

Future Power



Where on Earth can our energy-hungry society turn to replace oil, coal, and natural gas?

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Freedom!

I stand in a cluttered room surrounded by the debris of electrical enthusiasm: wire peelings, snippets of copper, yellow connectors, insulated pliers. For me these are the tools of freedom. I have just installed a dozen solar panels on my roof, and they work. A meter shows that 1,285 watts of power are blasting straight from the sun into my system, charging my batteries, cooling my refrigerator, humming through my computer, liberating my life.

The euphoria of energy freedom is addictive. Don't get me wrong; I love fossil fuels. I live on an island that happens to have no utilities, but otherwise my wife and I have a normal American life. We don't want propane refrigerators, kerosene lamps, or composting toilets. We want a lot of electrical outlets and a cappuccino maker. But when I turn on those panels, wow!

Maybe that's because for me, as for most Americans, one energy crisis or another has shadowed most of the past three decades. From the OPEC crunch of the 1970s to the skyrocketing cost of oil and gasoline today, the world's concern over energy has haunted presidential speeches, congressional campaigns, disaster books, and my own sense of well-being with the same kind of gnawing unease that characterized the Cold War.

As National Geographic reported in June 2004, oil, no longer cheap, may soon decline. Instability where most oil is found, from the Persian Gulf to Nigeria to Venezuela, makes this lifeline fragile. Natural gas can be hard to transport and is prone to shortages. We won't run out of coal anytime soon, or the largely untapped deposits of tar sands and oil shale. But it's clear that the carbon dioxide spewed by coal and other fossil fuels is warming the planet, as this magazine reported last September.

Cutting loose from that worry is enticing. With my new panels, nothing stands between me and limitless energy—no foreign nation, no power company, no carbon-emission guilt. I'm free!

Well, almost. Here comes a cloud.

Shade steals across my panels and over my heart. The meter shows only 120 watts. I'm going to have to start the generator and burn some more gasoline. This isn't going to be easy after all.

The trouble with energy freedom is that it's addictive; when you get a little, you want a lot. In microcosm I'm like people in government, industry, and private life all over the world, who have tasted a bit of this curious and compelling kind of liberty and are determined to find more.

Some experts think this pursuit is even more important than the war on terrorism. "Terrorism doesn't threaten the viability of the heart of our high-technology lifestyle," says Martin Hoffert, a professor of physics at New York University. "But energy really does."

Energy conservation can stave off the day of reckoning, but in the end you can't conserve what you don't have. So Hoffert and others have no doubt: It's time to step up the search for the next great fuel for the hungry engine of humankind.

Is there such a fuel? The short answer is no. Experts say it like a mantra: "There is no silver bullet." Though a few true believers claim that only vast conspiracies or lack of funds stand between us and endless energy from the vacuum of space or the core of the Earth, the truth is that there's no single great new fuel waiting in the heart of an equation or at the end of a drill bit.

Enthusiasm about hydrogen-fueled cars may give the wrong impression. Hydrogen is not a source of energy. It's found along with oxygen in plain old water, but it isn't there for the taking. Hydrogen has to be freed before it is useful, and that costs more energy than the hydrogen gives back. These days, this energy comes mostly from fossil fuels. No silver bullet there.

The long answer about our next fuel is not so grim, however. In fact, plenty of contenders for the energy crown now held by fossil fuels are already at hand: wind, solar, even nuclear, to name a few. But the successor will have to be a congress, not a king. Virtually every energy expert I met did something unexpected: He pushed not just his own specialty but everyone else's too.

"We're going to need everything we can get from biomass, everything we can get from solar, everything we can get from wind," says Michael Pacheco, director of the National Bioenergy Center, part of the National Renewable Energy Laboratories (NREL) in Golden, Colorado. "And still the question is, can we get enough?"

The big problem is big numbers. The world uses some 320 billion kilowatt-hours of energy a day. It's equal to about 22 bulbs burning nonstop for every person on the planet. No wonder the sparkle is seen from space. Hoffert's team estimates that within the next century humanity could use three times that much. Fossil fuels have met the growing demand because they pack millions of years of the sun's energy into a compact form, but we will not find their like again.

Fired up by my taste of energy freedom, I went looking for technologies that can address those numbers. "If you have a big problem, you must give a big answer," says a genial energy guru named Hermann Scheer, a member of the German parliament. "Otherwise people don't believe."

The answers are out there. But they all require one more thing of us humans who huddle around the fossil fuel fire: We're going to have to make a big leap—toward a different kind of world.

- Solar
- Wind
- Biomass
- Nuclear
- Fusion

As all energy experts will tell you, this proves a well-established theory. There's only one force tougher to manage than plasma: politics.

Although some politicians believe the task of developing the new energy technologies should be left to market forces, many experts disagree. That's not just because it's expensive to get new technology started, but also because government can often take risks that private enterprise won't.

"Most of the modern technology that has been driving the U.S. economy did not come spontaneously from market forces," NYU's Martin Hoffert says, ticking off jet planes, satellite communications, integrated circuits, computers. "The Internet was supported for 20 years by the military and for 10 more years by the National Science Foundation before Wall Street found it."

Without a big push from government, he says, we may be condemned to rely on increasingly dirty fossil fuels as cleaner ones like oil and gas run out, with dire consequences for the climate. "If we don't have a proactive energy policy," he says, "we'll just wind up using coal, then shale, then tar sands, and it will be a continually diminishing return, and eventually our civilization will collapse. But it doesn't have to end that way. We have a choice."

It's a matter of self-interest, says Hermann Scheer, the German member of parliament. "I don't appeal to the people to change their conscience," he said in his Berlin office, where a small model of a wind turbine turned lazily in a window. "You can't go around like a priest." Instead, his message is that nurturing new forms of energy is necessary for an environmentally and economically sound future. "There is no alternative."

Already, change is rising from the grass roots. In the U.S., state and local governments are pushing alternative energies by offering subsidies and requiring that utility companies include renewable sources in their plans. And in Europe financial incentives for both wind and solar energy have broad support even though they raise electric bills.

Alternative energy is also catching on in parts of the developing world where it's a necessity, not a choice. Solar power, for example, is making inroads in African communities lacking power lines and generators. "If you want to overcome poverty, what do people need to focus on?" asks Germany's environment minister, Jürgen Trittin. "They need fresh water and they need energy. For filling the needs of remote villages, renewable energy is highly competitive."

In developed countries there's a sense that alternative energy—once seen as a quaint hippie enthusiasm—is no longer alternative culture. It's edging into the mainstream. The excitement of energy freedom seems contagious.

One afternoon last year, near a village north of Munich, a small group of townspeople and workers inaugurated a solar facility. It would soon surpass the Leipzig field as the largest in the world, with six megawatts of power.

About 15 people gathered on a little man-made hill beside the solar farm and planted four cherry trees on the summit. The mayor of the tidy nearby town brought out souvenir bottles of schnapps. Almost everyone had a swig, including the mayor.

Then he said he would sing to the project's construction supervisor and a landscape artist, both American women. The two women stood together, grinning, with the field of solar panels soaking up energy behind them. The German mayor straightened his dark suit, and the other men leaned on their shovels.

Fifty years ago, I thought, there were still bombed-out ruins in the cities of Europe. The Soviet Union was planning Sputnik. Texas oil was \$2.82 a barrel. At the most, we have 50 years to make the world over again. But people change, adapt, and make crazy new stuff work. I thought about Dan Shugar talking about disruptive technologies. "There's a sense of excitement," he had said. "There's a sense of urgency. There's a sense that we cannot fail."

On the hilltop, the mayor took a deep breath. He sang, in a booming tenor, without missing a note or a word, the entire song "O Sole Mio." Everyone cheered.