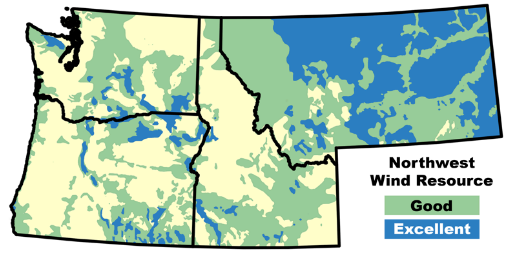
Wind Power

Renewable Northwest Project



WIND ENERGY IN THE NORTHWEST		
	Potential	Installed Capacity*
Oregon	7,991 aMW	886 MW
Washington	7,078 aMW	1165 MW
Idaho	5,594 aMW	75 MW
Montana	116,438 aMW	164 MW
Resource type	Variable, predictable	
Capacity factor		28-36%
Real levelized cost (2006$)		4-7 ¢/kWh
Construction lead time		1-3 years

**Installed capacity as of February 2008.*
MW= Megawatts (capacity),
aMW = average MW;
Sources: see endnote 1.

Potential

As the above table shows, the Pacific Northwest has the potential to generate over 137,000 aMW of electricity from wind power. This is enough to provide nearly four times the current electricity consumption in the region. The majority of the region's potential wind resources are in Montana, which alone has enough potential wind resources to supply one quarter of the electricity needs of the United States.[2]

Nearly 2,300 MW of nameplate wind power capacity is currently generated at Northwest wind farms and projects currently in development could triple that figure over the next several years.[3] Texas leads the United States in wind development with over 4,350 MW of currently installed capacity each. California, has nearly 2,500 MW of installed capacity and Colorado, Minnesota, and Iowa are also making rapid investments in wind power, with over 1,000 MW currently in service in each state.[4]

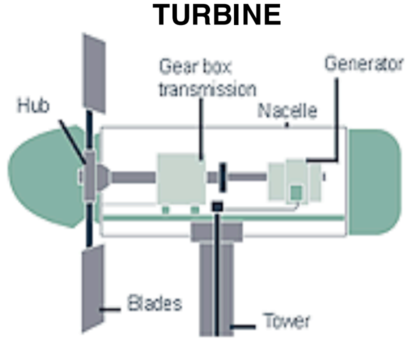
Between 2001 and 2007, the U.S. wind generating capacity expanded at a remarkable rate of 49% per year on average. By the end of 2007, the U.S. had over 16,800 MW of wind capacity online, enough to power over 1.5 million homes for the entire year![5]

However, Europe currently remains far ahead of the U.S. in wind development, with 56,535 MW of wind capacity online as of the end of 2007.[6]

Cost

Advances in technology and increased experience have made wind power competitive with many traditional sources of electricity, especially when factoring in risk factors for traditional generation resources such as fuel volatility and future environmental regulation. The price of wind-generated electricity has decreased approximately 90% from the early 1980s; modern wind farms now generally have levelized costs in the range of 4-7 cents per kilowatt-hour over the life of a project (including federal tax credits) making them competitive with many new coal or natural gas facilities. Costs for individual projects vary and depend on the strength and consistency of the wind, financing terms, and transmission infrastructure. All else being equal, the cost effectiveness of wind farms generally increases with the turbines' capacity factor, the size of the turbines, and number of turbines installed.[7]

ANATOMY OF A WIND TURBINE



Source: see endnote 8

"Montana ... alone has enough potential wind resources to supply one quarter of the electricity needs of the United States."

Economic Benefits

Tapping our domestic wind resources brings a host of economic benefits. Since the strongest wind resources are often located in rural areas, rural counties and landowners can benefit from wind power. Wind farms are capital intensive, infusing money into the local economy during construction phases and paying property taxes to the host county and royalties to local landowners during operation. At the 24 MW Klondike Phase I Wind Farm in Sherman County, Oregon, the wind project contributes 10% of the county's property tax base. Wind turbines are also compatible with rural land uses like farming and ranching and can provide extra income to property owners via power sales or royalty payments. On average, landowners make between $2,000 and $7,000 annually for each modern wind turbine located on their land.

In contrast, a natural gas plant drains an estimated $200,000-$350,000 per MW of capacity out of the regional economy annually for fuel imports. Additionally, wind energy produces 27% more jobs per kilowatt-hour than coal plants, and 66% more jobs than natural gas plants.[9]

Wind energy is clearly a homegrown energy source that strengthens the economy and increases the nation's energy security.

How it Works

Turbine blades, modeled after airplane wings, rotate due to a pressure differential caused by air moving over the surface of the blade. The blades cause a rotor to turn, which drives an electrical generator. Turbines can adjust so that they always face toward the wind.

Wind turbines can be designed to operate either at variable speeds or at a single, fixed speed. The variable speed designs are more complex but they convert wind power into electricity more efficiently.

Most wind turbines are designed to use wind blowing anywhere from 8 to 56 mph. Sizes for new U.S. utility-scale turbines for onshore sites range from 850 kW to 2.5 MW and turbines rated 3.5 MW and larger are being used in offshore wind projects.

System Integration

While variable, wind energy can be integrated into a utility system using existing load-matching capabilities for a minimal cost of 0-0.5 cents/kWh.[10] Weather forecasting can predict wind power output with a fair degree of confidence. Additionally, multiple wind sites in different locations can be combined to create a relatively stable power supply curve.

Environmental Impacts

Wind turbines generate electricity without producing any pollutant emissions. In contrast fossil fuel plants emit toxic mercury, nitrous oxides that cause smog, sulfur dioxide that causes acid rain and large quantities of carbon dioxide, the main greenhouse gas. Although wind is one of the most benign power sources, if not properly sited, it too may have environmental impacts. Wildlife and avian impacts are often the greatest concern. New tower, blade and turbine designs and careful siting help minimize environmental impacts.

Incentive Programs

The federal production tax credit offers an important tax credit to new wind production. Each state in the region offers several additional incentives for wind development, from residential projects to utility-scale developments. Oregon, for example, provides personal and business tax credits and low-cost financing for renewable energy projects, while Washington provides small wind turbine owners a strong production incentive and grants sales tax exemptions for renewable energy equipment. Idaho offers a residential tax deduction and a sales tax exemption for renewable energy systems as well as low-interest loans for small-scale wind installations and state-backed bonds for utility-scale wind projects. Finally, Montana offers corporate income and property tax incentives and a residential tax credit for renewable energy installations. Additional incentives are offered as well.

More Information

National Renewable Energy Laboratory: www.nrel.gov/wind/

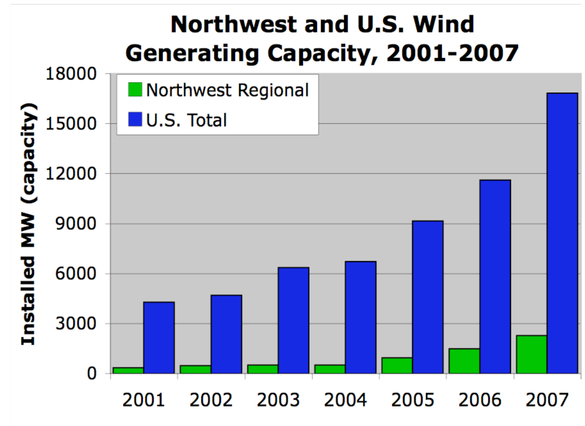
Northwest SEED: www.nwseed.org

National Wind Technology Center: www.nrel.gov/wind/

Renewable Energy Research Laboratory Fact Sheets: www.ceere.org/rerl/about_wind/

American Wind Energy Association: www.awea.org

DSIRE: Database of State Incentives for Renewable Energy: www.dsireusa.org/



Source: see endnote 11.

Sources and Notes:

[1] Wind potential from *Renewable Energy Atlas of the West*, Land and Water Fund of the Rockies, et al. (July 2002).

-Installed capacity from "Renewable Energy Projects Serving Northwest Load", Renewable Northwest Project (RNP) (Feb 19, 2008), www.rnp.org/Projects/projectlist.php, accessed 2/19/08.

-Capacity factor from *Fifth Northwest Electric Power and Conservation Plan*, Northwest Power and Conservation Council (NWPCC) (May, 2005). See Appendix I.

-Levelized costs include transmission and integration costs and the federal Production Tax Credit.

[2] 2005 Northwest consumption from NWPCC, *op. cit.* note 1.

-2004 total U.S. electricity generation from *Annual Energy Outlook 2006*, Energy Information Administration (Feb. 2006). See Table A8.

[3] Installed capacity and projects in development from RNP, *op. cit.* note 1.

[4] "U.S. Wind Energy Projects". American Wind Energy Association (AWEA) (Jan 16, 2008). www.awea.org/projects/ accessed 2/19/08.

[5] Annual growth figures from "Wind Power, U.S. Installed Capacity", AWEA, www.awea.org/faq/instcap.html, accessed 2/19/08. 2007 year-end installed capacity from "Installed US Wind Power Capacity Surged 45% in 2007", AWEA (Jan 17, 2008).

[6] "Statistics", European Wind Energy Association, http://www.ewea.org/index.php?id=180, accessed 2/19/09.

[7] Cost trends from "The Economics of Wind Energy", AWEA (Feb 2005). Levelized costs include transmission and integration costs and the federal Production Tax Credit.

[8] Graphic from "Renewable Energy", New South Wales Department of Energy, Utilities and Sustainability. http://www.seda.nsw.gov.au/ren_wind_body.asp, accessed 9/27/06.

[9] Natural gas fuel cost assumes a 55% efficient combined cycle plant with a 90% capacity factor using natural gas at $4-$7/mmBtu.

-Jobs figures from "Wind Energy for Rural Economic Development", US Department of Energy, EERE (2003).

[10] *Wind Taskforce Report*, Western Governor's Association (March 2006)

[11] U.S. from AWEA, *op. cit.* note 5, NW from RNP, *op. cit.* note 1.