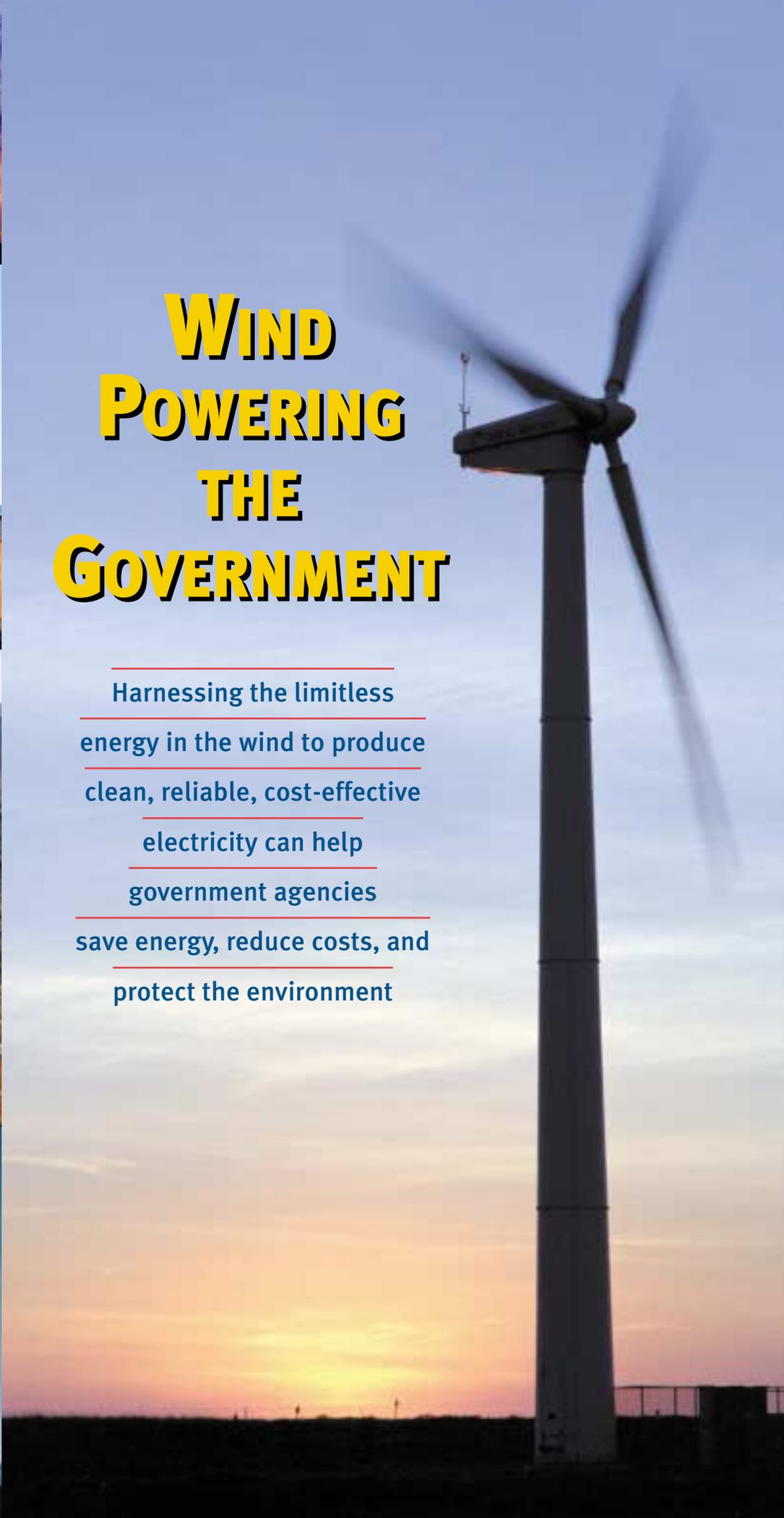




# WIND POWERING THE GOVERNMENT

Harnessing the limitless  
energy in the wind to produce  
clean, reliable, cost-effective  
electricity can help  
government agencies  
save energy, reduce costs, and  
protect the environment



# WIND POWERING THE GOVERNMENT

## WHY CHOOSE WIND POWER?

Wind power is the fastest-growing energy technology in the world today. By choosing wind power, Federal agencies can reduce their electricity bills and their use of fossil fuels to help protect the environment and increase our nation's energy security. Modern wind energy systems can provide clean, reliable electricity almost anywhere the wind blows. Examples of Federal facilities currently using wind energy systems include military bases; sites with remote communications equipment and navigation aids; and ranger stations, visitor centers, and other park facilities.

Federal agencies can also purchase power produced by the wind, or "green power," from electricity providers in states with both regulated and restructured electricity markets. Green power products may not be available in some states. But Federal agencies might want to include a provision for green power in their request for proposals, to help stimulate the green power market. Another option is to purchase "green tags" or "green certificates." By purchasing green tags, the customer pays for the delivery of renewable energy into the grid. The environmental benefits created by the renewable energy facility are attributed to that customer, directly offsetting the environmental impact of the customer's conventional energy use.



Northern Power Systems/PIX08958

**The National Science Foundation found that a hybrid wind-PV-diesel system works well even in Antarctica's harsh environment.**



Warren Gretz, NREL/PIX08688

**The wind systems on San Clemente Island are reducing smog-producing nitrogen oxides and other emissions associated with traditional generators.**

turbines totaled about \$2.2 million. The first two turbines were financed jointly by the Department of Defense, the Department of Energy (DOE), and the Environmental Protection Agency through the Strategic Environmental Research and Development Program; the third was funded chiefly through the Department of Energy's Federal Energy Management Program. Technical assistance was provided by Wind Program staff at DOE's National Renewable Energy Laboratory. Although diesel generators continue to back up the turbines when winds are very low or calm, diesel use has been greatly reduced. Resulting fuel cost savings are projected to be more than \$160,000 annually. From February 1998 to April 2000, the turbines produced 2 million kilowatt-hours of electric power. It is estimated they will provide at least 15% or more of the island's electricity needs. The Navy is also considering a fourth turbine for San Clemente to use for water desalination.

## HERE ARE THREE OF THE MANY WAYS THAT AGENCIES ARE HARVESTING THE WIND:

**1**

### The Navy: Three Large Turbines for San Clemente Island

To reduce the high fuel and operating costs associated with its diesel generator systems and improve air quality, the U.S. Navy, Department of Defense, recently installed three large 225-kilowatt wind turbines mounted on 90-foot tubular steel towers on San Clemente Island. San Clemente, one of the Channel Islands off the coast of southern California, is a site for Navy activities in research, development, testing, evaluation, and training; it covers about 57 square miles.

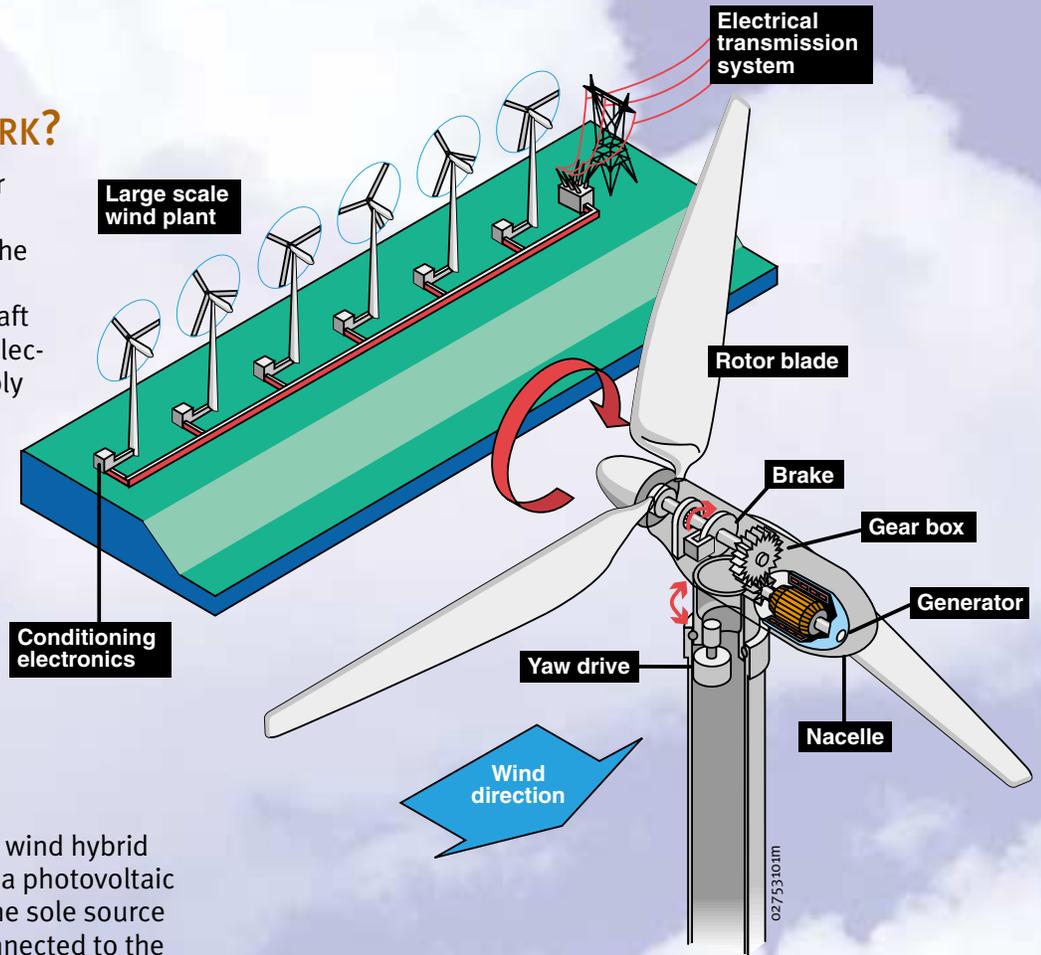
Purchase, installation, and other related costs for the three

## HOW DO WIND SYSTEMS WORK?

Today's turbines are versatile, modular sources of electricity. Their blades are aerodynamically designed to capture the maximum energy from the wind. The wind turns the blades, which spin a shaft connected to a generator that makes electricity. The rotor and generator assembly sits atop a tall tower, in order to harvest the swiftest winds.

Large turbines can be grouped together to form a wind plant or "wind farm," which feeds power to the electrical transmission system. Each large, utility-scale turbine generates from 100 to 2000 kilowatts of power, depending on its size. A 750-kilowatt turbine can produce enough electricity for approximately 250 average-size homes.

Wind turbines with storage systems or wind hybrid systems with backup generation (e.g., a photovoltaic system or a diesel generator) can be the sole source of power in remote areas or can be connected to the grid to feed excess generation into the utility system. Small wind turbines are available in a range of sizes from 300 watts up to 100 kilowatts.



## 2 The Bureau of Indian Affairs: Nine Small Turbines for Fort Apache

Five fire lookout towers, used for surveillance and radio communications, dot the forest lands of the Fort Apache Indian Reservation in eastern Arizona. Four are powered by solar electric systems, which work well until unusually heavy usage or poor atmospheric conditions intervene. In such extreme conditions, interruptions in power supplies can disrupt critically important communications.

To provide reliable backups to the solar systems, the Fort Apache Agency in the Bureau of Indian Affairs, U.S. Department of the Interior, decided to install nine small wind turbines (up to 500 watts each). The wind resource is excellent in the forests of Arizona's White Mountains, where average wind speeds are about 18 miles per hour. So it made sense to choose these small, rugged, highly efficient machines. The three-bladed turbines, with rotor diameters of about 60 inches (1.5 meters), were designed specifically for extremely windy conditions. They were purchased and installed with funds contributed by both the agency (about \$10,000) and DOE FEMP (about \$23,500).

**These small but rugged turbines, barely visible inside the lookout tower structure, produce up to 500 watts of power each.**

## HOW MUCH DOES WIND ENERGY COST?

Wind systems still require a higher initial investment than fossil-fueled generators do. Costs range from \$1,000 to \$3,000 per kilowatt, depending on the system's size. Generally, the larger the system, the lower the per-kilowatt cost. On a life-cycle-cost basis, however, wind energy is cost-effective today, because there is no fuel to purchase and transport and operating expenses are minimal. Life-cycle costs range from around 5 to 15 cents per kilowatt-hour.

There are several ways to finance Federal wind energy projects and purchase wind power: direct appropriations; DOE's Federal Energy Management Program (FEMP) Super Energy Savings Performance Contracts (Super ESPCs); utility service contracts, incentives, or financing programs; and green power or green tag purchases.

Some agencies use appropriations to meet the goals of Executive Order (E.O.) 13123; small wind turbines can be purchased from the GSA supply schedules. And FEMP can provide help with free energy audits and assistance with Super ESPC and utility contracts, which often cover capital equipment costs.

Section 404c1 of E.O. 13123 directs agencies to include provisions for green power purchases in their requests for bids from electricity providers. Most utilities that provide green power charge a small monthly premium, so the order

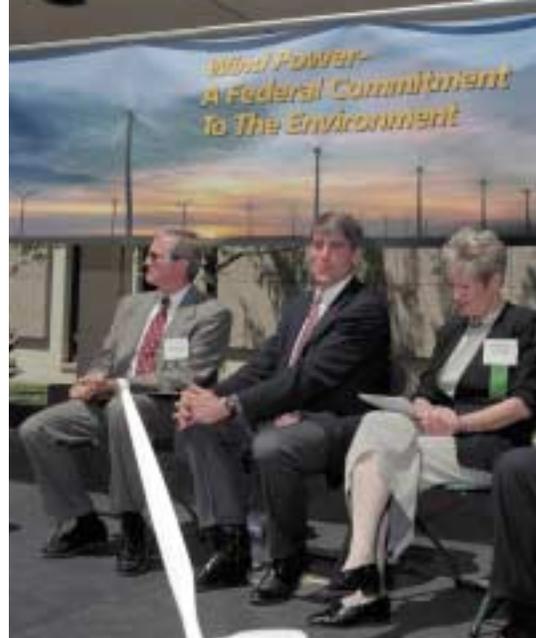


Warren Gretz, NREL/PIX08604

**The Ponnequin Wind Facility in northern Colorado generates power for more than 14,500 customers and plans to expand.**

The Denver Federal Executive Board, a group of top government agency officials, helped to spearhead the initiative. Participating agencies include DOE (through the Golden Field Office, Denver Regional Office, National Renewable Energy Laboratory, and Rocky Flats Environmental Site), the General Services Administration (GSA), the Environmental Protection Agency (EPA), the Departments of Agriculture, Defense, and the Interior, and many others. According to the GSA, EPA's contract alone is for 384,000 kilowatt-hours of wind power per year. Windsource power is generated at Public Service's Ponnequin Wind Facility in northern Colorado. The facility housed 29 turbines when the announcement was made; more new turbines are planned. The environmental impact of this initiative is roughly equal to planting 11,250 acres of new trees, or reducing automobile travel in the area by 54 million miles a year. Agencies in other regions are also obtaining power from the wind and other renewable energy sources, and more than 40 utilities in 17 states now have "green pricing" programs. See GSA's Green Power Web site for more information ([www.gsa.gov/pbs/centers/energy/green.htm](http://www.gsa.gov/pbs/centers/energy/green.htm)).

**Chuck Fuller, New Century Energies (left); Rep. Mark Udall of Colorado; and Susan Damour, GSA Regional Administrator spoke at ceremonies announcing the Front Range Wind Power Purchase in April 2000.**



Warren Gretz, NREL/PIX02790

encourages agencies to pursue financing options. These include using savings obtained through energy efficiency measures and "bundling" energy efficiency with green power purchases.

Where green power is not yet available, agencies can purchase green tags. In a green tag transaction, the customer continues to purchase energy from its existing utility or power marketer and purchases green tags from a different seller such as the Bonneville Environmental Foundation (BEF). For a small premium, about 1 or 2 cents per kilowatt-hour, any agency can pay BEF to purchase power from renewable energy plants and give the agency credit for the environmental benefits of the green power purchase, such as reduced emissions. For more information about green tags, please call Robert Harmon, BEF, 206-463-4986.

## **3** Rocky Mountain Front Range: 10 Megawatts for More Than 30 Agencies

In April 2000, more than 30 Federal agencies in the Rocky Mountain Front Range announced they will purchase 10 megawatts of wind power from Public Service Company of Colorado's Windsource program and other electricity providers. In the largest single wind power purchase to date, several agencies have already signed contracts for blocks of Windsource electricity at a small premium, about \$2.50 per 100-kilowatt-hour block. DOE's Federal Energy Management Program is assisting many agencies in financing these purchases with the money they save by implementing energy efficiency measures.

The Denver Federal Executive Board, a group of top government agency officials, helped to spearhead the initiative. Participating agencies include DOE (through the Golden Field Office, Denver Regional Office, National Renewable Energy Laboratory, and Rocky Flats Environmental Site), the General Services Administration (GSA), the Environmental Protection Agency (EPA), the Departments of Agriculture, Defense, and the Interior, and many others. According to the GSA, EPA's contract alone is for 384,000 kilowatt-hours of wind power per year. Windsource power is generated at Public Service's Ponnequin Wind Facility in northern Colorado. The facility housed 29 turbines when the announcement was made; more new turbines are planned. The environmental impact of this initiative is roughly equal to planting 11,250 acres of new trees, or reducing automobile travel in the area by 54 million miles a year. Agencies in other regions are also obtaining power from the wind and other renewable energy sources, and more than 40 utilities in 17 states now have "green pricing" programs. See GSA's Green Power Web site for more information ([www.gsa.gov/pbs/centers/energy/green.htm](http://www.gsa.gov/pbs/centers/energy/green.htm)).



David Parsons, NREL/PIX06776

**These wind systems each produce 550 kilowatts for Green Mountain Power Corporation in New England.**

## WIND POWERING AMERICA

Wind Powering America, a new initiative announced by the Department of Energy in 1999, promotes greater use of wind energy throughout the United States. Meeting the goals of this initiative will help to save energy, increase our energy security, and strengthen the economy, particularly in many rural areas where "wind farms" can harvest the considerable power of the wind without harming the environment.

Wind Powering America challenges the nation to meet at least 5% of our electricity needs with wind energy by 2020. Because there are more than half a million Federal buildings, with electric bills totaling about \$3.5 billion per year, the government is in a unique position to help meet the nation's goal for wind energy. Therefore, the initiative challenges the Federal government to obtain at least 5% of its electricity from wind by 2010.

Today, most of the Federal government's electricity comes from traditional sources such as fossil fuels. However, the emissions associated with burning fossil fuels can have adverse effects on our air, our health, and our climate. Therefore, the President directed Federal agencies to reduce greenhouse-gas emissions by 30% from 1990 levels, and reduce conventional energy use by 35% from 1985 levels, by 2010 (see Executive Order 13123). The order also states

that "each agency shall strive to use electricity from clean, efficient, and renewable energy sources," which include solar, geothermal, and biomass as well as wind resources.

**For more information about how your agency can benefit from harnessing the power in the wind, please visit <http://www.eren.doe.gov/windpoweringamerica/>, or contact one of the program specialists listed on the back of this brochure.**

*The GSA Rocky Mountain Region looks forward to helping Federal agencies clean up our air and do our part to meet DOE's challenge to purchase 100 megawatts of wind energy by 2001.*

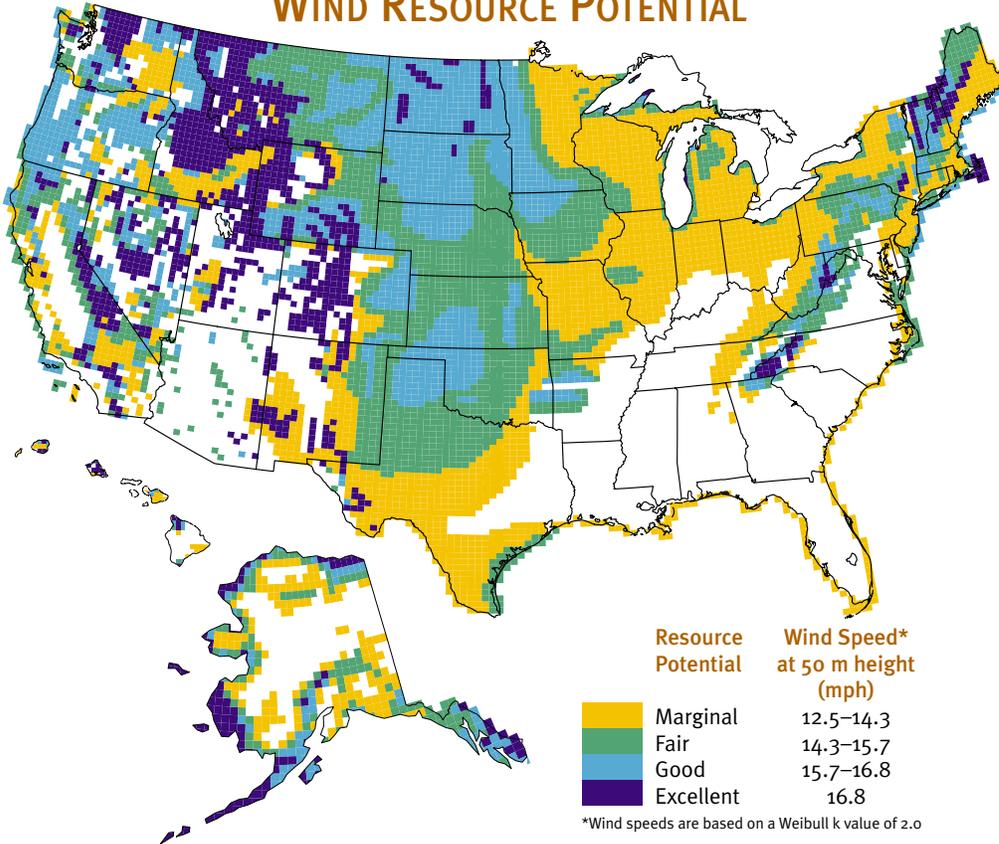
**— Susan Damour, Regional Administrator, GSA Rocky Mountain Region**



Warren Gretz, NREL/PIX03407

**Representatives from Federal agencies signing up to purchase wind power along the Rocky Mountain Front Range gather around the 7.9-meter (26-foot) wind turbine blade displayed at the Earth Day 2000 Wind Power Commitment ceremonies in Denver.**

## WIND RESOURCE POTENTIAL



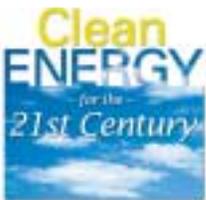
## THE U.S. WIND RESOURCE

Wind energy is abundant in the United States. The average wind speed is the critical feature in determining an area's potential for wind power, because the energy in wind is proportional to the cube of the wind speed. In other words, a stronger wind can mean a lot more power.

Wind resources are characterized by wind-power density classes, ranging from marginal to excellent. Most states have at least marginal wind resources, and many states have excellent resources. In fact, North and South Dakota alone have enough wind to meet two-thirds of the nation's current electricity needs.

The map above shows the major wind resources in the United States. Note, however, that local wind regimes cannot all be shown on a map this size. If you have questions about resources in your area, contact the National Wind Technology Center (see column at right) or see its Web site at <http://www.nrel.gov/wind/database.html>.

The Department of Energy researches, develops, and deploys clean, efficient, and renewable energy technologies to help meet America's energy needs while protecting the environment and strengthening the economy. Energy technologies supported and promoted by the Department will play a key role in providing Clean Energy for the 21st Century.



United States Department of Energy  
1000 Independence Avenue, S.W.  
Washington, D.C. 20585



## FOR MORE INFORMATION

For information about DOE's wind programs, please contact:

U.S. Department of Energy  
Wind Energy Program  
1000 Independence Ave., S.W.  
Washington, DC 20585  
Phone: 202-586-5348

For information about free SAVEnergy audits, and about how your agency can qualify for design assistance or obtain FEMP Super ESPC project financing, please contact:

Patrina Eiffert  
Deployment Programs  
National Renewable Energy Laboratory  
1617 Cole Blvd.  
Golden, CO 80401-3393  
Phone: 303-384-7548  
E-mail: [Patrina\\_Eiffert@nrel.gov](mailto:Patrina_Eiffert@nrel.gov)

For assistance with technical information, wind project feasibility studies, or wind resource assessments for your area, please contact:

Ed Cannon  
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National Renewable Energy Laboratory  
1617 Cole Blvd.  
Golden, CO 80401-3393  
Phone: 303-384-6920  
E-mail: [Ed\\_Cannon@nrel.gov](mailto:Ed_Cannon@nrel.gov)

And visit these sites on the Internet:  
<http://www.eren.doe.gov/wind/>  
<http://www.eren.doe.gov/femp/>  
<http://www.gsa.gov/>

Produced for the U.S. Department of Energy (DOE), by the National Renewable Energy Laboratory, a DOE national laboratory

DOE/GO-102000-0967  
August 2000

Cover photos, counterclockwise from top left:  
Warren Gretz, NREL/PIX07158; Kent Bullard, National Park Service/PIX05426; Pacific Industrial Electric/PIX06132; Northern Power Systems/PIX08954; Warren Gretz, NREL/PIX08699.

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