

This may sound too good to be true, but the U.S. has a renewable-energy resource that is perfectly clean, remarkably cheap, surprisingly abundant and immediately available. It has astounding potential to reduce the carbon emissions that threaten our planet, the dependence on foreign oil that threatens our security and the energy costs that threaten our wallets. Unlike coal and petroleum, it doesn't pollute; unlike solar and wind, it doesn't depend on the weather; unlike ethanol, it doesn't accelerate deforestation or inflate food prices; unlike nuclear plants, it doesn't raise uncomfortable questions about meltdowns or terrorist attacks or radioactive-waste storage, and it doesn't take a decade to build. It isn't what-if like hydrogen, dean coal and tidal power; it's already proven to be workable, scalable and cost-effective. And we don't need to import it.

This miracle juice goes by the distinctly boring name of energy efficiency, and it's often ignored in the hubbub over alternative fuels, the nuclear renaissance, T. Boone Pickens and the green-tech economy. Clearly, it needs an agent. But it's a simple concept: wasting less energy. Or more precisely, consuming less energy to get the same amount of heat for your shower, light for your office and power for your factory. It turns out to be much less expensive, destructive and time-intensive to reduce demand through efficiency than to increase supply through new drilling or new power plants. A nationwide push to save "negawatts" instead of building more megawatts could help reverse our unsustainable increases in energy-hogging and carbon-spewing while creating a slew of jobs and saving a load of cash.

Now this may sound like Jimmy Carter's 30-year-old plea for us to turn down the heat and put on sweaters or like an eco-lecture nagging us to turn off lights, drive less and otherwise change our behavior to save energy. It would be nice if we did, but that's conservation, not efficiency. We don't have to sacrifice comfort or change routines to get efficient. Doing less with less may be admirable, but efficiency is about doing the same or more with less. And studies by groups as diverse as the Natural Resources Defense Council (NRDC), the U.S. Chamber of Commerce and even the National Petroleum Council have identified efficiency as the way to start addressing our energy and climate crises. In fact, we've already started; the Alliance to Save Energy calculates that without the efficiency gains we've made since the last energy crisis, in 1973, our economy would use nearly 50% more energy today. That's more

than we get from oil, twice what we get from coal or natural gas and six times what we get from nuclear plants.

But we could save much more. A McKinsey study found that a global effort to boost efficiency with existing technologies could have "spectacular results," eliminating more than 20% of world energy demand by 2020. Efficiency guru Amory Lovins argues that today's best techniques could save the U.S. half our oil and gas and three-fourths of our electricity. That would mean no more imports from the Middle East, lower utility bills for everyone and a big step off our path toward a hotter planet. Honeywell CEO Dave Cote brags that widespread adoption of just his own company's efficiency products could slash U.S. energy use 20%. 'There's a huge amount of low-hanging fruit,' he says.

There are two basic ways to save energy without deprivation or daily effort. We can use more efficient machinery, like fuel-efficient cars that guzzle less gas, or those pigtailed compact fluorescent light bulbs that use 75% less power than traditional bulbs, or state-of-the-art refrigerators that are three times as efficient as 1973 models. We can also use machinery more productively. That can be as simple as insulating pipes and ducts, caulking doors and windows and otherwise weatherizing our homes to avoid heating our attics and the outdoors. Or installing motion sensors and programmable thermostats that turn out lights and air conditioners when no one's in the room. President-elect Barack Obama noted on the campaign trail that if we all just properly inflated our tires and maintained our engines, we could save as much oil now as new offshore drilling would produce by 2030. And since buildings devour two-thirds of our power, commercial and industrial operations can weed out even more waste through green construction and automated systems that practically import power as needed. "We've hit rock bottom in our addiction to fossil fuels," says Ian Bowles, Massachusetts energy and environmental affairs secretary. "We need an intervention, and energy efficiency is it."

Change does seem to be coming. Obama was widely mocked for his tire-inflation comments, but he's still a true believer, calling efficiency "the cheapest, cleanest, fastest energy source." He is also surrounding himself with true believers, including primary rivals Joe Biden, Hillary Clinton and Bill Richardson, as well as his National Security Adviser, James Jones, whose last job was running the Chamber of Commerce's energy institute. Carol Browner, who will be Obama's White House climate czar, promoted aggressive efficiency standards for appliances when she ran the Environmental Protection Agency; Steven Chu, his nominee for energy secretary,

hailed them in a recent speech, declaring that "I cannot impress upon you how important energy efficiency And Obama has pledged to cut 20% of all energy use by the Federal Government, the world's largest consumer; in December, he specifically promised to make public buildings more efficient and modernize the energy grid. "The stars are really aligned for efficiency," says Kateri Callahan, president of the Alliance to Save Energy. "I want to tamp down expectations, but I can't."

Something clearly is changing when companies like IBM, GM, Wal-Mart and Chevron run ads touting their energy-saving commitments, when cities, universities, supermarkets and hospitals race to reduce their carbon footprints. But the national debate has still focused on "drill, baby, drill," a fledgling renewable industry, and a much ballyhooed resurrection of nuclear power. So the near magical potential of efficiency raises an obvious question: If the experts consider it such a win-win no-brainer, why don't we already do more of it?

Part of the answer involves marketing; even superefficient motors, boilers, routers and compressors lack a wow factor, and politicians don't get to cut ribbons for efficiency tweaks. But most of the answer involves money. Efficiency's growth has been stunted by perverse financial disincentives that we need to understand and untangle if we want to avoid a future of unaffordable new plants, catastrophic new emissions and dangerous dependence on dictatorial oil merchants. The recent collapse in oil prices has eroded the sense of emergency, but our economy, our security and our planet still need the ambulance. "A lot of simple answers are just sitting around waiting for us to execute,' says Tom Reddoch, an efficiency expert at the Electric Power Research Institute (EPRI). "But the execution part isn't so simple."

Wasting Our Energy

We complain about the cost of our energy, but we still throw away most of **it**. Our power plants, for example, waste enough energy to power Japan. Only 4% of the energy used to **run** a typical incandescent bulb produces light; the rest is frittered away as heat at the plant, over transmission lines or in the bulb itself, which is why you burn your fingers when you touch it. Our cars, water heaters and industrial motors are still embarrassingly inefficient compared with Japanese and European models.

Our new fridges, dryers and air conditioners are quite efficient, but most of us still use old ones, and even our new consumer electronics — the fastest-growing segment of power demand — slurp alarming quantities of juice. On a tour of EPRI's energy-efficiency lab in Knoxville, Tenn., Reddoch showed me how those inconspicuous set-top boxes on our televisions use half as much energy as refrigerators whether they're on or off. And video-game consoles devour two fridges' worth of electricity when your

kids leave them on, which they probably do, because manufacturers ship them with the auto power-down disabled. 'We're throwing money down the toilet,' Reddoch says.

Experts have identified dozens of attractive targets for eliminating waste, from streetlights to servers. And with the Department of Energy predicting a 30% increase in power demand in America by 2030, the utilities that will supply the extra wattage are keenly aware that the cheapest new plant is the one they don't have to build. Duke Energy has proclaimed efficiency its "fifth fuel," unveiling ambitious plans to help its customers retrofit their homes and buildings and buy more efficient appliances and equipment. "We're really excited to get into this market," says Ted Schultz, Duke's vice president for energy efficiency. 'We're ready to roll.'

But Duke isn't rolling yet — because it would shaft its shareholders if it really helped customers save energy. In most states, utilities reap more profits if they sell more power; also, they are guaranteed generous returns on their investments in new generating plants. But not on their investments in efficiency, which is why Duke is mostly limiting its efforts to demonstration projects until state regulators agree to change the rules. 'If there's no return on investment, it's not much of an investment,' Schultz says.

The best evidence that these disincentives matter is the record of California and the Pacific Northwest, where they don't exist. In that part of the country, utilities have been aggressive promoters of efficiency, and per-capita electricity use has been stable for three decades — while soaring 20% in the rest of the country. Now utilities expect to make another \$2 trillion in capital investments over the next two decades to meet rising demand, and most of them have no incentive to invest in efficiency.

There are also disincentives on the demand side. Most efficiency investments pay for themselves within three years, but all require at least some up-front costs. So developers are less likely to install smart heating and cooling systems controlled by cutting-edge optimization software when they're not going to get stuck with a building's energy bills, just as landlords are less motivated to splurge on Energy Star washer-dryers when their tenants enjoy the savings. Even home and business owners who do reap the benefits of efficiency are often reluctant to shell out for top-of-the-line furnaces, thicker windows, reflective roofs or front-loading washers in a brutal economy. "People want cheap," says Honeywell's Cote. Those \$3 twisty bulbs are a classic example: they last eight times as long as regular bulbs and their payback period are a few months, but after several years of impressive growth, their sales dropped 28% last quarter. "I'm afraid cash is king," says Kaj den Daas of Philips Lighting. "If you live paycheck to paycheck, a few cents up front makes a difference.'

But it's becoming clear that when incentives are properly aligned, efficiency happens, and innovation does too. Companies like DuPont, Dow, Cisco and Wal-Mart have all saved big bucks by greening buildings, vehicles and operations, and a burgeoning industry of high-tech energy-services companies is helping businesses reduce their energy bills in exchange for a slice of the verifiable savings. At Honeywell, a \$36.6 billion company, half its portfolio is now related to efficiency. And even utilities that lack incentives to reduce overall demand are trying to reduce peak demand so that they don't have to turn on costly plants or buy expensive power on the open market. That search for demand response has inspired smart meters and other gadgets that help customers monitor and control their energy consumption, as well as automated systems that use wireless sensors and smarter optimization software to maximize efficiency through a kind of energy-use cruise control. In one case, Duke helped a beer distributor precool his refrigerators overnight, saving him \$150,000 a year while reducing Duke's peak loads. Utilities also outsource demand response to firms like Boston-based EnerNOC, which pays supermarkets, hotels and other large consumers to let it dim lights or adjust heat or shut down elevator banks at peak hours. EnerNOC can now reduce 1,800 megawatts' worth of consumption on command — the equivalent of two medium-size power plants. "Saving energy can be lucrative," says CEO Tim Healy. "We just need to get the incentives right."

The Silver Bullet

Unfortunately, money has also created a political disincentive. Thanks to furious lobbying by the Detroit Three, fuel-efficiency standards have stagnated, while Big Oil, King Coal and utilities have wired Washington and state capitals for policies promoting more electricity supply. There hasn't been a big-business counterweight pushing for less demand for fuel and power. So while everyone pays lip service to efficiency, the political world has focused on expanding drilling for oil and gas, relaxing pollution rules for coal and showering subsidies on nuclear and biofuels as well as less controversial renewables like wind and solar. The Washington consensus has been that we need to do all of the above to solve all our problems — and increase efficiency too — because there's no silver bullet.

But as we enter a new age of economic and environmental limits, not all solutions are created equal. Coal and oil are too dirty. Nuclear and solar are too costly. Wind is our fastest-growing source of new energy, but it's still only some 1% of our supply.

Efficiency is the only cost-effective energy source that addresses global warming, energy dependence and volatile prices. It may not be a silver bullet, but it's the best bullet we've got; we shouldn't spend billions on evidently inferior bullets until we've really given this one a shot.

Here's how:

Set tough standards. History has shown that when the government mandates efficiency, the market figures out how to achieve it. Fuel-efficiency standards were a hit in the 1970s, but the Big Three have fought off upgrades ever since by claiming that federal meddling would ruin their businesses, which they apparently preferred to do themselves. Obama has proposed annual 4% increases, a clearly achievable goal with lighter cars, more hybrids and gradual adoption of plug-ins. Similarly, California's strict building codes have promoted airtight shells, orientation that exploits natural heat and light, and efficient windows and appliances.

Appliance standards have been another success story; manufacturers always squeal when they're proposed but end up designing products that are not only more efficient but cheaper. But new proposals have languished in the Bush Administration, which routinely missed deadlines until it lost a lawsuit to environmentalists and is now finally adopting a few wimpy standards. Google.org energy director Dan Reicher, a member of Obama's transition team, says most furnaces on the market already meet the Bush team's latest proposal — and that its standards for boilers and transformers would be even weaker than proposals publicly endorsed by the industry. "In the Obama Administration, you're going to see a much, much stronger commitment," Reicher says.

Let utilities make money saving energy. Six states have already decoupled electricity profits from sales volume to give utilities incentives to eliminate energy waste, and nine more may follow. Regulated utilities should also be assured a reasonable rate of return on their investments in efficiency improvements for their customers, just as they are for other capital investments. And nine states already require utilities to meet a percentage of future load growth through efficiency; the American Council for an Energy-Efficient Economy says a tough national standard could eliminate the need for 450 power plants by 2020. At a meeting of the nation's utility commissioners in November, NRDC and the Edison Electric Institute issued a joint call for states to overhaul energy incentives in order to promote 'the increasingly urgent mutual goal' of efficiency. "That's a real milestone," says Ralph Cavanagh, a co-director of NRDC's energy programs. "The utilities want in on this."

Of course, cap-and-trade or any other national effort to price carbon would adjust incentives as well, which is one reason utilities are already showing so much interest in efficiency. "For a long time, the industry lost interest in the demand side," says Reddoch, whose institute is funded by utilities. "But now the enthusiasm is sky-high."

Stimulate the market. Mandates provide a big stick, but money is still the best carrot, and Obama has suggested that he wants to spend lots of it to promote

efficiency. He has promised that his gargantuan economic-stimulus plan will include smart meters and other elements of a smart grid that could someday keep your air conditioner off until your BlackBerry lets it know you're almost home. He also plans a dramatic expansion of a low-income weatherization program to retrofit 1 million homes a year and is considering incentives for retrofitting inefficient buildings, buying highly efficient appliances and building co-generation plants that help turn waste heat into energy. The idea is that spending money now and saving money later should both help the economy.

The most common knock on efficiency is that it can't possibly reduce our consumption enough to reverse our energy growth or stop global warming, not when the average U.S. household has 26 plug-in devices and China is building the equivalent of two new coal plants every week. Most studies suggest that efficiency can dramatically slow but not erase projected growth in energy demand and emissions. But those studies were conducted before the economy tanked. And most measured U.S. efficiency potential with status-quo assumptions, which is like trying to measure our industrial potential before World War II: it's hard to guess how a major crisis and a committed leader can mobilize the country and rearrange notions of what's possible. "The limits of efficiency have never been tested," says NRDC's David Goldstein. "We've run out of political will long before we've run out of opportunity.' Even if we refuse to put on sweaters, a national efficiency crusade combined with a prolonged recession could throttle energy demand enough to delay the need for new power, while the rapid growth of wind power could replace the dirtiest coal plants. 'Maybe we could buy enough time until solar matures," Goldstein says.

Still, it's true that efficiency alone probably won't save the world. But real efficiency combined with a real shift toward conservation — carpooling, telecommuting, recycling, running dishwashers full, downsizing McMansions and, yes, adjusting thermostats — well, that might do the trick. We need to squeeze more energy out of every electron. But pardon the ecolecture: if we really want to save the world, we might have to put on a sweater too.