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The Hydrogen Gold Rush Is On

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Move over, Ben Franklin. Todd Livingstone has a plan to solve the energy crisis by capturing huge amounts of energy from lightning.

The idea itself is not new. But Livingstone, an inventor and electronics technician from Boston -- the town where Benjamin Franklin was born 300 years ago next month -- has added a unique twist. Using lasers to capture lightning bolts, he wants to channel them through a large tank of water, producing near-limitless amounts of hydrogen.

The implications, says Livingstone, are "mind-boggling." Put up a network of lasers in a lightning-prone area like Florida, he says, convert that energy into hydrogen, "and we could create more energy than the world needs."

Livingstone has a small-scale prototype of the system and a patent application on file with the U.S. Patent and Trademark Office. He's busy negotiating with potential investors.

There's only one problem. His system, according to knowledgeable scientists, probably won't work any time soon. So far, at least, lasers can't capture lightning.

Livingstone isn't the only person with a scheme to save the world through hydrogen. The last two years has seen a boom in hydrogen investment. In 2003, President Bush announced that the federal government would invest $1.2 billion into hydrogen over the next five years. General Motors has said it is spending at least a billion dollars on hydrogen and fuel-cell technologies, and companies like BP, Chevron and Shell are also making significant investments.

All that money has spawned a gold rush of inventors, all seeking the mother lode of cheap hydrogen. There's plenty of fool's gold in the dash for the moolah, and marvelous hydrogen inventions are shaping up as the perpetual-motion machines of a new age.

"Eighty percent or more of the ideas that come directly to us violate the laws of physics," says Patrick Serfass, a spokesman for the National Hydrogen Association.

"When you put that kind of money out there, anybody who has even the most marginal technology related to hydrogen comes out of the woodwork," says Joseph Romm, an assistant energy secretary during the Clinton administration and author of the book *The Hype About Hydrogen*.

Plenty of sound science relates to hydrogen, and a number of real-world technologies are either under development or already in use. Mazda recently announced it will begin selling a hydrogen version of its RX-8 sports car within three years. And a number of applications are being used in large-scale stationary projects or handheld devices, says Serfass.

A Folsom, California, company called Jadoo Power Systems, for example, is selling a hydrogen fuel cell for professional video cameras that outperforms existing battery packs, according to Serfass. And at a Dow Chemical plant in Freeport, Texas, fuel cells made by General Motors are turning excess hydrogen from the chemical-manufacturing processes into electricity, which is then used to help power the plant.

But as with any new technology, figuring out which ideas are based in legitimate science and which are crackpot isn't always easy.

"I spend a lot of my time trying to separate those two," says Serfass, who reviews anywhere from five to 10 new hydrogen-technology proposals a month. With many of them, like "the perpetual-motion machines, or projects claiming 100 percent efficiency, it's clear immediately they won't work," he says.

Sometimes the presentation provides a preview of an idea's scientific value. Serfass said the red flags go up "when they say this technology has been proven for a long time, and they've presented it to executives at a lot of different companies, but no one has ever called them back."

Many of the proposals Romm hears come with stories that are remarkably alike. "Typically, he says, "they involve a scientist from some Eastern European country, in his 70s. And a common theme is that they've tried to get money from the government, but some government scientist or national lab was working on a similar thing, and shut them out."

Serfass says some of the ideas he rejects don't appear to violate the laws of science, but "are impractical economically." One such plan would use offshore wind turbines to produce hydrogen, and then use that hydrogen to fuel New York City's taxicab and bus fleets. Another proposal would manufacture hydrogen deep underwater, so it's already compressed when it's produced.

Livingstone's proposal doesn't violate any laws of physics, and, at first glance, at least, it appears feasible -- though the invention would have a long wait between useful lightning bolts.

That's because despite its fearsome appearance, most lightning doesn't carry much power. The storm clouds that produce lightning contain enormous amounts of energy, but by the time a lightning bolt hits the ground, surprisingly little of that energy remains, says physicist

Martin Uman, head of the Lightning Research Group at the University of Florida. Most of the energy goes into producing thunder and radio waves, lighting up the sky, and super-heating the nearby air. A typical lightning strike hitting the ground probably holds only enough energy to light a 60-watt light bulb for three months, he says.

Other, less-frequent strikes -- called "positive lightning" -- do contain more energy, but still not enough to be of much use by the time it hits the ground. So Livingstone would rely on lasers to capture the lightning bolts in the sky. The lasers would create a channel of ionized molecules in the air, providing a path of lower electrical resistance for the lightning to follow, much like it ran along Ben Franklin's kite string.

Livingstone is eager to roll out his system, but other scientists say the technology just doesn't exist yet. "We can easily send electricity along a laser for a meter or so," says Jean-Claude Diels, a University of New Mexico physicist whose lab has been trying for a number of years to trigger lightning strikes with lasers. "Beyond that, we've tried, and other labs have tried, but no one has made much progress."

Japanese scientists reported in 1999 that they had successfully captured a lightning strike with photo-ionizing lasers. But that feat has apparently never been replicated, and other scientists speculate it may have simply been an accident.

Even if Livingstone can manage to capture enough electricity from lightning, he faces other challenges. It would be extremely difficult to convert a large tank of water into hydrogen, says chemist Peter Lehman, director of the Schatz Energy Research Center at Humboldt State University in Arcata, California.

Current methods of producing hydrogen involve spreading water out in extremely thin, filmlike layers, he says, to reduce electrical resistance.

None of this, of course, is likely to deter Livingstone, or other erstwhile inventors. Which is perhaps how it should be. "We are a nation of tinkerers and patenters," says Romm. And sometimes, it takes a long time for that tinkering to pay off.

"The Boeing 747 doesn't look at all like what the Wright Brothers flew at Kitty Hawk," adds Sterling Allan, executive news editor of the Open Source Energy Network, a website on new energy technologies.

So if other scientists are skeptical of Livingstone's invention, who knows, it might just be that, like Ben Franklin, the inventor is ahead of his time.

"Early technology solutions produce a lot of things that don't work," says Catherine Rips, managing director of the California Hydrogen Business Council, "but sometimes what people are experimenting with today is what ends up working 20 years from now. We can't predict how fundamental breakthroughs will impact technology."