

THE PARLIAMENT MAGAZINE ESSAY:

# THE DAWN OF THE HYDROGEN ECONOMY

Jeremy Rifkin of the Foundation on Economic Trends discusses the revolution in energy production that he believes will come from harnessing hydrogen.

Imagine, for a moment, a world where fossil fuels are no longer burned to generate power, heat and light. A world no longer threatened by global warming or geopolitical conflict in the Middle East. A world where every person on earth has access to electricity. That world now looms on the horizon.

We are in the early stages of an 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. Meanwhile, a wholly new energy regime is being readied. Hydrogen - the lightest and most abundant element of the universe - is the next great energy revolution. Scientists call it the "forever fuel" because it never runs out. And when hydrogen is used to produce power, the only by-products are pure water and heat.

It's difficult to comprehend a world beyond oil when so much of the Modern Age has been built off the burial grounds of the Jurassic Era. We heat our homes and businesses, run our factories, power our transportation and light our cities with fossil fuels. We grow our food and construct our buildings with materials made from fossil fuels, treat illness with pharmaceuticals made from fossil fuels, and produce our clothes and home appliances with petrochemicals. Virtually every

aspect of modern life is made from, or powered by, fossil fuels.

Now, however, the era of cheap crude oil has nearly run its course. Our petrogeologists tell us that global production of oil is likely to peak as early as 2010 or as late as 2037.

Hydrogen has the potential to end the world's reliance on oil from the Persian Gulf, the most politically unstable and volatile region of the world. 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.

## HOW HYDROGEN POWER WORKS

Hydrogen is found everywhere on Earth, yet it rarely exists free floating in nature. Instead, it has to be extracted from either hydrocarbons or water. Today, the most cost-effective way to produce commercial hydrogen is to harvest it from natural gas. Yet the supply of natural gas is as finite as our oil supplies. But there is another way to produce hydrogen - one that uses no fossil fuels in the process. Renewable sources of energy - photovoltaic cells, wind, hydro, geothermal and biomass - are increasingly being used to produce electricity. That electricity, in turn, can be used, in a process called electrolysis, to split water into hydrogen and oxygen.

Once produced, the hydrogen can be stored and used, when needed, to generate electricity. Storage is the key to making renewable energy economically viable. That's because when renewable energy is harnessed to produce electricity, the electricity flows immediately. So, if the sun isn't shining or the wind isn't blowing, or the water isn't flowing, electricity can't be generated and economic activity grinds to a halt. But, if some of the electricity being generated is used to extract hydrogen from water, which can then be stored, for later use, society will have a continuous supply of power.

While the costs of harnessing renewable technologies and extracting hydrogen are still high, new technological breakthroughs and economies of scale are dramatically reducing these costs every year. Meanwhile, the direct and indirect costs of oil and gas on world markets are going to continue to rise. As we approach the nexus between the falling price of renewables and hydrogen and the rising price of fossil fuels, the old energy regime will steadily give rise to the new energy era.

## THE FUTURE IS NOW

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 major



A hydrogen car prototype

automakers already have spent over \$2 billion developing hydrogen cars, buses and trucks, and the first mass-produced vehicles are expected to be on the road beginning in 2009.

The hydrogen economy will make possible a vast redistribution of power, with far-reaching consequences for society. Today's centralized, top-down flow of energy, controlled by global oil companies and utilities, could become obsolete. In the new era, every human being with access to renewable energy sources could become a producer as well as a consumer of his or her own energy, using so-called "distributed generation." When millions of end-users connect their fuel cells into local, regional and national hydrogen energy webs (HEWs), using the same design principles and smart technologies that made possible the world wide web, they can begin to share energy - peer-to-peer - creating a new decentralized form of energy generation and use.

In the new hydrogen fuel-cell era, even the automobile itself becomes a "power station on wheels" - with a generating capacity of twenty kilowatts. Since cars are parked most of the time, owners can plug them into the home, office or the main interactive electricity network, during non-use hours, selling the electricity they produce back to the grid. If just twenty-five percent of drivers used their vehicles as mini-power plants, we could eliminate all the giant, environmentally polluting power plants we now depend on.

#### THE STRUGGLE TO CONTROL HYDROGEN ENERGY

Like the ongoing struggle to control the

world wide web, we are likely to see a fierce struggle for control over hydrogen energy webs. Even as users have argued that information should flow free over the Internet, Microsoft, AOL-Time Warner, and others have fought hard to control access to the portals of cyberspace. Expect some global energy companies and the world's leading power and utility companies to try to exercise similar control over the emerging hydrogen energy web. Only by organizing collectively to control their own energy can end users hope to gain a modicum of energy independence.

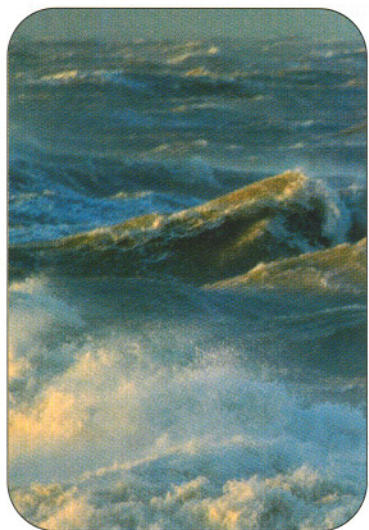
#### EMPOWERING THE POOR

Incredibly, sixty-five percent of the human population has never made a telephone call, and a third of the human race has no access to electricity. Today, the per capita use of energy throughout the developing world is a mere one-fifteenth of the consumption enjoyed in the United States. The disparity between the connected and the unconnected is deep and threatens to become even more pronounced as world population is expected to rise from the current 6.2 billion to nine billion people in the next half-century.

Lack of access to electricity is a key factor in perpetuating poverty around the world. Conversely, access to energy means more economic opportunity. Electricity frees human labour from day-to-day survival tasks. It provides power to run farm equipment, operate small factories and craft shops, and light homes, schools and businesses. Making the shift to a hydrogen energy regime holds great promise for helping to lift billions of people out of poverty.

Were all individuals and communities in the world to become the producers of their own energy, the result would be a dramatic shift in the configuration of power. Local peoples would be less subject to the will of far-off centres of power. Communities would be able to produce goods and services locally and sell them globally. This is the

Wind, Sun and Sea - three key renewable energy sources for the hydrogen age.



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essence of the politics of re-globalisation from the bottom up.

### TOWARDS A THIRD INDUSTRIAL REVOLUTION

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. In October 2002, the European Union became the world's first superpower to announce a long-term plan to make the transition out of fossil-fuel dependency and into a renewable based, hydrogen economy.

While the EU understands that much of the hydrogen will have to be extracted from fossil fuels in the immediate future, its long-term game plan is to rely increasingly on renewable sources of energy to extract hydrogen [the EU has set a target to generate twenty-two percent of its electricity and twelve percent of all of its energy from renewable sources of energy by 2010]. Now, the U.S. business community is worried that it might fall behind Europe in getting to a hydrogen future and has begun to put pressure on the Bush White House to spearhead a similar effort. Even though the President embraced the hydrogen future in his State of the Union Address, in reality, the new energy bill being readied for deliberation on Capital Hill focuses, almost entirely, on subsidizing research and development aimed at extracting hydrogen from fossil fuels and by harnessing nuclear power to the task, with little emphasis on developing renewable sources of energy to extract hydrogen. The failure to imagine a new energy era and to take the steps to get

there could put the United States woefully behind Europe as a world power by mid century. What is incontrovertible is that the hydrogen energy revolution will have a greater impact on the global economy than any other single development in the next half-century.

### ABOUT THE AUTHOR

Jeremy Rifkin is the author of *The Hydrogen Economy: The Creation of the World Wide Energy Web and the Redistribution of Power on Earth*



(Tarcher/Putnam: 2002). Mr Rifkin is also the president of the Foundation on Economic Trends in Washington, DC and a fellow at the Wharton School in Philadelphia. Mr Rifkin also serves as an advisor to Commissioner Romano Prodi. In that capacity, he advised on the strategic white paper that led to the EU adoption of a new energy initiative to become the first fully integrated hydrogen economy in the 21st century.

*The Hydrogen Economy* by Jeremy Rifkin has also been published in several languages in the following countries: Italy (Mondadori, 2002); Spain (Paidós, 2002); Germany (Campus Verlag, 2002); France (Editions la Découverte et Syros, 2002); UK (Polity Press, 2002).

