



*wind: powering a cleaner, stronger america*

## **WIND ENERGY BASICS**

**February, 2009**

**Wind energy is a mainstream energy source today. A total of 8,358 megawatts (MW) of wind generation –enough to power more than 2 million American households annually – was installed in the United States in 2008 alone. With the right government policies, this cost-effective source of energy could provide at least 20% of the nation’s electricity by 2030, create thousands of jobs, and revitalize farms and rural communities–without consuming any natural resource or emitting any pollution or greenhouse gases.**

**Wind power is a steadily growing source of electric power.**

- One of the world's fastest growing energy sources on a percentage basis, U.S. wind power capacity has grown by an average of 32% each year for last five years – 2004-2008.
- Wind power has been second only to new natural gas for four years in a row as a share of the entire new generating capacity added annually in the U.S.
- Total installed U.S. wind capacity at the end of 2008 was 25,170 MW, or enough to serve the equivalent of close to 7 million average U.S. households (17 million people).
- The United States is the world’s leader in cumulative installed wind power generating capacity (25,170 MW), overtaking long-time leader Germany in 2008 (23,902 MW).
- Denmark, Spain, and some regions of Germany now generate 10% to 25% of their electricity with wind power, as does Xcel Energy, a major U.S. electric utility.

**Over 8,300 megawatts of wind generation – enough to serve the equivalent of more than 2 million American households annually – was installed in the United States in 2008 alone.**

- The new wind projects installed in 2008 generate enough to serve more than 2 million households annually – equivalent to all the households in Missouri, or Colorado, or Oklahoma.
- 2008’s new installations include more than 700 MW in Texas, now the leading state in wind power capacity with 7,116 MW installed. The rest of the top five in cumulative installations are Iowa (2,790 MW) (Iowa overtook California as #2 in 2008), California (2,517 MW), Minnesota (1,752 MW), and Washington (1,375 MW). Colorado also has over 1 GW (1,000 MW) of wind power installed.

### **With the right government policies ...**

- In the short term, the provisions in the 2009 economic stimulus bill need to be successfully implemented so that they provide incentives for new wind generation even when financial markets are adverse.
- A national renewable electricity standard (RES) of at least 25% by 2025 with demanding near-term targets (e.g., 10% by 2012) is needed to create a long-term and stable market for capital investment in wind projects, wind turbine component manufacturing facilities, and transmission infrastructure. An RES is a low-cost, market-friendly way to boost clean energy sources (28 states and District of Columbia now have RES, also know as RPS, policies).
- Construction of a new, national, high-voltage transmission system or “green power superhighway” is needed to carry electricity generated by renewable energy to the more populated areas where demand is highest.
- The U.S. is on its way to establishing a long-term extension of the federal Production Tax Credit (the 2009 stimulus package extended the PTC’s expiration date from 2009 to 2012).
- We should expand research funding from the current \$50 million annually to a level of \$217 million per year. This increase can be phased in over five years.
- The Federal government, the largest U.S. electricity consumer, should take the lead in renewable energy procurement – so-called green power purchases
- State incentives – Texas RPS (5,880 MW of renewables by 2015), New York RPS (increase renewables from 17% of state’s electricity use to 25% by 2013) and New York government procurement (10% by 2005, 20% by 2010), California RPS (increase renewables from 12% of state’s electricity use to 20% by 2010, 33% by 2020), others – can play major role.
- See [www.newwindagenda.org](http://www.newwindagenda.org) for details on federal policies to promote wind.

### **...this cost-effective source of energy...**

- With its federal incentive, “large” wind is now in a competitive range (7-9 cents per kilowatt-hour, depending on the project size and average wind speed at the site) with any other type of power plant built today.
- Wind power is “inflation-proof” because it doesn’t use any fuel – once a wind plant is built, the cost of energy is known, and is not affected by fuel price volatility.
- Because of fuel savings over time, investments in wind power and in new transmission lines for renewable energy pay for themselves.
- Technology is steadily improving (rotor blade airfoils specially designed for wind turbines, variable-speed generators, power electronics, sophisticated computer modeling of design changes).
- New, larger turbines (1.5 MW to 3 MW) generate 120 times as much electricity as 1980s models at one-fourth the per-unit cost.
- Wind plants can be built quickly to respond to predicted electricity shortages.
- In windy areas, small machines are most economical self-generation option.

### **...could provide at least 20 percent of the nation’s electricity by 2030 ...**

- About as much electricity as nuclear or natural gas supplies today
- No technological breakthrough needed

- Cost-effective—incremental cost including investment in transmission lines would be modest and equivalent to 50 cents per household per month; value of environmental and economic benefits far outweigh cost.
- European Wind Energy Association (EWEA) now believes 100,000 MW of wind can be installed in Europe by 2010.
- Offshore wind has great potential. The U.S. Department of Energy's May 2008 report on a 20% wind energy scenario found offshore wind capacity could be 54,000 MW of the 300,000 MW envisioned. A number of projects have been proposed off the mid-Atlantic states. The U.S. Interior Department is expected to issue rules governing offshore wind projects in 2009.

### **...thousands of jobs...**

- The industry estimates that, as of the end of 2008, it employed 85,000 workers, up from 50,000 a year before—creating a net 35,000 jobs in 2008 at a time when the U.S. lost about 2 million jobs.
- In 2008, 55 new wind turbine component manufacturing facilities opened, expanded or were announced in the United States.
- AWEA estimates that the share of domestically made components in wind turbines rose from about 30% in 2005 to nearly 50% by the end of 2008.
- If wind expands to the extent that it is providing 20% of U.S. electricity by 2030, that would create an estimated 500,000 jobs.

### **...and revitalize farms and rural communities ...**

- A single wind turbine can provide \$2,000-\$4,000/year or more in farm income even though only 2-5% of the land within wind farm boundary is used for turbines and access roads.
- Wind plants can be valuable source of property tax income for local governments (especially rural counties).
- Wind energy helps diversify income for farmers, ranchers, and other landowners.
- Wind provides ~1 skilled O&M (operations/maintenance) job for every 10 turbines installed.

### **...and increase the security of U.S. electricity supply**

- Wind is a domestic and inexhaustible energy supply.
- U.S. winds could generate more electricity in 15 years than all of Saudi Arabia's oil, *without being depleted*.
- Wind plants consist of small individual generators that cannot be easily damaged at the same time and that are easy to replace.
- If a wind plant is damaged, there is no secondary threat to the public (such as in the release of radioactivity, explosions, or the breaching of a dam).

### **...without consuming any natural resource or emitting any greenhouse gases.**

- Today's 25,000-MW wind project fleet avoids emissions of nearly 44 million tons of CO<sub>2</sub> annually—equivalent to taking 7 million cars off the road.
- Using more wind energy can save water in the arid western U.S. To generate the same amount of electricity as a single 1-MW wind turbine using either fossil

fuels or nuclear power requires, on average, withdrawing roughly 60 million gallons of water a year from streams or rivers, of which nearly 1 million gallons is lost to evaporation.

- A single 1-MW turbine annually displaces 1,800 tons of carbon dioxide, the primary global warming pollutant, (equivalent to planting a square mile of forest), based on the current average U.S. utility fuel mix.
- To generate the same amount of electricity as a single 1-MW turbine using the average U.S. utility fuel mix would mean emissions of 9 tons of sulfur dioxide and 4 tons of nitrogen oxide each year.
- To generate the same amount of electricity as a single 1-MW wind turbine for 20 years would require burning 29,000 tons of coal (a line of 10-ton trucks 11 miles long) or 92,000 barrels of oil.
- To generate the same amount of electricity as today's U.S. wind turbine fleet of 21,000 MW would require burning 30.4 million tons of coal (a line of 10-ton trucks over 11,500 miles long) or 91 million barrels of oil *each year*.
- 300,000 MW of wind energy (20% of U.S. electricity by 2030) would avoid annual CO<sub>2</sub> emissions by 825 million metric tons annually in 2030.

**...or causing any other significant environmental impact.**

- Pre-construction site surveys are now standard, and reduce the threat to birds to minimal levels. Cats, hunters, glass windows, communications towers are far more dangerous to birds.
- Bat collisions are issue at some sites; industry is helping fund ambitious research effort with leading bat conservation group to reduce mortality.
- Potential habitat (not collision) effect on prairie grouse and grassland songbirds is a concern in areas of the Midwest and West; industry is funding a cooperative research effort on this issue as well.
- With its minimal footprint, wind generating equipment can be placed on working farms or ranches.
- Wind has no pollution impact on people, wildlife, or habitats.
- A wind turbine a quarter of a mile away is no louder than a kitchen refrigerator.
- No mining or drilling is required for fuel.
- Wind produces no toxic waste.

Assumptions:

- 35% average capacity factor assumed for machines installed in 2008.
- 31% average capacity factor assumed for entire turbine fleet
- Average annual household consumption (U.S.) = 10,656 kWh
- 10-ton truck is 20 feet long