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Mobilizing Energy Solutions

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America is at war. The economy is down. Global prosperity, stability, and environment are at risk. Domestic politics are reverting to gridlock, driven by the coming battle for both houses of Congress. And energy policy, strongly polarized, is back on the agenda.

Have we learned anything since the first oil shock in 1973 that could enable our country to craft an energy strategy to make America secure, stimulate the domestic economy, and foster global development? Is there a way to use energy policy to make the world safer, protect the climate, and rebuild national consensus? Is there an approach that makes sense and makes money, solves or avoids many big problems at once without making new ones, advances technology, increases equity, and strengthens competitive markets as well as grass-roots democracy?

There was more at stake in the Gulf War than just oil; but we'd hardly have sent half a million troops there if Kuwait just grew broccoli.

There is, but it requires getting straight what the energy problem is. Until 1976, many thought (and some still do) that the energy problem is simply that we're running out of it. If so, then the urgent task is where to get more energy—more, of any kind, from any source, at any price—to avert the end of life as we know it. This requires government intervention—taxes, subsidies, mandates, new rules—devised by energy experts and politicians who naturally favor familiar technologies and powerful constituencies.

Variations on this theme have been proposed, and many carried out, under every Republican president since Richard Nixon and in part by Democrat Jimmy Carter, who launched the U.S. Synthetic Fuels Corporation. (Oddly, Nixon controlled energy prices and Carter freed them.) Despite devouring many hundreds of billions of dollars, these top-down, supply-centric policies have disappointed. Projecting demand growth and building one's favorite kinds of centralized, costly facilities to meet it—as policy makers do to excess after each drop in supply or spike in price—has proven expensive, financially risky, logistically difficult, and politically unpleasant. With brief exceptions, energy supplies generally have been maintained, but at a rising cost ranging from the Gulf War, global warming, and dismayed stockholders to lung disease, degraded national security, and dependence on the Saudi royal family.

By defining the problem as "we're running out" and the answer as forcing more traditional supply, policy has undercut the real solution that the market has struggled to implement after each energy shock: impartially choosing the cheapest mix of ways to reduce demand or increase supply. The market, being technology-neutral, mainly chooses more efficient use, because it's faster and cheaper. Technology enhances both resources, but it expands efficiency more and faster than it does supply. Thus, invisibly to most policy makers, huge reserves of underutilized efficiency are getting bigger and cheaper, even as reserves of domestic fuels, wrung ever harder by policy, are getting smaller and costlier.

Efficient use is how Americans after the 1979 oil shock cut oil use 15 percent in six years while the economy grew 16 percent. It's part of how Californians cut peak electricity demand per dollar of gross domestic product (adjusted for weather) by 14 percent in six months—a third of customers cut their usage by 20-plus percent—abruptly ending a crisis that the White House claimed would require 1,300 to 1,900 more power plants nationwide.

Supply proponents unfamiliar with the efficiency resource are perplexed when markets choose it and crash their favorite industries with each cycle of price fluctuation and policy response. (That happens pretty often: World oil prices have fluctuated randomly for at least 115 years.) Pushing on supply—pursuing the worst buys first—while the market favors efficiency puts supply industries at risk by amplifying their boom-bust cycle. It also wastes money, loses precious time, and hazards national competitiveness and security.

This mistake can be avoided by asking a different question[1]: Why do people want energy in the first place? Customers don't want lumps of coal, raw kilowatt-hours, or barrels of sticky black goo. Rather, they want the services that energy provides: hot showers and cold beer, mobility and comfort, spinning shafts and energized microchips, baked bread and smelted aluminum. And they want these "end uses" provided in ways that are secure, reliable, safe, healthful, fair, affordable, durable, flexible, and innovation friendly. Is that possible? Of course it is. This empirical question has been answered. Wide and deep experience, documented at home and abroad, demonstrates that these goals can all be achieved simultaneously. Here's how.

Negawatts and Negabarrels

More efficient use is already America's biggest energy source—not oil, gas, coal, or nuclear power. There are many ways to measure progress in saving energy, but even by the broadest and crudest measure—lower primary energy consumption per dollar of real GDP—progress has been dramatic. By 2000, reduced "energy intensity" (compared with 1975) was providing 40 percent of all U.S. energy services. It was 73 percent greater than U.S. oil consumption, five times domestic oil production, three times total oil imports, and 13 times Persian Gulf oil imports. The lower intensity was mostly achieved by more productive use of energy (such as better-insulated houses, better-designed lights and motors, and cars that were safer, cleaner, more powerful, and got more miles per gallon), partly by shifts in the economic mix, and only slightly by behavioral change. Since 1996, saved energy has been the nation's fastest-growing major "source."

Economists, the high priests of energy policy, often assume that markets are essentially perfect and that price is the main or even the only important influence on behavior. If you believe that, then the only way to use less energy is to raise prices. But that's not so. The energy-saving revolution of 1979 to 1985 was undoubtedly spurred by high and rising energy prices. Yet from 1996 to 1999, energy savings were nearly as fast even though energy prices were nearing record lows and falling. Something else was getting our attention.

Price does matter, but ability to respond to price matters even more. Between 1990 and 1996, a kilowatt-hour cost about half as much in Seattle as in Chicago. Yet in percentage terms, electric load was being reduced 12 times as fast, and annual electric use some 3,640 times as fast, in Seattle as in Chicago. That's because utilities helped people save electricity in Seattle but discouraged them in Chicago.

Another example: DuPont recently found that its European chemical plants, though they'd long paid twice the energy prices paid by the company's U.S. plants, were no more energy efficient: All the plants were designed by the same people, using similar processes and equipment. Thus, high energy prices don't guarantee efficient energy use and aren't necessary to achieve it. At today's prices, investing to save much, even most, of the energy used in existing factories and commercial buildings often yields after-tax returns of 100 percent to 200 percent per year while providing improved services. Superefficient new designs often cost less to build than today's inefficient ones. Yet most of these juicy returns aren't being captured, and it's vital to examine why.

Energy can certainly be priced more accurately. But it's more important to enable people to respond to price fully and promptly. Scores of specific obstacles to buying energy efficiency can be turned into business opportunities.[2] A decade ago, for example, roughly nine states rewarded regulated utilities for cutting customers' bills instead of selling more energy. Today only Oregon, soon to be joined by California, still does so; electricity restructuring distracted the rest.[3]

Similarly, architects and engineers are usually paid according to how much they spend, not how much they save; but performance-based fees[4] reward measured savings and yield better-designed buildings. Britain lets businesses write off energy-saving investments against taxable income, exactly as they write off the energy they waste. Such "barrier busting"—tweaking policy so that optimally efficient energy use can compete fully and fairly—would be the top priority of an effective, balanced, market-oriented energy strategy.

In nearly every case, energy efficiency is not costly but profitable: It costs less, usually far less, than the fuel or electricity that it saves. Yet the 40 percent drop in U.S. energy intensity since 1975 has barely dented the potential. The United States has cut annual energy bills by about $200 billion yet is still wasting at least $300 billion a year. That number keeps rising as we learn more about how smarter technologies can wring more and better service from less energy by using less money and more brains.

And the side benefits can be even more valuable—for example, from 6 percent to 16 percent higher labor productivity in energy-efficient buildings.[5]

Energy efficiency is big and robust enough to serve as the centerpiece of national energy policy. For President Carter, it was intentionally so, and its effects lingered for half a decade after his term. Between 1979 and 1986, while GDP grew 20 percent, Americans cut total energy use 5 percent—a 21 percent intensity drop that was five times bigger than the expanded coal and nuclear output at the core of President Reagan's policy.

The Race Is to the Quick

Energy efficiency can come online far faster than expanding energy supply. From 1983 to 1985, the nation's third-largest investor-owned utility was cutting its decade-ahead forecast of peak demand by about 8.5 percent *each year*, at roughly 1 percent of the cost of new supply. Using the marketing techniques of a decade ago, the nation's largest investor-owned utility signed up 25 percent of new commercial construction projects for design improvements in just three months; so it raised its target for the next year—and hit it by January 9. Well-designed efficiency programs have captured up to 99 percent of target markets. A huge literature attests that savings' size and cost can be accurately predicted and measured. Thousands of practitioners' skills are little used beyond the West Coast, though, because perverse utility regulation and restructuring penalize their use.

Efficiency's speed and size made energy prices crash in the mid-1980s. On entering office in 1981, President Reagan stimulated fossil-fuel and nuclear-energy supplies without realizing that the United States was already cutting energy intensity at the record pace of 3.5 percent per year. Five years later, energy efficiency—disdained as an intrusive sacrifice and a wimpy distraction from America's supply prowess—had preempted the markets that were supposed to pay for costly supply expansions. Many of the producers Reagan meant to help were ruined.

This history echoed eerily in 2001 as President George W. Bush sought with similar ardor to stimulate energy supplies, even though in 1996 the United States had quietly resumed saving energy by 3.2 percent a year. Repeating the mid-1980s experiment is already starting to yield the same result.

Panicked by California's 2000–2001 power crisis, developers planned a year ago to add electric generating capacity equivalent to 83 percent of the state's current total demand, 96 percent of the western region's, and at least one-third of the nation's—consistent with Vice President Dick Cheney's call to build at least one power plant a week. But in August 2001, *Barron's* cover story noted the coming glut of electricity (as we'd warned six months earlier). By now, scores of plants have been canceled for lack of demand[6], and their irrationally exuberant builders are reeling as Wall Street, stung by Enron's collapse, downgrades their bonds.

Avoiding boom-and-bust requires understanding its three root causes. First, efficiency costs far less than energy supply, so most people, given the choice, buy it instead. Second, policies that force acquiring *both* these competing investments risk getting both—but then customers will use only one (usually the cheaper one), idling the other. Third, efficiency is far *faster* than new supply. Efficiency reaches the finish line long before big, slow, centralized plants can be built, let alone paid for.

New technologies and implementation methods make efficiency's speed advantage even greater today than it was 20 years ago. In just the first six months of 2001, customers wiped out California's previous five to 10 years of demand growth, taking away new plants' market before they could even be finished. Much of that saving was temporary, but technological improvements, plus quick micropower and wind-farm installations, will probably consolidate their effect permanently.

Contrary to myths that sparked a short-lived power-plant gold-rush, California didn't suffer soaring demand, didn't stop building power plants in the 1990s (those built exceeded the state's nuclear-power capacity), and wasn't short of generating capacity.[7] The same system that met a 53-billion-watt load in summer 1999 couldn't meet a 29-billion-watt load in January 2001—not because half the capacity vanished, but because 10 billion watts called in sick. Nutty restructuring left seven nonutility suppliers controlling two-thirds of the market. Each could make more money by selling less electricity at a higher price, so they did. In this self-inflicted ticket-scalper's paradise, the Federal Energy Regulatory Commission interpreted its core duty—"just and reasonable" wholesale prices—to mean whatever the market would bear. The market performed brilliantly; nobody guarded the public interest. But Californians now realize that their demand-side choices are a potent weapon against speculators and price gougers. The same is true for all Americans—and not just for electricity.

The Fading Oil Economy

America has a big problem with oil—her largest energy source besides efficiency. After pumping up oil longer and faster than any other country, finding and lifting the dwindling oil that's left typically costs more than buying it on the world market from less-depleted nations. Other than a centrally planned economy, there are only three possible responses:

- **protectionism**—help domestic oil to compete by increasing its subsidies or by taxing imports (thereby violating both market principles and free-trade rules);
- **trade**—import the cheaper foreign oil as nearly all countries do, including America's strongest competitors (thereby requiring the importing nation to earn enough through foreign exchange to pay for it—a $109-billion cost to the United States in 2000); or
- **substitution**—do the same tasks with less oil by substituting other energy sources or more efficient use.

The House version of Vice President Cheney's national energy policy greases the skids and adds roughly $26 billion in subsidies for fossil fuels and nuclear power over the next nine years (plus $8 billion for renewable sources and measurable efficiency). This is classic protectionism, favoring marketplace losers over winners. It suppresses energy efficiency by distorting price signals, thus damaging national competitiveness and security. It also pretends that the solution to domestic oil depletion is to deplete faster—a strategy the late conservationist David Brower called "Strength Through Exhaustion."

The House bill focuses on an extravagantly hyped oil-supply mirage that reappears whenever oil prices tick up: drilling for oil beneath the Arctic National Wildlife Refuge.[8] But the U.S. Geological Survey's authoritative, honest, peer-reviewed reassessment found the Refuge's geology ugly. USGS determined that there is probably *no* economically recoverable oil beneath the Refuge—at the moderate oil prices discovered in the futures market, forecast by industry and government, and relied upon by the state of Alaska's revenue forecasts.

At improbably high sustained prices, USGS expected likely reserves averaging about three billion barrels—one-fourth of what Prudhoe Bay has yielded. Starting in about a decade, that could probably provide, over 30 years, less than 1 percent of projected U.S. oil needs—enough to run 2 percent of today's cars and light trucks. For a few years of peak output, it might provide about 1 percent of the world's oil output and cut U.S. oil imports by up to 5 percent. With such modest reserves and inherently high costs, there's no business case for drilling.

The better technology that proponents claim will overcome Refuge oil's cost disadvantage will instead exacerbate it by enhancing competing prospects that are less remote, hostile, and risky. Major oil companies (which we've long advised) have lately slashed exploration investments even as oil prices soared, because they expect advancing technology to keep the world awash in oil that's too cheap for Refuge drilling to beat. They assess a global portfolio of prospects, not just the self-interest of the Alaskan branch office. Not one lusts to drill in the Refuge: The more they examine the USGS analysis and their own secret data, the less interested they get.

Oil-industry strategists understand, too, that it wouldn't take much efficiency to displace those three billion hypothetical barrels. Making the car and light-truck fleet more efficient by 0.4 mpg would save enough gasoline to save that much crude oil[9]; in the early 1980s, that was happening every five months. Refuge oil could be displaced by making 4 percent of the light-vehicle fleet as efficient as the 48-mpg Prius hybrid-electric sedan, by making a fraction of car and light-truck replacement tires as efficient as the originals, or by putting superwindows into a fraction of U.S. buildings. Refuge investment would be especially at risk if oil prices *did* unexpectedly rise high enough to justify it, because then consumers would probably save energy even faster. A tiny fraction of the proven efficiency potential could make Refuge investors lose their shirts, because America's total known oil-saving potential today equals roughly 54 Refuges' worth of oil—at a sixth of its cost.

America's Secret Weapon against OPEC

The last time the United States was paying attention—between 1979 and 1985—GDP grew 16 percent while oil consumption fell 15 percent and Persian Gulf imports fell 87 percent. Had this continued at the same pace, we'd have needed no Gulf oil thereafter. Instead, in 1986, President Reagan's rollback of car and light-truck efficiency standards doubled Gulf imports and wasted the same amount of oil he sought from beneath the

Arctic Refuge. In 1991, with oil imports back up, the United States deployed 0.56-mile-per-gallon Abrams tanks and 17-feet-per-gallon-equivalent aircraft carriers to the Persian Gulf because we hadn't deployed 32-mpg cars at home. The Gulf War cost this country more net dollars than it would have cost to save all the oil imported from the Gulf. To be sure, there was more at stake in the Gulf War than just oil; but we'd hardly have sent half a million troops there if Kuwait just grew broccoli.

The mid-1980s also proved that America could choose to buy less oil faster and on a larger scale than OPEC could adjust to selling less oil. New U.S.-built cars became 7 mpg more efficient in just six years. Other countries did similarly, though via higher fuel taxes rather than efficiency standards.[10] Shrinking demand soon tipped the world oil market in buyers' favor. Between 1977 and 1985, while GDP rose 27 percent, U.S. oil imports fell 42 percent, depriving OPEC of one-eighth of its market. The entire world oil market shrank by one-tenth; OPEC's share was slashed from 52 percent to 30 percent, cutting its output by 48 percent. The United States accounted for one-fourth of that reduction, most importantly through new cars that each drove 1 percent fewer miles on 20 percent fewer gallons. Only 4 percent of those savings came from making the cars smaller.

That 52 percent gain in U.S. oil productivity in eight years demonstrated a strikingly effective new source of energy security and a powerful weapon against OPEC's price gouging. By boosting the nation's oil productivity at will, the United States could exercise more market power than the supply cartel, beat down prices, and enable more secure, diverse, and domestic sources of energy to serve a larger fraction of the reduced needs.

Today, only one-fourth of the oil consumed by the United States comes from OPEC; most imports come from the Western Hemisphere. But the Mideast's increasing reserve concentration, vulnerability, and instability make imports a concern. The greater that concern, the stronger the case for substituting not just any option but the cheapest and fastest one. Indeed, buying anything else will make oil imports bigger and more protracted than they would have been if cheaper, faster options had been purchased instead. The United States made just this error when national policy in the 1970s and 1980s drove utilities to buy $200 billion worth of coal and nuclear-power plants. Buying those instead of cheaper energy efficiency made America continue to import oil, produce nuclear waste and nuclear-bomb materials, and damage the earth's climate.

Efficiency's advantages don't mean it will or should displace all supply. Continued supply is important too. But its traditional emphasis—centralized, high-quality electricity and fuels—poorly matches end-use needs, which are mainly decentralized and for low-quality heat. If supplies are to be chosen by experts, they should match end-use needs. But market choices are better. Lately, the markets have mainly chosen efficient use plus distributed and often renewable supplies. That's good for the economy, the environment, and national security. It also dampens energy suppliers' destructive boom-bust cycles. Part two of this article will outline a national energy policy that harnesses these advantages.

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Annotations to "Mobilizing Energy Solutions"

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(different question)

[1] A.B. Lovins, "Energy Strategy: The Road Not Taken?," *Foreign Affairs* **55**(1):65 (1976). U.S. primary energy consumption in 2000 was within a few percent of the "soft energy path" graph suggested in that controversial 1976 article. See also *Soft Energy Paths: Toward a Durable Peace*, Ballinger/Friends of the Earth (Cambridge MA/San Francisco), 1977, Pelican (UK), 1977, Harper & Row (NY), 1979, and *ca.* 35 responses to critiques, compiled in U.S. Senate Select Committee on Small Business and Committee on Interior & Insular Affairs, *Alternative Long-Range Energy Strategies*, 2 vols., USGPO, 1977, and H. Nash, ed., *The Energy Controversy: Soft Path Questions and Answers*, Friends of the Earth (San Francisco), 1979.

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(turned into business opportunities)

[2] A.B. & L.H. Lovins, *Climate: Making Sense* and *Making Money*, Rocky Mountain Institute, 1997, www.rmi.org/images/other/C-ClimateMSMM.pdf, gives 60–80 examples at pp. 11–20.

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(rewarded)

[3] Roughly 50 U.S. states and territories still reward utilities for selling more energy and penalize them for reducing customers' bills, even though in 1989, the National Association of Regulatory Utility Commissioners unanimously agreed to stop doing so and instead to align utilities' with customers' interests.

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(performance-based fees)

[4] Charles Eley Associates, "New Building Performance Contracting," www.eley.com/perf_cont/prf_intro.htm, reports an Energy Foundation-funded project with Rocky Mountain Institute.

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(higher labor productivity)

[5] That's because workers can see better what they're doing, breathe cleaner air, hear themselves think, and feel more comfortable. Offices typically pay about 100 times as much for people as for energy, so 6–16% higher labor productivity increases profits by about 6–16 times as much as eliminating the entire energy bill. See J.J. Romm & W.D. Browning, "Greening the Building and the Bottom Line," Rocky Mountain Institute, 1994/98, www.rmi.org/images/other/GDS-GBBL.pdf; www.h-m-g.com/Daylighting/daylighting_and_productivity.htm.

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(canceled)

[6] R. Smith, "Power Industry Cuts Plans for New Plants, Posting Risks for Post-Recessionary Period," *Wall St. J.*, p. A3, 4 January 2002, reports data from Energy Insight (Boulder, CO), showing that at least 18%, or 91 out of a total announced portfolio of 504 billion watts planned for construction, had been cancelled or tabled by the end of 2001. (The 504-billion-watt portfolio included longer-term projects than those summarized at the beginning of this paragraph.) Ms. Smith interprets the reductions as likely to

create power shortages; we interpret them as likely to reduce financial losses when demand assumptions prove exaggerated—especially if saving electricity is allowed to compete fairly with producing it.

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(California)

[7] Details are at www.rmi.org/images/other/E-WorldwatchPPT.pdf.

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(Arctic National Wildlife Refuge)

[8] For all details on Arctic Refuge oil, see our July/August 2001 *Foreign Affairs* article "Fool's Gold in Alaska." Its published plain text and a hypertexted and heavily annotated version are both at www.rmi.org/sitepages/pid171.php.

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(0.4 mpg)

[9] This and the comparisons below assume that saving a barrel of gasoline results in saving 2.16 barrels of crude oil, reflecting the U.S. average ratio of refinery crude-oil input to gasoline output in 2000, because marginal crude-oil imports are driven mainly by light-product demand. The oil industry actually handles such shifts in demand in a far more complex and unanalyzable way. However, a 1:1 ratio of crude-oil to gasoline savings is almost certainly too small. During the steepest recorded decline in gasoline demand, 1978–82, inputs of crude oil to U.S. refineries fell 3.58 times as much as their gasoline output declined (or 3.11 times counting blending components together with crude oil).

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(efficiency standards)

[10] The U.S. gains were very largely driven by CAFE standards for cars and analogous ones for light trucks. The standards became law at the end of President Ford's term, effective starting with the 1978 model year for cars and 1979 for light trucks, and were implemented by the Carter Administration.

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