'SET AMERICA FREE'
A BLUEPRINT FOR U.S. ENERGY SECURITY

Introduction

Historically, the United States has pursued a three-pronged strategy for minimizing the vulnerabilities associated with its dependency on oil from unstable and/or hostile nations: diversifying sources of oil, managing inventory in a strategic petroleum reserve and increasing the efficiency of the transportation sector's energy consumption. In recent years, the focus has been principally on finding new and larger sources of petroleum globally.

Rapidly growing worldwide demand for oil, however, has had the effect of largely neutralizing this initiative, depleting existing reserves faster than new, economically exploitable deposits are being brought on line. Under these circumstances, diversification among such sources is but a stop-gap solution that can, at best, have a temporary effect on oil supply and, hence, on national security. Conservation can help, but with oil consumption expected to grow by 60% over the next 25 years, conservation alone will not be a sufficient solution.

The 'Set America Free' Project

Long-term security and economic prosperity requires the creation of a fourth pillar – technological transformation of the transportation sector through what might be called "fuel choice." By leading a multinational effort rooted in the following principles, the United States can *immediately* begin to introduce a global economy based on next-generation fuels and vehicles that can utilize them:

- **Fuel diversification:** Today, consumers can choose among various octanes of gasoline, which accounts for 45% of U.S. oil consumption, or diesel, which accounts for almost another fifth. To these choices can and should promptly be added other fuels that are domestically produced, where possible from waste products, and that are clean and affordable.

- **Real world solutions:** We have no time to wait for commercialization of immature technologies. The United States should implement technologies **that exist today and are ready for widespread use.**

- **Using existing infrastructure:** The focus should be on utilizing competitive technologies that do not require prohibitive or, if possible, even significant investment in changing our transportation sector's infrastructure. Instead, "fuel choice" should permit the maximum possible use of the existing refueling and automotive infrastructure.

- **Domestic resource utilization:** The United States is no longer rich in oil or natural gas. It has, however, a wealth of other energy sources from which transportation fuel can be safely, affordably and cleanly generated. Among them: hundreds of years worth of coal reserves, 25% of the world's total (especially promising with Integrated Gasification and Combined Cycle technologies); billions of tons a year of biomass, and further billions of tons of agricultural and municipal waste. Vehicles that meet consumer needs (e.g., "plug-in" hybrids), can also tap

America's electrical grid to supply energy for transportation, making more efficient use of such clean sources of electricity as solar, wind, geothermal, hydroelectric and nuclear power.

- **Environmentally sensible choices:** The technologies adopted should improve public safety and respond to the public's environmental and health concerns.

Key Elements of the 'Set America Free' Project

► ***Vehicles:***

- **Hybrid electric vehicles:** There are already thousands of vehicles on America's roads that combine hybrid engines powered in an integrated fashion by liquid fuel-powered motors and battery-powered ones. Such vehicles increase gas-consumption efficiency by 30-40%.

- **Ultralight materials:** At least two-thirds of fuel use by a typical consumer vehicle is caused by its weight. Thanks to advances in both metals and plastics, ultralight vehicles can be affordably manufactured with today's technologies and can roughly halve fuel consumption without compromising safety, performance or cost effectiveness.

- **"Plug-in" hybrid electric vehicles:** Plug-in hybrid electric vehicles are also powered by a combination of electricity and liquid fuel. Unlike standard hybrids, however, plug-ins draw charge not only from the engine and captured braking energy, but also directly from the electrical grid by being plugged into standard electric outlets when not in use. Plug-in hybrids have liquid fuel tanks and internal combustion engines, so they do not face the range limitation posed by electric-only cars. Since fifty-percent of cars on the road in the United States are driven 20 miles a day or less, a plug-in with a 20-mile range battery would reduce fuel consumption by, on average, 85%. **Plug-in hybrid electric vehicles can reach fuel economy levels of 100 miles per gallon of gasoline consumed.**

- **Flexible fuel vehicles (FFVs):** FFVs are designed to burn on alcohol, gasoline, or any mixture of the two. About four million FFV's have been manufactured since 1996. The only difference between a conventional car and a flexible fuel vehicle is that the latter is equipped with a different control chip and some different fittings in the fuel line to accommodate the characteristics of alcohol. The marginal additional cost associated with such FFV-associated changes is currently under $100 per vehicle. That cost would be reduced further as volume of FFVs increases, particularly if flexible fuel designs were to become the industry standard.

- **Flexible fuel/plug-in hybrid electric vehicles:** If the two technologies are combined, such vehicles can be powered by blends of alcohol fuels, gasoline, and electricity. If a plug-in vehicle is also a FFV fueled with 80% alcohol and 20% gasoline, fuel economy could reach ***500 miles per gallon*** of gasoline.

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

► ***Fuels:***

- **Fuel additives:** Fuel additives can enhance combustion efficiency by up to 25%. They can be blended into gasoline, diesel and bunker fuel.

- **Electricity as a fuel:** Less than 2% of U.S. electricity is generated from oil, so using electricity as a transportation fuel would greatly reduce dependence on imported petroleum. Plug-in hybrid vehicles would be charged at night in home garages -- a time-interval during which electric utilities have significant excess capacity. **The Electric Power Research Institute estimates that up to 30% of market penetration for plug-in hybrid electric vehicles with 20-mile electric range can be achieved without a need to install additional electricity-generating capacity.**

- **Alcohol fuels: ethanol, methanol and other blends:**

  Ethanol (also known as grain alcohol) is currently produced in the U.S. from corn. The industry currently has a capacity of 3.3 billion gallons a year and has increased on the average of 25% per year over the past three years. Upping production would be achieved by continuing to advance the corn-based ethanol industry and by commercializing the production of ethanol from biomass waste and dedicated energy crops. *P-Series* fuel (approved by the Department of Energy in 1999) is a more energy-efficient blend of ethanol, natural gas liquids and ether made from biomass waste.

  Methanol (also known as wood alcohol) is today for the most part produced from natural gas. Expanding domestic production can be achieved by producing methanol from coal, a resource with which the U.S. is abundantly endowed. The commercial feasibility of coal-to-methanol technology was demonstrated as part of the DOE's "clean coal" technology effort. Currently, methanol is being cleanly produced from coal for under 50 cents a gallon.

  It only costs about $60,000 to add a fuel pump that serves one of the above fuels to an existing refueling station.

- **Non-oil based diesel:** Biodiesel is commercially produced from soybean and other vegetable oils. Diesel can also be made from waste products such as tires and animal byproducts, and is currently commercially produced from turkey offal. Diesel is also commercially produced from coal.

► ***Policy Recommendations:***

- Provide incentives to auto manufacturers to produce and consumers to purchase, hybrid vehicles, plug-in hybrid electric vehicles and FFVs across all vehicle models.

- Provide incentives for auto manufacturers to increase fuel efficiency of existing, non-FFV auto models.

- Conduct extensive testing of next-generation fuels across the vehicle spectrum to meet auto warranty and EPA emission standards.

- Mandate substantial incorporation of plug-ins and FFVs into federal, state, municipal and covered fleets.

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

- Encourage gasoline distributors to blend combustion enhancers into the fuel.

- Provide incentives for existing fueling stations to install pumps that serve all liquid fuels that can be used in the existing transportation infrastructure, and mandate that all new gas stations be so equipped.

- Provide incentives to enable new players, such as utilities, to enter the transportation fuel market, and for the development of environmentally sound exploitation of non-traditional petroleum deposits from stable areas (such as Canadian tar sands).

- Provide incentives for the construction of plants that generate liquid transportation fuels from domestic energy resources, particularly from waste, that can be used in the existing infrastructure.

- Allocate funds for commercial scale demonstration plants that produce next-generation transportation fuels, particularly from waste products.

- Implement federal, state, and local policies to encourage mass transit and reduce vehicle-miles traveled.

- Work with other oil-consuming countries towards distribution of the above-mentioned technologies and overall reduction of reliance on petroleum, particularly from hostile and potentially unstable regions of the world.

A New National Project

In 1942, President Roosevelt launched the Manhattan Project to build an atomic weapon to be ready by 1945 because of threats to America's and to explore the future of nuclear fission. The cost in today's prices was $20 billion. The outcome was an end to the war with Japan, and the beginning of a wide new array of nuclear-based technologies in energy, medical treatment, and other fields.

In 1962, President Kennedy launched the Man to the Moon Project to be achieved by 1969 because of mounting threats to U.S. and international security posed by Soviet space-dominance and to explore outer space. The cost of the Apollo program in today's prices would be well over $100 billion. The outcome was an extraordinary strategic and technological success for the United States. It engendered a wide array of spin-offs that improved virtually every aspect of modern life, including but not limited to transportation, communications, health care, medical treatment, food production and other fields.

The security of the United States, and the world, is no less threatened by oil supply disruptions, price instabilities and shortages. It is imperative that America provide needed leadership by immediately beginning to dramatically reduce its dependence on imported oil. This can be done by embracing the concepts outlined above with a focus on fuel choice, combined with concerted efforts at improving energy efficiency and the increased availability of energy from renewable sources.

The estimated cost of the 'Set America Free' plan over the next 4 years is $12 billion. This would be applied in the following way: $2 billion for automotive manufacturers to cover one-half the costs of building FFV-capability into their new production cars (i.e., roughly 40 million cars at $50 per unit); $1 billion to pay for at least one out of every four existing gas stations to add at least one pump to supply alcohol fuels (an estimated incentive of $20,000 per pump, new pumps costing approximately $60,000 per unit); $2 billion in consumer tax incentives to procure hybrid cars; $2 billion for automotive manufacturers to commercialize plug-in hybrid electric vehicles; $3 billion to construct commercial-scale demonstration plants to produce non-petroleum based liquid fuels (utilizing public-private cost-sharing partnerships to build roughly 25 plants in order to demonstrate the feasibility of various approaches to perform efficiently at full-scale production); and $2 billion to continue work on commercializing fuel cell technology.

Since no major, new scientific advances are necessary to launch this program, such funds can be applied towards increasing the efficiencies of the involved processes. The resulting return-on-investment – in terms of enhanced energy and national security, economic growth, quality of life and environmental protection – should more than pay for the seed money required.