

## De revolutie van de waterstofeconomie

Volgens Jeremy Rifkin, voorzitter van 'The Foundation of Economic Trends' in Washington, staan we aan het begin van een nieuwe baanbrekende revolutie. De wereld zal radicaal transformeren door de opkomst van de waterstofeconomie, net zoals dat eens door de uitvinding van de stoommachine en de winning van fossiele brandstoffen het geval was.

Door de waterstofeconomie behoort niet alleen een schone energievoorziening tot de mogelijkheden, maar komt ook een vergaande decentralisatie van de opwekking van energie in het vizier. Veranderingen in de richting van een waterstofeconomie hoeven echter niet per definitie duurzaam te zijn. Dit is namelijk sterk afhankelijk van de energiebron die gebruikt wordt om de waterstof te maken. Volgens Rifkin zijn de investeringen van Bush in de ontwikkeling van een waterstofeconomie in hoge mate gebaseerd op het onttrekken van waterstof uit fossiele brandstoffen en eindige nucleaire energie. De door hem gepropageerde inzet voor de Europese Unie om in toenemende mate waterstof te halen uit vervangbare bronnen zal Europa halverwege deze eeuw een schone en duurzame toekomst en een enorme voorsprong op de Verenigde Staten geven.



JEREMY RIFKIN

**A world without oil looms on the horizon.**

### Imagining a World without Oil

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 byproducts 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 petro-geologists tell us that global production of oil is likely to 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 used up. Once that point is reached, prices will begin to rise dramatically and continue to do so as society moves down the backside of the oil production bell curve.

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 via a steam reforming process. Yet the supply of natural gas is as finite as our oil supply, and therefore not a dependable source. 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. Moreover, hydrogen powered fuel cells are two-and-one-half times more efficient than internal combustion engines. 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. Consumers will be able to power up their cell phones, lap tops computers, and other appliances for forty days or more with a single cartridge. The major 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. The average house only requires two to four kilowatts of power. 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.

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### A 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 labor 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, using renewable resources and technologies to extract the hydrogen, and creating distributed generation energy webs that can connect communities all over the world, 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 centers of power. Communities would be able to produce goods and services locally and sell them globally. This is the essence of the politics of re-globalization from the bottom up.

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### 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 2003 State of the Union Address, in reality, the new energy bill being debated 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. In other words, the Bush administration would like to head into a hydrogen future without ever leaving an old-fashioned fossil fuel and nuclear energy regime. 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.

*Mr. Jeremy Rifkin is de auteur van verschillende spraakmakende werken, zoals *The end of work* (1995), *The Age of Access* (2000) en *How Europe's Vision of the Future is Quietly Eclipsing the American Dream* (2004). Deze bijdrage is gebaseerd op *Hydrogen Economy: The Creation of the World Wide Energy Web and the Redistribution of Power on Earth* (Tarcher/Putnam: 2002 US, Polity Press;2002 UK, zie ook de bespreking van dit boek elders in CDV door Prof Reijnders). Mr. Rifkin is voorzitter van de *Foundation on Economic Trends in Washington DC* en als fellow in management en onderwijs verbonden aan *Wharton School in Philadelphia* 1994. Mr. Rifkin is tevens adviseur van *Romano Prodi*, de voorzitter van de *Europese Commissie*. In deze hoedanigheid leverde hij het strategische witboek dat de *Europese Unie in de 21 eeuw moet voeren naar de eerste volledig geïntegreerde waterstofeconomie*.*