WIND ON THE GRID

Why Wind?

Wind power continues the long hydro tradition of using emission-free renewable resources to meet Northwest loads. Rising concerns over greenhouse gas emissions are prompting city, state, regional, and federal governments to enact policies that promote renewable energy in an effort to stem, or at least slow, the effects of potentially devastating climate change. Wind power has become the preeminent new source of energy due to high reliability and competitive costs. As with other renewable energy sources, the cost of power is not dependent on volatile markets for fossil fuels.

The nameplate capacity of wind on the Bonneville Power Administration grid already exceeds that of nuclear power. On some hours, BPA has received more wind generation than the entire output of the region's remaining nuclear plant. Northwest wind resource additions are growing at nearly 50% per year.

Public power is increasingly involved with wind projects. Last Mile Electric Coop's White Creek project was the first consumer-owned wind project exceeding 200 MW. Energy Northwest's Nine Canyon Wind Project boasts 95.9 MW.

Wind's Place in the Generation Portfolio

Wind resources present important operational challenges to utility operators. From an operational standpoint, resources that are dependable and dispatchable are the most desirable—though flexibility and dispatchability often come with additional costs. In contrast, wind resource output is variable, acting more like system load, but in ways that can be less predictable. In fact, the variable and uncertain properties of wind output are accommodated by power systems in exactly the same way as for load.

The need for certain kinds of ancillary service requirements, such as regulating reserves and generator ramping capability, is increased when a significant amount of wind is brought into a power system. The cost associated with the increased ancillary service requirements is commonly referred to as wind integration cost. The exact amount of those costs is difficult to determine, usually requiring sophisticated power system dispatch models and statistical techniques. Although difficult to calculate, wind integration costs generally fall roughly in the range of 5 - 15% of the total cost of wind generation.

Despite the challenges, wind resources serve substantial fractions of load in some areas. In Europe, Denmark receives more than 20% of its electric power from wind. Germany topped 14% in 2007. Closer to home, both Minnesota and Iowa receive nearly 5% of their electricity from wind. In the US, Texas is King, installing wind generation faster than anywhere else in the world.

Wind is the fastest growing resource in the US and Northwest

Wind Resource Potential

The Renewable Energy Atlas of the West identifies some 5 - 8 average gigawatts of potential wind resource in each of Oregon, Washington, and Idaho. The same source estimates more than 100 average gigawatts of wind resource in Montana. There are other limiting factors such as availability of high voltage transmission to access the resources, siting concerns, and the ability of the existing power system to absorb the variable output of wind projects. The Northwest Power and Conservation Council's Fifth Power Plan identified 6,000 MW (approximately 2,000 average megawatts) of potentially cost effective wind that could be developed in the Northwest.

Web Based Resources

Utility Wind Integration Group
www.uwig.org

American Wind Energy Association
www.awea.org

National Renewable Energy Laboratory
www.nrel.gov

Renewable Northwest Project
www.rnp.org

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Limits to Wind Development

BPA and the Northwest Power and Conservation Council became concerned that the quantity of wind identified might be more than the existing power system could reliably accommodate. In response, a regional study was launched to investigate the issue, resulting in the Northwest Wind Integration Action Plan published in March 2007. The Action Plan concluded that no technical impediments exist to integrating 6,000 MW of wind, while recognizing that the transmission system would need to be expanded to transport all the new resources to load.

The Action Plan identified 16 Action Items necessary to minimize the cost of accommodating wind on the system, and do a better job of evaluating both the value and integration cost of wind. Concerns regarding potential loss of hydro system flexibility and the perceived need for additional storage that were raised are addressed in the Action Plan. Work on the Action Plan Action Items continues at a brisk pace through the Northwest Wind Integration Forum facilitated by the Northwest Power and Conservation Council.

"Backing Up" Wind Resources

It is common to view power plants in terms of their ability to meet customer demand as needed. Wind is primarily an energy resource. For example, BPA ascribes no peaking capability to wind in its published Load and Resources "Whitebook" analysis. In other words, BPA is relying on other identified resources to meet load over the critical peak hours. When the wind blows, the generation from the other resources is displaced. There is no explicit need to add resources to a power system to "back up" the wind. There may be some additional power system services (e.g., ramp rate, regulating reserves, etc.) that are provided by other resources and assessed as wind integration costs.

For More Information

Wind resources place new and sometimes difficult challenges on power planners and operators. There is however a growing body of information available that addresses these concerns. The Northwest Wind Integration Action Plan and updates on the workings of the NW Wind Integration Action Forum are available from the Northwest Power and Conservation Council and at:

http://www.nwcouncil.org/energy/Wind/Default.asp

A very readable survey of the current status of wind technology and interactions with power systems can be found in the IEEE Power & Energy Magazine, vol 5, num 6, Nov/Dec 2007.

Free copies of either of the above documents are available by contacting:

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A far more comprehensive, if slightly older, treatment of wind on power systems can be found in the text Wind Power in Power Systems, ed. Thomas Ackermann, John Wiley & Sons, 2005.

The Utility Wind Integration Group (www.uwig.org) is a great resource for utility personnel seeking information and collaboration with others facing the reality or prospect of wind resources on their systems.