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Comment

GENERATING SECURITY: Our centralized power grid is an invitation to terrorists to attack. The sooner we reconfigure it like the Internet, the better, says economic futurist **JEREMY RIFKIN**

Brace for the next attack

It has been a year since the al-Qaeda terrorists struck the World Trade Center towers and the Pentagon, killing nearly 3,000 people. As horrific as the attacks were on 9/11, they were more symbolic in nature, designed to destroy the icons of American economic and military power. What really has government officials and business leaders in the United States and Canada worried is the prospect that the next time, terrorists will strike at the heart of the system, the power grid itself, crippling a large swath of the economy and paralyzing urban society. An attack on North America's power grid could have serious consequences for the entire global economy.

And our power grid is increasingly vulnerable. Even before the Sept. 11 attacks, government officials worried that power plants, transmission lines and the telecommunications infrastructure could be targets for terrorists. In 1997, president Bill Clinton's Commission on Critical Infrastructure Protection issued a warning that cyberterrorists' next target might be the computer programs at the power-switching centres that move electricity around the country, wreaking havoc on the nation's economic and social infrastructures. And Richard A. Clarke, who heads the cyberterrorism efforts of the Bush administration, warns of an "electronic Pearl Harbor."

In recent months, more troubling U.S. Department of Defence intelligence reports coming from the field suggest that al-Qaeda operatives have been preparing attacks on power facilities and that their planning scenarios are far more sophisticated than previously thought.

The only real answer to the increasing vulnerability of the existing power infrastructure to terrorist threats, say some experts, is to move to energy that could be generated locally and decentralize power grids.

How? In the near future, renewable sources of energy — including wind, hydro, photovoltaic, geothermal and biomass — will increasingly be used to generate electricity locally, and that electricity, in turn, will be used to electrolyze water and separate out hydrogen that can be used to power fuel cells.

Hydrogen is clean energy. Its only by-products, when burned, are heat and pure water. The shift from fossil fuels to hydrogen will greatly reduce CO_2 emissions and mitigate the long-term effects of global warming.

The same kind of security considerations that gave birth to the Internet are now being used by advocates of locally generated hydrogen energy. The Pentagon created the precursor to the Internet in the late 1960s because the military was concerned about the potential vulnerability to attack or other forms of disruption of centrally controlled communication operations. They sought a new kind of decentralized communications medium in which all of the parties could produce and send information to, and receive information from each other in a way that would continue to function even if part of the system was disrupted or destroyed.

The solution came in the form of the ARPANET, developed by the Defence Department's Advanced Research Projects Agency. When ARPANET shut down in 1990, the National Science Foundation's net became the main vehicle for connecting computers and eventually metamorphosed into the Internet.

Individual hydrogen-powered fuel cells are analogous to those personal computers that were first introduced into the market in the 1980s. Personal computers replaced centralized main frames and allowed millions of people to become both the producers and consumers of their own content. Commercial fuel cells powered by hydrogen are just now being introduced into the market for home, office and industrial use. The major auto makers have spent more than $2-billion (U.S.) developing hydrogen cars, buses and trucks; the first mass produced vehicles are expected to be on the road in just a few years.

Like personal computers, hydrogen-powered fuel cells allow end users to become the producers and consumers of their own energy — so-called "distributed generation." And the fuel cells are just now becoming connected to each other with the help of sophisticated computer software, smart digital technologies, and Internet access to form the beginnings of hydrogen-energy webs (HEWs). Soon, end users will not only produce their own hydrogen and electricity, but be able to share both with others (peer-to-peer energy sharing) — posing a fundamental challenge to the top-down, unidirectional energy regime currently in place around the world.

The consequences of connecting every owner of a fuel-cell micro power plant with every other owner in an energy-sharing network will be as profound and far reaching as was the development of the World Wide Web in the 1990s. When end users also become the producers of their energy, existing power plants will change their role and become "virtual power plants" that can manufacture and market fuel cells, bundle energy services and coordinate the flow of energy over the existing power grids.

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In the new hydrogen fuel-cell era, even the automobile will be a "power station on wheels," with a generating capacity of 20 kilowatts. Because the average car is parked most of the time, it can be plugged in during non-use hours to the home, office or the main interactive electricity network, providing premium electricity back to the grid. The revenue gained from selling energy back to the grid could help defray the cost of the lease or purchase price of the vehicle. If just 25 per cent of drivers used their vehicles as power plants to sell energy back to the grid, Canada could eliminate its power plants altogether.

Better yet, hydrogen power has the potential to end the world's reliance on imported oil; it would help diffuse the dangerous geopolitical game being played out between Muslim militants and Western nations.

The existing power grid was designed to ensure a one-way flow of energy from a central source to all end users. Before hydrogen-energy webs can be fully actualized, we must redesign existing power grids to assure easy access to the web, and a smooth flow of energy services over the web. Connecting thousands and then millions of fuel cells to main grids will require sophisticated dispatch-and-control mechanisms to route energy traffic during peak and non-peak periods.

This new infrastructure will require investment; so will the many new commercial ventures accompanying the new energy regime — especially the software and smart technologies to manage hydrogen-energy webs. But we now have the potential to democratize energy, and to make our economy and society less vulnerable to terrorist attacks or oil shortages. The road to global security lies in lessening our dependence on Middle East oil and assuring everyone on Earth access to the energy they need. The hydrogen economy can be a promissory note for a safer world.

Jeremy Rifkin is president of the Foundation on Economic Trends in Washington. His latest book, The Hydrogen Economy: The Creation of the World Wide Energy Web and the Redistribution of Power on Earth, *will be published tomorrow.*