



## Energy Co2 : Renewable Energy

### Surrounded by Opportunity: Profiles of Four Leading Renewable Energy Technologies

**With growing global demand, big investors and governments are channeling billions into renewable energy. But what do the four most important technologies - solar, wind, biomass, and hydrogen - really offer?**



Solar energy is only one of the several renewable energy sources attracting the attention of governments, companies, and investors around the world.

Christopher Flavin, president of US-based think-tank Worldwatch, says the "action" on renewable energy is happening "at the national and state levels and in private industry where business is booming - 38 billion US dollars of investment in renewables in 2005, according to our estimate."

#### Wind

Many experts see wind power as the renewable source of energy with the greatest potential for growth and investment. Government and investor interest has increased significantly as wind has evolved into a more cost-effective mode of producing electricity. The Global Wind Energy Council reports that in 2005 alone, the total number of wind-produced megawatts (MW) produced on the global market increased by over 40 percent.

The wind sector stands to grow by leaps and bounds if global reliance on renewable energy continues its upward trajectory. Germany, currently a global leader in wind power production and consumption, produced roughly 26.5 billion kilowatt hours (kWh) of wind-generated electricity - the most of any form of renewable. This figure could dramatically increase in the coming years if the German government stays committed to reaching its goal of 20-25 percent reliance on renewables by 2010.

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And that is only in Germany. Other countries, including Spain, India, and China are also embracing wind power on a large scale. Recognizing the opportunities of wind energy, industrial and financial giants, such as the Allianz Group, which made its first investment in a wind farm project in Sicily, Italy, in December 2005. Wind will play a central role in Allianz's plans to invest 300 to 500 million euros in renewables over the next five years.

### **Solar**

The various means of capturing the sun's energy - including concentrating solar power (CSV), photovoltaic (PV) power, and solar heating - also represent promising investment opportunities. Public solar firms - such as SolarWorld AG and Evergreen Solar Inc. - were some of the shooting stars on European and North American stock markets in Europe and North America in 2005.

Governments, such as Israel, China, and India, are also investing in the development of PV power stations that will supplement energy grids and provide affordable energy solutions for rural communities. The United States Department of Energy hopes that PV power will account for up to 10 percent of the nation's energy generation by 2030.

### **Biomass**

Biomass is a term that refers to the variety of ways to that organic matter can be converted to energy, often through combustion or the production of gases and liquid fuels.

Biogas, biodiesel, and ethanol fuel are some of the current buzzwords among energy investors and politicians not only because of record-high oil prices and periodic turbulence in international relations, but also because they represent viable long-term alternatives to fossil fuels. Biofuels allow for significant reductions in carbon emissions and dependence on energy from abroad, as well as providing a boost for many domestic economies, particularly in the agricultural sector.

### **Hydrogen**

The "hydrogen economy" reflects the idea that hydrogen - the world's most abundant element - could someday replace fossil fuels, coal, nuclear, and hydroelectric energy as a primary source of energy. Aside from hydrogen's availability and high-energy content, what makes this resource attractive its ability to generate energy without producing significant levels of pollution. The typical by-product of hydrogen fuel cells, for example, is water.

Although the vision of economies and industries driven by hydrogen power may seem a long way from becoming realized, governments have already begun to invest in the development of hydrogen technologies, such as fuel cells, and have taken steps at encouraging their application

The United States government introduced the Hydrogen Fuel Initiative in 2003, an investment of over one billion US dollars in hydrogen research and development. The success of recent schemes of introducing

hydrogen-powered buses to European cities has also prompted the European Union to expand investment in and promotion of hydrogen technology.

### **No "silver bullet"**

The four renewables discussed above and others, such as geothermal power, are all being explored as sustainable and long-term alternatives to conventional energy sources. Each has the potential to help states and companies meet their energy requirements with cleaner and more-stable options. Entrepreneurs, researchers, and policymakers are all trying to find an effective balance between immediate and long-term initiatives.

"Wind and solar are becoming relatively mature, with major utilities and large manufacturers such as General Electric making a positive impact on our energy landscape right now, and doing so in a profitable way," says Andrew Shapiro, founder and CEO of GreenOrder, an environmental strategy firm based in New York City.

"There is also a robust and growing ecosystem of entrepreneurial firms, venture capitalists, and researchers exploring next-generation solutions - such as thin-film solar, cellulosic ethanol, or sterling engines," adds Shapiro. "Everyone in this field recognizes that there is no 'silver bullet' for our energy future."

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