

# Wind Power

## for Public Power Utilities

*A brief on wind program development, the benefits of wind in the resource portfolio, and tools that public power utilities can use to launch a wind program today.*



# Proven Pathways for Wind Development

**P**ublic power utilities, including municipal utilities, public power districts, and joint action agencies, have long been leaders in wind power development. Today, hundreds of public power utilities include wind power in their resource portfolios. These utilities support wind development in diverse ways, suited to their unique interests and needs.

## With Customer Support

More than 50 public power utilities, including 10 wholesale suppliers serving hundreds of member communities, offer green pricing programs today. Although green pricing may support any renewable resource, wind dominates this market. To participate in a green pricing program, customers opt to pay a little more per kilowatt-hour or to purchase a set amount of renewable energy each month. Utilities use this money to acquire resources through direct ownership or power purchase agreements. Whether it is the utility's only way to support wind power or whether it complements other wind acquisitions, green pricing is an effective way to diversify the utility resource portfolio, support customer choice, and boost community spirit.

## By Contract

Power purchase agreements are familiar to municipal utilities and public power districts, many of which have little or no native generation. Supply contracting is well suited for wind power acquisitions because it allows the utility to

- Outsource expertise needed for wind project development, maintenance, and operations
- Outsource many project risks, including financing risk
- Specify the amount of wind power it needs and the terms of delivery
- Enjoy cost advantages associated with large wind developers and marketers.

Austin Energy, Sacramento Municipal Utility District, and Los Angeles Department of Power and Water are three of the many public power utilities that purchase wind power.



*In the late 1990s, Colorado-based Fort Collins Utilities worked with its supplier, the Platte River Power Authority, to launch one of the first utility green pricing programs in the nation. Fort Collins signed up more than 700 subscribers, even before turbine construction began. Backed by continuing customer support, Fort Collins recently promised to meet 15 percent of its energy needs with renewables by 2017. The utility will add rate-based wind power to subscription-based acquisitions to meet this goal.*

## By Ownership

Some public power utilities and joint action agencies invest directly and drive wind development from project design and financing through construction, commissioning, and the use or sale of wind power. Advantages include potentially lower costs and greater flexibility in balancing wind's role in the resource portfolio. Smaller wind projects have been cash-financed, but trends point to larger projects, using better financing instruments and longer terms.



*The Nine Canyon Wind Project, developed, owned, and operated by Energy Northwest in Washington State, is one of the nation's largest public power wind projects. Built in two phases, it includes 49 turbines, with a total generating capacity of about 64 MW. The project used investment-grade tax-exempt municipal bond financing and has received federal Renewable Energy Production Incentive (REPI) support. A careful technical and financial strategy has resulted in highly competitive wind energy production at about 3.5 cents per kWh.*

## Together

Today's big wind projects typically have multiple investors. Partnerships among public power utilities or joint action agencies offer special advantages, such as compatible views on financing and transmission-access issues and opportunities for joint marketing. And the key players in these partnerships are not just the biggest investors. Sometimes a small utility can spur a wind partnership that has benefits region-wide.



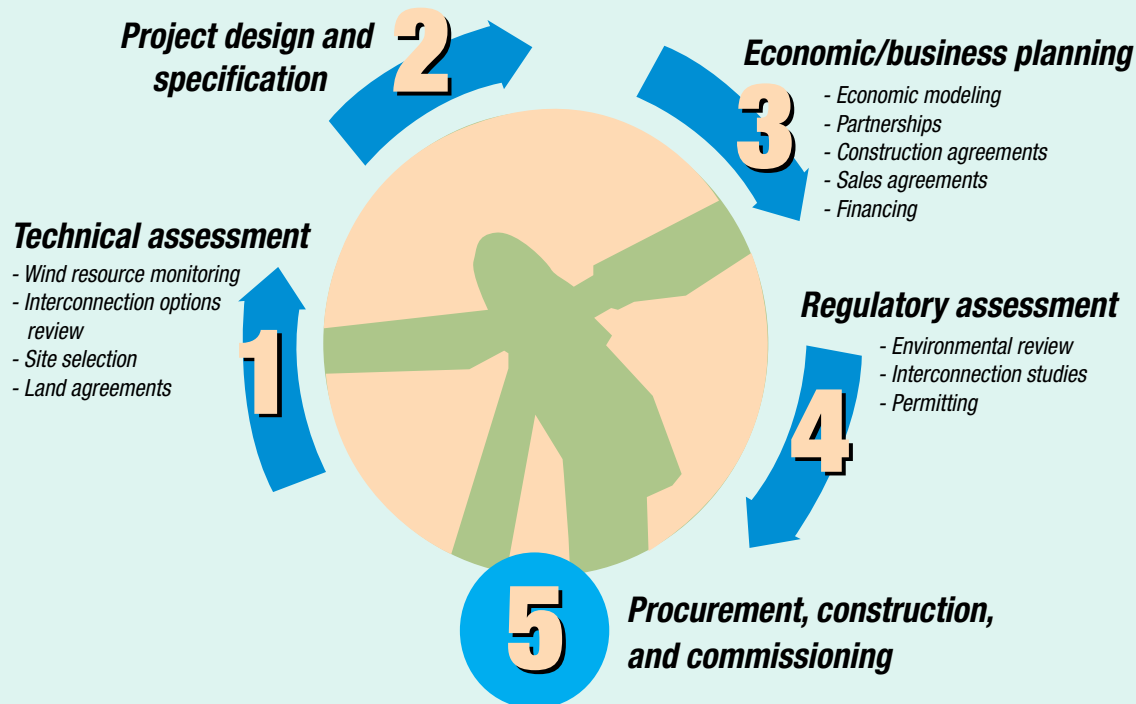
*Teamwork helped the Municipal Energy Agency of Nebraska (MEAN) to achieve its status as a national leader in wind power development. Early on, Phil Overeynder, manager of a member utility in Aspen, Colorado (right, with NMPP Energy retired CEO Richard Duxbury), urged other MEAN member utilities to support wind development. Interest snowballed, and the result was a 10.5 MW project at Kimball, Nebraska. Recently, MEAN teamed up with the Nebraska Public Power District to buy 7 MW of NPPD's new 60 MW wind project near Ainsworth.*

## With Industry

To some degree, every public power wind project involves industry partners, from expert engineering consultants to technology providers to power marketers. But some projects work these partnerships to their greatest advantage, helping small utilities or joint action agencies to contain costs and to work more effectively in an increasingly competitive wind market. For example, AMP-Ohio partnered with Green Mountain Energy to launch a project at Bowling Green, and the Arkansas River Power Authority worked closely with GE Wind to coordinate with an expansive wind development near Lamar, Colorado.

# Common Steps and Customized Approaches

## The Wind Power Development Process



### Notes:

- Some of the activities in the wind power development process must be concurrent and interactive.
- Utilities that plan to buy wind power through power purchase agreements instead of pursuing capital investments will be most concerned with the economic and business planning aspects of the project development process. Still, utility decision makers should evaluate prospective wind power suppliers thoroughly, including reviewing technical plans and all aspects of credit worthiness.

## Getting Started

Explore the following links and find dozens more tools and resources to support public power wind development.

**The Public Renewables Partnership (PRP)** web site, [www.repartners.org](http://www.repartners.org), is a one-stop shop for public power utilities, cooperatives, and tribal utility authorities working to establish renewable energy programs. The site is supported by the U.S. Department of Energy (DOE) and other federal agencies, American Public Power Association, National Rural Electric Cooperative Association, state agencies, and non-profit organizations. Web site visitors can find

state-specific wind information, technical references, and updates about special events.

**Wind resource maps** are easy to find on the U.S. DOE Wind Powering America Web site, [www.eere.energy.gov/windandhydro/windpoweringamerica](http://www.eere.energy.gov/windandhydro/windpoweringamerica), or through a quick link on the wind page of the PRP web site, [www.repartners.org](http://www.repartners.org). These recently refined maps show wind resources from Class 1 (low) to Class 7. To be cost-effective, a utility-scale wind project usually requires wind resources of Class 3 or above. Microclimates greatly affect wind resources, as does the height of the wind tower. Onsite monitoring should follow the map-based resource review.



**Wind monitoring equipment** may be loaned to utilities served by the Western Area Power Administration. See [www.wapa.gov/es/loan](http://www.wapa.gov/es/loan). Utilities also may check the open listing of consultants that specialize in wind resource assessment, provided by the American Wind Energy Association, [www.awea.org](http://www.awea.org).

**The Wind Workshop in a Box CD-ROM** links users to updated Web-based information. It also includes resources to help create a workshop for local decision makers. It was developed by the Western Area Power Administration in partnership with the Interstate Renewable Energy Council and DOE Wind Powering America Program. See [www.repartners.org](http://www.repartners.org).

**Public Power Investments in Wind** is a case study collection produced for the American Public Power Association with support from the Western Area Power Administration and the DOE Wind Powering America program. The 2006 updated edition (on CD-ROM) includes searchable case studies of utility and joint action agency projects. See [www.repartners.org](http://www.repartners.org) or contact American Public Power Association at [DEED@APPAnet.org](mailto:DEED@APPAnet.org).

**A Guidebook to Expanding the Role of Renewables in a Power Supply Portfolio**, produced for the American Public Power Association with support from the Western Area Power Administration and Gila Resources (2004), provides a detailed review of the development process for wind and

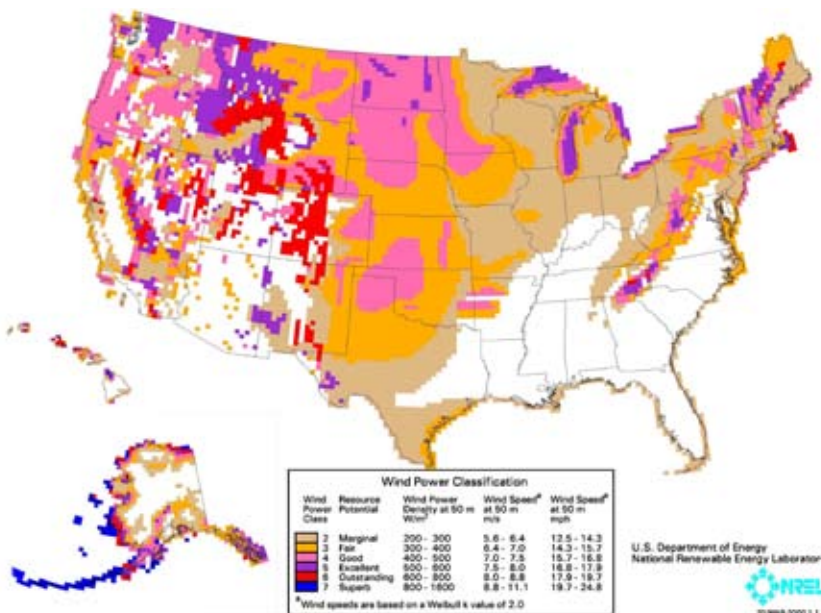
other renewable energy resources. See [www.repartners.org](http://www.repartners.org) or contact American Public Power Association at [DEED@APPAnet.org](mailto:DEED@APPAnet.org).

**The Database of State Incentives for Renewable Energy**, [www.dsireusa.org](http://www.dsireusa.org), is an interactive Web site providing updated information on state incentives, regulations, and guidelines for renewable energy.

**The Utility Wind Integration Group**, [www.uwig.org](http://www.uwig.org), is focused on technical issues associated with utility systems planning, design, and operation to accommodate significant amounts of wind energy. UWIG members include utility professionals working in close association with DOE and NREL wind programs.

**Windustry**, [www.windustry.org](http://www.windustry.org), promotes community wind development through educational materials, technical assistance, and collaborative efforts to assist rural landowners, local communities, and utilities. Windustry serves interests of both distributed and grid-integrated wind development.

**The Green Power Network**, at [www.eere.energy.gov/green-power](http://www.eere.energy.gov/green-power), offers information and support for utility green pricing programs. It features the NREL "Top Ten" listings of utility green power programs and information on renewable energy certificates.



Today's wind resource maps help planners to zero in on good sites for project development.

# Why Wind?

Utilities all consider favorable economics as key to any successful wind project. When wind power is available, it is a low-cost resource, offering an inexhaustible supply and a stable cost outlook for the life of the equipment—up to 30 years or more. But the other project drivers—the ones that inspire leadership and success—are unique to each community. Usually they relate to one or more of these interests

- Resource portfolio diversification
- Strategies to hedge reliance on natural gas
- Strategies to balance emissions from other resources
- Response to customer interest in green power
- Support for wind power as a local or regional resource
- Economic development opportunities



*Hometown Green. The Arkansas River Power Authority (ARPA) and a member utility, Lamar Light and Power, own a total of five 1.5 MW wind turbines near the sprawling Colorado Green wind project in southeastern Colorado. A number of drivers prompted this public power effort, including the chance to share the larger development's economy of scale, the chance to balance coal and natural gas resources in the utilities' portfolios, and a long-term interest in developing the region's wind to benefit the people who live and work there.*

## Looking for Answers

The intermittent performance of wind plants has raised important questions for utility system planners and operators—questions that wind research agencies, industry, and electric utilities have been collaboratively working to answer. For some questions, research has provided definitive answers and remedial tools. For others, uncertainties remain.

### **Do wind plants need backup with dispatchable generation?**

Based on a 2003 review of operating data at current wind penetrations, the Utility Wind Interest Group (now the Utility Wind Integration Group) concluded, “The need for additional generation to compensate for wind variations is substantially less than one-for-one, and generally small relative to the size of the wind plant.” The electric grid is designed to address most temporary outages and load fluctuations, including those associated with wind generation. Yet there are costs for balancing loads and electricity supplies on the grid and for meeting wind generation safety and reliability standards. These costs are mostly for ancillary services, including

- Near-instantaneous system regulation
- Load following (forecasted hourly, typically in five- to ten-minute increments)
- Unit commitment (forecasted a day to a week ahead).

Ancillary services are required for all generation resources. For wind, these services usually add less than 10 percent to the wholesale cost. Actual costs will be site-specific and depend on factors such as wind characteristics, accuracy of wind forecasts, and the level of wind penetration within the control area.

### **Are there other solutions to wind intermittency?**

Technical and operational strategies that can further improve wind integration include

- Incorporation of wind forecasts into standard utility-operations planning tools
- Resource diversity, including a variety of dispersed wind projects on the grid
- Coordination with generating capacity that has good ramping and load following capability

- Assignment of real-time control of wind generators to larger control areas
- Greater use of customer load-management technology and markets for price-responsive loads
- Low-speed wind turbines that extend resource availability
- Electricity storage, including pumped hydropower and compressed air storage.

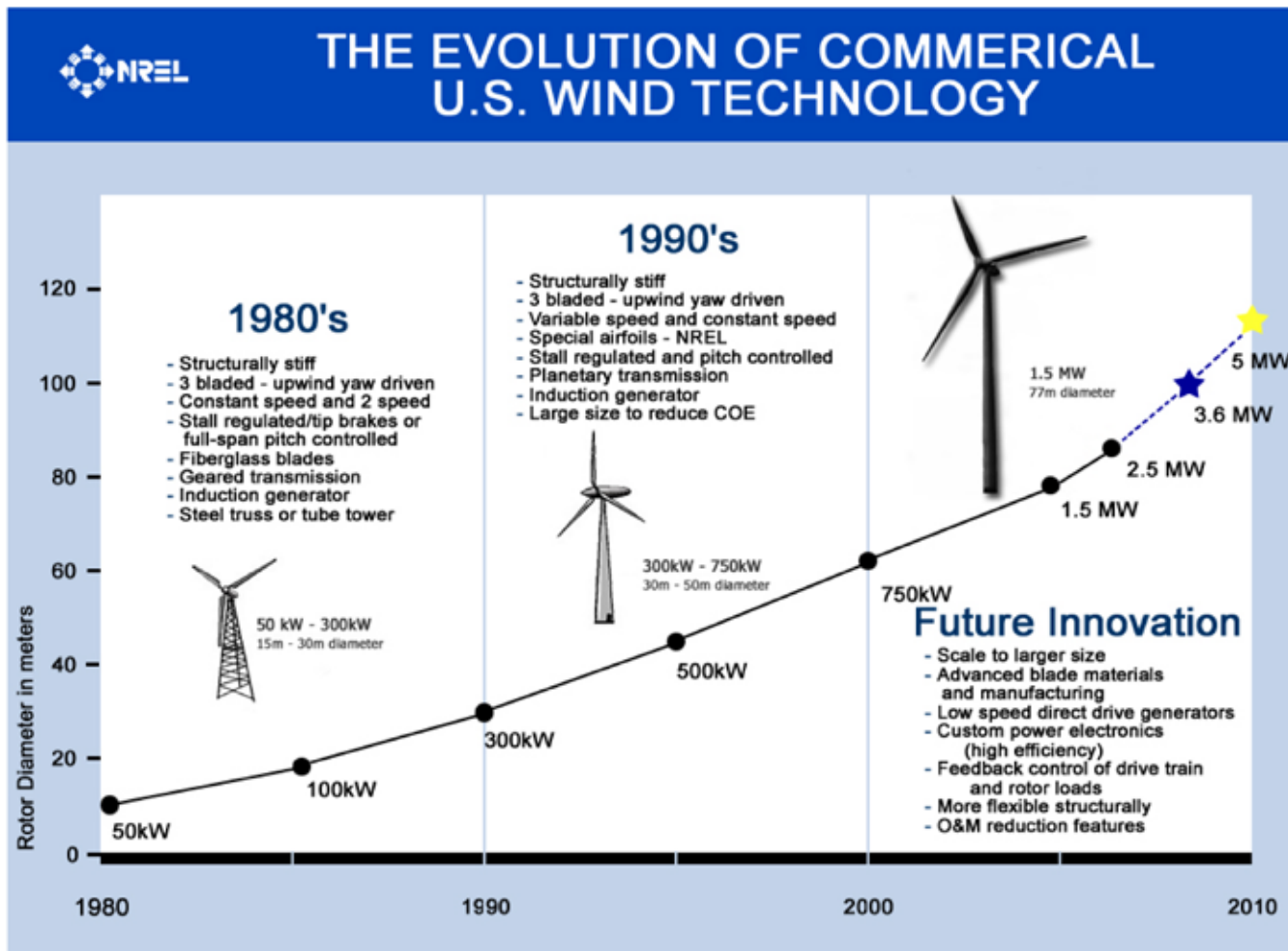
**Is wind generation useful on the distribution level, or must it be tied to the transmission grid?**

Limited transmission access is a real barrier to wind development. However, in many cases utilities can connect directly to the distribution system in amounts up to about the rating of the nearest substation transformer. Multi-megawatt utility wind projects in Waverly, Iowa; Bowling Green, Ohio; and Lamar, Colorado connect directly to distribution grids, thus reducing overall project costs. Increasingly, partners from regionally dispersed utilities are willing to share the costs of projects that technically serve the utilities near-

est the turbines, so long as the economic and environmental benefits are shared among all the partners. New, nearly quiet, low-speed wind turbines are helpful, too, enabling utilities to site wind projects near their load centers.

**What about the environmental impacts of wind power?**

Wind energy is, for the most part, environmentally benign. It produces no air or water pollution. It uses relatively little land, and as a renewable resource it cannot be depleted. Yet wind projects present some environmental concerns, including avian impacts, visual impacts, noise, and possible radar or communications signal interference. Usually, these impacts can be avoided or reduced. In fact, public power utilities near wind projects report that their customers tend to be enthusiastic wind supporters. The visual presence of turbines can increase tourism and community pride. But project planners must appreciate sensitive community needs. The National Wind Coordinating Committee ([www.nationalwind.org](http://www.nationalwind.org)) offers some useful resources for working with environmental stakeholders.



# Financing Makes It Happen

## First: Design for economic advantage

In the early 1980s, wind-generated electricity cost more than 30 cents per kilowatt-hour. Today, properly sited wind plants are generating electricity for 3 to 6 cents per kilowatt-hour. When available, wind power competes well with new coal- or gas-fired generation. And wind costs are expected to decline again, as the industry addresses today's tight market for construction steel and finished turbine products. For greatest success, planners must also consider

**Siting savvy.** The energy that can be tapped from the wind is proportional to the cube of the wind speed, so a slight increase in wind speed results in much greater electricity generation. Planners should test wind resources at slightly different locations and tower heights. But grid access and land costs are also practical siting concerns.

**Turbine selection.** Generally speaking, the greater the tower height and the wider the sweep of the blades, the more wind energy will be captured. Advances in electronic monitoring and controls, blade design, and other features improve performance, too.

**Economies of scale.** Larger turbines are more cost-effective than small ones, and larger wind projects bring a host of advantages, from per-unit savings on design and construction to operations and maintenance savings. Some public power utilities create partnerships to “grow” a successful project.

**Interconnection and transmission strategies.** Technical aspects and regional market conditions are important concerns. Public power utilities lead in finding technical and contractual strategies to keep interconnection and transmission costs down. Recommended starting points include networking through the American Public Power Association or the Utility Wind Integration Group, ([www.uwig.org](http://www.uwig.org)).

*A joint venture of ten AMP-Ohio member utilities owns this 7.5 MW wind project at Bowling Green. The project is sited on county land, and it ties into the local distribution grid, making the marginal Class 3 wind resource cost-effective. A development partnership with Green Mountain Energy, which assured a long-term market for the project's environmental benefits, helped ease project financing.*

## EPACT expands financing options

The 2005 Energy Policy Act provides significant incentives for wind development, including some incentives that support public power wind projects:

- **Extends the production tax credit (PTC)** for wind and other renewable resources, providing an estimated \$2.7 billion in incentives through 2007. The PTC is 1.9 cents per kWh, for a 10-year term, inflation adjusted. Public power utilities cannot benefit from the PTC directly, but they may work with tax-liable partners.
- **Reauthorizes the Renewable Energy Production Incentive (REPI)**, an incentive for non-profit utilities, which is intended to be similar to the PTC. The REPI is set at 1.5 cents per kWh, inflation adjusted. Currently the REPI provides about 1.8 cents per kWh. However, adequate funding may not be available for all applicants in all years, since this is a budget-authorized program.
- **Creates a Clean Renewable Energy Bond (CREB)** program to support renewables development by tribes, electric co-ops, and consumer-owned utilities. The





initial allocation, which applies through 2007, tags \$500 million for governmental units, including public power. Bondholders receive a taxable income tax credit instead of interest. CREBs provide value similar to that of the PTC. This incentive may be reauthorized after its initial expiration in 2007. For more information, contact the Government Relations staff at American Public Power Association. The Public Renewables Partnership web site ([www.repartners.org](http://www.repartners.org)) also offers updated information on CREBs and other wind financing options.

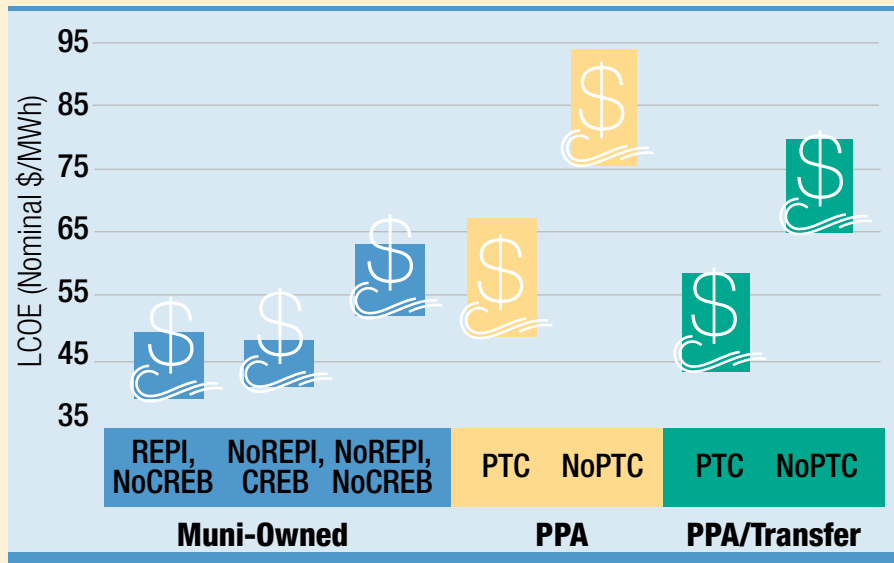
- **Additional measures aimed at building** the market for wind power, including authorization for R&D funding, targets for adding renewables at federal facilities, and mandates that utilities must develop policies for interconnection, net metering, and electronic metering for onsite wind generators.



*Waverly (Iowa) Light and Power won the first Wind Powering America Public Power Wind Pioneer Award in 2003. Subsequent winners have included Fort Collins (Colorado) Utilities and Austin Energy. In 2005, public power utilities nominated more than a dozen outstanding wind projects for the award.*

## A new look at the “buy versus build” decision

There is no one right answer for public power utilities that wish to create a strong wind project financing plan. Yet many public power utilities want to know, all things being equal, how do available financing approaches and incentives stack up? An analysis by DOE’s Lawrence Berkeley National Laboratory (summarized below) suggests that public power utilities may use any of the leading financing approaches cost-effectively.



The figure above presents the 20-year levelized cost of energy (LCOE) per MWh resulting from different approaches to project finance. The ranges for LCOE reflect a range of installed costs (\$1,300 to \$1,700 per kW). Excluding the unlikely case where no incentives are used, the resulting LCOE ranges from \$39 to \$67 per MWh. Municipal ownership using CREB financing results in the lowest LCOE. REPI offers similar benefits, but allocations depend on annual budget allocations. The power purchase agreement is a strong option, especially if the utility can take ownership of the project after expiration of the PTC and 10-year accelerated depreciation, but during a continued period of low-cost tax-exempt financing. Note that installed costs for wind are up by one-third or more, compared to costs a few years ago. But for public power, the end-result—wind power for less than 5 cents per kWh—remains attractive. Source: Bolinger, M. and Wiser, R., Lawrence Berkeley National Laboratory (2005).

# Green and Growing

In the 1990s, public power utilities pioneered a new way to support wind power development. They encouraged their customers to voluntarily pay a small premium on their electric bills to help fund wind plant construction or wind power purchase agreements. Today, green pricing is established among utility and non-utility providers in 34 states. It serves more than 330,000 customers and is growing at a rate of 25 percent more new customers each year. The growth in green energy sales is even more dramatic—increasing by nearly 45 percent per year.

Green pricing programs have diversified as they have grown in number. Today, customers may buy green power or green tags (also called renewable energy certificates or RECs) that represent investments in renewable energy from a range of providers. But public power utilities still lead the field. The top ten utility green power marketing programs in the U.S., based on customer participation rates, consistently include public power programs. Industry-wide green pricing programs typically attract about 1.5 percent customer participation. But the top public power programs have achieved around 5 percent participation, or more.

## Choices and Trends



**RECs count.** A REC represents the environmental attributes of energy generated by renewable resources, including wind. One REC typically represents the attributes associated with one MWh of green energy. Public power utilities that do not face state Renewable Portfolio Standard (RPS) requirements can own a wind project and sell the RECs, or they may wish to keep the RECs to support their own green power needs. If a utility sells the RECs from a wind project, then the remaining energy component is considered generic (not green) electricity. For more information on

utility programs that use RECs, see the DOE Green Power Network, at [www.eere.energy.gov/greenpower](http://www.eere.energy.gov/greenpower).



**Tags or turbines?** A growing number of public power utilities are buying RECs instead of buying a “whole wind” product or investing in their own wind generation. Green power marketers offer RECs from specific wind projects or from diverse market sources. Public power utilities that use RECs cite these advantages:

- 1) RECs are available from projects located in resource-rich regions, so communities can support green power regardless of local resource conditions. Often, RECs are available at considerably less cost than whole wind power.
- 2) Utilities usually obtain wholesale RECs through contracts that ensure delivery on time and in the right amounts. REC contracts tend to be shorter and more flexible than power purchase agreements.



*The Washington-based Our Wind Co-op sells RECs in order to support small wind development on farms, homes, and schools. The Bonneville Environmental Foundation assists with financing, based on projected REC production. Public power utilities, including Seattle City Light, and Klickitat Public Utility District and Chelan County Public Utility District, also purchase RECs from the Our Wind Co-op. It's a winning partnership that supports utility-scale investment and cost-effective small wind development.*



3) Some utilities buy RECs to support their green power programs, but use utility-owned (rate-based) resources to reach renewable portfolio targets. This allows for greater overall investment in green power and more flexibility in managing the green power portfolio.

A utility that buys RECs must evaluate the provider and the contract carefully. It may need a separate plan to meet energy needs. Plus, some utilities say their customers prefer whole wind power simply because it is easy to understand.



**Why certify?** Several organizations, including Green-e and the Environmental Resources Trust, offer certification to participating green power providers that meet specific standards.

For example, to be certified, utility programs and REC providers must be supplied with only new renewable resources, and the RECs must only be claimed once. The trend toward certification is fueled by an increase in green power options and by new REC-trading markets that demand quality assurance.



**Rate-based renewables.** As utilities increase their renewable portfolio goals, they are more likely to invest in wind power for all customers, spreading the cost across the rate base.

This is also more likely as wind becomes cost-competitive with conventional resources. Some utilities like to balance rate-based investments with those supported by green power subscriptions.



**Getting to yes!** A survey of utility green pricing programs nationwide showed that the most effective ways to boost customer participation include Web-based marketing,

direct mail, direct sales, publicity coverage of events and achievements, marketing partnerships, and invitations printed on the bill payment envelope.

*The King Mountain Wind Ranch near Odessa, Texas added almost 77 MW of capacity to the state's wind power capacity in 2001. Austin Energy purchases the power produced by the 59, 1300-kW turbines.*

## Austin Beats All

Year after year, Austin Energy's GreenChoice program has sold more green power than any other program in the country. In 2005, it sold more than 440,000 MWh to subscribers, including 8,200 residential customers and 350 businesses. The utility currently has 213 MW of wind projects under contract in West Texas, and it plans to meet 20 percent of its energy needs with wind and other renewables by 2020. How does Austin Energy do it? The GreenChoice staff believes these five strategies help:

- 1) Marketing strategy treats GreenChoice as a product.
- 2) Pricing, which is locked in for ten years, attracts customers who like the long-term price stability of renewables, compared to the volatility of fossil fuel prices.
- 3) A product manager runs the program, with an inter-departmental team.
- 4) The program has executive support and city council support.
- 5) Marketing emphasizes the business customer recognition package.

# Wind Power and Public Power—A Natural Partnership

There are more than 2,000 public power utilities in the United States. Together, they provide energy services to 40 million people in 49 states. Los Angeles, Austin, and Omaha have municipal utilities—but so do hundreds of small hometowns. Public power is rooted in the American tradition of local people working together to meet community needs.

It's no wonder public power utilities are leaders in developing wind. Clean, competitive wind energy is a regional resource throughout most of the United States. Developing wind today is one way public power utilities say yes to the

future on behalf of their customers and their communities.

Dozens of public power utilities use direct investment, power purchase agreements, and contracts to buy green tags or renewable energy credits as cost-effective ways to support wind development.

For more information on public power wind development, see the Public Renewable Energy Partnership Web site at [www.repartners.org](http://www.repartners.org) or contact the American Public Power Association DEED program at [DEED@APPAnet.org](mailto:DEED@APPAnet.org).



*The arrival of a turbine blade, ready for installation, gives local children cause to celebrate the Naperville, Illinois wind power program.*

