OPPORTUNITY 08

Independent Ideas For Our Next President

Ending Oil Dependence

Protecting National Security, the Environment and the Economy

David Sandalow

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 Presidential leadership and robust policies will be needed. There are no simple or short-term solutions. The next President should:

- transform the auto fleet with federal purchases of plug-in hybrid vehicles, tax incentives for the purchase of plug-in hybrid vehicles paid for with the federal gasoline tax , a fund to help automakers 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 additional supply
- 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. To solve the problems created by oil dependence, we must give drivers a choice between oil and other fuels.

Context

Large majorities of Americans agree that oil dependence is a serious problem. National security hawks raise alarms about vast sums sent to the Persian Gulf. Environmentalists warn about global warming. Farmers see new fortunes in a transition to ethanol. Consumers cry out when oil prices rise. Politicians as different as President George W. Bush, Senator Richard Lugar (R-Ind.), Senator Tom Harkin (D-Iowa), and Democratic National Committee Chair Howard Dean all call for an end to Americans' oil "addiction."

Yet today oil provides more than 97 percent of the fuel for our vehicles, barely different than a generation ago. Oil use continues to climb, in the United States and around the world. Meanwhile game-changing technologies are moving closer to market, propelled by considerable investor interest. Plug-in hybrid engines and biofuels could reshape the transportation sector. In the years ahead, a confluence of factors—political, technological, and financial—will create an opportunity for transformational change. With sustained commitment, the next President can help end the United States' debilitating dependence on oil.

The Oil Paradox

First, a question: How did a product so widely used become so widely resented? 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'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.

The solution to these problems would appear straightforward—develop substitutes for oil and use less of it. Yet the challenge is immense. Oil's near-total dominance as a transportation fuel is the result not only of its inherent properties, but also a century of favorable government policies, deeply ingrained cultural patterns, and huge infrastructure investments (in pipelines, service stations, and conventional vehicle manufacturing facilities). Three facts underscore the challenge:

- ***Modern vehicles depend almost completely on oil.*** If you're thirsty and don't want a soda, you can drink water or orange juice. If you'd like to relax and don't feel like watching 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 an alternative fuel, such as E85 (85 percent ethanol, 15 percent gasoline), sold at less than 1 percent 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.
- ***Oil's dominance is deeply entrenched, in part because capital stock turns over slowly.*** It takes roughly 15 years for the nation's auto fleet to turn over. Designing new oil-saving technologies and then re-tooling production facilities can take several years at least. Policymakers eager to see dramatic reductions in oil consumption—say, within the term of an elected official—will find the pace of change frustratingly slow.
- ***Oil's dominance reflects a century of favorable government policies.*** Eminent domain authority has been used to 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 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.* Securing diverse and reliable supplies of oil has been a priority of Presidents and top government officials for generations.

Problems with Oil Dependence

National Security Threats

The United States is in a long war. Islamic fundamentalists struck our shores and are determined to do so again. *Oil dependence is an important cause of this threat.* 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." 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 is a powerful *jihadist* recruitment tool. Resentment grows not just from the war in Iraq, but also from our relationship with the House of Saud, the presence of our forces throughout the region, and more. Yet the United States cannot easily extricate itself from this contentious region. The Persian Gulf has half the world's proven oil reserves, the world's cheapest oil, and its only spare production capacity. So long as modern vehicles run only on oil, the Persian Gulf will remain an indispensable region for the global economy

Furthermore, *the huge flow of oil money into the region helps finance terrorist networks.* Saudi money provides critical support for *madrassas* promulgating 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 world community's leverage 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 powerful 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. 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.

Finally, *oil dependence jeopardizes the safety of our men and women in uniform*. Fuel convoys are highly vulnerable to ambush. Diesel generators display an easily detected heat signature. In many Army deployments, oil makes up a staggering 70 percent of the tonnage that must be transported to the front lines. In June 2006, Major General Richard Zilmer, head of the Multi-National Force in Al-Anbar Province, Iraq, made a "Priority 1" request for renewable energy technologies on the front lines. Zilmer's memo declared that, without renewable power, U.S. forces "will remain unnecessarily exposed" and will "continue to accrue preventable . . . serious and grave casualties."

Environmental Threats

Oil is one of Earth's principal reservoirs of carbon. When oil is burned, this carbon is transformed into carbon dioxide (CO_2), which stays in the atmosphere—trapping heat—for more than a century. Today, oil accounts for 42 percent of the world's energy-related CO_2 emissions (more than coal). Total emissions from oil use are climbing sharply in the United States and around the world. Oil is also a major cause of urban smog and, as a result, of asthma and heart disease. Oil spills have contaminated land and water supplies and damaged marine ecosystems worldwide.

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. Ethanol made from cellulose or sugar is a substantial improvement over oil. Ethanol made from corn also helps, though only slightly, since growing corn typically involves substantial fossil fuel inputs.

Life-cycle emissions of heat-trapping gases from corn-based ethanol are slightly lower than those from oil.

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

The worst fuel from a global warming standpoint—considerably worse than oil—is liquefied coal. Although the global warming impacts of liquefied coal could be partially mitigated if carbon were sequestered at production facilities, the resulting fuel is still rich in carbon. At present there is no way to use liquid coal so that, on a life-cycle basis, it produces fewer heat-trapping gases than oil.

Economic Threats

Oil dependence exposes the U.S. economy to the volatility of world oil markets. Price increases can occur suddenly and, because there are no widely available substitutes for oil, consumers and businesses may be unable to respond by changing consumption patterns. At the national level, the climb in oil prices during the past few years has imposed considerable costs. Between summer 2003 and summer 2006, world oil prices rose from roughly $25 per barrel to more than $78 per barrel. Each $10 increase requires roughly $50 billion of additional foreign payments (approximately 0.4 percent of GDP) per year. In 2006, U.S. foreign payments for oil were more than $250 billion.

Solutions

To solve the problems created by oil dependence, drivers must have a choice between oil and other fuels.

Since the 1970s, “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:

- 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 United States 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 United Kingdom 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.

Plug-In Hybrid Electric Vehicles (PHEVs)

To end 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 reducing oil dependence, because cars can't connect to it. If we built cars that ran on electricity, the potential for displacing oil would be enormous. Fortunately, we can. Several small companies are already doing this. General Motors recently announced plans to produce light duty plug-ins.

Historically, electric cars have been limited by several factors, including short range (think golf carts), battery weight, and cost. The range problem is solved by hybrid engines that automatically switch over to a standard gas tank when the battery is drained. The weight problem is being addressed with new kinds of batteries made with nickel or lithium. Upfront costs are still high—roughly $5,000 to $6,000 more than a car with an internal combustion engine—but well within range of commercial acceptability. Purchase costs will drop once plug-in hybrids are in mass production.

The potential benefits are enormous. Electric utilities typically have substantial unused capacity each night, when electricity demand is low. Further, 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, based on the national average for electricity prices.

Plug-in hybrids would dramatically cut local air pollutants and would be better from a global warming standpoint than cars with standard internal combustion engines. True, the energy to recharge a plug-ins 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 to 34 percent, while that of an internal combustion engine is roughly 20 percent. In terms of heat-trapping gases emitted, plugging a car with an electric motor directly into a coal plant is better than running it on oil with an internal combustion engine.

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

Table 1. Potential Fleetwide Oil Savings from Plug-in Hybrids (PHEVs) – An Illustrative Scenario

Year	*PHEVs as a % of new car sales*	*% of PHEV's in U.S. auto fleet*	*Fleetwide Oil Savings*
2008	0	0	0
2010	5%	0.3%	0.2%
2015	35%	7.2%	4.8%
2020	75%	27.6%	18.4%
2025	75%	52.0%	34.7%

Notes: New car sales are roughly 6.5 percent of the total U.S. fleet each year. Calculations assume that each PHEV uses 2/3 the gasoline of a conventional vehicle.

Finally, tens of millions of PHEVs could be added to the fleet without the need for new electric generating capacity. Even with PHEVs making up half the US fleet, electricity demand would increase by only 4-7%. PHEVs could be recharged at night, when electricity demand is low. In fact, PHEVs could even sell electricity back to the grid to ease peak loads.

Biofuels

Over the next several decades, biofuels have the potential to replace a significant fraction of U.S. oil use. Estimates of these savings range from 25 to 100 billion gallons per year by 2025 (roughly 20 to 70 percent of 2005 consumption). In 2006, the United States produced roughly 5 billion gallons of ethanol—more than 3 percent of gasoline consumption. A small but growing number of U.S. gas stations are selling E85.

The U.S. ethanol industry is growing rapidly, with at least 73 new ethanol plants under construction. Projected capacity of the U.S. industry in 2008-2009 is in the range of 11 billion gallons per year. Today, almost all U.S. ethanol is made from corn. Last year about 20 percent of the corn crop was used for ethanol production. Many experts believe corn can produce a maximum of roughly 15 billion gallons of ethanol per year. Politicians and the investment community are very interested in ethanol from cellulosic sources, such as switchgrass, corn stalks, and fast-growing trees. However, at present, no U.S. commercial plants produce ethanol from cellulose. 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, U.S. ethanol imports from Brazil and the Caribbean totaled 212 million gallons.

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 mass-produced hybrids were introduced into the U.S. market in 1999 amidst some skepticism they would find a market. But consumers eagerly accepted them, and the technology is rapidly moving into new models.

Beyond hybrid engines, many existing or emerging technologies can substantially reduce fuel consumption without sacrificing vehicle performance, safety, or comfort. According to the National Academy of Sciences, "Technologies exist that, if applied to

passenger cars and light-duty trucks, would significantly reduce fuel consumption within 15 years."

Smart Growth

Americans are driving more and enjoying it less. Between 1993 and 2003, U.S. vehicle miles traveled increased 26 percent. Drivers now spend an average of 62 minutes a day in their vehicles, and traffic congestion is a growing frustration for millions. More sensible urban-suburban growth patterns could both improve quality of life and reduce oil dependence. "Transit-oriented development"—building mixed-use communities around transit stations—is one increasingly popular approach. According to a study for the American Public Transportation Association, doubling ridership on mass transit nationally could save 1.4 billion gallons of gasoline per year.

Other Technologies

Hydrogen power is unlikely to help reduce U.S. oil dependence for at least several decades, because of the cost of separating hydrogen from the compounds in which it occurs naturally and then transporting it in useable form. **Liquefied coal** faces two significant barriers: high costs and adverse impacts on global warming.

Policies

The United States cannot end its dependence on oil without Presidential leadership. The next President should develop an aggressive program and build bipartisan support to sustain it. Principal elements could include the following.

Transform the Auto Fleet

Federal Purchases

Each year, the federal government buys more than 65,000 new cars. These purchases should be used to transform the automobile industry. For example, the federal government could order 30,000 plug-in hybrid vehicles a year, starting soon. (State, utility, and private sector fleets could be invited to join in.) *No single step would do*

more to 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.

A 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' product lines, which sends consumers to foreign manufacturers. For financially weak companies, investments in new fuel-efficiency technologies may be especially difficult.

One solution is a federal trust fund to help defray automakers' retiree health care costs in exchange for investments in fuel-saving technologies. Several structures are possible. The fund could reimburse qualifying expenses involved in retooling production lines, or it could make payments based upon the fuel-efficiency of new vehicles sold. Sen. Barack Obama (D-Ill.) has proposed such a trust fund and suggested initial appropriations of $670 million per year. Another analysis suggests a one-time appropriation of $10 billion.

Fiscal Policy

A federal commitment to provide $6,000 tax credits to purchasers of the first million flex-fuel plug-in hybrids would dramatically accelerate deployment. Similarly, tax credits could help bring down the cost of any vehicle with superior fuel efficiency in its weight class. Credits should be fully refundable, so all Americans – including those with little or no tax liability – could benefit. Tax credits could be funded by an increase in the gasoline tax (currently 18.4 cents per gallon). Raising the federal gasoline tax 20 cents per gallon would generate close to $28 billion the first year—enough to underwrite the proposed tax credits as well as capitalize a trust fund to help convert production lines.

Of course, public opposition to a federal gas tax increase is widespread and shared by almost all members of Congress. However, many states have raised gasoline taxes in recent years. Several commentators from across the political spectrum have recently supported an increase. Public opinion polls indicate support for an increase aimed specifically at reducing the country's dependence on foreign oil. Voters are much more open to taxes dedicated to a specific and popular purpose than taxes that go into general revenues.

CAFE Standards

Corporate average fuel economy (CAFE) standards helped improve the fuel efficiency of the U.S. auto fleet in the late 1970's and early 1980's. Since then, the standards—and the fleet's average efficiency—have remained roughly flat. The Bush Administration has proposed structural reforms to the CAFE rules, but only modest increases in the standards themselves. CAFE standards should be reformed to increase automatically by several percentage points each year, unless such increases are found to be infeasible as part of a rulemaking process.

Transform the Fuel Supply

E85 pumps

Fewer than 1,000 of the nation's roughly 120,000 service stations dispense E85 fuel. Retrofitting costs $2,000 to $3,000 per pump, and some franchise agreements prohibit station owners from pumping ethanol on islands with petroleum fuels. To address these barriers, major oil companies could be required to retrofit pumps for E85 at half their owned or branded stations. This would put E85 pumps in just under a quarter of the nation's service stations—enough to give drivers confidence that E85 could be found easily. Provisions in franchise agreements that limit ethanol pumps should be prohibited.

Ethanol Subsidies

Currently, ethanol receives a subsidy of 51 cents per gallon, in the form of an excise tax credit to fuel blenders. This subsidy is justified from a public policy standpoint,

because of the many subsidies received by the oil industry. However, federal ethanol support could be reformed in at least three ways:

- First, the subsidy should vary with the price of oil. If oil prices drop, the subsidy should climb, to keep ethanol competitive. Such a mechanism would provide important protection against attempts by OPEC to slow the growth of renewable fuels by manipulating oil prices. Similarly, if oil prices climb, the subsidy should fall, to avoid unnecessary federal expenditures at times in which ethanol is fully competitive with petroleum.
- Second, the subsidy should be increased significantly for ethanol made from cellulosic sources.
- Finally, the subsidy should be paid directly to domestic farmers instead of to blenders.

Ethanol Tariff

The United States currently imposes a 54-cent per gallon "secondary tariff" on ethanol imports (plus a 2.5 percent tax on the value of each gallon). There is rich irony in taxing ethanol imports but not oil imports. A diverse group of politicians support ending the tariff, including President George W. Bush, Rep. John Boehner (R-Ohio), Connecticut Governor Jodi Rell, and Senator Dianne Feinstein (D-Calif). U.S. farm groups are vigorously opposed. The potential for ethanol production in Brazil, the Caribbean and Central America is considerable. The region could likely supply the United States with 5 to 10 billion gallons of ethanol annually within the decade, with more thereafter. Social and environmental impacts of such imports could range from positive to negative, depending on the standards used in overseas production.

One possibility would be to phase out the tariff slowly—perhaps by 10 cents per year—and limit reductions to ethanol from facilities that meet international labor and environmental standards. Another compromise, proposed by venture capitalist Vinod Khosla, would be to lift the tariff, but dye imported ethanol a distinctive color and prohibit it from being used in 90 percent gasoline/10 percent ethanol blends. This would guarantee U.S. corn farmers a roughly 15 billion gallon market—more than they

will be able to produce for years—while allowing imported ethanol to help supply the market for E85.

Off-Peak Electricity Pricing

Requiring utilities to implement off-peak pricing for retail customers could help with early deployment of plug-in vehicles. Many utilities have unused baseload generation at night, and giving plug-in vehicle owners maximum incentive to recharge during those hours could relieve any strains on the grid.

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 California and the Northeastern states, and an increasing number of large multinational corporations (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. Also, of great importance, such legislation would help make sure oil is replaced with fuels that *reduce* emissions of heat-trapping gases.

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 this research will take place in the private sector, but government can pursue research with strong social benefits or pay-offs beyond the time horizons of the private sector. The National Academy of Sciences,

among others, has recommended creation of a new federal energy research agency. The Academy's version would have initial funding of roughly $300 million annually, building to roughly $1 billion per year.

Transforming Oil Diplomacy

Traditional oil diplomacy focuses on securing adequate and reliable supplies. This will remain a necessary element of U.S. diplomacy for years to come. But this strategy 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 United States wherever they occur. Improving fuel efficiency in China could do more to protect our national security, fight global warming, and promote economic growth than securing additional supply from the Persian Gulf. (Improving fuel efficiency in the United States could be even better.) To speed the diffusion of oil-saving technologies and promote rapid transformation of global transportation fleets, the next President should give priority to cooperative dialogues that encourage, for example, global adoption of plug-in hybrid engines and sustainable production of biofuels.

Establishing an "Oil Addiction Index"

The "Misery Index" first emerged in the 1970s 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. Yet lowering it was a sensible, easily understood goal.

Today, the United States needs an Oil Addiction Index. One simple measure: oil's share of the transportation fuels market. In 2005, that stood at more than 97 percent. Sharply reducing that percentage—by developing alternative fuels and improving fuel efficiency—should be an important goal for policymakers. Of course this is not the only important goal. Cutting heat trapping gases from the transport sector and reducing household fuel costs are also vitally important. But oil's share of the transportation

fuels market is a critical indicator. The Department of Energy should calculate and publicize this figure annually.

Concluding Observations

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 outlined above were implemented, the nation could end its dangerous and debilitating dependence on oil in a generation. Under reasonable assumptions, plug-in hybrids could replace 45 billion gallons of gasoline by 2025 (Table 1); biofuels could replace roughly 40 billion gallons more; and efficiency technologies could cut fuel use by a third. Reaching these goals would initially cost the federal government several billion dollars per year, increasing to roughly $10 billion per year and declining thereafter. (Table 2).

The problem of oil dependence cannot be solved by tinkering at the margins. An unusual political consensus and game-changing technologies give the next President a rare opportunity to address several of the nation's most important security, environmental and economic challenges.

Table 2. Federal Budget Costs

Expense Category	***Annual Dollar Estimates (in millions)***
Federal purchases of PHEVs	$200
"Grand Bargain" with the Auto Industry	$700
Tax Credits	$2,000 to $8,000
CAFE Reforms	----
E85 Pumps	——
Ethanol Subsidy Reforms (five years only)	$500
Ethanol Tariff Reforms	$0 to $100
Off-Peak Electricity Pricing	——
Climate Protection	——
Research Investments	$1,000
Diplomatic Initiatives	——
Oil Addiction Misery Index	——
TOTAL	***$4,400 to $10,500***

Notes: Costs of the tax credit would start much lower and increase as flex fuel plug-in hybrids became commercially available in large quantity. Ethanol tariff costs based on 2005 imports of 135 million gallons, which produced approximately $73 million in revenues.

About the Author and the Project

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Opportunity 08 aims to help 2008 presidential candidates and the public focus on critical issues facing the nation, presenting policy ideas on a wide array of domestic and foreign policy questions. The project is committed to providing both independent policy solutions and background material on issues of concern to voters.

Additional Resources

Aspen Institute. *A High Growth Strategy for Ethanol*. Report of an Aspen Institute Policy Dialogue, Thomas W. Ewing and R. James Woolsey, co-chairs. Aspen Institute, 2006. Available at http://www.aspeninstitute.org/atf/cf/{DEB6F227-659B-4EC8-8F84-8DF23CA704F5}/EEEethanol1.pdf.

Bailey, Linda. *Public Transportation and Petroleum Savings in the U.S.: Reducing Dependence on Oil.* Report prepared for American Public Transport Association, January 2007. Available at http://www.apta.com/research/info/online/documents/apta_public_transportation_fuel_savings_final_010807.pdf

The California Cars Initiative: http://www.calcars.org.

Council on Foreign Relations, National Security Consequences of Oil Dependence , John Deutch and James Schlesinger, co-chairs (2006)

Hendricks, Bracken 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)

Kalicki, Jan and Goldwyn, David (eds.), Energy and Security: Toward a New Foreign Policy Strategy (Woodrow Wilson Center Press 2005);

Khosla, Vinod. *Imagining the Future of Gasoline.* Draft paper, September 2006. Available at http://www.khoslaventures.com/presentations/ImaginingTomorrowSept2006a.doc.

Lovins, Amory. *Winning the Oil Endgame: Innovation for Profit, Jobs and Security.* Old Snowmass, Colo.: Rocky Mountain Institute, 2005.

Minsk, Ron "Ending Oil Dependence As We Know It: The Case for National Action ,"Progressive Policy Institute report (January 30, 2002) http://www.ppionline.org/documents/ending_oil.pdf

National Academy of Sciences. *Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards*. Washington, D.C.: National Academy Press, 2002. Available at http://www.nap.edu/catalog/10172.html.

Raskin, Amy, and Shah, Saurin. *The Emergence of Hybrid Vehicles: Ending Oil's Stranglehold on Transportation and the Economy.* New York: AllianceBernstein, June 2006. Available at http://www.calcars.org/alliance-bernstein-hybrids-june06.pdf.

Yergin, Daniel "Ensuring Energy Security," Foreign Affairs (March/April 2006)

This is a condensed version of a longer paper. The full paper is available on the Brookings website at http://www.brookings.edu/views/papers/fellows/sandalow20070122.htm