edu/views/speeches/katz/20060123_trb.htm at p.6; See, generally, Anthony Downs, *Still Stuck in Traffic* (Brookings Institution Press, 2004)

[33] Linda Bailey "Public Transportation and Petroleum Savings in the U.S.," January 2007 (report prepared for American Public Transport Association)

[34] Andres Duany et al., *Suburban Nation* (Farrar, Straus & Giroux, 2000) at pp.88ff.

[35] See, generally, Edward Beirnborn and Puentes, Robert, "Highways and Transit: Leveling the Playing Field," Federal Transportation Policy, December 2003 (http://www.brookings.edu/es/urban/publications/20031215_beimborn.htm)

emissions from liquid coal could be reduced to levels roughly equal to those from oil, if all heat-trapping gases at CTL production facilities were captured and sequestered underground. But this would add costs to an already expensive process and the resulting fuel would still be no better than oil from a global warming standpoint. A better use for coal is to burn it in state-of-the-art modern power plants and use the electricity generated to recharge plug-in hybrid engines.[36]

F. Hydrogen-powered cars.

Hydrogen is the most abundant element in the universe. It burns cleanly, without local air pollutants or heat-trapping gases.

Yet there are few if any experts who believe hydrogen fuel could have a significant impact on U.S. oil dependence for at least several decades. First, although hydrogen is abundant, it does not exist in nature in usable form. To be used in a vehicle, hydrogen would need to be separated from the compounds in which it occurs naturally (such as water), which requires vast amounts of energy.[37]

Second, hydrogen cannot be distributed through the liquid fuel tanks found in service stations. (The temperature required to convert hydrogen to a liquid is minus 423 degrees Fahrenheit, only 36 degrees above absolute zero.)[38] Massive change in the nation's fuel distribution infrastructure – including pressurized gas tanks at service stations -- would be required to accommodate hydrogen-powered vehicles. Continuing with advanced research in hydrogen may have benefits, but there is little basis to believe that hydrogen can help in any material way to reduce oil dependence during the next 25 years.[39]

V. POLICY OPTIONS

Can federal leadership make a difference in ending oil dependence? Yes -- indeed it is essential. Following are policy options in six categories: transforming the auto fleet, transforming the fuel supply, protecting the climate, investing in research, transforming oil diplomacy and establishing an Oil Addiction Index. Together, these policies could end oil dependence in a generation.

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[36] See, generally, Scientific American (July 2005) (http://www.sciam.com/issue.cfm?issueDate=Jul-05). See, also, Testimony of David Hawkins, U.S. Senate Committee on Energy and Natural Resources (April 24, 2006) (http://energy.senate.gov/public/index.cfm?FuseAction=Hearings.Testimony&Hearing_ID=1546&Witness_ID=4370)

[37] For this reason, many experts note that hydrogen is best thought of not as an energy source, but as a medium for transmitting energy, such as electricity.

[38] Wendell H Wiser, Energy *Resources - Occurrence, Production, Conversion, Us*, (Springer-Verlag New York, Incorporated, 1999), p. 6.

[39] See, generally, Joseph Romm, *The Hype About Hydrogen: Fact And Fiction In The Race To Save The Climate* (Island Press, 2004)

A. Transforming the Auto Fleet

1. Federal Purchases

Each year, the federal government buys more than 65,000 new cars.[40] These purchases could be used to transform the automobile industry.

For example, the federal government could order 30,000 plug-in hybrid vehicles for delivery in one of the next few model years. (State, utility and private sector fleets could be invited to join in.)[41] The General Services Administration, which administers federal vehicle purchases, could commit to repeat this order for subsequent years. This would quickly jump start the market for PHEVs, help finance the conversion of existing production lines and create economies of scale. If the additional cost for each car were $6,000, the total cost of this program in its first year would be roughly $180 million.

2. Grand Bargain with Detroit

The financial position of major U.S. automakers has never been worse, with some analysts speculating about impending bankruptcies. One reason is the cost of retiree health care, which averages $680 per vehicle, hurting competitiveness and straining corporate balance sheets. Another reason is the lack of fuel-efficient vehicles in the companies' products lines. For companies in a weakened financial position, investing in new fuel-efficiency technologies may be especially difficult.

One solution is a federal trust fund to help defray auto makers' retiree health care costs in exchange for investments in fuel-saving technologies.[42] Several structures are possible. The fund could reimburse qualifying expenses to retool production lines for plug-in hybrid engines or other oil-saving technologies. The fund could also make payments based upon the fuel-efficiency of new vehicles sold by a manufacturer in a model year. Sen. Barack Obama (D-IL) has proposed such a trust fund and suggested initial appropriations of $670 million per year.[43] Another analysis suggests a one-time appropriation of $10 billion.[44]

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[40] In 2005, the figure was roughly 68,000. In 2004, that figure was roughly 65,000. GSA Federal Fleet Report, Table 2-9 (http://www.gsa.gov/gsa/cm_attachments/GSA_DOCUMENT/FFR2005_R2K-g6_0Z5RDZ-i34K-pR.pdf)

[41] See www.pluginpartners.org, a national campaign to collect "soft orders" for plug-in hybrids to demonstrate to automakers that a market exists today.

[42] See Bracken Hendricks et al., "Health Care for Hybrids: Investing in Oil Savings, Retiree Health Care, and a Revitalized Auto Industry for a Stronger America" (http://www.thebreakthrough.org/images/Health_Care_for_Hybrids_white_paper.pdf)

[43] Barack Obama and Jay Inslee, "Salvaging the auto industry," Feb 8, 2006 (http://obama.senate.gov/blog/060208-salvaging_the_auto_industry/index.html). See, also, "Securing Our Energy Future," A Resources for the Future Policy Leadership Forum with Senator Barack Obama, September 14, 2005 - Washington, DC (http://www.rff.org/rff/Events/loader.cfm?url=/commonspot/security/getfile.cfm&PageID=19786

[44] Hendricks supra note 42 at p.13

3. Fiscal Policies

Tax credits could play a pivotal role in transforming our vehicle fleet. For example, a federal commitment to provide $6,000 tax credits to purchasers of the first million flex fuel plug-in hybrids would dramatically accelerate deployment of such vehicles.[45] Similarly, tax credits for purchasers of other fuel efficient cars and trucks could help speed deployment of such vehicles. Credits should be fully refundable, so all Americans – including those with little or no tax liability – could benefit.[46] Together with policies to assist automakers re-tool production lines, such tax credits could revitalize the American auto industry.

How could such tax credits be funded? One possibility -- with an increase in the gasoline tax.[47] For example, a 20-cent per gallon levy would raise close to $28 billion in the first year – enough to give $6,000 tax credits to the first million purchasers of flex fuel plug-in hybrids, provide tax credits to purchasers of other fuel efficient cars and capitalize a trust fund to help convert production lines, with funds to spare.

Of course, opposition to a federal gas tax increase is deep and widespread. Such increases are opposed by almost all Members of Congress. One recent poll found 85% of Americans opposed to a gas tax increase.

However, the same poll asked "What if the increased tax on gasoline would reduce the United States dependence on foreign oil?" Fifty-five per cent of respondents said they would *support* such an increase.[48] Voters are much more open to taxes dedicated to a specific and popular purpose than taxes that go into general revenues.

Interestingly, state legislatures around the country have been much more willing to impose modest gasoline tax increases than the U.S. Congress. In recent years Indiana, Kansas, Maine, Nebraska, North Carolina and West Virginia – among others – have all raised gas levies. In addition, a growing number of commentators on both the right and left – including Charles Krauthammer, John Tierney, Gregg Easterbrook and Tom Friedman – have called for increases in the gas tax.[49] Greg Mankiw, Chair of the Council of Economic Advisers under President George W. Bush from 2003-2005, supported a gas tax hike before serving at CEA and is now a leading advocate for such an increase.[50]

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[45] Cars should meet strict fuel efficiency criteria for purchasers to be eligible.

[46] See Peter R. Orszag, Fred T. Goldberg, Jr., and Lily L. Batchelder, "Reforming Tax Incentives into Uniform Refundable Tax Credits," Brookings Policy Brief (August 2006)

[47] The federal gasoline tax is 18.4 cents per gallon, unchanged since 1993.

[48] Americans are Cautiously Open to Gas Tax Rise, Poll shows," New York Times, February 28, 2006 (http://www.nytimes.com/packages/pdf/national/20060228_poll_results.pdf)

[49] Charles Krauthammer, "Tax and Drill," *Washington Post*, May 21, 2004, A25; John Tierney, "The Solve-Everything Tax," *New YorkTimes*, October 4, 2005, A27; Thomas Friedman, "The Real Patriot Act," *New York Times*, October 5, 2003, A13; Thomas Friedman, "Driving toward Middle East Nukes in Our Own SUVs," *New York Times*, February 10, 2006, A25.

[50] Mankiw maintains a blog on which he lists supporters of gasoline tax increases from both the right and left. See http://gregmankiw.blogspot.com/2006/10/pigou-club-manifesto.html

Voter resistance to sudden increases in the gasoline tax is hardly surprising or irrational. In the absence of alternative fuels, drivers have few options for adjusting behavior to minimize the tax burden. However, public attitudes might be influenced if an increase were phased in slowly and coupled with a highly visible program to give drivers a choice of fuels. Explaining the tax as part of a vital national security program – which it is – could also make a difference. With adequate funding, a program to provide tax credits for the purchase of advanced vehicles could help transform the U.S. fleet.

4. CAFE Reform

Corporate average fuel economy standards helped improve the fuel efficiency of the U.S. auto fleet in the late 1970's and early 1980's. Since then, both standards and the average of efficiency of the U.S. fleet have remained roughly flat.[51] The Bush administration has proposed structural reforms to the CAFE rules, designed to promote fuel efficiency within a vehicle weight class and assist domestic car manufacturers (who sell larger cars than their foreign competitors). However, these proposals include only modest increases in the standards themselves.

Automotive performance technologies improve regularly, like most technologies. In the past, many of these improvements have been used for attributes other than improved fuel efficiency. Given the national stake in reducing oil consumption, performance improvements should be used to enhance efficiency, absent a compelling reason to the contrary. CAFE standards could be modified accordingly, to increase automatically by several percent each year absent a showing of infeasibility.

B. Transforming the Fuel Supply

1. E85 pumps

A principal barrier to growth in ethanol markets is the lack of ethanol pumps at service stations around the nation. Although numbers are expanding quickly, fewer than 1000 of the nation's roughly 120,000 service stations currently have pumps capable of dispensing E85 fuel.[52] Barriers include retrofitting costs of $2000-$3000 per pump and franchising agreements that limit station owners from pumping ethanol on islands with petroleum fuels.

To address this problem, oil majors should be required to retrofit pumps for E85 at 50% of their owned or branded stations. Since the oil majors have roughly 55,000 owned or branded stations, this requirement would put E85 pumps in just under a quarter of the nation's service stations, enough to give drivers confidence E85 could easily be found. With record profits in the past year, the oil majors can afford the cost of retrofits. (Costs per company would range from

[51] In 1981, light duty vehicles averaged 20.5 mpg. In model year 2004, they averaged 20.8 mpg. EPA – Light Duty Automotive Technology and Fuel Efficiency Trends (April 2004) (Available online at http://www.epa.gov/otaq/fetrends.htm)

[52] Service station figure is from 2002 Census. Figure for E85 pumps is from Alternative Fuel News (Nov 27, 2006) (http://domesticfuel.com/?cat=15)

roughly $12 million -$24 million.[53]) Provisions in franchise agreements that limit ethanol pumps should be prohibited.

2. Ethanol Subsidy Reform

Currently, ethanol receives a subsidy of 51 cents per gallon, which is provided as an excise tax credit to fuel blenders. The subsidy is available without reference to the price of oil.

The ethanol subsidy could be reformed in at least three ways. First, the subsidy could vary with the price of oil. As oil prices decline, the subsidy could climb to be sure that ethanol remains competitive. Such a mechanism would provide important protection against attempts to manipulate oil prices by OPEC or others. Such a mechanism would also provide important reassurance to Wall Street about the returns on ethanol project investments.[54] Similarly, the subsidy could fall as oil prices climb. This would avoid unnecessary federal expenditures in times when ethanol is fully competitive with petroleum products.

Second, the subsidy could be enhanced significantly for cellulosic feedstock. The nation has a considerable interest in jump-starting the market for ethanol from cellulose. Short-term subsidies could play a big role.

Finally, the subsidy could be paid directly to domestic farmers instead of to blenders.

3. Ethanol Tariff Reform

The United States currently imposes a 54 cent per gallon "secondary tariff" on imports of ethanol.[55] There is rich irony in the United States' taxing ethanol imports but not oil imports, notwithstanding decades of strong political rhetoric about the dangers of imported oil. A diverse group of politicians support ending the tariff, including President George W. Bush, Rep. John Boehner (R-OH), Connecticut Governor Jodi Rell and Senator Diane Feinstein (D-CA). U.S. farm groups are vigorously opposed.

There are no comprehensive estimates of the potential impact on supplies of lifting the tariff. Nevertheless, the potential for sugar ethanol production in Brazil, the Caribbean and Central America is considerable. It is not difficult to imagine the region supplying 5-10 billion gallons of ethanol to the United States annually within the decade, with amounts increasing thereafter. [56] The social and environmental impacts of such production could range from positive to negative, depending on the standards used in production.

One possibility would be to phase out the tariff slowly – perhaps by 10 cents per year. Tariff reductions could be limited to ethanol from facilities that meet international labor and environmental standards.

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[53] Total owned or branded stations in the US: Chevron -12,000; Shell - 13,000; BP - 14,000; Exxon Mobil - 16,000.
[54] See Vinod Khosla, "My Big Biofuels Bet," Wired Magazine, October 2006
[55] An additional "ad valorem" tariff of 2.5% of value is also imposed on each gallon.
[56] Small amounts of ethanol can already enter the US duty free under the Caribbean Basin Initiative and Central American Free Trade Agreement.

Venture capitalist Vinod Khosla suggests another political compromise-- lifting the tariff, but dying imported ethanol a distinct color and prohibiting it from being used in 90% gasoline/10% ethanol blends. This would guarantee U.S. corn farmers a roughly 14 billion gallon market – more ethanol than they will be able to produce for years -- while allowing imported ethanol to help supply the market for E85.[57]

4. Off-Peak Electricity Pricing

The infrastructure for distributing electricity to plug-in cars already exists. Indeed, this is one of the great attractions of the technology. Nevertheless, one policy reform that would help with early deployment is to require off-peak pricing for retail customers at utilities around the nation. Many utilities have unused baseload generation at night, and making sure that plug-in owners have maximum incentive to recharge during those hours would relieve any strains on generating capacity and reduce costs to consumers.

C. Protecting the Climate

Global warming legislation is gaining momentum in the U.S. Congress. Factors include the new Democratic majority, considerable support from Republican lawmakers (including Senators John McCain and Richard Lugar), laws imposing binding limits on heat-trapping gases in place in California and Northeastern states, support from evangelical leaders and an increasing number of large multinationals (including GE, DuPont and Wal-Mart) positioning themselves to profit from clean energy markets.

Such legislation alone will not wean the nation from oil. The biggest impact of global warming legislation would likely be on coal, which has a much higher concentration of carbon per unit of energy than oil. However, if properly designed, federal global warming legislation can play an integral role in helping shape the nation's transition from oil. For example, an economy-wide "upstream" cap-and-trade system that applied to all fossil fuels would promote alternatives to oil. Also, of great importance, such legislation would help make sure oil is replaced with fuels that *reduce* emissions of heat-trapping gases.

D. Investing in Research

Many of the technologies we need to end oil dependence are available today. Others are almost ready for widespread commercial use. Yet breakthroughs in nanosciences, biotechnology, genomics and other disciplines can play an important role in helping end oil dependence more quickly.

Much of the research behind these breakthroughs will take place in the private sector. However the private sector is unlikely to invest adequately in research with strong social benefits or pay-

[57] Vinod Khosla, "A Near Term Energy Solution" (September 2006, draft) http://www.khoslaventures.com/presentations/KhoslaBiofuelsPolicySept2006.doc

offs beyond the time horizons of private companies. Public sector research also has an important role.

The National Academy of Sciences recommends creating a new federal energy research agency, "ARPA-E," modeled after the Defense Advanced Research Projects Agency (DARPA).[58] The National Academy recommends establishing ARPA-E with initial annual funding of roughly $300 million, building to roughly $1 billion per year. Many other proposals have been offered for a "Manhattan Project" or "Apollo Project" to speed the deployment of clean energy technologies. With a careful eye toward ensuring that money is well spent, substantially increased federal research funding should be committed to developing alternatives to oil.

E. Transforming Oil Diplomacy

Traditional oil diplomacy focuses on securing adequate and reliable supplies.[59] This will remain a necessary element of U.S. diplomacy for years to come. But this focus must be supplemented by another: reducing oil dependence in all consuming nations.

Oil is a fungible product, traded globally. Improvements in fuel efficiency and the use of clean alternative fuels benefit the U.S. wherever they occur. Changes in U.S. consumption alone make a difference, in part because the U.S. is a dominant purchaser in global oil markets, with 25% of total consumption.[60] But diffusion of oil-saving technologies around the world advances U.S. interests as well.

To speed this diffusion and promote rapid transformation of global transportation fleets, the U.S. government should give priority to cooperative dialogues on oil-saving technologies. Dialogues to promote global adoption of plug-in hybrid engines, for example, could help bring down battery costs more quickly. Discussions focused on the sustainable production of biofuels are essential to protect tropical rainforests and other natural resources as that industry grows.

Traditional oil diplomacy is no longer adequate. Fuel efficiency improvements in China could do more to protect our national security, fight global warming and promote economic growth than additional supply from the Persian Gulf. (Fuel efficiency improvements in the United States could be even better.) We need a new 21st century energy diplomacy in the years ahead.[61]

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[58] National Academy of Sciences, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future* (2005) (http://www7.nationalacademies.org/ocga/testimony/Gathering_Storm_Energizing_and_Employing_America2.asp)

[59] See, e.g., Hearing on Oil Diplomacy, U.S. House of Representatives Committee on International Relations, June 20, 2002 (http://commdocs.house.gov/committees/intlrel/hfa80291.000/hfa80291_0.htm)

[60] For a discussion of the "monopsony effect" of U.S. purchases on the world market, see NHTSA Corporate Average Fuel Economy and CAFE Reform for MY 2008-2011 Light Trucks (March 2006) at pp. VIIII-31ff (http://www.nhtsa.dot.gov/staticfiles/DOT/NHTSA/Rulemaking/Rules/Associated%20Files/2006_FRIAPublic.pdf)

[61] See, generally, CFR, National Security Consequences of Oil Dependence; Kalicki, Jan and Goldwyn, David (eds.), Energy and Security (2005); Yergin, Daniel, "Energy Security and Markets" in Kalicki and Goldwyn; Yergin, Daniel "Ensuring Energy Security," Foreign Affairs (March/April 2006); Rauch, Jonathan, "Not a Gas Tax – a Gas Pact," National Journal (July 8, 2006)

F. Establishing an Oil Addiction Index

In the 1970s, the "Misery Index" first emerged as an easily understood summary of macroeconomic problems. Defined as the sum of the inflation and unemployment rates, the Index was a somewhat odd apples-and-oranges combination. No one claimed it was a fully comprehensive or analytically perfect measure of the nation's economic well-being. Yet lowering the Misery Index was a sensible -- and easily understood -- goal for policymakers.

Today, the United States needs an Oil Addiction Index. Indeed it is odd that, despite the broad consensus about oil dependence, there is no widely accepted way of measuring it.[62] The Oil Addiction Index need not be fully comprehensive or analytically perfect. It should provide a sensible goal for policymakers, easily understood by the public at large.

One simple measure of our addiction: oil's share of the transportation fuels market. In 2005, that stood at more than 97%.[63] Sharply reducing this percentage – by developing alternative fuels and improving overall fuel efficiency -- should be an important goal for policymakers.

Of course, this is not the only important goal. Cutting heat-trapping gases from the transportation sector is vitally important as well. Reducing household fuel costs is important for countless Americans.

The Department of Energy should calculate an Oil Addiction Index -- defined as oil's share of the transportation fuels market – annually. The Department should publish the result along with several other measures, such as emissions of heat-trapping gases from the transportation sector and average household fuel costs. Doing so would provide political leaders and the public with important information in shaping energy policy in the decades ahead.

VI. CONCLUSION

Ending oil dependence doesn't mean ending oil use. It means ending our near-total reliance on oil as a transportation fuel. It means giving drivers a choice between oil and other fuels.

If most or all of the proposals above were implemented, the United States could end its debilitating dependence on oil in a generation. Under reasonable assumptions, plug-in hybrids could replace more than 45 billion gallons of gasoline per year by 2025. (See Table 1.) Biofuels could replace roughly 40 billion gallons of gasoline in the same time frame. (This would require

[62] The metric most frequently used – oil imports as a percentage of total oil consumption – is unsatisfactory for several reasons. See "Energy Independence: The Wrong Target for Policymakers," Washington Post (January 21, 2007). In 2006, the National Commission on Energy Policy convened a group of experts to examine possible indicators for measuring oil dependence. See John Fialka, "Energy Independence: A Dry Hole," Wall Street Journal (July 5, 2006).

[63] Gasoline - 141 billion gallons; on-highway diesel oil – 38 billion gallons; ethanol - 4.0 billion gallons; biodiesel – 75 million gallons. See http://tonto.eia.doe.gov/dnav/pet/pet_cons_wpsup_k_w.htm; http://www.eia.doe.gov/neic/quickfacts/quickoil.html; http://www.ethanolrfa.org/industry/statistics/#D; http://tonto.eia.doe.gov/dnav/pet/pet_cons_821dsta_dcu_nus_a.htm; www.biodiesel.org

production of roughly 60 billion gallons of ethanol, due to ethanol's lower energy content.) Efficiency technologies could cut fuel use by a third. The result would be a transformed market for transportation fuels.

Although estimates of federal budget costs depend on many specific decisions concerning program design, costs could run from several billion to approximately to $10 billion per year. Rough cost estimates are set out at Table 2.

Oil dependence lies behind several of the most important problems facing the United States. The strong consensus about the gravity of the problem and new technologies provide an opportunity for transformational change.

TABLE 1

FLEETWIDE OIL SAVINGS FROM PLUG-IN HYBRIDS
SAMPLE SCENARIO

Year	new car sales/ total cars	PHEV sales/ new car sales	%PHEVs in fleet	oil savings from each PHEV	fleetwide oil savings
2007	6.5%	0%	0.0%	66.7%	0
2008	6.5%	0%	0.0%	66.7%	0
2009	6.5%	0%	0.0%	66.7%	0.0%
2010	6.5%	5%	0.3%	66.7%	0.2%
2011	6.5%	10%	1.0%	66.7%	0.7%
2012	6.5%	15%	2.0%	66.7%	1.3%
2013	6.5%	20%	3.3%	66.7%	2.2%
2014	6.5%	25%	4.9%	66.7%	3.3%
2015	6.5%	35%	7.2%	66.7%	4.8%
2016	6.5%	45%	10.1%	66.7%	6.7%
2017	6.5%	55%	13.7%	66.7%	9.1%
2018	6.5%	65%	17.9%	66.7%	11.9%
2019	6.5%	75%	22.8%	66.7%	15.2%
2020	6.5%	75%	27.6%	66.7%	18.4%
2021	6.5%	75%	32.5%	66.7%	21.7%
2022	6.5%	75%	37.4%	66.7%	24.9%
2023	6.5%	75%	42.3%	66.7%	28.2%
2024	6.5%	75%	47.1%	66.7%	31.4%
2025	6.5%	75%	52.0%	66.7%	34.7%

TABLE 2

Federal Budget Cost Summary

The following figures are rough estimates and would vary depending on program design:

Federal Purchases...	$180 million per year
Grand Bargain…	$700 million per year
Tax Credits...	$2 billion - $8 billion per year*
CAFE Reform...	--
E85 pumps…	---
Ethanol Subsidy Reform…	$500 million per year**
Ethanol Tariff Reform…	$0-$75 million/year***
Off-Peak Electric Pricing…	---
Climate Protection…	---
Investing in Research…	$1 billion per year
Diplomacy…	---
Oil Addiction Misery Index	---
TOTAL…	appr. $4.5 billion – $10.5 billion per year

*Costs would start at the low end of this range, increase as flex fuel plug-in hybrids become commercially available, and then decrease once the first million such cars have been sold.
** For five years
*** 2005 imports were 135 million gallons, producing approximately $73 million in revenues from the secondary tariff.