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Wind Energy Profile: The Big Promise

Theoretically, wind could produce enough energy to meet global demand. In 2006, however, less than one percent of global electricity consumption came from wind. Why such an imbalance?



Swans swim at the closed storm surge barrier "De Maaslandkering" in Hoek van Holland, Netherlands. Many good wind sites are located in coastal areas or offshore (Photo: Reuters)

Worldwide Importance and Future Prospects

Global installed wind capacity in 2006 was around 74 Gigawatts (GW), according to the World Wind Energy Association. This was more than one percent of global electricity consumption, but because installed capacity does not reflect actual production, its contributions to the global energy mix are less than that.

Wind energy capacity is expected to more than double between early 2007 and 2010. Growth will be driven by rapidly developing countries, such as India, Brazil, and China. Several offshore wind parks are being planned in northern Europe and North America. Improving efficiency and falling costs of turbine production and installation will make wind power more price competitive.

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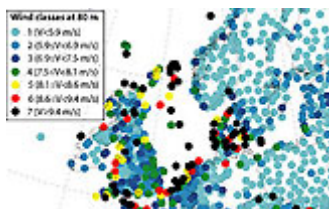
The price of producing utility-scale wind power have fallen by 90 percent in the last 20 years, and according to General Electric, global prices range between 3.5 and 4 cents per kilowatt hour, making wind competitive with coal, oil, nuclear, and gas energy.

Global Resources and Producers

Global land and near-shore wind resources are around 72,000 GW, or five times the world's current energy use, according to a study at Stanford University. But sites convenient for wind power production are limited by factors such as land use for agriculture or living, distance to consumers, and technology. Experts from the Intergovernmental Panel

on Climate Change estimate that only four to ten percent of given resources could be used in an economically viable way.

An entirely wind-powered economy is thus not yet possible. Global growth in wind power, however, is still tremendous. In 2005, markets grew by 41 percent. The value of new generating equipment installed in 2006 was about 18 billion euros.



Picture Gallery (click on the picture to start)

Maps of the wind resources on six continents (Graphic: Archer and Jacobsen, 2005)

In terms of Megawatts, the biggest producers of wind energy are Germany, Spain, India, and the United States, together accounting for about 80 percent of global capacity. Denmark produces the most wind energy per capita, and meets roughly 20 percent of its energy needs from wind energy. Other countries with rapidly growing wind power sectors include Canada, France, China, Britain, and Portugal.

Energy Output

The amount of wind energy generated depends mostly on the size, height, type, and location of a wind turbine. Some small turbines, such as those fixed on a sailboat, can generate as little as a few hundred watts - enough to power a few light bulbs. On the other side of the spectrum are the large, utility-scale turbines like the Vestas V90 that produces 3 MW. According to the manufacturer, these turbines produce in 2-3 hours the electricity that an average European family consumes in one year. The Enercon E126 turbines installed in Germany in late 2007 will produce 6MW each, making it the most powerful turbine on the market.

Most wind power turbines are still installed on land, but the future could lie offshore. Wind speeds over oceans are on average twice as high as over land, making offshore wind parks an interesting alternative, but technically more challenging alternative.

Environmental Impact and Drawbacks

Wind turbines - large or small - are not always welcome additions to the landscape. Many people find them loud and unsightly. They are also known to disrupt electro-magnetic communication signals. Others claim that turbines endanger wildlife, particularly birds, though this is disputed.

The biggest technical problem is that wind energy cannot be produced just anywhere; average wind speeds must be good enough to make installing a turbine cost-effective. Germany, the world's largest wind energy producer, is already said to be approaching its potential for on-

land wind production, but investors are looking at big growth potential for offshore wind farms off the coasts of northern Europe and the British Isles.

Energy storage is another issue. Like photovoltaic solar panels, the amount of electricity that wind turbines produce can vary significantly. This makes it more difficult to incorporate wind power in grid systems.

editor: Valdis Wish

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