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OIL: OUR FATAL DEPENDENCE

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Photo by Ian Woldie/Getty Images

Ending Our Oil Dependence

Replacing all the oil the U.S. needs will cost less than buying it

By Amory B. Lovins

The United States of America has the world's mightiest economy and most mobile society. Yet the oil that fueled its strength has become its greatest weakness.

Fortunately, this 10,000-gallon-a-second oil habit is also uneconomic, and American business is the greatest force on earth for turning market imperfections into profits.

The United States can *eliminate* its oil dependence and revitalize its economy—not by passing federal laws, taxing fuels, biasing markets, subsidizing favorites, mandating technologies, limiting choices, or crimping lifestyles, but by adopting smart business strategies. If government steers, not rows, then competitive enterprise,

supported by judicious policy and vibrant civil society, can turn the oil challenge into an unprecedented opportunity for wealth creation and common security.

How can this be done? President Ronald Reagan's National Security Advisor, Robert C. McFarlane, wrote in an op-ed in *The Wall Street Journal* published on Dec. 20, 2004 that "perhaps the most rigorous and surely the most dramatic analysis...was tasked by the Pentagon and carried out by...Rocky Mountain Institute, a respected center of hard-headed, market-based research." Three months earlier, my team released that independent, peer-reviewed, 329-page study—*Winning the Oil Endgame: Innovation for Profits, Jobs, and Security*—and posted it with all technical

backup at www.oilendgame.com. More than 170,000 free copies have already been downloaded. Here's a summary. But first, a little history is necessary.

In 1850, oil from the giant whaling industry lit most homes. Yet in the nine years before Drake struck oil in 1859, five-sixths of the whale-oil market vanished: competition elicited cheaper alternatives that the whalers had not expected. They ran out of customers before they ran out of whales, the rest of which were saved by capitalists and technological innovators.

Today, the globe-girdling oil industry seems poised to follow suit. Might oil become uncompetitive even at low prices before it becomes unavailable even at high prices? To find out, my economists, engineers, scientists and consultants added up the modern competitors for the first time. We examined decades' backlog of powerful new technologies for saving and displacing oil. We arranged them in order of increasing cost on a uniform accounting basis. Surprise! The robustly competitive options could save half the oil America uses and substitute cheaper alternatives for the rest, all led by business for profit. The transition beyond oil has three parallel elements:

- **Redouble the efficiency of using oil.**

The United States now gets twice as much GDP per barrel as in 1975, but can wring out twice as much again by applying proven 2004 technologies. Saving each barrel will cost only \$12 (in year-2000 dollars)—less than half what the government forecasts oil will cost in 2025, or a fourth the recent price, so even more efficiency would be worth buying. Conservatively, we valued oil's unmonetized economic, military and environmental costs at zero, and assumed the same activities, vehicle attributes and lifestyles as the government forecast—then found ways to deliver these outcomes with less oil, less money and more brains.

Personal vehicles use 42% of U.S. oil and cause 58% of its forecast growth. Only 1% of their fuel energy moves the driver. Yet George P. Shultz's Foreword to our study says: "Hybrid technology is already on the road and currently increases gas mileage by 50% or more....New, ultralight-but-safe materials can nearly redouble fuel economy at little or no

extra cost....” Ultralight, ultrastrong carbon-fiber composite autobodies (make-able by a technique displayed by a Tier One supplier at the 2005 Detroit Auto Show), backstopped by new lightweight steels, can yield uncompromised, affordable 66-mpg hybrid SUVs and 92-mpg hybrid cars that pay back in three years. The materials’ extra cost is offset by simpler auto-making and smaller propulsion systems. Per pound, the composites can absorb 6–12 times as much crash energy as steel, so by making cars big, which is protective, but not heavy, which is hostile and fuel-wasting, they can save oil *and* lives.

Even without lighter materials, if 2025’s cars and light trucks were only as efficient as 2005’s popular hybrids, they’d save a sixth of forecast oil use, or two Persian Gulfs’ worth. Together, cost-effectively efficient vehicles, factories and buildings can cut U.S. oil use by 29% in 2025, rising to 52% as vehicle stocks turn over.

- **Save half of natural gas at an eighth of today’s market price, and then substitute it for nearly a third of the oil.** Established, highly profitable efficiency techniques can save 12 trillion cubic feet (TCF) of gas a year. In all, 15 TCF a year can be freed up to displace oil, directly or (more efficiently and profitably) via hydrogen. Saving just 1% of U.S. electricity, including peak hours, saves 2% of total gas use and cuts gas prices by 3–4%. By this leverage, just the early savings would make gas affordable and abundant again, cut gas and power bills by \$55 billion a year, and avoid the cost, siting problems and vulnerability of new liquefied natural gas (LNG) terminals and power lines.
- **Replace the last fifth of U.S. oil with modern biofuels.** Two percent of U.S. gasoline today is substituted by costly, heavily subsidized ethanol made from corn-based sugars. Making ethanol instead from the woody parts of plants like switchgrass and poplar doubles the yield while saving capital and energy. Without competing for food crops’ land or water, such “cellulosic ethanol,” plus biodiesel, can cost-effectively displace nearly four million barrels of oil per day, create 750,000 rural jobs, and boost farm income by tens of billions of dollars a year. (Sugarcane ethanol has displaced 25% of Brazil’s gasoline, repaying initial

subsidies 50 times over, and now beats gasoline without subsidy.)

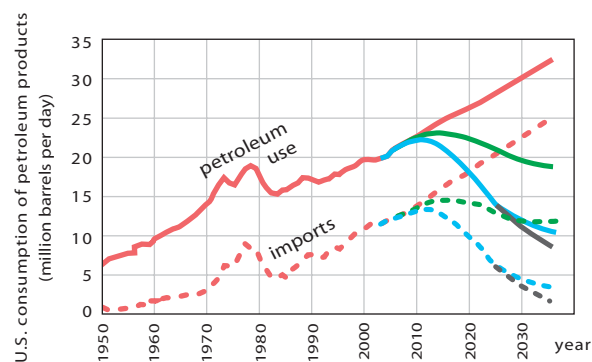
Within two generations, combining these three steps could make a more prosperous and secure America completely oil-free (see graph). This will require \$90 billion of investment to retool the car, truck and plane industries, so that rather than importing efficient vehicles to replace foreign oil, we *make* efficient vehicles and import neither. Building an advanced biofuels industry will take another \$90 billion. This \$180 billion of private investment will by 2025 return *every year* more than \$150 billion gross (\$133 billion of it from saved oil) or \$70 billion net, add a million new jobs, and preserve another million jobs, chiefly automotive, now at risk.

Making America More Competitive

The business case is compelling: cheaper trucking with doubled margins, affordable petrochemical feedstocks and airline fuel, lower and more stable fuel prices for all, and restored American primacy in making cars, trucks and planes. And the alternative is grim. China’s ambitious car-export plans fit Beijing’s new energy policy focused on efficient use and breakthrough technologies. Will China export your uncle’s Buick? More likely you’ll drive home your super-efficient Chinese car from Wal-Mart. The Big Three automakers will be toast unless they adopt advanced efficiency technologies first.

Such “disruptive” business shifts are hard. However, hesitating risks a slow, chaotic transition rife with wars and disruptions. Protecting national competitiveness and security requires instead an orderly transition harnessing America’s strengths in technology and private enterprise, accelerated by light-handed policies that support, not distort, business logic.

Our study therefore suggested modest policy innovations that are market-oriented without taxes, innovation-driven with-



How oil efficiency and substitutions, deployed at historically reasonable rates, can profitably eliminate oil dependence over the next few decades.

Further details at www.oilendgame.com.

out mandates, doable administratively or at a state level (where many are bubbling up), and previously overlooked in Washington. For example:

- “Feebates” for new cars and light trucks combine fees on inefficient models with rebates on efficient ones—all calculated separately within each size class, so one isn’t penalized for choosing an SUV, but rewarded for choosing an *efficient* SUV. Whatever vehicle size you want would offer more choices as the greater price spread between more and less efficient models pulls innovations faster from the lab to the showroom. Feebates encourage you to invest in fuel savings over the vehicle’s life, not just the first few years. Rebates no bigger than current \$4,000–5,000 manufacturer sales incentives would actually make money for producers as well as consumers, and be tried up each year to stay revenue-neutral. The fuel savings would be like buying gasoline at 57¢ a gallon—worthwhile even if the big savings made oil prices plummet.
- Low-income families lack affordable personal mobility—the last frontier of welfare reform. Junking clunkers and creatively financing super-efficient and reliable new cars could cleanse urban air, expand low-income employment opportunities, and create a profitable new million-car-a-year market for advanced-technology vehicles.
- Governments buy hundreds of thou-

sands of light vehicles a year. Smart procurement can speed innovation and reduce automaker's investment risk.

- Innovation-friendly policies like temporary federal loan guarantees (structured to cost the Treasury nothing) can help automakers retool and retrain, and airlines buy efficient airplanes while scrapping inefficient ones.
- Tweaking USDA rules can let profitable biofuels and biomaterials replace loss-making crops and durable revenues replace subsidies, ultimately tripling net farm and ranch income.
- The 48 states that reward gas and electric distribution utilities for selling more energy and penalize them for cutting customers' bills can easily purge this perverse incentive—as state utility commissioners unanimously urged in 1989.
- The military imperative of light, agile, fuel-efficient forces can protect troops and fuel supply lines, save tens of billions of dollars in annual fuel-logistics costs, realign force structures from tail to tooth, avoid poisonous geopolitical rivalries over oil, and ultimately help prevent the fighting of wars over oil.

Being able to treat countries with oil the same as countries without oil, and no longer giving anyone cause to think U.S. actions are about oil, would help defuse global suspicions and conflicts. By modestly shifting its technology budgets and procuring fuel-efficient platforms, the Defense Department could spawn broadly transformative advanced-materials civilian industries—just as it did with the Internet, GPS, and microchips that propel today's economy.

A Better Energy Policy

The required one-time \$180 billion investment, spread reasonably over a decade, averages \$18 billion a year. That's what America now pays for foreign oil every 5–6 weeks. At the forecast 2025 price of \$26 a barrel, the oil saving of \$133 billion a year would act like a large and permanent tax cut, but one that corrects, not exacerbates, today's fiscal imbalances. And the savings would become big even in the first decade.

Rather than sending \$120 billion a year abroad for oil (partly to fund our enemies), we would reinvest it in our own companies and communities, and pocket the surplus. Drilling for oil under Detroit, we would discover a trove of vehicular effi-

ciency bigger than Saudi Arabia's oil output, but all-American, squeaky-clean and inexhaustible.

Our analysis assumed vehicle improvements two-fifths slower than after the 1979 oil shock, and enormously slower than in the 1920s (when autobodies shifted from wood to steel in six years) or in World War II (when Detroit mobilized in six months). Indeed, our proposed oil savings are much slower than America achieved when she last paid attention. During 1977–85, 27% GDP growth was accompanied by 17% lower oil use, 50% lower oil imports, and a stunning 87% drop in Persian Gulf imports. OPEC's sales fell 48%, breaking the cartel's market power for a decade. The United States showed it had more market power than OPEC—but on the demand side: America is the Saudi Arabia of negabarrels, able to save oil faster than OPEC can conveniently sell less oil. Today's potent technologies and policy options could make that old play even more successful.

Automakers are already scrambling to make advanced-technology vehicles, and the oil industry, where I've consulted for 32 years, is generally receptive. Shell's former Chairman, Sir Mark Moody-Stuart, wrote in his Foreword that our study reflects "technical rigour, good humour, and common sense," as well as "refreshingly creative policies... [that] merit serious attention...." Many oil-industry leaders agree that with foresight and supportive policies, they can profitably redeploy assets and skills in the post-petroleum era, as some already do with branded biofuels. The hydrogen in their oil may even be worth more without the carbon than with the carbon (even if nobody pays to keep carbon out of the air), because hydrogen can be used far more efficiently than hydrocarbons.

The result: By 2015, early savings will displace as much annual oil as the United States now gets from the Persian Gulf; then every seven years (at 3% annual GDP growth) can save another Gulf's worth. By 2040, oil imports could be gone. By 2050, the United States economy could be oil-free and thriving, dominant again in transportation equipment. A more effective and efficient but less overstretched military could refocus on protecting American citizens, not foreign pipelines. Rather than prolonging for decades our reliance on the frighteningly vulnerable Trans-Alaska Pipeline to haul oil that's too costly for oil

majors to drill, this grave threat to national energy security could phase out on schedule. Carbon emissions would shrink by one-fourth as a free byproduct of profitable oil savings. Federal budget deficits would shrink slightly, trade deficits vastly. The United States could regain moral stature and esteem as it led a more peaceful world beyond oil.

Oil dependence is a problem America needn't have, and it's cheaper not to. Getting profitably, attractively and completely off oil—led by business, implemented through markets, sped by barrier-busting, boosted technologically by the Pentagon for military effectiveness and conflict prevention—would express America's highest ideals, honor its market and political principles, and enhance its security. Informed citizens will drive this transition as they guide markets, enforce accountability and create grassroots innovation.

A better energy policy process would offer even wider benefits for a stronger country and a safer world. Letting all ways to save or produce energy compete fairly at honest prices—no matter what kind they are, what technology they use, how big they are, or who owns them—is far from today's hogs-at-the-trough approach, but it's what conservative economics demands and what the nation's broad hidden consensus (www.nepinitiative.org) would support.

Mr. Shultz concludes: "We can, as Amory Lovins and his colleagues show vividly, win the oil endgame." Mr. McFarlane concurs: "It is becoming clear...that the means to achieving near-term energy security and ultimate independence from foreign oil are at hand. Courage and leadership are all that it takes to get us there." And the preamble to President George W. Bush's 2001 energy policy statement says it best: "Our country has met many great tests. Some have imposed extreme hardship and sacrifice. Others have demanded only resolve, ingenuity, and clarity of purpose. Such is the case with energy today." ☞

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