

The New Power Generation

Soccer moms, taco shops, even real estate developers - mainstream America is starting to pull the plug and rely on homegrown solar energy. Call it the dawn of the hybrid age.

By Daniel H. Pink

In the old days, being green meant being hardcore. Earnest enviros plugged their poky electric cars into the wall like four-wheeled toaster ovens. They bought organic food at dusty co-ops staffed by vegan clerks in hemp ponchos. And if they were really serious, they disconnected from planet-ravaging modernity altogether and lived in a creaky cabin off the grid.

Today, hardcore has given way to hybrid. Soccer moms tool around in the Toyota Prius, with its nifty gas-electric engine that saves both fossil fuel and family funds. The suburbs are stuffed with flexitarians - mostly-veggies who pick up their staples from the gleaming organic produce section at the local Whole Foods but also opt for an occasional free-range-chicken breast.

Now come the first stirrings of what may be the most telling sign of this shift from hardcore to hybrid: people who are both middle of the road and off the grid. Across the US some 185,000 households have switched from the local power company to their own homegrown, renewable energy. The fastest-growing segment of this population - their ranks are doubling each year - isn't doing a full Kaczynski. Sure, these folks are slapping solar panels on the roof and erecting the occasional wind turbine, but they're staying connected to the grid, just to be safe. And in many cases, they're operating as mini-utilities, selling excess electricity back to the power company. Just as their cars aren't kludgy and their food isn't flavorless, their homes aren't drafty or dimly lit. Call them hybriders. And look for them soon in a neighborhood near you. Because - trendmeisters, take note - hybrid is the new Prius.

Three hours northwest of Indianapolis, plopped in the middle of an ocean of cornfields, sits the unincorporated village of Stelle, Illinois, population 110. Steve and Jan Bell make their home here, on Tamarind Court, in an ordinary house with blue siding, a tidy front yard, and an attached garage. There's a 32-inch Sony in the rec room, family photos in the living room, a Kitchen Aid double oven and a hefty Amana refrigerator. Steve, a 52-year-old former firefighter with thinning reddish-blond hair and a neatly

trimmed beard, rounds out the picture of Midwestern normalcy. The Sunday afternoon that we meet, he's wearing jeans and a floral patterned shirt - just a regular middle-class guy spending the weekend helping a friend move, mowing the lawn, and tinkering in his basement.

In the backyard, the scene is less ordinary. Standing 115 feet tall, a wind turbine gazes out on the surrounding cornfields. Next to it is a 14-foot solar tracker - 880 watts' worth of photovoltaic panels that follow the sun atop a swivel pole. There are 28 more panels on the roof. All this feeds into a basement power plant. The alt-energy control center features an inverter, about the size of a PC tower, that converts sun and wind energy into AC current to run the lights and appliances. A bank of 24 batteries, each about 160 pounds, stores the electricity for later use.

On cloudy or windless days, the Bells rely on the batteries and then, when they run dry, draw juice from the Commonwealth Edison grid. But when the wind blows or the sun shines, their homegrown energy powers the house. And if their turbine and solar panels are producing more electricity than they need or can store in their battery bank, the couple sells the excess to ComEd.

The Bells prefer to live autonomously. They heat their home with a wood-burning stove. Their hot water, dryer, and stove use liquid propane. When I ask about their energy costs, Steve grabs some old electric bills and a pocket calculator and we take a seat at the dining room table.

In the last year, he figures, he purchased about 4,400 kilowatt-hours of electricity and sold back about 2,400 kilowatt-hours. For approximately five months in 2004, his electricity bill was zero. He pecks at the calculator to add the heating expenses, then taps a few more keys and scribbles a figure on his notepad. Last year, the total cost of electricity and gas to run this perfectly ordinary, perfectly comfortable 2,200-square-foot home was \$340. The typical American household spends about \$1,400 annually on heat and electric utilities. But by living neither totally on the grid nor totally off it, the Bells met all their heating and electricity needs for a full year for about the price of an iPod.

The electricity meter is one of those things that homeowners scarcely think about. Each time you flick a light switch or turn on a coffeemaker, your meter creeps forward a bit, registering the inflow of energy and charging you for it. But the sun is shining on Maplewood Court this afternoon, so I'm stationed in the bushes outside Robert Candey's ranch house to watch his Westinghouse meter perform a little hybrid magic.

Candey, who lives with his wife, Amy Hansen, outside the nation's capital in Greenbelt, Maryland, has 48 solar panels on his roof and a grid-tied inverter in the basement. On this sunny, temperate day, the Candey's are producing more electricity than their home uses; they've already topped off their batteries. When I first begin staring at their meter, the dial - think of it as an electricity odometer - reads 4,561 kilowatt-hours. Then the silver platter in the center of the device begins slowly spinning from right to left, instead of its usual left-to-right course. Three minutes later, the dial clicks. Presto! 4,560 kilowatt-hours. Welcome to the Candey Utility Company.

What's going on in Greenbelt could soon be unfolding in suburbs across America. A combination of forces is pushing hybridizing into the mainstream. Start with the cost of energy. Most US homes use natural gas for heat. Natural gas prices have been soaring. So has the price of electricity produced by coal-burning power plants. And that's not even factoring in the more than \$1 billion in subsidies that go to the oil and gas industry, or the environmental damage - increased greenhouse emissions and mercury pollution - caused by burning fossil fuels.

At the same time, the conventional power grid is showing signs of age. Energy use has increased far

more quickly than capacity has been added. So blackouts and brownouts occur more often. According to Jay Apt, director of the Electricity Industry Center at Carnegie Mellon University, every four months the US endures a blackout large enough to cut power to half a million homes. Add the threat of terrorism, and homeowners understandably want greater security and control over their power. "I'd rather do it myself than trust the experts," Bell says. When the grid goes down, his lights stay on.

Of course, alternative energy has been the next big thing for the past 40 years. But solar power has never been able to shake a couple of problems. First, converting the sun's light energy is expensive. As recently as 1980, the cost of using photovoltaic panels to turn sunlight into electricity was \$1 per kilowatt-hour. By 1995, that figure had fallen by two-thirds to 33 cents. But that was still more than eight times the cost of using coal. Only a handful of hardcore greens were willing to multiply their energy bills by eight to save the planet. Thanks to advances in technology and changes in public policy over the past 10 years, however, the cost of solar has nearly halved again and continues to fall, according to the US National Renewable Energy Laboratory. Solar thermal - using sun energy to heat water - now costs in the range of 6.5 cents per kilowatt-hour, one-tenth of its price 25 years ago. And more progress appears to be on the way. Several companies are using nanotechnology to develop solar cells the thickness of Saran Wrap that are even more efficient, easier to install on roofs, and cheaper to produce.

Still, going hybrid remains a comparatively pricey proposition. Bell spent more than \$15,000 on his solar modules, almost the same amount for the rest of the system, including the wind turbine, plus \$5,000 for two inverters. But several states have stepped in to subsidize homeowners who want to deploy renewable energy. For instance, Illinois cut the Bells a \$12,800 check. The Candey's bought \$12,000 worth of solar panels but paid only \$8,500 after a rebate from the state of Virginia, where the panels were manufactured. And the state of Maryland gave them a \$3,600 grant, plus a 15 percent tax refund. All this brought the actual cost down to \$3,625. At that price, their hybrid system will pay for itself in reduced utility bills in six years. Meantime, New Jersey subsidizes up to 70 percent of the cost of a new home solar system. Massachusetts and New York offer substantial rebates. California governor Arnold Schwarzenegger recently proposed additional subsidies and tax credits to cover a million California rooftops with solar panels.

Sun power, of course, has a more fundamental disadvantage. It's called nighttime. The modern world may depend on power 24/7, but the sun operates on its own schedule. So to make this option truly viable, homeowners need to store the energy made while the sun is shining. Until recently, the only storage receptacles were batteries like the ones Steve Bell has in his basement. In general, these units cost a lot and store only a little. Bell's bank of 24 batteries, for instance, could power his house for just five to six days.

However, the grid itself is in many ways a gigantic battery. If homeowners could fill up their individual batteries and feed the surplus back to the grid, they wouldn't waste their excess energy and they'd even help reduce demand on the grid. Transferring power from a home source to the grid in this way wasn't legal in many states until recently. But today 37 states have laws or provisions for "net metering." And the grid-tied inverters that enable the process - hard to find only a handful of years ago - have become widely available.

Now if hybriders produce more energy than they can use or store, local utilities are required to buy it from them and credit their electric bills. This has created a growing network of mini power plants that supply renewable energy to their less environmentally enlightened neighbors. "If I can grow tomatoes in my backyard," says Richard Perez, publisher of *Home Power* magazine, "I can now grow electricity on my roof."

Of course, it's still much easier to buy a hybrid car than to outfit a hybrid home. Steve Bell is a self-described tinkerer who found configuring his home so interesting that he went to work for a solar company. Robert Candey is no techno-slouch either; he works at Goddard Space Flight Center. But as word spreads, technology improves, and costs drop, hybrid power, like the hybrid car, will become another form of low-hassle environmentalism that lets people have their eco-cake and eat it, too.

It's lunchtime on Belmont Avenue - a bustling artery of laundromats, used-car dealerships, and Polish-American video stores that runs through the heart of a working-class, multiethnic neighborhood on Chicago's west side. A crowd files into the Taco Burrito King, where a cashier takes orders in English and Spanish and a cook chops chicken and onions that will eventually make their way into burritos. It could be just another Monday lunch rush at any one of hundreds of Windy City taquerias - except for what's happening on the roof. Up there, smiling southward into the noontime sun, are nine giant solar panels.

Salvador Lamas wears the crown of the Taco Burrito King, a chain of five restaurants. His motivation for going solar is simple: He was paying through the nose to heat 500 gallons of water every day. So he dropped \$30,000 on a local contractor called Solar Service, received a \$5,000 rebate from Illinois' renewable energy fund, and installed the panels on the roof of his Belmont Avenue building, the newest restaurant in the chain.

Lamas now saves money by heating water directly with solar thermal. He also saves indirectly, by consolidating the prep work for the entire chain - washing and cooking vegetables, for example - where the energy comes cheapest. As a result, he saves close to \$2,000 a month. At that rate, his investment will pay for itself in less than five years. "It's good for everybody," he says. "And it can actually make you money."

That's why real estate developers - not exactly your classic tree-huggers - have begun building solar-powered hybrid developments in Arizona, California, and Virginia. It's why the amount of captured solar energy is expected to nearly quintuple by 2010, as baby boom renovators look for easy, cost-effective ways to go green without going crazy. It's why architects such as Noel Cross, who lives in San Jose, California, in a breathtaking hybrid home he designed himself, are turning their attention to this area. "The stuff that came out the '60s and '70s was little hippie shacks," he says. "I want to build beautiful buildings."

Today's standard mode of creating energy - burning carbon and distributing it over long distances - requires a massive infrastructure and triggers what economists call externalities (and the rest of us call pollution). Yet while power generation has remained largely centralized, much of the rest of society has become decentralized - sometimes radically so. Think peer-to-peer networks, open source, and, of course, the Internet.

The US derives less than 2 percent of its energy from solar and wind power. But hybriders will nudge that figure upward and, in doing so, will further decentralize power (both electric and political) in the US. After all, sunlight is free. It doesn't pollute. It has no need for armies to protect it or pipelines to distribute it. And enough of it falls on Earth each hour to meet the world's energy demands for one year. Clean, free, plentiful, and - finally - practical. Not bad for an energy source.

The hybrid movement has the makings of something big - the sort of market revolution that is born of a confluence of timing, technology, and politics, and is led by a few path-clearing pioneers. "Other energy - once you use it, it's gone. The sun is always there," Lamas says. "If we don't use it, shame on us."

In hybrid times, perhaps we can all live like the Taco King.

Daniel H. Pink (www.danpink.com) is a Wired contributing editor.