Up and Atom

Could hydrogen power fuel a global energy revolution?

By Jeremy Rifkin

We are in the early stages of a historic change in the way we organize the Earth's energy. The industrial age, which began with the carrying of coal from Newcastle several hundred years ago, is now winding down in the oil fields of the Middle East. Many petrogeologists tell us that global production of oil will likely peak as early as 2010 or as late as 2037. Peak refers to the point at which half of the known reserves of cheap crude oil are exhausted. Beyond that point, prices will begin to rise dramatically and continue to do so as society slides down the backside of the production bell curve.

Meanwhile, a new energy regime is in the works. I am confident that hydrogen holds the key to the next energy revolution. Hydrogen has the potential to end the world's reliance on oil. It will dramatically cut down on carbon dioxide emissions and mitigate the effects of global warming. And, because hydrogen is so plentiful, people who have never before had access to electricity will be able to generate it.

Hydrogen is found everywhere on Earth, yet it rarely exists free-floating in nature. It must be extracted from either hydrocarbons or water. Today, the most cost-effective way to produce commercial hydrogen is to harvest it from natural gas via a steam reforming process. Yet the supply of natural gas is as finite as our oil supply, and not a dependable source. We can also extract hydrogen from coal, but that increases the emissions of carbon dioxide into the atmosphere. Our best option for producing hydrogen relies on renewable energy sources—photovoltaic cells, wind, hydro and geothermal—that create electricity to split water molecules into hydrogen and oxygen. We can also extract hydrogen from energy crops and agricultural waste, or biomass.

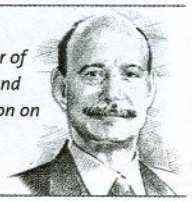
While renewable sources account for a only a small percentage of the energy used today, that is changing. I have been working with the European Commission to transition to renewable energy by extracting hydrogen through electrolysis and biomass. To adhere to the Kyoto Global Warming Treaty, Europe must obtain 22 percent of its electricity and 12 percent of its total energy from renewable sources by 2010, and double that amount by 2020. We must have a storage capacity for this energy; hydrogen will play that role. In fact, because renewable energy sources such as the sun and wind are intermittent, a renewable-energy society is impossible unless the energy can be stored in the form of hydrogen.

Stationary commercial fuel cells powered by hydrogen are just now being introduced for home, office and industrial use. Portable fuel cell cartridges will be on the market in a few years. The large automakers have already spent over $2 billion developing hydrogen cars, buses and trucks, and the first mass-produced vehicles will appear on the road in 2009.

The hydrogen economy will make possible a vast redistribution of power. Today's centralized, top-down energy flow, controlled by oil companies and utilities, could become obsolete. In the new era, every person with access to renewable energy sources could become a producer, as well as a consumer, of his own energy. Millions of these users will be able to connect their fuel cells to hydrogen energy webs, using the design principles and smart technologies that made possible the World Wide Web. They will then be able to share energy—peer to peer—creating a decentralized form of energy generation and use.

In the hydrogen fuel cell era, the automobile will become a power station on wheels. The average house requires approximately two to four kilowatts of power for heat and electricity. Each fuel cell–driven car will have a generating capacity of 20 kilowatts. When cars sit idle, owners can plug them into the home, office or main interactive electricity network to sell the unused electricity back to the grid. If just 25 percent of drivers used their vehicles as mini power plants, we could eliminate all the polluting power plants we now depend on.

The harnessing of hydrogen will alter our way of life as fundamentally as the introduction of coal and steam power in the 19th century and the shift to oil and the internal combustion engine in the 20th century. Making the transition to a hydrogen economy represents the single most important challenge and greatest opportunity of our time. W



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