WIND POWER OUTLOOK 2004

Stiff Challenges, Big Opportunities

The U.S. wind energy industry demonstrated once again in 2003 that it can quickly ramp up production to meet the nation's growing power demand. The industry chalked up a near-record year in new wind farm installations, and utility and policy decision-makers are clearly taking notice of this zero-emissions, domestic power source.

The wind industry's momentum was cut short, however, as the federal wind energy production tax credit (PTC) again expired at the end of the year, due to the inability of Congress to agree on comprehensive energy policy legislation. (The PTC provides a tax credit as an incentive to companies that own wind farms.) Unless the PTC is extended early on, the boom of 2003 is likely to be followed by a bust in 2004. This would be the third such boom-and-bust cycle inflicted on the U.S. wind energy industry in the past five years. The industry is calling on Congress to pass a long-term extension of the PTC to provide a stable market environment and unleash the technology's pent-up potential.

Large Potential Ready to Meet the Power Needs of the 21st Century

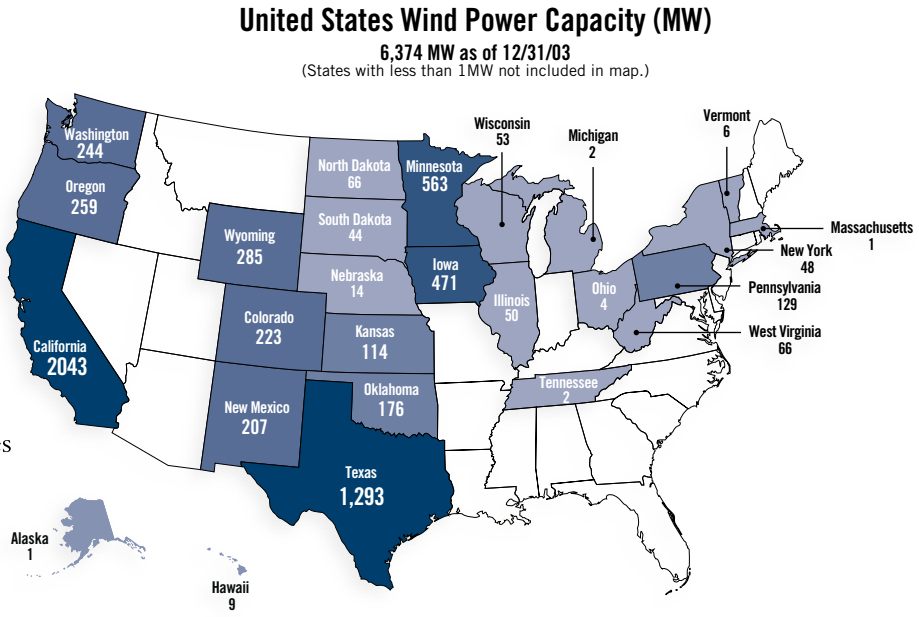
America's wind resources are vast, and may be even greater than previously estimated, according to a 2003 Stanford University study. Previously uncharted offshore potential along the southeastern and southern coasts makes wind power generation feasible in these areas, where little or none had been deemed possible before. Taller sizes and sophisticated electronic controls also allow modern turbines to wring ever more power from the wind.

Tapping only a fraction of America's vast wind resources would easily yield much of the new power that the country will need in the years ahead: in order to generate 15 % of America's electricity (twice what hydropower generates today) only 0.6% of the land of the lower 48 states would have to be developed with wind power plants, according to a study by the Pacific Northwest Laboratory for the U.S. Department of Energy. Within that area, as little as 5% of the land would be taken up by equipment and access roads, and most existing land use, such as farming and ranching, would continue as it is now.

With its abundant, inexhaustible potential, its increasingly competitive cost, and environmental advantage, wind energy is one of the best technologies available today with which to meet the world's growing demand for power.

U.S. Wind Energy Industry Sets Near-Record in 2003

2003 came very close to the best year ever in the U.S., with 1,687 megawatts (MW) of new wind power constructed -- only a few megawatts shy of the record 1,696 MW installed in 2001. Current installed capacity in the U.S. is 6,374 MW, with utility-scale wind turbines installed in 30 states. One megawatt of wind capacity generates enough to power the equivalent of 300 average American households.



The large buildup in capacity is a 36% increase over the installed wind power base in the U.S. at the beginning of the year. Over the last five years (1999-2003), U.S. wind generating capacity has expanded at an annual average rate of 28%.

The wind industry would only have to maintain an annual growth rate of about 18% to achieve the American Wind Energy Association's (AWEA) estimate that wind can provide 6% of the nation's electricity by the year 2020. The past year has shown that rate to be a readily achievable goal with consistent policy support from federal and state governments. More wind power in the nation's power portfolio means less reliance on fossil fuels and vulnerability to spikes in the cost of fuel, more economic development in rural areas, and more pollution-free power.

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Voluntary green power programs are helping bring new wind farms online throughout the country. Altogether, green power programs have facilitated over 1,200 MW of renewable energy — much of it wind power — since the concept was launched some ten years ago. Universities have been particularly strong first adopters of green power.

Oklahoma, Illinois, and Ohio saw their first installations of large-scale wind turbines.

Minnesota added the most new wind power (226 MW) of any state in 2003, moving back into third place in total capacity behind only California and Texas. Three other states topped the 200-MW mark in new installations in 2003: California, with 212 MW; New Mexico, with 205 MW; and Texas, with 204 MW.

Spanish turbine manufacturer Gamesa and Indian manufacturer Suzlon installed their first machines in the U.S. in 2003, both in Minnesota. More than half of the new capacity installed in the U.S. in 2003 consisted of GE Wind turbines.

In other wind turbine manufacturing news, Vestas and NEG Micon, two global market leaders, announced that they would merge, creating the world's largest single wind turbine manufacturing company. The wind energy industry is also producing ever larger, more powerful, and more sophisticated machines. Several companies introduced turbines in the 2-MW range for land-based commercial applications, and even larger turbines are being tested as prototypes. In 2003 GE Wind installed its first offshore 3.6-MW units, off the coast of Ireland -- the largest commercial wind turbines at the time.

Uncertain Policy Environment

In spite of strong bipartisan support, the wind energy production tax credit (PTC) expired December 31, 2003. An extension of the PTC through December 31, 2006, is contained in wide-ranging energy policy legislation on which Congress has been unable to reach final agreement. The PTC, enacted in 1992, provides a 1.8 cent per kilowatt-hour credit (adjusted periodically for inflation) for electricity produced from a wind farm during the first 10 years of operation, and is important for financing wind projects. The delay in the PTC's renewal is inflicting a high cost on the industry — initial estimates by AWEA were that, with a timely extension, a record-busting 2,000 MW of new wind capacity would have been installed in the U.S. in 2004.

The comprehensive energy policy bill also contained a new investment tax credit for small wind turbines (rated at 75 kW and below) used to power an individual home or farm. The credit would help reduce the cost of a small wind system, making it more affordable for consumers.

Absent from the comprehensive energy bill was a "renewables portfolio standard" (RPS) requiring that a growing share of the nation's power supply come from renewable sources by 2020. The Senate had included an RPS in its energy bill in 2002, and in 2003, a majority of Senators urged Congressional leaders to include the RPS in the final energy bill. That effort did not succeed. By rejecting the RPS, Congress failed to provide the type of stable market signal that will stimulate U.S.-based manufacturing and large-scale deployment of renewable energy.

At the state level, implementation of a state-level RPS announced by New York Governor George Pataki in early 2003 is proceeding slowly. The California RPS, passed by the legislature in 2002, is also moving slowly at the Public Utilities Commission. In a more positive development, in early 2004, an RPS was under consideration in both Colorado and Illinois. In Colorado, advocates were preparing to take the RPS directly to voters in a referendum in case the effort failed in the legislature.

Small Wind Systems At Work in U.S. and Overseas

Small wind turbines allow homeowners, farmers, businesses, and public facilities to generate their own clean power and reduce their electricity bills. In 2003, for example, Hershey Park, an amusement park in Pennsylvania, installed a small wind energy system (right) to promote the benefits of clean energy to the park's 2.4 million annual visitors. The 10-kW Bergey Windpower wind turbine and 80-ft. tower were installed with support from the Pennsylvania Sustainable Energy Fund. The system also includes a small solar array. The amount of clean power generated from the wind turbine and the solar panels is displayed in real time. The environmental benefit is equal to not driving almost 30,000 miles each year or to planting over 2,000 trees.

Small wind energy systems also allow off-grid homes and remote communities to generate their own power. In 2003, for example, two 1-kW wind turbines and small solar arrays were installed for a CARE water treatment project in Afghanistan. By eliminating fuel requirements and generator maintenance, such systems greatly reduce the logistics burden for military or relief agencies. The small systems are easy to ship and install. A 1.2-kW hybrid (wind + solar) system can typically supply enough energy to power a school, a clinic, water pumps, or disinfection systems.

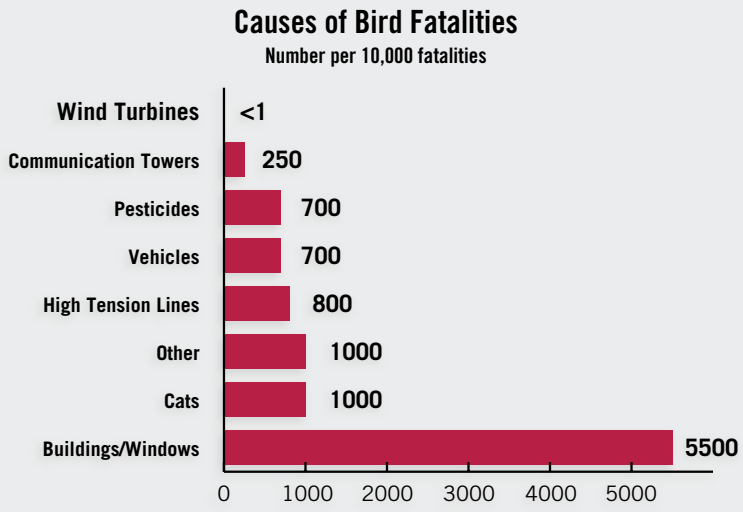
Transmission Reform and Planning: Gordian Knot

As wind energy expands, it faces the challenge of gaining fair access to the utility transmission system and non-discriminatory treatment on its wires. The stakes are high: for the country to tap its wind power potential in a big way and provide 6% or more of the nation's power supply, wind power generators need to get their product to market--for example, from wind-rich areas in the Great Plains and Interior West to urban centers with growing electricity demand.

Securing fair rules, and a planning process that includes wind alongside other power technologies in the design of transmission upgrades and new lines, are key to getting wind power to market across the country.

Over 200 different "tariffs" throughout the country govern the costs and conditions for access to, and use of, the grid. Many of these charge heavy, discriminatory penalties against new technologies like wind. Securing fair rules, and a planning process that includes wind alongside other power technologies in the design of transmission upgrades and new lines, are key to getting wind power to market across the country.

This challenge has been complicated by the sidelining of efforts by the Federal Energy Regulatory Commission (FERC) to overhaul and standardize transmission access rules. National rules proposed by FERC would have eliminated unfair penalties associated with variable output, streamlined interconnection procedures, and leveled the playing field for wind energy. Instead, such non-discriminatory rules will need to be secured on a piecemeal basis. A few jurisdictions, like the Electricity Reliability Council of Texas (ERCOT) and the PJM Interconnection in the mid-Atlantic states, have adopted non-discriminatory transmission pricing, and demonstrate how such reforms enhance competition and benefit consumers. Partial reforms are also in place in California and at the Bonneville Power Administration in the Pacific Northwest. The rules proposed by FERC and already at work in Texas and PJM provide a model for regional transmission organizations throughout the country.



Source: Erickson et al., 2002, Summary of Anthropogenic Causes of Bird Mortality.

Help Save Wildlife With More Wind Power

One of the recurring arguments used by skeptics or opponents of wind energy is that it kills birds. In fact, wind energy is one of the cleanest, most environmentally friendly energy sources available. Estimates run by wind power opponents themselves show that bird deaths due to wind development will never be more than a very small fraction of those caused by other human activities. See **www.yes2wind.com**, the joint Web site of WWF, Friends of the Earth and Greenpeace created to support wind power.

FACT: Even if wind were to generate 100% of U.S. electricity needs today, wind would account for only one of every 250 human-related bird deaths. Leading direct threats to birds include buildings, vehicles, cats, pesticides.

FACT: Power plants are the largest industrial source of air pollutants (including sulfur dioxide, nitrogen oxide, particulate matter, and mercury) in the U.S. A report by the National Wildlife Federation finds that the common loon and other aquatic wildlife in the Great Lakes are at risk from high concentrations of mercury. "Protected" areas such as state and national parks offer no protection to wildlife from this and other forms of airborne pollution.

FACT: Power plants also account for about 34% of the carbon dioxide (CO2) emitted by the U.S., itself the largest emitter of CO2 worldwide. Carbon dioxide is the leading greenhouse gas associated with climate change.

FACT: Climate change is predicted to result in countless bird deaths through large-scale alteration of habitat, according to a Defenders of Wildlife report. WWF reports that the gradual warming of the Arctic is already endangering the lives of birds in the polar region. A study published in *Nature* (January, 2004) found that one million species--more than one-third of native species of plants and animals worldwide--could disappear or approach extinction by 2050 if global warming continues.

FACT: The new wind capacity installed in the U.S. in 2003 will displace emissions of three million tons of carbon dioxide (the leading greenhouse gas) annually.

Lots More Wind Power = Cheaper Natural Gas

The cost of wind power, once a wind farm has been built, is steady over time, and not subject to fuel price volatility. This, along with its economic benefits for rural areas and its environmental advantage, makes wind an attractive technology with which to diversify the nation's power portfolio and help reduce the looming natural gas shortage predicted by many energy experts.

As part of a national energy program aimed at moving quickly to deal with the shortage and increase overall reliability of the national electricity transmission system, AWEA has launched a three-step "wind pipeline" proposal to collect wind-generated electricity from the windy, lightly-populated heartland and deliver it to urban centers in the Midwest and West.

Phase I: Transmission reform to more fully utilize existing power line capacity and ensure non-discriminatory access. Cost: $0. New wind capacity facilitated: ~4,000 MW (equivalent to ~0.4 billion cubic feet (Bcf)/day of natural gas, or electricity needs of 1 million homes).

Phase II: Addition of several new local transmission lines to remove existing system bottlenecks and bolster secondary-level reliability. Cost: ~$1 billion. New wind capacity facilitated: ~26,000 MW (equivalent to ~2.4 Bcf/day of natural gas, or electricity needs of 6.5 million homes).

Phase III: Construction of two major high-voltage lines from the northern Plains to the East (Trans-Prairie Wind Pipeline) and West (Interior West Wind Pipeline). Cost: $10 billion to $20 billion. New capacity facilitated: 30,000 MW to 60,000 MW (equivalent to ~2.8-5.5 Bcf/day, or electricity needs of 7.5 million to 15 million homes). Three Bcf/day is about as much natural gas as the states of Colorado and Alaska produce today. Neither Phase III nor any construction of new major transmission lines should occur unless non-discriminatory access and reliability standards are in place.

The AWEA proposal would improve reliability of the electric system, and provide a sturdy link between the Midwest and West. The large-scale investments in wind energy would not only relieve pressure on natural gas prices, but also revitalize rural communities in many parts of the Great Plains.

Wind/Natural Gas Compatibility

WIND		NATURAL GAS
Low Operating Cost	⟷	High Operating Costs
High Capital Cost	⟷	Low Capital Cost
Non-dispatchable	⟷	Dispatchable
No Fuel Supply/Cost Risk	⟷	Fuel Supply/Cost Risk
No Emissions	⟷	Smog, Greenhouse Gas Emissions

Wind and natural gas power plants are a winning combination on the grid and in a utility's power portfolio because of their complementary characteristics.

Wind Energy: A Popular Energy Source

As wind power expands, so has publicity about occasional, not-in-my-backyard (NIMBY) opposition to proposed wind farms. Could wind energy face a backlash of public opinion?

Public opinion surveys conducted over the years and in 2003 in fact reveal strong backing for wind power, and for renewable energy in general.

The Nebraska Public Power District in August, 2003, asked its customers whether it should go forward with a $200 million wind project if that meant that utility rates would increase by up to 2.5%. The response was stunning: 96% said yes, and 37% thought the wind project should be larger. A more traditional opinion poll of Colorado residents in March likewise found 82% supporting "wind and solar" even if rates would increase as a result.

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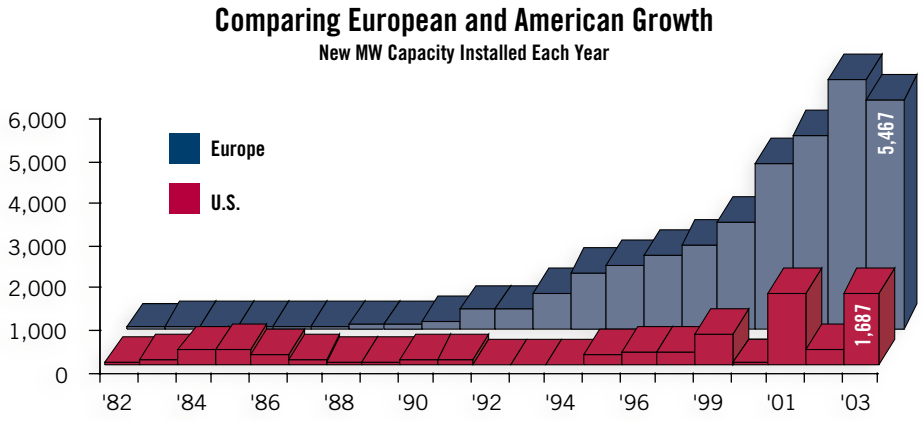
In Scotland, according to a 2003 survey, people living close to the 10 largest wind farms in the region strongly support wind, 82% of the respondents want an increase in electricity generated from wind, and 54% support an increase in the number of turbines at their local wind farm. In Spain, studies surveying the Catalonian province of Tarragona showed that four out of five Catalonians favor wind energy, with the strongest support coming from people residing near a wind farm.



Smart Wind Turbines Can Enhance Grid Reliability

The massive blackout that affected much of the American Northeast in August, 2003, exposed long-standing weaknesses in the nation's transmission infrastructure and management. However, agreement on what needs to be done remains elusive.

Inefficient, "balkanized" markets and tariffs should be avoided, and development of "smart" transmission system controls should be aggressively pursued, according to AWEA. Sophisticated new communications and monitoring hardware and software should be installed to enable grid controllers to monitor and manage power flows more easily. The cost of such investments to expand capacity and efficiency of transmission is relatively small compared to the costs of a large blackout or to the savings that would be gained from increased efficiency in the much-larger electricity generation sector.

The wind energy industry is developing performance standards and interconnection requirements for its own technology that could enhance grid reliability. New designs make it possible for wind turbines to continue operating through a problem on the utility system such as a short circuit or a lightning strike instead of being required and designed to shut down. In fact, turbines have become so advanced that they can stay connected in such events and actually help maintain the stability of the system's power quality. The offshore Horns Rev wind farm in Denmark, a country that gets more than 20% of its power from wind, provides an example of such advances in the technology.

The challenge facing the U.S. wind energy industry is to ensure that officials at the North American Electric Reliability Council (NERC) and regional and state counterparts, backed by effective enforcement by the Federal Energy Regulatory Commission (FERC), not only recognize wind's technological capabilities, but also work with the wind energy industry to establish fair, non-exclusionary reliability standards.

World Market Expands Steadily

Global wind power generating capacity increased by over 8,000 MW in 2003, a 26% increase, with most of the market growth occurring in Europe. The near-record year in the U.S. offset a slight decline in new installations in the massive German market. Spain added the most wind power (1,377 MW) after Germany (2,645 MW) and the U.S. (1,687 MW). The world's total wind power generating capacity was over 39,000 MW at the end of 2003—up from just over 31,000 MW a year before. In 2002, some 6,868 MW of new capacity were installed worldwide.

European installations grew by 5,467 MW in 2003, according to the European Wind Energy Association (EWEA), bringing total capacity in the European region to 28,706 MW. Europe– and within Europe, Germany, Spain, and Denmark– remains the world's largest wind power market.

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