



CAROL WERNER  
EXECUTIVE DIRECTOR

ENVIRONMENTAL AND ENERGY STUDY INSTITUTE  
122 C STREET, N.W., SUITE 630 ■ WASHINGTON, D.C., 20001 ■ 202-628-1400 ■ [www.eesi.org](http://www.eesi.org)

# Renewable Energy Fact Sheet

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Contact:

Fredric Beck (202) 662-1892, [fbeck@eesi.org](mailto:fbeck@eesi.org)

## Wind Energy

### Harnessing the wind to generate electricity

#### Key Facts

- The spinning blades of wind turbines convert energy from the wind's motion into electricity.
- Installed US wind power plants had 6,740 megawatts (MW) of electrical capacity in 2004, enough to serve 1.6 million households.
- The cost of wind power is competitive with other energy sources. With the Production Tax Credit of 1.9 cents per kilowatt-hour (kWh), wind power costs between \$0.03 and \$0.06 per kWh, a huge decline from \$0.80 per kWh in 1980.
- Wind power is one of the fastest growing energy sources in the United States: its capacity increased on average 25 percent per year from 1990 to 2003. Although capacity increased by only 6 percent in 2004, due to the expiration of the Production Tax Credit, the American Wind Energy Association anticipates that over 2000 MW of wind power capacity will be added in 2005, more than in any previous year.

#### Wind Energy Production

- Wind energy currently provides 0.3 percent of electricity in the United States. Wind power could satisfy six percent of US electricity demand by 2020, according to the American Wind Energy Association.
- *Commercial wind power:* Commercial wind turbines range in size from 0.7 to 1.8 megawatts (MW). One megawatt of energy generates around 3 million kWh of electricity annually, enough for 300 households. Large-scale wind turbines with a capacity of 5 MW are currently being developed.
- *Distributed power generation:* Small-scale wind turbines with a capacity of less than 100 kilowatts can provide power to rural landowners or allow businesses to generate electricity on-site.
- *Intermittent power:* Wind turbines only operate when the wind is blowing. Well-situated turbines can produce energy 65-80 percent of the time, although they often run at less than maximum capacity. Wind turbines produce 30-35 percent of their maximum capacity on average. PacifiCorp, a major electric utility in the Northwest, has assigned its wind plants a 20 percent capacity credit, meaning it considers 20 percent of its wind farms' capacity to be reliable, base-load power.

#### Locations

- *Onshore:* Although two-thirds of US wind generation was concentrated on land in California and Texas in 2002, 34 states have existing or planned wind energy projects. Regions in at least 40 states have sufficient winds for wind power generation—the US Department of Energy maps show that 14 percent of the land in the contiguous states, or one million square kilometers, has good wind potential.
- *Offshore:* Wind turbines can be sited offshore as well as on land. Denmark constructed the first offshore wind farm in 1991, and the first offshore wind farms in the United States are being considered off the East Coast, at sites near Long Island and Cape Cod. Fifty percent more power can generally be produced offshore than in equivalent onshore facilities, due to stronger, more consistent, and less turbulent winds. However, operations, maintenance, and transmission costs are higher offshore, and the initial capital costs of offshore wind facilities are 30 to 70 percent higher than for onshore facilities.

## **Benefits**

- *Pollution prevention:* Wind farms in the United States generated approximately 16 billion kWh of electricity in 2004. If generated by the average utility fuel mix, that much electricity production would have released an additional 10.6 million tons of carbon dioxide, 56,000 tons of sulfur dioxide, and 33,000 tons of nitrogen oxides into the atmosphere.
- *Added land value:* A quarter-acre wind farm earns \$2,000 to \$4,500 from leasing payments annually, thereby increasing land value, and providing farmers a barrier against crop price fluctuations. Turbines occupy only 5 – 15 percent of wind farm land, so landowners can simultaneously use wind farms for ranching and conventional farming.
- *Jobs:* According to the American Wind Energy Association, over 2,000 MW of wind capacity will be added in 2005, resulting in 10,000 new jobs. In addition, four US firms supply at least one-third of the total global market for small wind turbines—one of the country's few remaining energy technology exports.

## **Costs**

- Wind energy has no fuel costs. Capital costs account for approximately 70 percent of wind energy's total cost, and these costs are falling. The cost of wind power has fallen from \$0.80 per kWh in 1980 to \$0.03 to \$0.06 per kWh today, including the 1.9 cent per kWh Production Tax Credit.
- Transmission line infrastructure must often be extended to wind farms, creating additional costs and complicating construction.
- Wind power can be scaled up quickly, as wind farms can be built in under six months. The entire building process, including finding the site, measuring the wind, and obtaining construction permits usually takes 18 months to 2 years.
- Small wind turbines are often the least expensive power source for remote sites not connected to the grid.

## **Issues**

- The United States was once the international leader in wind energy, but German installed wind capacity has exceeded US capacity since 1997. Wind capacity is growing faster in Spain, Denmark and the United Kingdom than in the United States, and those countries are taking the lead globally in developing and marketing new wind technologies.
- Concerns about wind turbines' visual impact, noise pollution, and bird deaths persist, but are being addressed by new technologies and careful siting of wind farms.
- The federal Production Tax Credit (PTC) has driven domestic wind power production. During the first ten years of a wind farm's operation, producers receive 1.9 cents for each kWh of power produced. When the PTC expired in 2004, development of wind resources declined dramatically: 1690 MW of capacity was added in 2003, compared to only 390 MW in 2004. Construction of wind turbines has resumed with the reauthorization of the PTC through December 31, 2005, and over 2000 MW of new wind power capacity is under construction in 2005, according to the American Wind Energy Association. Uncertainty about the tax credit's long-term future, however, is slowing investment into wind energy. Additionally, the PTC is focused on large-scale commercial wind production and does not benefit small or community wind systems.

## **For More Information**

American Wind Energy Association <http://www.awea.org/faq/index.html>

Energy Information Agency <http://www.eia.doe.gov/cneaf/solar.renewables/page/wind/wind.html>

National Renewable Energy Laboratory <http://www.nrel.gov/wind/>

Renewable Energy Policy Project <http://www.repp.org/wind/>

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