Final Report
Regarding Activities to Provide "Assistance to States on Policies Related to Wind Energy Issues"

By
The National Conference of State Legislatures

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Final Report
Of the
National Conference of State Legislatures
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I. EXECUTIVE SUMMARY

Thie final report summarizes work carried out under agreement with the US Department of Energy, related to wind energy policy issues. This project has involved a combination of outreach and publications on wind energy, with a specific focus on educating state-level policymakers. Education of state policymakers is vitally important because state policy (in the form of incentives or regulation) is a crucial part of the success of wind energy). State policymakers wield a significant influence over all of these policies. They are also in need of high quality, non-biased educational resources which this project provided.

This project provided outreach to legislatures, in the form of meetings designed specifically for state legislators and legislative staff, responses to information requests on wind energy, and publications. The publications addressed: renewable energy portfolio standards, wind energy transmission, wind energy siting, case studies of wind energy policy, avian issues, economic development, and other related issues. These publications were distributed to legislative energy committee members, and chairs, legislative staff, legislative libraries, and other related state officials. The effect of this effort has been to provide an extensive resource of information about wind information for state policymakers in a form that is useful to them. This non-partisan information has been used as state policymakers attempt to develop their own policy proposals related to wind energy in the states.

II. All activities described in the original workplan are complete.

III. FINAL PRODUCTS DEVELOPED UNDER AWARD

The National Conference of State Legislatures addresses the needs of state legislatures by serving as an impartial educational resource for state legislators and legislative staff. This project has enabled the NCSL Energy Project meet the increasing demand for information about issues surrounding wind power. The effort described in this final report is the result of NCSL's DOE-funded activities in this area.

All of the following proposed deliverables have been completed. In addition to the required deliverables, NCSL Energy Project staff made numerous presentations to DOE-funded state wind working groups and others involved in the state policymaking process.

The following summarizes the deliverables prepared under this project.

<u>Report on Renewable Portfolio Standards</u>

This document reviews the reasons that states have put portfolio standards in place, describes the major state policy issues that legislatures address when they examine renewable portfolio standards, and offers a series of lessons learned about renewable portfolio standards in the states. The document makes a number of detailed conclusions for state policymakers to consider, but focuses on the fact that state portfolio standards work only if policymakers consider specific details related to: definition of eligible resources, funding and cost recovery issues, eligibility of out of state resources, rules related to renewable energy credits and credit trading, and issues such as the phase-in of the portfolio standard.

Report on Wind Energy Transmission

This report reviews the importance of transmission to wind energy facilities given the fact that wind resources are location-specific and often not located close to the major load centers in the country. It provides a brief review of federal transmission policies as they relate to wind energy, and then describes a set of state policy options. Because the Federal Energy Regulatory Commission controls most cost and cost recovery issues, this brief focuses on the issues that are under state control, namely some wind transmission financing issues as well as state facility siting rules. It concludes with a set of policy options related to wind transmission that state policymakers can consider.

Report on Wind Energy Siting Issues Report on Wind Energy Siting Issues

This report outlined siting issues for wind power technologies, describing the elements of a wind farm that must be permitted and typical siting processes for wind facilities. It describes case studies from several states and offered perspectives on best practices in wind siting. A Power Point presentation was developed on this topic as well.

Issue Brief on Wind Power and Economic Development (Tax and Landowner Revenues)
This two -page brief features information on tax and landowner revenue that large-scale wind farms are generating for counties and landowners in Iowa, Kansas, Minnesota, New York, Oregon, Texas, Washington and Wyoming.

One State Legislative Report (SLR) on State Policy Options for Developing Wind Power
This report focuses on the price of wind power, landowner and tax revenue associated with large wind projects, the location of the resource, barriers preventing the development of a more widespread wind industry and the policy options that legislators can employ in order to address these issues. Policies covered in the report include renewable portfolio standards, system benefits charges, production tax incentives, and disclosure and certification programs. The report also lists states where these policies are in place.

One State Legislative Report (SLR) on Expanding Commercial Wind Power in Four States

This report looks at North Dakota, South Dakota, Texas and Wyoming as case studies of what has helped or hindered wind development in each state. It features a discussion of the role of the key factors driving wind development such as: legislative action, consumer demand, utility interest, economic development and air quality. The report also includes an appendix for each state which further analyzes how electric utility restructuring, a states' energy resources, transmission availability and the political climate have encouraged development in Texas and Wyoming but hindered development in North Dakota and South Dakota.

One State Legislative Report (SLR) on Commercial Wind Power and Bird Species

This report describes the interaction between birds and wind turbines. It begins with a description of the problem at the Altamont Pass Wind Resource Area and gives a sense of perspective by discussing collisions with other human constructions. The report also mentions advances in siting methods since the early wind development and how researchers can mitigate potential conflicts by understanding bird migration patterns and other behavioral aspects.

Power Point Presentations for Legislators and Staff

NCSL has created several Power Point presentations on various aspects of wind power that state legislators and staff can use either as a resource or in their own presentations before legislative committees. The presentations are based on information included in the three SLRs mentioned above. The following presentations are posted on NCSL's website:

- Tax and Landowner Revenue from Wind Projects
- Electric Power's Perspective on Wind Power: Institutional Issues
- Status of Bird and Wind Turbine Interaction Issues
- Environmental Perspective on Wind and State Policy
- State Policy Options for Developing Wind Energy
- Siting Wind Power and Other Power Plants

A Region-Specific Legislative Strategy Session

Most of the growth in the wind industry in recent years has occurred in midwestern states; however, state legislatures in this region are unfamiliar with wind energy. The types of incentives that appeal to them may be different from the incentives that appeal to legislators in other parts of the country. Indeed, wind power may have a far different political reputation in these states as well.

As a result, NCSL convened a two-day legislative strategy session for legislators from the midwestern states, combined with a tour of the Department of Energy's Wind Technology Center. Both DOE and NREL personnel were able to speak at and attend the meeting. Topics discussed over the course of the meeting included:

- Review and analysis of power markets in 2000-2001
- Analysis of reasons for, and state policy option to address, volatile retail prices
- Security of the energy system
- Green markets

- Wind resources, projects and technology
- Tax and landowner revenue from wind projects
- Identifying and surmounting barriers to wind development
- Wind power and avian issues
- State policies for renewable energy
- Environmental perspective on wind and state policy
- A developer's perspective on wind and state legislative needs
- Capturing air quality benefits from wind power

Attendees and Materials

Legislators and staff attended the Energy Institute from Arizona, California, Colorado, Idaho, Iowa, Kansas, Montana, Nevada, North Dakota, Pennsylvania, South Dakota, and Wyoming. Officials from the US Department of Energy, state regulatory agencies, and representatives of environmental, industry and consulting organizations rounded out the list for a total of thirty-five attendees. (Several other legislators from Nebraska, New Mexico and Oklahoma were forced to cancel reservations shortly before the meeting, due to illness or various scheduling conflicts such as special legislative sessions).

Each attendee received a binder that included information on meeting logistics, five wind power reports written by NCSL staff, speaker presentations, and a variety of papers from other organizations including NREL, DOE, Edison Electric Institute, Western Interstate Energy Board and Environmental Defense.

Follow Up to the Strategy Session

The meeting described above generated a lot of interest among attendees in wind issues. NCSL responded to requests for further information, mailed out requested publications and established contacts between attendees, industry representatives and DOE and NREL staff.

A Review of State Wind Activity

State legislators have little up to date information about the rapid growth in wind and other renewable energy technology and installations around the country. This report, presented in NCSL's State Legislatures magazine as a cover story, was designed specifically for a state legislative audience and offered an update on wind energy technology and development, as well as a review of some other renewable energy policy issues. NCSL's monthly magazine "State Legislatures" is distributed to over 15,000 policymakers from the state and federal sector. This cover story, "Harnessing Renewable Energy", featured a discussion of the economic development potential of wind power, advances in turbine technology and how states are interested in the ability of wind to hedge against volatile natural gas prices. The article includes quotes from two state legislators who have wind power in their state and a landowner in Minnesota who leases a portion of his land to developers.

A Session at NCSL's Annual Meeting and a Tour

Nearly 7,000 people attended NCSL's 2002 annual meeting in Denver, Colorado. One of the sessions that NCSL's Energy Program staff put together featured a discussion of efforts by the federal and state governments to improve the efficiency and price competitiveness of renewable energy. The session also looked at innovative policies aimed at increasing the use of renewables. NCSL staff also took 35 attendees on a tour of the National Renewable Energy Laboratory's (NREL) wind facilities and combined the tour with a brief policy discussion.

Responsive Information Assistance and Outreach

Energy Project staff responds daily to information requests from state legislatures. Calls range from locating a specific piece of energy legislation, to providing state-by-state information and comments on pending legislation. NCSL's Energy Project staff provided legislators and staff with information on wind technologies, policies and state and federal efforts throughout the legislative sessions of 2000, 2001, 2002 and 2003.

Technical Assistance

Technical assistance programs are available at no cost to state legislatures at their request. These formal, on-site assistance programs typically include summaries of key issues, state and federal legislative and programmatic activities, and a review of policy issues and options for consideration by the legislature. Often participating with NCSL staff are legislators from other states with expertise in renewable energy and other national experts and state energy or DOE officials. Technical assistance can also include Energy Project staff providing written testimony to a committee, in-depth research not available to a committee and bill writing and analysis. NCSL provided technical assistance on wind energy issues to legislative committees in Arizona, Colorado, Idaho, Maryland, North Dakota, and Pennsylvania.

Coordination with the National Wind Coordinating Committee

NCSL worked and coordinated with the NWCC to ensure that state legislatures were represented in all aspects of the NWCC's efforts. NCSL brought legislators to participate in the NWCC from Kansas, Oklahoma and Iowa. NCSL participated in NWCC steering committee conference calls, attended and participated in NWCC business meetings and reviewed publications for the NWCC.

Copies of all the above referenced documents and presentations are included as attachments to this summary.

State Renewable Portfolio Standards
A Review and Analysis

by
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Jennifer A. DeCesaro

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The National Conference of State Legislatures is the bipartisan organization that serves the legislators and staffs of the states, commonwealths and territories.

NCSL provides research, technical assistance and opportunities for policymakers to exchange ideas on the most pressing state issues and is an effective and respected advocate for the interests of the states in the American federal system. Its objectives are:

- To improve the quality and effectiveness of state legislatures.
- To promote policy innovation and communication among state legislatures.
- To ensure state legislatures a strong, cohesive voice in the federal system.

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Mr. Brown is responsible for advising state legislators on such issues as electric industry regulation, energy security, renewable energy, state energy planning, energy efficiency and alternative fuel vehicles. Mr. Brown has authored or co-authored numerous publications on energy and environmental issues, including a recent primer on energy and air quality issues, numerous publications on electricity regulation and several on renewable energy. Mr. Brown also has conducted numerous other related analyses on energy regulation, energy security and related policies. He has testified before more than 35 state legislative bodies on energy issues—often focusing on renewable energy technology and policy—and has worked closely with many state legislatures on their state energy policies. He also works extensively with other energy policy organizations' and general energy audiences on these and other energy-related issues.

Mr. Brown holds a BA from Brown University in Providence, Rhode Island, and an MBA from New York University.

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Ms. DeCesaro works on a wide range of topics, including air quality, renewable energy, and the nexus between energy and air quality issues. She is the author or co-author of numerous publications on energy and environment issues, including a recent primer on energy and air quality issues, and several other related analyses. She has testified before state legislative committees and task forces on renewable portfolio standards and other renewable energy policies. In addition, she presents regularly to legislators on issues ranging from state greenhouse gas reduction policies, multi-pollutant emission reduction strategies, and other air quality policies. Ms. DeCesaro serves on the Steering Committee of the National Wind Coordinating Committee. Before she came to NCSL, Jennifer worked in the U.S. Virgin Islands as an environmental consultant on various projects, including a large-scale clean-up, NEPA permitting, and environmental monitoring.

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Executive Summary

Beginning in the late 1990s, many state policymakers began to express their concern that their state's energy mix had become too dependent on out-of-state fossil energy sources. These policymakers saw the economic benefits they could derive from building new in-state energy resources. Many also thought their states would benefit from the environmental attributes of renewable energy resources. As a result, the states began to adopt a renewable portfolio standard—commonly called an RPS. As of mid-2005, 19 states plus the District of Columbia have adopted a renewable portfolio standard.

In its early years this standard dictated that any electricity retailer in the state generate some part of its power from renewable energy. As it developed, portfolio standards began to rely on a new system of tradable renewable energy credits to guarantee and verify compliance. Through this credit system, each retailer needs to accumulate enough credits to demonstrate that it had met the portfolio standard's goals. One credit is equal to one megawatthour of renewable electricity. Thus, if a retailer's obligation was to comply by using 1,000 megawatt hours of electricity from renewable energy, the retailer could either generate renewable power on its own or it could buy it from another company.

As renewable portfolio standards developed, a number of similar questions began to appear in state after state. These were as follows.

•What resources qualify toward meeting the RPS?

Typically, solar, wind geothermal and small hydroelectric qualify. States do not always allow large hydro, certain kinds of biomass or other technologies like fuel cells from hydrogen to qualify, however. One state—Pennsylvania—allows waste coal to qualify for its advanced energy portfolio standard.

•How large should the RPS be, and how quickly should it be phased in?

The size of the RPS varies a great deal, from only 2 percentage points of the total state's generation to as high as 25 percent in the case of New York. The RPS is always phased in over a period of several years.

•How will regulated utilities recover their costs?

In some cases, but not all, the RPS will impose additional costs on utilities or their customers. Most state laws and regulations allow utilities to recover any additional costs related to complying with the portfolio standard, but some also place restrictions on cost recovery. A few use other funds, called public benefit funds, to reimburse utilities for any additional costs of the RPS.

•Will out-of-state resources qualify for the state's RPS?

Most states allow renewable energy generated from out of state to qualify for the RPS. Some place restrictions on qualification, saying that the energy must be delivered to the state or that the energy must be delivered to the regional system operator that, in turn, feeds electricity into the state.

•Can companies use their green pricing programs to qualify toward their RPS obligations?

Only Arizona currently allows utilities to use their green pricing programs (programs through which customers voluntarily pay a little extra each month to subsidize utility renewable energy investments) to help meet the renewable energy goals of the RPS. In general, states have concluded that green pricing programs are voluntary and are designed to allow customers to help utilities pay for investments they are not otherwise required to make.

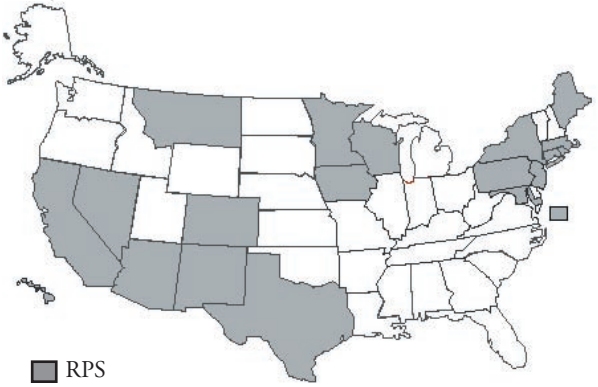
The experience with renewable portfolio standards is somewhat limited to date; many are in the early years of a multi-year phase-in. States can begin to derive some early lessons from the experience thus far, however The document concludes with a discussion of these lessons.

Introduction

The United States generates its electricity with gas, coal, nuclear power, some oil, and some renewable energy such as wind, hydroelectric power, solar power, biomass or geothermal energy. Coal, gas, hydropower and nuclear energy dominate that mix, and probably will continue to do so for the foreseeable future. Renewable energy's currently small proportion of the total is increasing rapidly, but from a very small base. As state policymakers seek to speed up the growth in renewable energy, one of the most common policies under consideration is a renewable portfolio standard (RPS).

The renewable portfolio standard is a flexible mandate that requires power retailers to put renewable energy into the mix of fuels they use to generate electricity. In its most basic form, the portfolio standard places a requirement on utilities, saying they must build or buy a certain amount of renewable energy capacity each year. In practice, most portfolio standards have developed into more complex and nuanced policies. Nineteen states and the District of Columbia now have such a standard as shown in figure 1.

Figure 1. States with Renewable Portfolio Standards



Source: NCSL, 2005.

This document describes how portfolio standards work and answers the major questions that state policymakers ask about their design. With 19 laws[1] in place around the country, a body of experience now is available that can instruct policymakers on the design of these standards.

This document is divided into several sections:

1. A discussion of what the RPS accomplishes and fails to de well;
2. Cost of the RPS and cost recovery for the RPS;
3. A description of what resources qualify for these standards;
4. The structure, size and phase-in of these standards;
5. A discussion of who administers the RPS;
6. Applicability of and exemptions from the RPS;
7. How out-of-state resources qualify;
8. A discussion of tradable renewable energy credits;
9. The overlap between green pricing programs and the RPS; and
10. Lessons from the RPS.

This document is not designed to analyze the advantages or disadvantages of a renewable portfolio standard, but to provide background to help states determine whether an RPS suits its resources, needs and priorities. Table 1 summarizes the major arguments for and against the portfolio standard.

Table 1. Portfolio Standards Pros and Cons

Proponents Say	Opponents Say
The RPS can save customers money or, at the very least can add an element of stability to electricity rates, since most renewable "fuel" is free. The capital cost of wind energy is competitive with that of coal plants.	The cost of renewable energy lies in its high capital cost, which can be as much as twice the cost of the lowest cost natural gas-fired power plants. It is possible to lock in fuel prices for natural gas.
Renewable energy can contribute to energy security by helping the country become more energy independent and, at the same time, by protecting the environment.	Renewable energy helps energy security but must be considered in the context of domestic resources such as coal or natural gas.
Wind energy is predictable, to a point. Techniques for day ahead and hour ahead projections of wind output at a particular location have improved substantially. So long as wind is well integrated with the rest of the electric system acting as a backup, wind can work well. When wind makes up around 15 percent of electricity generation, typical integration costs are around one-half cent per kilowatt hour (kWh). Solar installed in southwestern regions of the country has a production profile that closely matches the peak energy needs in those regions. Biomass, geothermal and hydroelectric power are not intermittent and can be baseload.	Wind energy is intermittent and that intermittency adds cost to wind power plants. Power companies need to be able to lock in a predictable supply of power.
The RPS presents a market-based approach to integrating valuable new renewable resources into the electric system. Perfect markets do not exist in the delivery of electric energy services. Utilities traditionally have little or no experience with such technologies. Thus, RPS policies help overcome market barriers.	An RPS is a mandate that adds complexity and new regulatory burdens to an already heavily regulated industry.
The RPS requires the power sector to adopt new technologies and to learn about and integrate those new technologies. They are ready for the marketplace, but many utility systems are not accustomed to them.	The RPS may force power systems to adopt new technologies before they are really ready. Renewable energy does not always fit into the existing system and, in some cases may need new transmission infrastructure.
The RPS diversifies the fuel mix the country uses to generate electricity. Fuel diversity can stabilize prices and alleviate the effects of supply disruptions.	Government mandates have failed in the past and can actually increase costs and risks.

Source: NCSL, 2005.

What Does the RPS Accomplish?

Depending on the area of the country, the RPS tends to produce a great deal of utility-scale wind development, landfill gas development, and some geothermal energy development. States can tailor the RPS so that, outside its simplest form, it can encourage other types of technologies such as solar, small-scale wind or fuel cells. In New England, the RPS is encouraging development of fluidized bed biomass systems.

Renewable energy project developers like the RPS because it guarantees a market for their product. The RPS creates certainty, and that certainty gives developers the confidence to make investments in resource assessment, to negotiate lease agreements with landowners, and to apply for permits. It gives them the certainty they need to make an investment and, in turn, helps developers secure financing.

As a policy tool, the RPS does a good job of using market forces to drive down prices for new renewable energy sources. Rather than set a floor price or offer a subsidy for green power, it creates a market and then drives developers to compete on price to supply that market.

What Does the RPS Fail to Do Well?

The RPS is not always the best policy tool to encourage small-scale or distributed energy technologies. In most cases, it has been designed to encourage large, utility-scale projects. Some states, such as Colorado, tailored their RPS to encourage small-scale renewable energy projects, but the results from that effort are not yet available.[2]

Unless it is designed to do so, the RPS is not the best policy to encourage higher-cost technologies. In general, it promotes competition among renewable energy technologies and results in large supplies of least-cost technologies. Several states, including New Jersey, have developed different percentage goals for different technologies. This approach creates a market for

both types of technologies and does not allow one technology to dominate. (The tiered technology approach is discussed further in the following section.)

How Much Does an RPS Cost?

Renewable portfolio standards may cost ratepayers additional money, or they may save money. This depends on several factors, including the region of the country and the design of the portfolio standard. There are several factors to consider.

- Higher requirements may equal higher costs if technology and investments are not able to keep up with the requirements of the portfolio standard.

- Regions with higher quality renewable resources may see cost reductions as the result of an RPS. Those with poorer resources may see cost increases. New Jersey, for example, does not have the near-term potential to develop the same amount of renewable resources that Colorado does, and, although Colorado has estimated that its RPS will result in cost decreases for electricity customers, New Jersey predicts that it will see cost increases of more than $11 per customer per year as the RPS reaches its targets.

- Regions that currently rely heavily on more expensive nonrenewable resources such as natural gas may see cost reductions.

- The design of the standard influences cost. A standard that asks for the lowest cost renewable energy technologies will be less expensive than one that requires carve-outs for specific, higher cost resources such as solar power. A higher goal for the less mature-and possibly more expensive-technology will make the standard more expensive.

- Cost is difficult to measure. Most renewables have no fuel cost and, as a result, can ensure price stability into the future, even if they may cost a bit more at first. There is some value to this price stability, although it is difficult to quantify. Fossil fuel-based generation faces risks from fuel price increases and future environmental regulation.

Table 2 demonstrates the results of several cost studies of renewable portfolio standards in various parts of the country. In general, the studies showed neither dramatic cost increases nor dramatic savings. Savings or cost increases all were within 0.5 percent of the existing rates, approximately $3.50 per year for the typical household. New Jersey was the exception to this rule, with a substantially higher cost estimate.

Table 2. Cost Impacts of Renewable Portfolio Standards

State	Author(s) of Study	Incremental Target Year	Overall Rate Impacts	Average Effect on Residential Bill
California	UCS/SEA/ LaCapra	41,000 GWh* (2010)	Savings: 0.5% in 2010	Savings:$3.50 per year in 2010
Colorado	Binz	4,500 GWh (2020)	Savings: 0.5% expected value	Savings: $2.40 per year expected value
Washington	Tellus et al.	14,300 GWh (2023)	No impact	No effect
Minnesota	Wind	6,300 GWh (2010)	Savings: 0.7% on average	Savings: $4.60 per year on average
Iowa	Wind	4,400 GWh (2015)	Savings: 0.3% on average	Savings: $3.40 per year on average
Wisconsin	UCS/SEA/ LaCapra	7,500 GWh (2013)	Cost: 0.6% on average after 2010	Cost: $3.30 per year on average after 2010
Pennsylvania	Black and Veatch	17,000 GWh (2015)	Cost: 0.46% on average	Cost: $3.50 per year on average
New Jersey	CEEEP/ Rutgers	15,500 GWh (2020)	Cost: 3.7% in 2020	Cost: $33 per year in 2020
New York	DPS/SEA/ LaCapra	12,000 GWh (2013)	Cost: 0.32% in 2009	Cost: $3 per year in 2009

* GWh = 1,000 MW

Source: Lawrence Berkeley National Laboratory, 2004.

Cost Recovery

The deployment of new renewable energy resources and supporting transmission infrastructure can be costly, and the method used by utilities to recover those costs can be an important issue for any state that still regulates some or all of its utilities' electricity rates. Even in states that restructured their utility industry, cost recovery methods can be controversial if the utilities continue to operate under a rate cap—meaning they cannot raise their electricity rates. States can address cost recovery in several ways. In some states, legislation specifically guarantees that they can recover their costs-eventually, if not immediately; in others, certain categories of costs are specified that utilities can or cannot recover. A third approach describes the mechanism through which utilities can recover their costs (such as a surcharge on utility rates for all customers).

- Arizona lets utilities use its system benefit fund (a fund established and financed through a small charge that every utility customer pays) to pay for additional costs that the RPS imposes on them.

- California's utility commission will set a benchmark price for renewable energy purchases. The system benefit fund will cover costs over this benchmark price. As of early 2005, the utility commission had not yet set the benchmark price, although it is likely to be based on an estimate of long-term market prices for renewable energy.

- Connecticut's distribution utilities (those that serve Connecticut customers with power they buy from other companies that own power plants) have a guarantee that they will recover the costs of the first 100 megawatt (MW) of renewable energy they purchase.

- Maryland and the District of Columbia guarantee that their utilities will be able to recover their prudently incurred costs, including compliance fees (those fees that companies pay as an alternative to buying renewable energy). The mechanism would be an additional fee placed on all customers' bills. Maryland specifies that compliance fees are recoverable only if the commission determines that compliance fees represent the least cost way to meet the standard, if the utilities' renewable energy supplier fails to meet its obligations, or if Tier I resources are unavailable.

- Legislation in Nevada, New Jersey, New Mexico, Rhode Island and Wisconsin specifies that utilities can recover costs related to the RPS if the commission determines that they are prudent and reasonable. In Nevada, contracts entered into between renewable energy providers and a Nevada utility and approved by the Nevada Public Utilities Commission are deemed prudent by statute for purpose of cost recovery. Conversely, New Mexico's statute stipulates that utilities can recover reasonable costs related to interconnecting the renewable energy generators with the power grid. This legislation adds that the utilities can defer recovery of their costs by tracking the costs in an account, and that those deferred costs can accrue interest until they are actually placed into the rate base. Rhode Island adds that the distribution utilities may recover their costs for supporting the New England credit trading program. (A later section of this paper addresses credit trading.)

Cost Caps on the RPS

Many states try to limit the effects of the costs of the RPS on individual consumers. They do this in several ways, including explicit caps on potential increases in consumers' bills or through indirect ways such as alternative compliance mechanisms and penalties, all of which are described below.

Colorado is one state that sets an explicit cost cap with a requirement that the portfolio standard not result in an additional charge of more than $.50 per residential customer per month. The cost cap in Colorado may create some difficulties as the state attempts to meet its 0.4 percent solar energy goal. Installation of solar energy tends to cost in the range of $8,000 to $9,000 per Kilowatt (kW), compared to a typical cost of approximately $1,000 to $1,200 for wind energy. The interaction of the cost cap and the solar requirement may create challenges for the state.

Massachusetts,[3] New Jersey, and Rhode Island give an option to comply with the RPS by paying a fee of $.05 per kWh; Connecticut's fee is $05.5, instead of purchasing either tradable renewable energy credits (RECs) or entering into a contract to buy renewable energy. In Maryland, compliance fees are $.02 per kWh for Tier 1 resources and $.015 for Tier 2 resources. The funds from these alternative compliance mechanisms in Connecticut, Maryland, Massachusetts and New Jersey go into a fund to support other clean energy projects.

Montana requires all non-restructured utilities to comply with the standard as long as the per kilowatt hour cost of the renewable generation does not exceed the cost of power from other generating sources by more than 15 percent. A public utility that does not comply with the standard may be assessed an administrative penalty of $10 for each megawatt hour of renewable energy credits they fail to procure.

What Qualifies as Renewable?

States make many distinctions about which resources count toward the renewable portfolio standard. They distinguish not only among the technologies that qualify as renewable, but also the size of the qualifying system and other characteristics of the system.

In the majority of states that have an RPS, all renewable generation meets the renewable standard, whether or not it existed prior to adoption of the standard. Thus, if a state had a 20 percent standard such as California's, then any existing renewable resources qualify, but companies would need to acquire new resources to come up to the 20 percent standard. Just six states address this point.

- Hawaii allows the use of all preexisting renewables to meet the RPS.
- Maryland places a limit on the use of preexisting renewables.
- Massachusetts does not allow preexisting renewables to count toward the RPS; all resources must be new. However, the Department of Energy Resources may provide a preexisting plant with a waiver that qualifies any increased output over a defined annual baseline as "new.
- Montana does not allow most pre-existing renewables to count towards the RPS—all qualifying resources must have commenced operations after January 1, 2005.
- Two of the remaining three states—Rhode Island and Wisconsin—allow preexisting facilities to account for only a certain percentage of each year's requirements. In Rhode Island, for example, no more than 2 percent of each year's requirements can be met with pre-1998 resources. Texas allows retail electric providers to use pre-1999 resources to offset some of their RPS obligation if they have preexisting supply agreements.

The size of the qualifying renewable energy system is a question only for hydroelectric power. States that include hydroelectric power in their standard usually limit the size of the system that qualifies. Finally, five states—Connecticut, Maryland, New Jersey, New York and Pennsylvania—and the District of Columbia, separate the qualifying technologies into two tiers. The rationale for having two tiers is not outlined in any state's RPS language. However, those included in the first tier tend to be less environmentally intrusive than those in the second tier, which usually include large-scale hydroelectric power and waste-to-energy facilities. States usually have different percentage goals for each tier. This is described in greater detail below.

Qualifying Technologies

Every renewable technology has its own definition and a unique set of policy issues. This section describes each technology and its relationship to the RPS.

Biomass

In the most general sense, biomass is plant matter such as trees, grasses, agricultural crops and residues or other biological materials, such as municipal solid waste and sewage sludge. Biomass power plants burn this material as fuel or convert it into liquid or gaseous forms to produce electricity, among other things. Some state definitions of biomass are more broad and may include landfill gas, municipal waste and digester gases from municipal wastewater treatment facilities.

Because biomass is one of the more complex renewable technologies, it consistently raises a number of policy issues. These include:

- Whether all the qualifying biomass resources included in the definition of biomass are truly renewable.

- What is the emissions profile of biomass? Biomass is unusual among the renewables in that it releases some emissions into the air. As a general rule, these emissions (especially of sulfur) are very low and are subject to the same regulations as all other power plants. Biomass power plants generate the same amount of carbon dioxide as fossil fuel plants, but as new trees or crops grow, they remove carbon dioxide from the atmosphere. As long as plants are continuously replenished to make

a feedstock for biomass energy, the biomass power plants are carbon neutral, meaning that they release zero net carbon dioxide emissions.

- Because of the abundance of biomass energy resources, the advanced stage of many biopower technologies, and the prevalence of landfill gas facilities, biomass has the potential in some states to dominate the resources that supply a state's RPS.

These policy discussions often result in laws that distinguish between desirable and less desirable kinds of biomass. Some states exclude certain categories of biomass (such as wood waste that has been treated with chemical preservatives) from the RPS altogether. Others place the biomass they feel is less desirable into Tier II.

Every state with a renewable portfolio standard includes biomass in its definition of a renewable energy resource. It is what is included in the definition of biomass that varies from state to state, however. Six states—Arizona, California, Iowa, Maine, Texas and Wisconsin—do not further define the biomass resource or generating system. The remaining states and the District of Columbia further define biomass.

Some of those states that further define biomass have an all-inclusive definition and some differentiate among resources. The definition of biomass in Colorado, Minnesota, Nevada, New Mexico and Rhode Island is comprehensive and includes agricultural wastes, wood wastes, energy crops, landfill methane, biogas, municipal wastes, industrial digester gases and neat biodiesel.[4]

In contrast, Hawaii differentiates among biomass resources and includes only the biomass portion of municipal solid waste, biofuels or fuels derived entirely from organic sources in its definition of biomass. Hawaii allows landfill gas and waste-to-energy to qualify for the RPS, but does not define them as biomass.

Montana is another state that differentiates among biomass resources and includes landfill or farm-based methane gas, gas produced from wastewater treatment, and "low-emission, nontoxic biomass" based on dedicated energy crops, animal wastes, or solid organic fuels from wood, forest, or field residues. Not included in this definition are wood pieces that have been treated with chemical preservatives such as creosote, pentachlorophenol, or copper-chroma-arsenic.

In Connecticut, a biomass facility may include biomass gasification plants that use as fuel biomass that regenerates or that, when used, will not deplete the resource. The state places these biomass facilities in Class I or Class II, based on the date that operations began. If the facility began operation after July 1, 1998, and has a nitrogen oxides emission rate of less than .075 pounds per million Btu of heat input, it is in Class I; facilities in operation prior to July 1, 1998, with a nitrogen oxides emission rate of .2 pounds per million Btu of heat input or less, are in Class II. Connecticut does not include methane gas from landfills in the biomass definition, but includes it as a Class I resource. Connecticut's NOx emission limit of 0.075 pounds per million Btu is an important criterion. Class I biomass resources must not emit more than .0075 pounds per million Btu of NOx.

Maryland identifies qualifying biomass as nonhazardous organic material available on a renewable or recurring basis. The state specifically excludes from this category unsegregated[5] solid waste, post-consumer waste paper, and invasive exotic plant species. Tier I includes all qualifying biomass, as well as methane from anaerobic digesters or wastewater treatment plants; Tier II includes the incineration of poultry litter and waste-to-energy technologies.

Biomass is included only in New Jersey's Class I renewables. Included in the definition are methane gas, bioenergy crops and wood wastes.

New York is another state that includes biomass only in one tier. Eligible biomass resources included in the Main Tier of New York's RPS are waste-to-energy facilities. The Main Tier[6] also includes biogas and liquid biofuels. The Customer-Sited Tier includes no biomass technologies.

Pennsylvania includes biomass in both Tier I and Tier II. The Tier I definition of biomass includes agricultural wastes, wood wastes, sustainable crops and biomass portions of municipal solid waste. Also included in Tier I, but not in the definition of biomass, are landfill methane, biogas and liquid biofuels. Tier II resources include wood pulp and wood manufacturing byproducts.
The District of Columbia defines qualifying biomass as agricultural wastes, wood wastes and cofired biomass.[7] Tier I includes all qualifying biomass, while Tier II includes waste-to-energy technologies.

Fuel Cells

Hydrogen is the simplest and most plentiful element, yet it does not occur naturally as a gas. Some type of conversion process must separate the

hydrogen from another element, such as from oxygen in water. This process requires an energy source, such as a wind turbine, solar cell or fossil fuel. Once the hydrogen is separated, a fuel cell passes hydrogen through a membrane to produce electricity, heat and water. Often compared to a battery—both convert the energy produced by a chemical reaction into usable electric power—a fuel cell will produce electricity as long as fuel (hydrogen) is provided and will never lose its charge. Hydrogen fuel cell technology shows a great deal of promise, but is still new and relatively untested.

Some states permit fuel cells to qualify as a renewable technology that can help meet the portfolio standard requirements. States that classify resources by tiers always class fuel cells as a Tier I resource. Two issues arise consistently when states discuss fuel cells, however:

- Fuel cell technologies still are in the early stages of development and their potential to penetrate the renewables market is small; and

- A state can specify that the fuel cells need to be powered by renewable resources; without this specification, a fuel cell powered by fossil fuels may receive credit in a state's RPS.

Thirteen states include some form of fuel cell technology in their RPS. Seven of the states—California, Hawaii, Massachusetts, Montana, New Jersey, Rhode Island and Wisconsin—and the District of Columbia qualify the fuel cell definition by requiring that the fuel cells use renewable resources. New Mexico states that the fuel cell may not be fossil fueled. Maryland specifically requires that the fuel cell use methane or qualifying biomass resources.

Hawaii is unique in that it addresses the potential for a fuel cell to be powered simultaneously by both renewable and nonrenewable energy sources, but only the renewable portion receives credit for the RPS. Pennsylvania states that the energy source for the fuel cell must be obtained without combustion.

Three states—Connecticut, Maine and New York—do not further qualify the requirements of the fuel cell.

Geothermal

Geothermal energy—the earth's heat—is the thermal energy contained in the rocks and fluids in the earth's crust. In most areas, this heat reaches the surface in a very diffuse state. Due to a variety of geological processes,

some areas—including substantial portions of many western states—are underlain by high-temperature geothermal resources, which have tremendous potential for producing electricity. Geothermal power plants use well-established technology but have a high initial cost (mostly because developers usually have to drill a significant number of exploratory wells before they locate an effective underground resource. There is no fuel cost once developers find the resource, however. Geothermal resources are based in nature and geothermal plants have capacity factors as high as 97 percent, higher than any other generation resource.

Certain issues consistently arise when states discuss geothermal resources.

- Although most geothermal power plants are considered to be a completely clean source of energy, certain air emissions may be associated with the operation of certain types of geothermal plants. Flash steam geothermal plants convert ("flash") hot water in an open process into steam to drive turbines. This process exposes the minerals and gases in the geothermal fluid to the above-ground atmosphere. The nitrogen oxide and sulfur dioxide emissions associated with flash steam geothermal plants result from capturing and incinerating the hydrogen sulfide that occurs naturally in some geothermal resources. The chemical composition of each geothermal reservoir is unique, but certain compounds such as arsenic and boron may be commonly found in these resources due to their volcanic nature. In a flash steam plant, these minerals may pose a hazard that must be addressed.

- Many newer geothermal plants use a modern binary geothermal process, where the geothermal fluids pass through a heat exchanger and never expand in the open above-ground atmosphere. In these binary plants, neither nitrogen oxide and sulfur dioxide emissions nor hazardous mineral deposits pose a problem, since binary plants are completely closed loop systems; the geothermal fluids are re-injected into the reservoir to be reheated and reused.

- Various siting issues may be associated with geothermal facilities. The initial resource exploration can be intrusive if numerous test wells are drilled into the ground. Once developers locate an adequate resource and they situate the geothermal power facility directly over that fuel source, it requires no additional land. In scenic areas, developers build the geothermal facility with a low height profile and use various mitigation measures to reduce intrusion on the visual landscape.

- Potential water quality issues arise in development of a geothermal well. Geothermal water contains higher concentrations of dissolved minerals than do cold groundwater aquifers. To prevent mixing geothermal water and groundwater, developers cement pipe or casing into the ground.
- The availability of the geothermal resource varies geographically. Geothermal resources that are capable of generating electricity exist in most western states including, Texas. No eastern states have resources that are capable of generating geothermal electricity.

- Some western states with a significant geothermal resource may find that geothermal energy takes a considerable share of the total renewable resource standard, potentially overwhelming some other resources.

Thirteen states—California, Colorado, Hawaii, Maine, Maryland, Montana, Nevada, New Jersey, New Mexico, Pennsylvania, Rhode Island, Texas and Wisconsin—and the District of Columbia, include geothermal resources in their definitions of what qualifies as renewable resource within the portfolio standard. Rhode Island does not directly refer to geothermal but, rather, to "the heat of the earth." Although some eastern states include geothermal in their definitions of renewable energy, they will not see development of geothermal electric power plants because they lack geothermal resources. Such states could, however, see geothermal heat pumps, which use the constant temperature a few feet below ground level to help pump warm air in winter or cool air in summer into a building or a home; heat pumps do not generate electricity.

Hydroelectric

Hydroelectric power is generated by the power of moving—but not necessarily falling—water. A pumped storage hydroelectric plant produces energy during peak demand periods using water pumped into an elevated reservoir during off-peak periods. When a facility uses both pumped reservoir water and natural current flow, it is referred to as a combined pumped-storage hydroelectric plant. Low-impact hydropower facilities minimize the environmental impacts—river flows, water quality, and threatened and endangered species—of their facilities, which does not necessarily mean that they are small in scale.

Hydroelectric is a well-established technology: therefore, its issues also are well established. They include the following.

- Hydropower facilities can affect a large geographic area. The storage

reservoirs can inundate large areas of forest, farmland, wildlife habitats, scenic areas and even towns, especially as part of larger projects with greater power generation. In addition, dams can cause significant changes in river ecosystems, both upstream and downstream.

- Operating hydropower facilities have had detrimental effects on fish populations, some of which are endangered or threatened species. Dam operators use mitigation efforts such as fish ladders and screens around turbine blades to lessen the severity of these effects, but the controversy over fish dominates discussion of hydropower policy, particularly in the Pacific Northwest.

- Because so many hydropower facilities—both large and small—are in operation and have paid off much of their capital costs, the technology potentially could take over the RPS unless states restrict the requirement by specifying that only new facilities qualify or by specifying that only facilities below a certain size qualify.

- Particularly with drought in the Pacific Northwest the output from hydropower plants is unpredictable.

Only four states do not include hydroelectric power as a qualifying renewable energy source in their portfolio standards. The 16 that include hydroelectric power do so at varying levels. Table 3 outlines the qualifications in each participating state.

Five of the states that include hydroelectric power in the RPS—Hawaii, Maine, Nevada, New Mexico and Texas—do not place restrictions on the types of facilities that qualify as renewable.

Table 3. State RPS Qualifying Hydroelectric Resources	
State/Jurisdiction	**Qualifying Hydroelectric Resource**
California	Small hydroelectric generation of 30 MW or less owned by an electrical corporation as of the enactment.
Colorado	Hydroelectricity with a nameplate rating of 30 MW or less.
Connecticut	Run-of-the-river hydroelectric power facilities with a generation capacity of 5 MW or less that does not cause an appreciable change in river flow that began operations after effective date.
Maryland	In Tier I, small hydroelectric power plants of less than 30 MW in capacity; in Tier II, hydroelectric power other than pump storage generation.
Minnesota	Hydroelectric power plants with a capacity of less than 60 MW.
Montana	Hydroelectric projects that do not require a new appropriation, diversion, or impoundment of water and that has a nameplate rating of 10 megawatts or less.
Nevada	Small hydroelectric generation of 30 MW or less.
New Jersey	Included only in Class II at hydroelectric generation facilities of 30 MW or less.
New York	Hydroelectric power plant upgrades and hydroelectric plants of under 30 MW without storage impoundments.
Pennsylvania	Low-impact hydroelectric in Tier I and large-scale hydroelectric (including pumped storage) in Tier II.
Rhode Island	Small hydroelectric generation of 30 MW or less.
District of Columbia	In Tier II, hydroelectric power other than pumped storage generation.
Source: NCSL, 2005.	

Ocean Energy

New technologies to harness the movement and heat of the ocean are in the early stages of penetrating the renewable energy market. One such technology uses wave movement to drive an electrical generator; the power then is transported to shore via an underwater cable. Ocean thermal energy conversion technologies use the ocean's natural thermal gradient—the fact that the ocean's layers of water have different temperatures—to drive a power-producing cycle. Technology also can harness tidal currents using offshore underwater devices that resemble wind turbines.

The world's oceans cover more than 70 percent of the earth's surface, giving them the potential to become one of the world's major power sources. In spite of this, there are issues associated with their inclusion in a state's RPS, including the following.

- Ocean conversion technologies are in the early stages of development, and their potential to penetrate the renewables market is so small at this time that they might be overlooked.

- Because of the off-shore nature of these technologies, their potential effect on the ocean's fisheries and surfers could prompt opposition.

Coastal states—California, Connecticut, Hawaii, Maine, Massachusetts, New Jersey, New York, Rhode Island and Texas—and the District of Columbia include ocean resources in their definitions of qualifying renewable energy technologies. Those that have tiered resource classifications include these technologies in the first tier. Identified resources include ocean waves, tidal current and ocean thermal energy conversion. Although Wisconsin, is not a coastal state, it borders Lake Michigan and includes tidal or wave action resources as qualifying technologies.

Solar

Solar technologies harness the sun's energy to provide heat, light, hot water and electricity. Photovoltaic (solar cell) systems convert sunlight directly into electricity. Concentrating solar systems use the sun's heat to run a generator to produce electricity.

Although solar technologies are widely accepted, there are issues associated with their inclusion in RPS policies, including the following.

- Solar technologies are commercially available, yet they rarely have been deployed on a large, utility-scale level. Without specific set-asides in a state's RPS policy, solar technologies are unlikely to benefit from the RPS.

- Large-scale solar installations require a considerable amount of open space, which could result in potential siting issues.

- If solar generators that are not connected to the power grid qualify for the

RPS, how are they tracked?

- Because solar system output varies with season and daily solar intensity (even though a photovoltaic system will provide some energy on a completely overcast day), solar energy production may not be entirely constant or predictable. This is usually a significant problem only in extremely rainy climate zones.

- Solar facilities cost considerably more than most other renewable resources and can drive up the cost of an RPS.

Every RPS allows solar resources to qualify. States with tiered resource structures include it in the first tier. Five states—Arizona, Colorado, Nevada,[8] New Jersey and Pennsylvania—set aside a specific percentage of their RPS goal solely for solar resources. These setasides recognize the high initial cost of solar and thereby ensure a market is created for solar development.

Wind

Fossil and nuclear generators create steam that spins a turbine to generate electricity; wind turbine blades connect to a shaft that spins the turbine to generate electricity. For utility-scale wind, a large number of high-capacity turbines are connected to a single point of control to form a wind plant or wind farm. Homeowners, farmers and ranchers in windy areas typically use small wind systems for off-grid electricity generation, water pumping or other applications.

Although wind energy produces no air or water pollution and poses no threat to public safety, it does face obstacles, including the following.

- The best wind sites often are far from major load centers and require significant transmission investment to develop.

- A public perception that the land between turbines is occupied and cannot be used for other purposes. In fact, wind turbines themselves occupy only a small fraction of this land area, and the rest can be used for gazing, agriculture, or other purposes or left in its natural state.

- Its effect on wildlife–especially bird and bat populations–whether endangered species are affected, and whether wind energy may contribute to habitat degradation or loss maybe a problem.

- Concerns exist about the visual effect of wind turbines and their effect on property values and tourism.

- Because the wind does not blow all the time, its intermittency can affect the integration of utility-scale wind facilities onto the grid.

- Wind technology is widely accepted and cost-effective; because of this, utility-scale wind facilities have the potential to dominate a state's RPS to the exclusion of other renewable technologies.

As is the case with solar, wind technologies are included in every RPS. In those states that have tiered resource structures, wind is included in the first tier. New York is the exception; here, it is included in both the Main Tier and Customer-Sited Tier. No state distinguishes between the types of wind technologies that qualify, i.e., small and utility-scale.

Other Resources

Additional resources and technologies are identified in the definitions of qualifying renewables in five states (see table 4).

Table 4. Other Qualifying Resources in State RPS	
State	**Other Qualifying Resources**
Connecticut	Low-emission advanced renewable energy conversion technologies included in the Tier I classification.
Hawaii	Includes an assortment of alternative energy sources such as solar and heat pump water heating; seawater air conditioning district cooling systems; solar air conditioning and ice storage; quantifiable energy conservation measures; and the use of waste heat from cogeneration and CHP (combined heat and power) facilities, excluding fossil-fueled qualifying facilities.
Massachusetts	Hydrogen from renewable energy resources and technologies.
Montana	The renewable energy fraction from the "eligible renewable resources" of electricity production from a multiple-fuel process with fossil fuels.
Nevada	Allows for "qualified energy recovery process." That is defined as a system with a nameplate capacity[9] of not more than 15 MW that converts the otherwise lost energy from: (a) The heat from exhaust stacks or pipes used for engines or manufacturing or industrial processes; or (b) The reduction of high pressure in water or gas pipelines before the distribution of the water or gas, to generate electricity if the system does not use additional fossil fuel or require a combustion process to generate such electricity. The term does not include any system that uses energy, lost or otherwise, from a process that has as its primary purpose the generation of electricity, including, without limitation, any process involving engine-driven generation or pumped hydrogeneration.
Pennsylvania	Incorporates a range of other resources and technologies, including waste coal, coal mine methane, demand-side management and distributed generation.
Texas	Specifically excludes all fossil fuels and waste products from fossil fuels. Indirectly, this excludes fuel cells that rely on hydrogen extracted from natural gas or any other fossil fuel.
Source: NCSL, 2005.	

Structure, Size and Phase-In of RPS

The size of the RPS—usually measured in a percentage of electric generation or electric capacity or energy—typically is one of its most important parts. Whether energy or capacity is used as the measure of the size of the RPS is an important factor. California and Nevada, for example, use energy as the RPS measure. Iowa, Minnesota and Texas use capacity as the RPS measure. For example, Texas requires 2,000 MW of renewable generation capacity by 2009. If this RPS requirement is met from wind with a 30 percent capacity factor, it could be less than the energy equivalent renewable output of only 800 MW of geothermal in Nevada with a 97 percent capacity factor. Thus, absolute percentages are not necessarily an accurate measure of the relative magnitude of a state RPS requirement.

Most states phase in their requirements over several years. Table 5 illustrates the size of the RPS in the 19 states and the District of Columbia, with a standard in place. They range from a low of 1.1 percent in Arizona to a high of 25 percent is in New York, with varying degrees in between. Again, these percentages must be compared in the context of whether they are an energy requirement or a capacity requirement.

Table 5. State RPS Requirements

State/ Jurisdiction	Title of Standard	Renewable Energy Requirement	Deadline
Arizona	Environmental Portfolio Standard	1.1%	2012
California	Renewables Portfolio Standard	20%	2010
Colorado	Renewable Energy Requirement	10%	2015
Connecticut	Renewables Portfolio Standard	10%	2010
Hawaii	Renewable Portfolio Standard	20%	2020
Iowa	Alternative Energy Law	105 MW - 2%	1999
Maine	Renewables Portfolio Standard	30%	2000
Maryland	Renewable Energy Portfolio Standard and Credit Trading	7.5%	2019
Massachusetts	Renewable Energy Portfolio Standard	4%	2009
Minnesota	Xcel Energy Wind and Biomass Generation Mandate	1,125 MW wind 125 MW biomass	2010 N/A
Montana	Montana Renewable Power Production and Rural Economic Development Act	15%	2015
Nevada	Renewable Energy Portfolio Standard	15%	2013
New Jersey	Renewables Portfolio Standards	6.5%	2008
New Mexico	Renewables Portfolio Standard	10%	2011
New York	Renewable Portfolio Standard	25%	2013
Pennsylvania	Alternative Energy Portfolio Standard	18%	2020
Rhode Island	Renewable Energy Standard	16%	2019
Texas	Goal for Renewable Energy	2,000 MW	2009
Wisconsin	Renewable Portfolio Standard	2.2%	2011
District of Columbia	Renewables Portfolio Standard	11%	2022

Source: NCSL, 2005.

States approach the timeline for meeting the RPS target in various ways. The majority has an annual or biannual incremental increase, often 1 percent, until a particular year. A handful of states have a five-year increase, and Colorado has uneven increases; of 3.6 percent and 10 percent. Most of the remaining states do not identify specific incremental increases; instead, they identify only the final target date.

Those states with tiered resource classifications tend to have a yearly increase for Tier I resources, while Tier II resources are either given one target or long-range incremental increases.

The deadline for meeting the standards in two states—Iowa and Maine—has passed; in fact, Maine met the standard with hydroelectric and biomass before the RPS passed, and Iowa exceeded its standard using wind. Texas will probably meet its 2009 goal by the end of 2005. The remaining of the states still faces deadlines, which range from 2007 to 2020. Massachusetts is the only state that has neither a fixed target date nor a percentage. The state has a 4 percent requirement by 2009 that will continue to increase by 1 percent per year until the state Division of Energy Resources ends the increases.

Oversight and Review of RPS

Three states—Hawaii, Maryland and Rhode Island—call for additional review of the RPS.

Hawaii RPS Study

The Hawaii Legislature passed a renewable portfolio standard during its 2004 legislative session. Senate Bill 2474 (Hi. Rev. Stat. Ann. §§269-91 – 269-95) required the public utilities commission (PUC) to conduct a renewable portfolio standards study. By December 1, 2006, the PUC must develop a utility ratemaking structure to provide incentives that encourage Hawaii's electric utility companies to use the state's renewable energy resources to meet the RPS. The PUC is to look at allowances for deviation from the standards if the utilities cannot meet them effectively.

In addition to its own study, the PUC must contract with the University of Hawaii's Natural Energy Institute to conduct independent studies about projected standards for five and 10 years beyond the current standards. The institute also will look at the capability of the state's utility companies to achieve the RPS in a cost-effective manner, factoring in the effect on

rates, reliability, cost of renewable energy resources and technologies, and environmental impacts.

The PUC will revise the RPS if the study indicates in conflict with the standards established in the 2004 legislation. The PUC will update the Legislature prior to the start of the 2009 session and every five years thereafter.

Maryland RPS Review

The Maryland General Assembly passed an RPS—Senate Bill 869, Md. Code Ann. §§7-700 – 7-710—during the 2004 legislative session. Included is a requirement that the Public Service Commission (PSC) provide a status report to both the governor and the General Assembly by December 1, 2009. The status report will include a review of the RPS implementation; the availability of, and the price effect on, Tier I renewable energy sources; the amount of compliance fees that electricity suppliers pay; and the subsequent use of those fees to create new Tier I renewable energy sources.

The PSC must conduct a review of the RPS before January 1, 2016, and report to the governor and General Assembly by January 1, 2017. This review will evaluate the environmental and economic effects of the standard, including the effect of Tier II renewable sources. The PSC will develop recommendations for the continuation of the RPS for both Tier I and Tier II sources and include the classification of resources in tiers, alterations to the tier system, and whether the tiers should continue, and if so, at what percentages.

Rhode Island RPS Review

The Rhode Island Public Utilities Commission (PUC) must determine the adequacy of renewable energy supplies to meet the increase in percentage requirements to go into effect in 2011 and then again in 2015. If the PUC determines that inadequate supply exists, it may delay the implementation of the scheduled percentage increases for one year or may recommend to the General Assembly a revised schedule of percentage increases.

Administration of the RPS

In almost all cases, a state's Corporation Commission, Public Utilities Commission, Public Service Commission or Public Utilities Board oversees administration of the RPS. A number of the commissions are left with the traditional powers of regulatory oversight and enforcement. However, a state may choose to grant the commission additional penalty authority to include levying fines for noncompliance with the RPS. A commission may verify compliance with the RPS through annual compliance filings by a load-serving entity. The Massachusetts energy agency the Division of Energy Resources (DOER), administers the RPS; this includes rulemaking and compliance verification. The ultimate penalty authority, however, is delegated to the D T E (PUC); this includes suspension or revocation of license to sell electricity at retail in Massachusetts.

Although legislation leaves the administration of the RPS in the hands of the commission, the rulemakings usually involve various entities that have expertise in different areas. In Pennsylvania, for example, the Energy and Technology Development Office determines resource eligibility, while the PUC outlines the trading and tracking system for the renewable energy credits as well as the interconnection and net metering standards. The Massachusetts RPS is administered by DOER, the energy agency, including rule making and compliance verification, but the ultimate penalty authority is delegated to the DTE (PUC) as suspension or revocation of license to sell electricity at retail in Massachusetts.

Applicability and Exemptions

Every RPS in place today outlines some specific applicability requirements. The Iowa RPS, for example, was applicable only to investor-owned utilities (IOU); New Jersey specifically calls for electric power suppliers to comply; Pennsylvania requires rural electric cooperatives to offer energy efficiency programs to customers; and the New Mexico PRC requires rural cooperatives to offer a voluntary green power tariff if their wholesale suppliers make these

renewable resources available, but does not require them to meet renewable energy requirements. Wisconsin is the one state that requires IOUs, municipal utilities and rural cooperatives to comply with the RPS. Minnesota's RPS is unique in that it applies to only one utility, Xcel Energy; all other utilities must demonstrate "good faith efforts."

Just as there are applicability requirements, there also are exemptions to compliance with an RPS. Almost every state with an RPS exempts municipal utilities and rural electric cooperatives from compliance. In a handful of states, however, this is not the case. In Colorado, for example, municipal utilities and rural cooperatives may self-certify their compliance if they have an equivalent RPS in place. Colorado also provides a compliance exemption for utilities that have less than 40,000 customers, and the state allows utilities to ask their customers for an exemption from the RPS on a one meter, one vote basis. Hawaii requires its cooperative on the island of Kauai to comply with the standard. Connecticut, a state with tiered qualifying resources, uses these tiers to exempt suppliers of solely Class II resources from compliance with the RPS. Montana exempts restructured utilities and cooperatives from the renewable energy standard. However, cooperatives with 5,000 or more customers must implement a renewable energy standard that recognizes the legislature's intent to encourage new renewable energy production and rural economic development.

Unique exemptions in other states include:

- Those exempt from electric restructuring;
- Electricity customers under a rate cap;
- Public power agencies;
- Load serving entities under restructuring rate freezes or stranded cost recovery; and
- Municipal utilities, unless they open their markets to retail competition.

Qualification of Resources Built out of State

State policymakers tend to focus on the RPS for many reasons, but one of the most important is that it encourages people to build renewable energy projects in state. Policymakers want the economic development that comes with the RPS. Many also want the other benefits that come with an RPS, including the environmental effects of renewable energy and the lower overall fuel price risk and higher energy security. For many people, however, the in-state economic development benefits are crucial. The RPS can be a tool to

encourage developers to build in the state that has the RPS policy. Some legal and practical issues exist, however, that may limit a state's ability to place a preference on in-state resources.

The Legal Background

Beginning in the 1920s, the U.S. Supreme Court began to interpret the Commerce Clause of the U.S. Constitution in ways that essentially precluded states from imposing barriers to commerce with other states. During the last 100 years, the courts have developed a long and extensive case history that makes it very difficult for a state to require that its residents purchase only products that are made in the state. Such a requirement would place an "undue" burden on interstate commerce that would make it difficult for companies based outside the state to sell their products to state residents.

The same arguments will likely follow for electricity, although no court case has specifically tested the application of the Commerce Clause to state renewable energy portfolio standards. In general, it seems clear that it would violate the courts' interpretation of the Commerce Clause to require that utilities buy power from in-state generators.

Since this requirement of RPS policies has not been challenged in the courts, states include language in their policies that restrict, or partially restrict, renewable energy production to in-state resources. Some states do not go so far as to require that the renewable power plant be in-state, but do require proof that the power plant is delivering electricity into the state.

- Arizona requires that electricity produced by landfill gas, wind and biomass be generated within the state. It also states that out-of-state solar power is eligible only if it is used by Arizona customers.

- California requires that the renewable generation be delivered into California for California customers' use.

- Nevada and Texas allow renewables to be located out of state if a dedicated transmission line brings them into the state. In Nevada, that transmission line cannot be shared with more than one other nonrenewable energy generator.

- Massachusetts requires that off-grid generators and those located on the customer side of the meter be located in the state. All other generators

either must be located in the ISO-New England control area or deliver their output into that control area.

- Rhode Island requires that small-scale, off-grid generators that are located on the customer side of the meter be located in the state.

- Massachusetts requires that off-grid generators and those located on the customer side of the meter be located in the state. All other generators either must be located in the ISO-New England control area or deliver their output into that control area.

Instead of disqualifying out-of-state resources outright, at least one state attempts to finesse the issue simply by offering extra credit to certain types of resources. (The utilities earn 1 credit per unit of every other resource) Colorado's law gives 1.25 credits to in-state resources; out-of-state resources would qualify for only one credit toward meeting the standard. Because this policy also sets up a preference for a resource that is not available to an out-of-state company, it could possibly raise the same constitutional issues as an outright prohibition on using out-of-state resources to satisfy the RPS standard. The final question, then, is whether it is worthwhile for any company or state to take these issues to the courts.

Legal or Not, Is it Helpful to Disqualify Out-of-State Resources?

Two policy goals conflict with one another in the determination whether to require in-state renewable resources. The first addresses economic development that results from new renewable energy projects inside the state. A new wind project, for example, generates tax revenue for local governments, new jobs, and annual revenues of about $2,500 per megawatt for landowners who host the wind turbines. There is little question that most state policymakers prefer that a renewable energy standard attract jobs and revenues into state.

On the other hand, restricting the portfolio standard to in-state resources can increase the cost of the standard if better renewable resources exist outside the state. Arizona's wind resources might be good, but Colorado's resources are better. It might be less expensive to let the market decide whether it makes sense to import renewable energy from far away or to build it in-state.

Renewable Energy Credits and Location of Resources

Many states do not require that an electricity retailer actually have a contract for a physical supply of renewable energy; instead they allow the retailer to buy tradable renewable energy credits. These credits could be generated inside or outside the state, or state laws could require that eligible credits be generated within a certain geographic region. Maryland, for example, requires that such credits be generated in the geographic region surrounding Maryland.[10] Texas, on the other hand, requires that such credits be generated inside the state or by a generator that is directly connected to Texas.

What Are Tradable Renewable Energy Credits?

When a wind, solar, biomass, geothermal or other renewable energy power plant generates electricity, a meter tracks how many megawatt hours or kilowatt hours of power it generates. The generator earns money by selling these megawatt hours. Renewable energy generators now can earn more money by selling another product, tradable renewable energy credits (RECs). An REC is a certificate that documents the generation of renewable energy; each REC demonstrates that someone produced 1 megawatt-hour or a kilowatt-hour of electricity from renewable energy. That certificate can be retired or can be sold to companies that need to comply with voluntary renewable energy goals or government mandates but that choose not to build or buy the renewable resources directly.

How Do RECs Work?

Using a wind farm as an example, details of REC operation are shown below.

1. A wind farm generates electricity, and a meter measures how much it generates. The meter can take the measurement in many places, but might do so at the substation where the power from the wind farm enters the electric grid, so that measurement would incorporate any losses that occur between the wind farm and the point where it enters the grid.

2. The meter sends the information to a central administrator that automatically records the megawatt hours generated, and assigns each megawatt hour a unique identification code. That code identifies where and when the megawatt hour of renewable energy was generated.

3. The central administrator puts the information on a Web site or electronic bulletin board in an account for the generator. The REC now can be tracked electronically if it is traded, used or retired. Again, one REC is equal to one megawatt hour of renewably generated electricity.

4. Different parties can see online the credits that are available. Under some models, the central administrator brokers deals between buyers and sellers of these credits, or the central administrator could simply record such deals as the buyers and sellers report them. Under the second model, the central administrator does not act as a broker, but only as a facilitator or an information hub that tracks the use, trading or retirement of RECs.

5. This system creates tradable renewable energy credits that allow the participants to prove they have acquired enough credits to meet their obligations under a portfolio standard or to meet voluntary goals. The system also ensures that a credit for a MWh is used appropriately and is not counted more than once.

6. Renewable energy producers that sell the tradable renewable credits are left with energy that lacks any renewable attributes. Any claim that the remaining energy has renewable attributes is deceptive and may attract the interest of state consumer protection enforcers.

What Policies Do RECs Support?

RECs support mandatory portfolio standards by providing a method by which companies that do not meet the requirements can comply by purchasing credits.

RECs also support voluntary green pricing programs by giving companies a way to meet their own goals. A voluntary green pricing program is one in which companies make a voluntary commitment to buy a certain percentage of their electricity from green energy. In Colorado, for example, Xcel Energy offers its customers an opportunity to pay $2.50 extra for 100 kWh blocks of wind-powered electricity. Xcel has chosen to sign power purchase agreements to buy power from wind farms. An alternative way for Xcel to meet its obligations would be to purchase RECs on the market.

State governments can use RECs to satisfy their internal goals for purchasing green power. For example, Rhode Island is purchasing 1,650 RECs per year for five years in order to partly offset the electric load from the State House. States can use estimated emission reductions from renewable energy measures and include them in state implementation plans (SIP). A SIP details how a state will meet an air quality standard in a nonattainment area. Electric sector projects that result in quantifiable emission reductions at fossil fuel-fired electric generating facilities and improve air quality in nonattainment

areas can qualify for SIP credit. The U.S. Environmental Protection Agency (EPA) has issued guidance that encourages states to increase the generation of electricity from renewable resources.

Where Are Credit Trading and Tracking Programs Being Used?

People in most of the country can buy tradable credits, but formal tracking systems are relatively new. Such systems exist in places where voluntary green pricing programs are becoming more popular and in places that have mandatory renewable energy portfolio requirements. Tracking systems exist—or will shortly be established—to cover New England, New York, the PJM area (Pennsylvania, New Jersey, Maryland, Delaware, Washington, D.C.), the upper great plains, Texas, and the full western region of the country.

Overlap Between Green Pricing Programs and Renewable Portfolio Standards

Green pricing refers to programs that almost all utilities offer through which their customers can pay a small amount of extra money to buy "green" power, or power generated from renewable energy resources. Colorado's Xcel Energy offers a green pricing program that it calls Windpower. Through this program, customers can pay an extra $2.50 each month for 100 kWh of wind power. If a customer wants to cover all her energy usage with wind power and that customer uses 700 kWh per month, the customer would pay and extra $17.50 per month. In general, it has been established that these green power purchases are in addition to what the utility would otherwise be doing to meet its regulatory mandates—but for the customer's voluntary green power purchase, the utility would not be buying, generating or supporting the wind or other renewable energy project. As a result, in every state except for Arizona, green power programs do not count towards utility's renewable energy obligations.

Lessons from the Renewable Portfolio Standard

✓ *Have realistic expectations of what the RPS can accomplish.*

In its simplest form, the RPS is a good policy to support the least expensive and large-scale renewable resources such as landfill gas, geothermal and wind. It is possible, although more complex and costly, to add additional measures within the RPS to stimulate other technologies such as solar power and fuel cells.

✓ *Recognize that long-term contracts are important to renewable energy producers, since renewables benefit by having a long time to recover their high initial capital costs.*

✓ *Be certain that goals are achievable.*

Renewable energy capacity is large, but not limitless. This is especially true in eastern states that attempt to limit the geographic scope of qualifying renewable resources and thus make it potentially difficult to meet the higher renewable resource goals in the later years of the standard. States may wish to consider not only their own requirements, but those of neighboring states, paying particular attention to any in-state or other geographic requirements placed on the portfolio standard. Goals should incorporate a realistic assessment of how long it takes to plan for and construct renewable energy facilities.

✓ *Be realistic about the interaction of cost caps and the requirements of the RPS.*

Colorado has a 1 percent per customer per month cost cap, but may have difficulty remaining within the bounds of that cost cap because it also has a 0.4 percent solar set-aside within the portfolio standard. Utilities are required to subsidize solar systems with a payment of at least $2 per watt; the cost of a fully installed solar system costs between $8 and $9 per

watt. It might be difficult to meet the solar set-aside requirement and still remain within the bounds of the 1 percent cost cap.

✓ ***Be clear about whether the portfolio standard will allow existing renewable resources to qualify or whether only new resources will qualify.***

Maine had more than achieved its 30 percent portfolio standard goal by the time it had enacted its legislation because its existing stock of renewable energy capacity qualified under the standard and exceeded 30 percent. Pennsylvania is addressing whether existing hydroelectric power plants should qualify or whether the standard should include only new plants.

✓ ***Be clear about the definition of qualifying resources.***

Both biomass and hydroelectric power have complex definitions. When crafting resource definitions, especially for biomass and hydroelectric power, it is important to be either extremely specific or intentionally general. An explicit definition lets the rulemaking body know that the resources outlined in the legislative definition are those that need to be included in the rules. A general definition, sometimes consisting of just one word, gives the rulemaking authority the discretion to identify eligible qualifying resources.

✓ ***Consider and define whether and how to let non-electric resources—such as geothermal heat pumps or energy efficiency—qualify.***

Hawaii gives credit in its portfolio standard for energy efficiency measures. No states explicitly allow geothermal heat pumps to qualify, although it would be possible to do so. These resources need to be measured carefully and verified if they are to count as qualifying resources. They also have the potential to overwhelm other resources if the standard does not limit them.

✓ ***Be careful about in-state qualification requirements.***

Some states attempt to require that the renewables be built in-state. Some states attempt to define a larger—but still restricted—geographic boundary in which the renewable energy project must operate. Some of these requirements may be contrary to Commerce Clause restrictions and may limit available, low-cost renewable resources.

✓ ***Provide the regulators some flexibility in how the RPS is implemented.***

Legislators rely on the RPS to be a market-based solution to the expansion of renewable energy development in their states. This makes it important that regulators have the capacity to respond quickly to the market and its changes. Regulators can use this flexibility when setting alternative compliance payment increments.

✓ ***Address how solar photovoltaics and other renewable resources located off the grid will count toward meeting the portfolio standard.***

New Jersey requires that the systems have an automated meter attached to them that measures the amount of electrical energy produced from the solar array. Inspectors verify that energy reported as generated is actually generated in order to qualify for renewable Energy Credits.

✓ ***Clarify who owns the renewable energy attributes for purposes of owning and selling renewable energy credits.***

Since tradable renewable energy credits (REC) may become an important part of the renewable energy financing picture and because these RECs are valuable, it may be important to clarify who owns them. If a utility subsidizes them or if taxpayers or ratepayers subsidize the utility to build renewable energy facilities, who owns the RECs? Is there a way to split ownership of the RECs? Is it too administratively burdensome to split ownership of such RECs? Should states specify in law who owns the credits?

✓ ***Clarify the relationship between renewables secured through green pricing programs and renewables secured because of renewable portfolio standards.***

Arizona is the only state that currently allows the utilities to count their purchases of renewable energy that are supported by voluntary payments to help them meet their obligations under the renewable portfolio standard. Other states have chosen to draw a division between these two programs because green pricing programs are generally understood to be voluntary programs that support purchases the utility or energy retailer would not make, but for the customer's voluntary payment.

✓ ***Be careful when crafting legislation that outlines the mechanisms for the renewable energy credit trading program.***

Trading programs generally have moved beyond individual state borders and now increasingly function at a regional level. If legislators place too many restrictions on the trading program they will not function as effectively as they might with more flexibility.

✓ ***Allow regulators the authority to set the alternative compliance payment (ACP) price.***

In New Jersey and other states, companies can pay an alternative compliance payment instead of actually buying RECs or installing renewable energy. If an ACP is set in legislation, the mechanism does not allow response to market forces in market time; the legislature may be required either to change the price or give regulators the authority to do so. For example, the New Jersey Public Utilities Board (PUB) sets the ACP annually, looking forward to the REC market for the upcoming year. The authority of the PUB protects against a few people controlling too much of the market or limited availability of RECs. As with REC trading programs, the setting of the ACP price benefits from a regional approach rather than an individual state approach.

✓ ***Understand that the more complex the RPS structure, the more difficult the standard may be to meet. Standards that include provisions such as set-asides for certain technologies, tiers, complicated and convoluted cost recovery and tracking mechanisms add complexity which can add cost and create difficulty in compliance.***

Notes

1. States have adopted portfolio standards through a variety of means; Colorado through ballot measure, New York and Arizona through committee order and the remainder through legislation.

2. Many small projects may qualify in Massachusetts. Perhaps the logic is backward——smaller projects may enjoy the RPS if barriers to small project deployment, such as interconnection, are removed.

3. For the Massachusetts RPS, the $.05 fee changes annually, according to changes in the Consumer Price Index. Accordingly, the payment for 2005 is $05.3.

4. Neat biodiesel refers to a 100 percent biodiesel fuel that is not blended with traditional diesel.

5. Unsegregated waste includes all wastes, whether chemically treated or not. Unsegregated waste has a far different emissions profile than untreated waste.

6. New York defines its tiers differently from some states. The Main Tier consists primarily of medium to large-scale electric generation facilities that are expected to compete against each other. The Customer-Sited Tier includes "behind the meter" facilities sited on customers' premises that generally are not economically competitive with Main Tier facilities.

7. Cofired biomass refers to biomass mixed and burned with coal to generate electricity.

8. Nevada specifically provides additional credit—a 2.4 multiplier—for installation of distributed solar photovoltaic systems. This multiplier is intended to reflect the added benefits from the installation of distributed renewable generation that does not incur line losses and provides local distribution system support.

9. Nameplate capacity refers to a power plant's maximum ability to generate electricity under ideal conditions.

10. Maryland specifies that credits must come from 1) the regional transmission organization, PJM; 2) a state adjacent to PJM; or 3) a control area adjacent to PJM if the energy is delivered into PJM.

Wind Transmission

National Conference of State Legislatures

Innovations in State Policy

The fastest growing new energy resource in the United States during the past several years has been wind power. With a federal tax credit to back them, developers are building new wind farms across much of the country. Yet, even as they do so, they are encountering a major obstacle; the best wind energy resources are far away from the places where people live. In the ideal situation, the distance between the energy resources and the markets would not be a concern; wind developers could simply connect to a transmission line to deliver power to market. In many cases, however, the transmission lines do not exist between the resources and the markets. Even where transmission lines are available, they do not have enough capacity to carry the amount of power that wind generators produce. Electricity transmission is a major issue that all wind developers must face.

When a wind power developer announces a new wind farm, it is the culmination of a series of studies concluding that it is economically feasible to build the power plant. A typical wind facility comes at a significant cost; the turbines, towers and other buildings that constitute the wind farm cost approximately $1,000 to $1,200 per installed kilowatt. A single turbine in a large wind farm usually is at least 1 megawatt (1,000 kilowatts), so a single turbine can cost $1 million to $1.2 million. A 100 megawatt wind farm costs around $100 million to $120 million. The investments are not trivial and require that prudent developers exercise diligence, especially in making sure they have access to the power transmission system.

Among the issues that developers examine when they decide to make such an investment are the following.

- The rules governing access to the existing power grid. By what rules do power generators need to abide in order to get their power onto the electric grid?
- The adequacy of the power delivery system. Is enough capacity available on the power transmission lines to be able to get power to consumers?
- The state and local tax regime. What state and local taxes will the developer be expected to pay on an ongoing basis (e.g., property taxes) and during construction (e.g., sales taxes).
- Siting certification. What siting certificates must the developers obtain, and is there likely to be substantial public opposition to building the wind facility?
- The wind resource. How fast and how consistently does the wind blow in the exact area in which the turbines will be built?
- Regional demand for renewable energy. Some states now require that electricity retailers supply a certain amount of their power from renewable energy. A wind developer may be able to sell power into the wind market in the state in which the wind farm is built or into another nearby state that needs renewable energy to satisfy voluntary green markets or mandatory portfolio standards.

Each of these issues is important. In fact, a substantial barrier in any one of these areas can persuade a developer to seek opportunities in more hospitable physical or political environments. By the same token, even if a developer wants to build a wind farm, bankers also must conclude that it makes economic sense to invest in the project.

This paper addresses just one of these issues: transmission. The physical capacity and regulations governing the transmission system constitute critical areas for wind power developers. It focuses on three major issues: 1) the reasons that transmission is so important to wind developers; 2) transmission policies that are important to wind developers, primarily implemented at the federal level; and 3) state policy options to address transmission.

The Importance of Transmission to Wind Developers

Transmission rules and engineering can seem esoteric, but they are critical for wind power developers. These developers rely on the transmission system to deliver their electricity to market, just as any other power plant developer that uses gas, coal, oil or nuclear power. Yet, wind differs from these other technologies because wind farm developers cannot shift the location of wind farms and maintain the same wind resource.

The wind resource is critical because the energy output of a wind turbine increases exponentially with the increase in wind speed; a 20 percent increase in average wind speed from 10 miles per hour to 12 miles per hour increases the electrical output of a wind turbine by 80 percent (check this figure). Thus, locating a wind turbine in an area that offers an excellent wind resource is far more advantageous to a wind developer than locating the resource in a good to very good wind location.

Many early wind farms failed because their developers did not understand the wind resource and a process known as micrositing. Micrositing refers to a process in which developers measure wind resources at highly specific locations. Moving a turbine a few hundred feet or less may significantly affect wind speed. Early developers discovered that many factors affect the wind resource; these factors may include small hills or other topographical features or the proximity of other wind turbines.

Because of the importance of micrositing it may prove difficult to move a wind farm from one location to another. Thus, the transmission system becomes extremely important to wind developers. In this respect, wind plants differ from natural gas power plants, since it is usually possible to build a pipeline that ships gas to a power plant. Coal, on the other hand, shares a need for transmission with wind because of the significant economic advantages to building a power plant at mine mouth, near the coal mine.

The rules that govern transmission markets are important factors in a developer's decision to build a wind farm. Wind is distinct from technologies that are not intermittent, such as natural gas, coal, nuclear and many hydroelectric facilities. Developers can predict with a fair amount of certainty how much their wind turbines will produce during the course of a year, a season or a month. However, they cannot always predict more than a day or so in advance precisely when the wind will blow. These unique features of wind and the wind resource make the rule that govern power markets—and especially the rules that govern transmission very important to wind developers.

Transmission Policies that Are Important to Wind

States and the federal government share jurisdiction over the transmission system, and the federal government asserts jurisdiction over major parts of the system. In general, the federal government holds jurisdiction over the rates and terms that transmission system owners can impose for others to use their transmission lines. The federal government also holds jurisdiction over the regional institutions that are being set up to govern the transmission system. State jurisdiction, on the other hand, falls into three primary areas:

- Siting transmission lines,
- Participating in regional planning for transmission, and
- Taxation and other financing considerations.

State policy options related to transmission tend to revolve around each of these four areas.

Siting Transmission Lines

The most important state role in the transmission market is siting of new transmission lines. Siting transmission lines is complex; few people want the lines built near them, and the mix of state and federal permitting requirements adds complexity. Transmission siting law is important to wind and most other power plant developers since they all depend on transmission to move their electricity to market. States might consider several policies to address transmission line siting.

- Explore possibilities for regional siting and collaboration in permitting and building new transmission lines.

With few exceptions, the transmission system is an interstate system. Wind energy in particular relies on the transmission system to deliver its power to markets, since the best wind resources are usually in places that do not use a great deal of electricity. Siting the transmission lines can be particularly difficult when one of the states hosting the transmission line is not benefiting directly either from the power or from the economic development associated with the power plant. In this situation, it may be beneficial for states to work together to plan the transmission system and to coordinate transmission line siting processes. It also may be beneficial for states to explicitly allow their siting authorities to consider regional benefits to building a new line, rather than focusing only on in-state benefits.

- Consider evaluating the "need" standard for transmission in the context of regional needs for power vs. in-state transmission impacts.

Many states require that applicants for a permit demonstrate that the transmission line is needed and that alternatives to building the transmission line have been considered. States could consider including a regional determination of need for the line in their definition of need. In the mid-1970s, for example, utilities built a power line from new coal-fired power plants in Montana to serve customers primarily on the west coast of the United States. Those power lines crossed Idaho, but Idaho did not need the power lines to meet its own demand. A regional definition of need might make it easier to site a similar power line.

- Consider various means to streamline the siting process for transmission lines. State siting processes to approve new transmission lines can be cumbersome. State policymakers may wish to consider several means to streamline those processes. Options include the following.
  - Eliminate the need for a siting process in cases where the transmission will be upgraded on an existing right-of-way.
  - Create a single-stop siting process to consolidate all state-level applications with one agency or siting commission.
  - Define, in statute or regulation, the issues that are germane to the siting decision and restrict interveners to discussion of those major issues.
  - Set out and enforce time limits on the siting decision.
  - Set out a clear definition of what constitutes a complete siting application.

Regional Transmission Planning

The electric power industry is now a regional industry, yet most laws that govern the industry are either state or federal. Many state regulators already are heavily involved in a number of regional transmission efforts. Some of these efforts may eventually benefit from state legislation that supports regional planning and regional collaboration.

NCSL has developed sample legislation that states may consider to encourage greater collaboration on transmission planning and to include regional planning efforts in the transmission siting process. The sample legislation is included as an appendix.

Taxation and Other Financing Considerations

States have the authority to tax transmission companies and to offer tax incentives for transmission. In some cases, it may make sense to consider offering tax incentives for building new transmission or for building certain types of transmission lines. It is important to consider, however, that utilities that build transmission lines pass their costs to ratepayers. Legislatures may want to consider more targeted types of incentives for transmission, if incentives are offered at all. Several policy alternatives follow.

- States could offer a targeted tax incentive for building new transmission, although it would be important to determine what investments transmission companies might make on their own, without incentives. States could target those incentives toward resources that seem most reliant on them; in the case of wind energy, it would be possible to offer an incentive for building a line that serves a wind resource.

- States could offer incentives to install new and efficient transmission technologies. These technologies improve the efficiency of the existing transmission system, allowing it to carry more electricity, thus reducing the need to building new lines.

- States could require payments to either landowners or to local governments that host transmission lines. Wisconsin statute requires transmission line owners to pay communities that host new transmission lines. Some states have considered requiring transmission line owners to pay landowners for the use of their land. Landowners already receive compensation when utilities condemn their land to build a new line, but some people have suggested that landowners should share in the income stream

that derives from the transmission line, much as landowners that host a wind turbine earn a royalty payment from that turbine. Such a policy might ease the siting process, although it would also have the effect of raising the cost of transmission and adding complexity, since a long transmission line crosses numerous pieces of property.

- States could establish a transmission finance authority. Wyoming enacted legislation that established a state authority with a broad goal of encouraging new transmission. The authority could go so far as to finance new transmission lines, or it could limit its activities to acting as a convener of various parties interested in new transmission. Six other states (Arizona, Kansas, Montana, New Mexico, North Dakota and South Dakota) are considering similar legislation in the 2005 legislative sessions. In most cases, these states are interested in exporting power from either coal or wind generators to distant markets.

- States will need to consider numerous issues before taking a financial position in a transmission project. Transmission is expensive, easily exceeding a cost of $1 million per mile, and any meaningful contribution could require either a significant cash outlay or the assumption of a significant risk. The state would need to carefully consider the costs and benefits of taking such. It is worth noting that no state has yet taken such a step because of the risks and costs involved.

Federal Policies

The Federal Energy Regulatory Commission (FERC) makes or approves many of the rules for the nation's transmission system. These rules clarify who pays to build new transmission lines, who pays for the embedded costs of the existing transmission system, who can own transmission, and how people who need to use the transmission system gain access to it (even if they do not own it). In general, the FERC has tried to create a system that gives power generators an equal opportunity to use the transmission system with other companies that own the transmission lines. It has been easier for the FERC to set the goals than to implement them, however, and a steady stream of FERC orders since the mid-1990s has attempted to meet the FERC's objectives. One hallmarks of each of the orders has been to delegate to regions the ability to set specific policies, while leaving approval of those policies to the FERC.

Wind energy developers focus on a small number of the FERC policies, all of which address the fact that wind is an intermittent resource that often is located far from large loads.

Paying to Upgrade the Transmission System

When a new power generator announces the intent to build a new power plant, the generator's first concern is to determine how to connect will the existing transmission system. One of the generator's first steps is to apply to the nearby transmission owner or to the regional transmission organization (RTO) for permission and an assessment of costs related to connecting to the power grid. Sometimes the transmission authority will determine that some parts of the grid will need to be upgraded as a result of the power flowing onto the grid from the new generator. In almost all cases, transmission will need to be built between the power plant and the nearest transmission line.

Texas is not subject to FERC regulation and has formulated its own policies that define who pays for the cost of upgrades to the transmission system. The Texas approach—which offers one example of how to pay for transmission upgrades—is to socialize the upgrades so that all customers pay for a portion of all upgrades. This approach contrasts with the state's previous approach to transmission upgrades, which required that the generator pay for them. In effect, the former approach meant that wind generators tended to build on wind sites close to the existing transmission system, even though better and otherwise more cost effective wind sites might exist at greater distances from the transmission system. The new policy has allowed wind generators to use locations that offer better and more consistent wind resources because the cost of somewhat longer transmission interconnections is borne by all ratepayers.

Penalties for wind intermittency

Wind plants produce power when the wind blows, and wind plant owners can only predict in general terms precisely when the wind will blow. Wind plants differ in this respect from other so-called "dispatchable" resources (such as coal or gas plants, over which the operator usually has control of power production). Many utilities assess a penalty on wind developers when they cannot meet certain generation schedules; these penalties, known as imbalance charges, can make wind plant financing uneconomical. The Federal Energy Regulatory Commission approves these charges and, as of early 2005, is reexamining the structure of these charges.

Paying to Use the Transmission Grid

Wind developers need to use transmission grid only when they are producing power, yet many of the rules that govern the use of the grid contemplate only generators that need to use the grid all the time. Because of the structure of these rules, and because the power grid already has been committed to many existing generators, new wind developers have not been able to receive a firm commitment from transmission owners that they will be able to gain access to the power grid. Some refer to this firm commitment as a firm transmission right. Without this firm transmission right, wind developers have no way to get their product to market, and it is difficult or impossible to secure financing to build a wind plant.

The FERC is now considering a new kind of transmission right that some people call "flexible-firm." This right would allow wind developers the firm right to use the transmission grid—such that they know they could deliver their power to market—but might mean the right could be superseded in cases when the power grid was overloaded.

Conclusion

State and federal governments play important roles in electricity transmission policies. The federal role is particularly strong in transmission and in wholesale power markets; however, state policymakers also play an important role in developing policy for transmission. This role is four-fold.

- Even where states do not have direct decision-making power, they can advocate for specific policies before the FERC and other federal bodies.

- States can examine their transmission line siting processes to determine areas in which siting rules could be streamlined without compromising fundamental state policy goals.

- States can examine the possibility of establishing a transmission finance authority.

- States can examine their tax policies relative to transmission to determine if tax policies may affect growth of new transmission.

The rules that govern transmission are evolving at the federal level and the even the structure of the transmission business is changing. State policymakers have at their disposal a number of policy options, all to be pursued within the broad context of a set of federal policies related to transmission for wind energy.

Appendix. NCSL Sample Legislation on Electric Transmission Planning and Siting

The U.S. electricity system comprises large grids that cover many states. Power generators and users often are located several states apart. However, state policy has not traditionally recognized the regional nature of the system. Electricity policy—like policy in most other areas—usually focuses on the needs of the state that creates it. To establish and maintain an electric system that reliably and efficiently serves consumers across large regions, state legislators may need to begin thinking of these systems as regional.

Many regional entities already exist. Some are formal—such as the Regional Transmission Organizations (RTOs) that must be approved by the Federal Energy Regulatory Commission. Others are less formal, such as the Northwest Transmission Assessment Committee (NTAC), which provides an interstate forum for discussion about transmission. In either case, state legislation may be necessary to enable a state agency or other entity to participate in regional planning efforts.

At the request of the National Conference of State Legislatures' Standing Committee on Energy and Electric Utilities, NCSL staff worked with the Committee's Transmission Working Group to offer states sample legislative language on interstate cooperation in transmission planning and siting. The legislation provides agencies that already have jurisdiction over planning and siting with legal authority to enter into discussions and collaboration with similar agencies in other states. Among its many provisions, the legislation:

- Contains provisions for those states affiliated with RTOs and for those states not affiliated with RTOs;
- Encourages interstate cooperation on determining the need for new transmission lines and necessitates an attempt to reach consensus with affected states and tribes;
- Calls for coordination among states in interacting with the public and filing for permits.

State policies vary widely regarding electricity transmission and jurisdiction over planning. The authority to site transmission lines does not rest with the same agency in every state. Thus, not every provision in this sample legislative language is applicable in every state. NCSL recommends that state legislators and staff select those provisions in the sample language that would be most applicable and helpful in each case.

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***Note**: Given the wide variation in state policies regarding electricity transmission, not every provision in this sample legislative language is applicable in every state. In using the sample language, please select those provisions that you feel would be most applicable and helpful for your state.*

Sample State Statute
Regional Coordination in Planning and Siting of Electric Transmission Lines

[Title, enacting clause, etc.]

Section 1. *[Short Title.]* This Act is known and may be cited as the "Regional Coordination in Planning and Siting of Electric Transmission Lines Act."

Section 2. Statement of Purpose.[1]
The purposes of this Act are: a) to give the *[agency with jurisdiction over siting of electric transmission lines]* the authority to effectively coordinate and cooperate with agencies of similar jurisdiction in other states on siting activities regarding proposed electric transmission lines that cross state and national boundaries; and b) to give the *[agency with jurisdiction over siting of electric transmission lines]* the authority to consider both state and regional needs and planning when evaluating whether a proposed electric transmission line should be approved.

Section 3. Definitions. In this Act:

A. "Electric transmission line" means a set of conductors, insulators, supporting structures and associated equipment used to transmit electric energy at high voltage, usually over long distances between a generating or receiving point and major substations or delivery points.

B. "Electric transmission route" means the geographic course that an electric transmission line follows.

C. "Energy demand" means the requirement for energy as an input to provide products and/or services.

D. "Intervention" means on-the-record participation by an interested party in a contested case or other formal activity undertaken by a state utility regulatory agency.

E. "Load management" means an energy conservation measure or a measure to shift electricity demand to times of lower use of the electricity system.

F. "Planning" means the process of determining when and where electric transmission lines will need to be built to serve demand for electricity.

G. "Regional" means an area encompassing all or part of more than one state.

H. "Regional organizations" mean formal or informal multi-state groups of electric transmission line siting or planning entities formed for the purpose of coordinating planning or siting of electric transmission lines. In most cases, member states are contiguous.

I. "Siting" means the process of evaluating whether a request for approval of the necessary certifications to build, maintain and operate a proposed electric transmission line should be granted and, if the request is granted, the process of issuing the necessary certifications.

Section 4. ***[Legislative authorization to enter into multi-state coordination.]***

A. The *[agency with jurisdiction over siting of electric transmission lines (hereinafter "agency")]* [2] may present the concerns and interests of the state to other states, regional organizations, and the federal government[3] on the location, construction, and operation of any electric transmission line that may affect the environment, health or safety of the citizens of the state.

B. The *[agency]* is authorized to participate in a regional transmission organization.[4]

1. The *[agency]* representative to any regional transmission organization recognized by the Federal Energy Regulatory Commission of which one or more *[State]* electric public utilities is a member is hereby authorized to participate fully in all decision-making bodies of such regional transmission organization, whether the decision of such bodies are advisory to or binding on the regional transmission authorization.
2. Nothing in this provision shall limit the *[agency]'s* regulatory jurisdiction or authority to appeal to the federal energy regulatory commission any decision by a regional transmission organization or relieves the *[agency]* of its obligation and authority to ensure that electric public utilities provide efficient and sufficient service.

C. The *[agency]* shall recognize the value to consumers of regional coordination and collaboration in transmission planning.

D. In considering planning and siting of electric transmission lines that cross state boundaries, national boundaries or tribal lands, the *[agency]* shall:

1. Consider the needs and planning of *[State]* and regional needs and planning when evaluating whether a proposed electrical transmission line should be approved.
2. Attempt to reach agreement with affected states and tribes on the points at which electric transmission lines enter and exit each state prior to designating an electric transmission route. In such a case, the *[agency]* shall hold joint hearings with agencies of similar jurisdiction in other affected states and with affected tribes on electric transmission planning and siting, with at least one such hearing to be held within the state.
3. Coordinate with other affected states the evaluation of the need for a proposed electric transmission line.[5] In evaluating need, the *[agencies]* may consider the following factors:
    a. Whether the proposed transmission line is necessary to serve a public use.
    b. Whether the proposed transmission line is needed to improve the reliability of the electric utility system.
    c. Whether the proposed transmission line is needed to provide market access to electric generation.
    d. The relationship of the proposed transmission line to comprehensive electric utility planning that has included, but was not limited to, an evaluation of various generation and transmission line options, alternative technologies, distributed generation, and targeted energy efficiency.
    e. Whether the proposed transmission line will substantially improve the ability to provide wholesale electric power to meet customer needs in a cost-effective manner.
    f. Any factors required to be evaluated by the laws of this state.
    g. Any other relevant factors.

E. In coordination with other states and tribal governments, the *[agency]* may also consider the following for electric transmission lines that cross state boundaries, national boundaries or tribal lands:

1. Setting joint schedules for various activities related to siting of electric transmission lines.

2. Determining completeness of applications for proposed electric transmission lines.
3. Requiring applicants to use application forms that jointly satisfy state and federal application requirements.
4. Reviewing and processing applications and conducting any necessary hearings or investigations, after agreeing that they are required.
5. Deciding whether a hearing or hearings regarding proposed electric transmission lines are required.
6. Taking judicial notice of related evidence in other states.
7. Coordinating prehearing procedures, including whether and when prehearing conferences will be held; making determinations of issues to be decided during hearings and criteria for evaluation.
8. Making joint investigations regarding electric transmission line siting. Such investigations could include, but are not limited to, investigations on the determination of the location where the electric transmission lines will cross each state boundary and determination of need for the electric transmission lines.
9. Negotiating and entering into agreements or compacts with other state siting authorities to develop cooperative efforts in siting and permitting the construction of electric transmission lines and enforcing respective state laws.
10. Coordinating procedures for notifying the public of electric transmission lines being considered and soliciting public input.
11. Coordinating procedures regarding requests for intervention in regulatory processes related to siting of electric transmission lines.
12. Determining issues and coordinating activities related to eminent domain, if needed.
13. Drafting and issuing joint or concurrent orders with agencies of similar jurisdiction in other states or with agencies of the United States that have jurisdiction over part or all of the proposed electric transmission line.
14. Drafting and issuing decisions regarding proposals for new electric transmission lines.

Notes

1. This is optional language for states that favor purpose statements.

2. Siting, permitting and transmission planning agencies take different forms and different responsibilities throughout the states. "Agency with jurisdiction over siting of electricity transmission lines" refers to the state public service commission, siting council or other entity that holds jurisdiction over permitting or planning for electricity transmission lines.

3. Those states that border Canada or Mexico may wish to include neighboring provinces or nations here.

4. This is optional language for states that are involved in regional transmission organizations.

5. Not every state has a requirement for demonstration of need for an electric transmission line. This is optional language for states that require demonstration of need.

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Siting Wind and Other Power Plants

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Outline

- Changes in the power markets
- What is wind energy?
- What is a typical power plant siting process?
- What's involved in the wind facility siting process?
- A couple of case studies.

Conclusions

- Wind facilities can prompt community opposition in some situations.
- Early education and outreach is critical.
- A siting process must include this early notice process, as well as ample opportunity for negotiation and flexibility between developer and community.

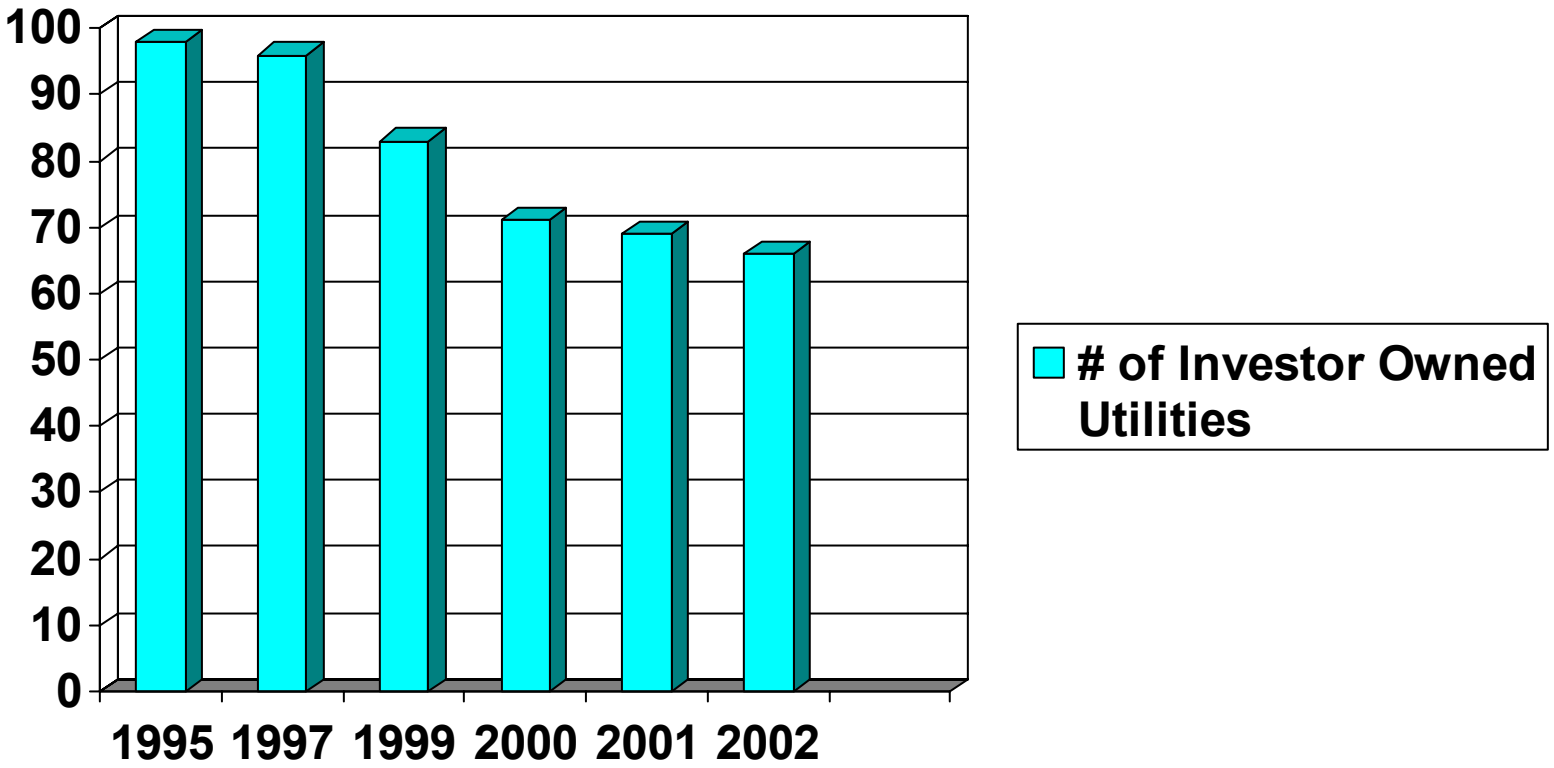
A Changing Industry

- "Deregulation" "De-monopolization" means new players, new focus.
- The old-style single-state/almost-local utility is less common.
- The old-style vertically integrated utilities are often no longer.
- These changes can making power plant siting more difficult.

Wholesale "De-monoplization"

- The industry used to consist of vertically integrated utilities. But often no longer.
- New categories of separate generators, power transmitters, power distribution companies exist.

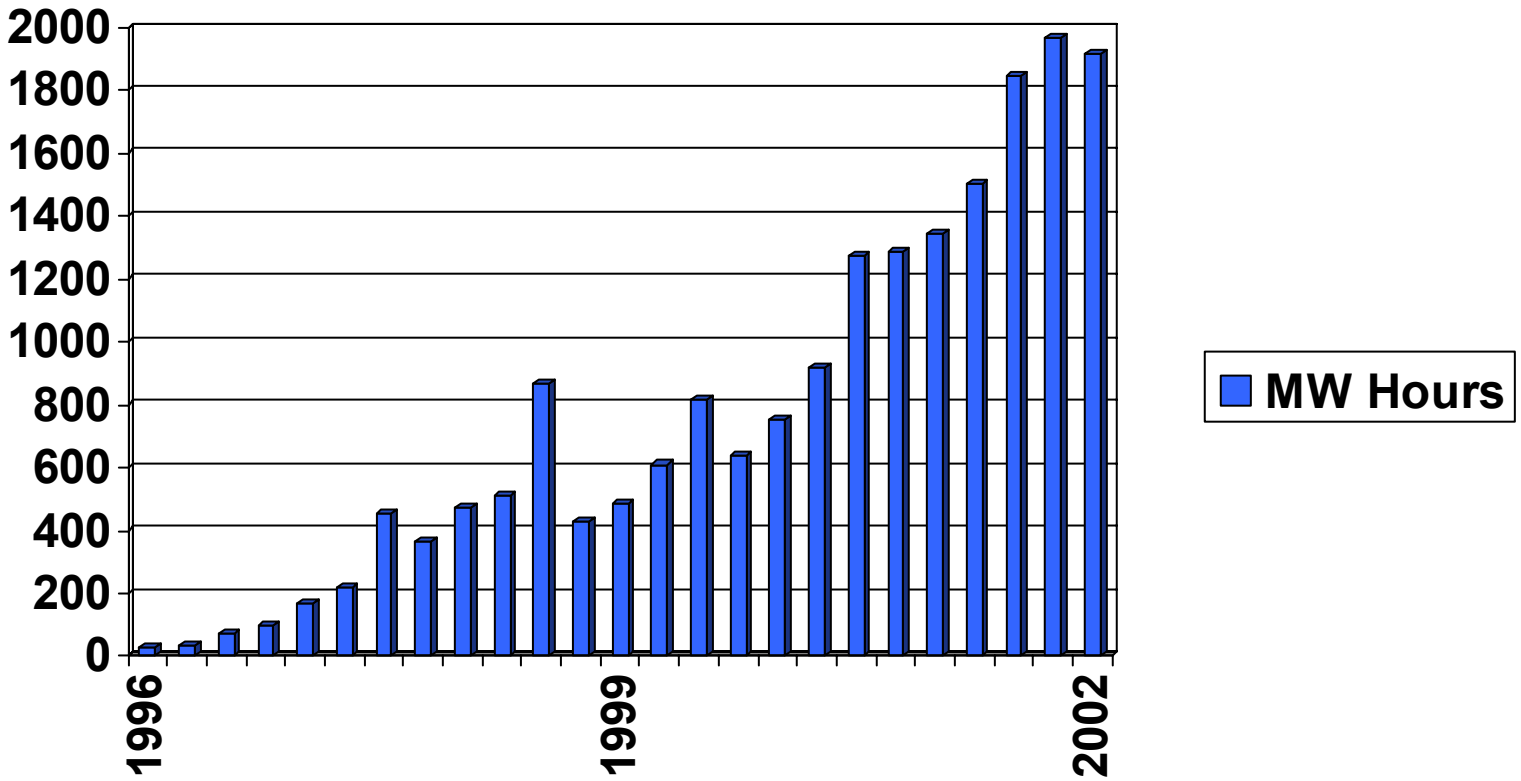
Consolidation, Declining Numbers of IOUs



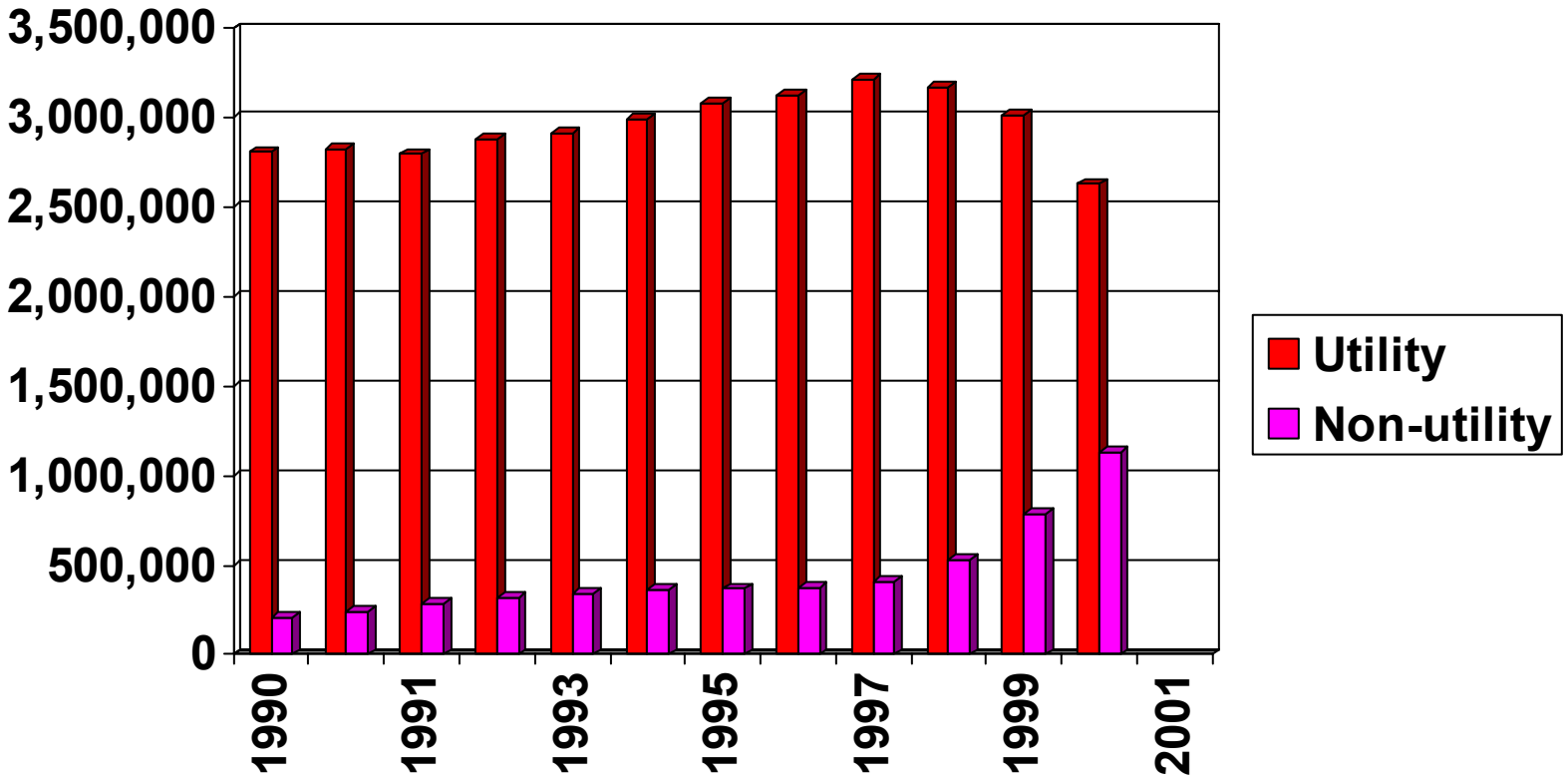
Source: Edison Electric Institute, 2002

Decline since Dec. 1995 27.6%

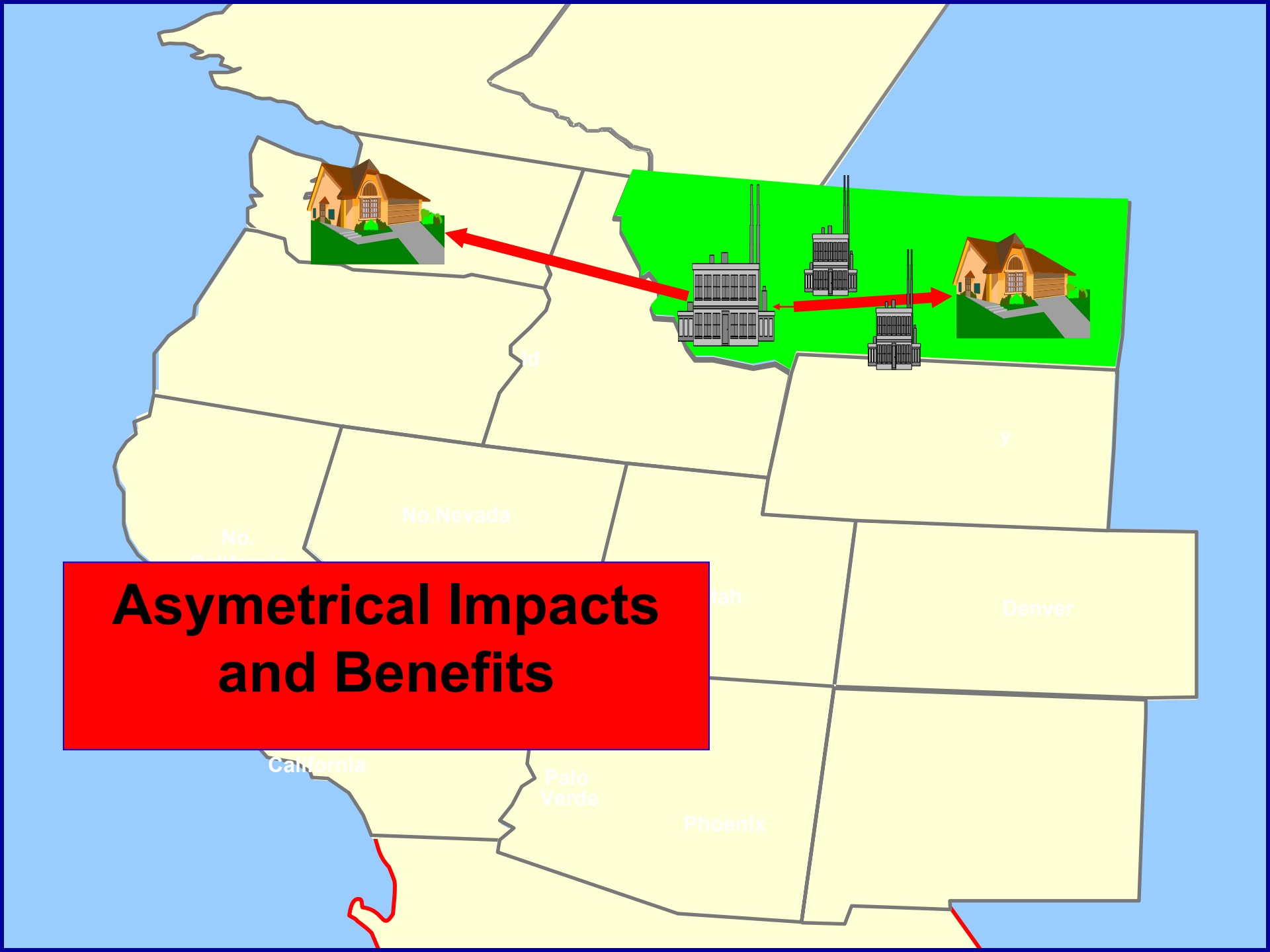
Power Marketer Sales



Utility vs. Non-Utility kWh Sales

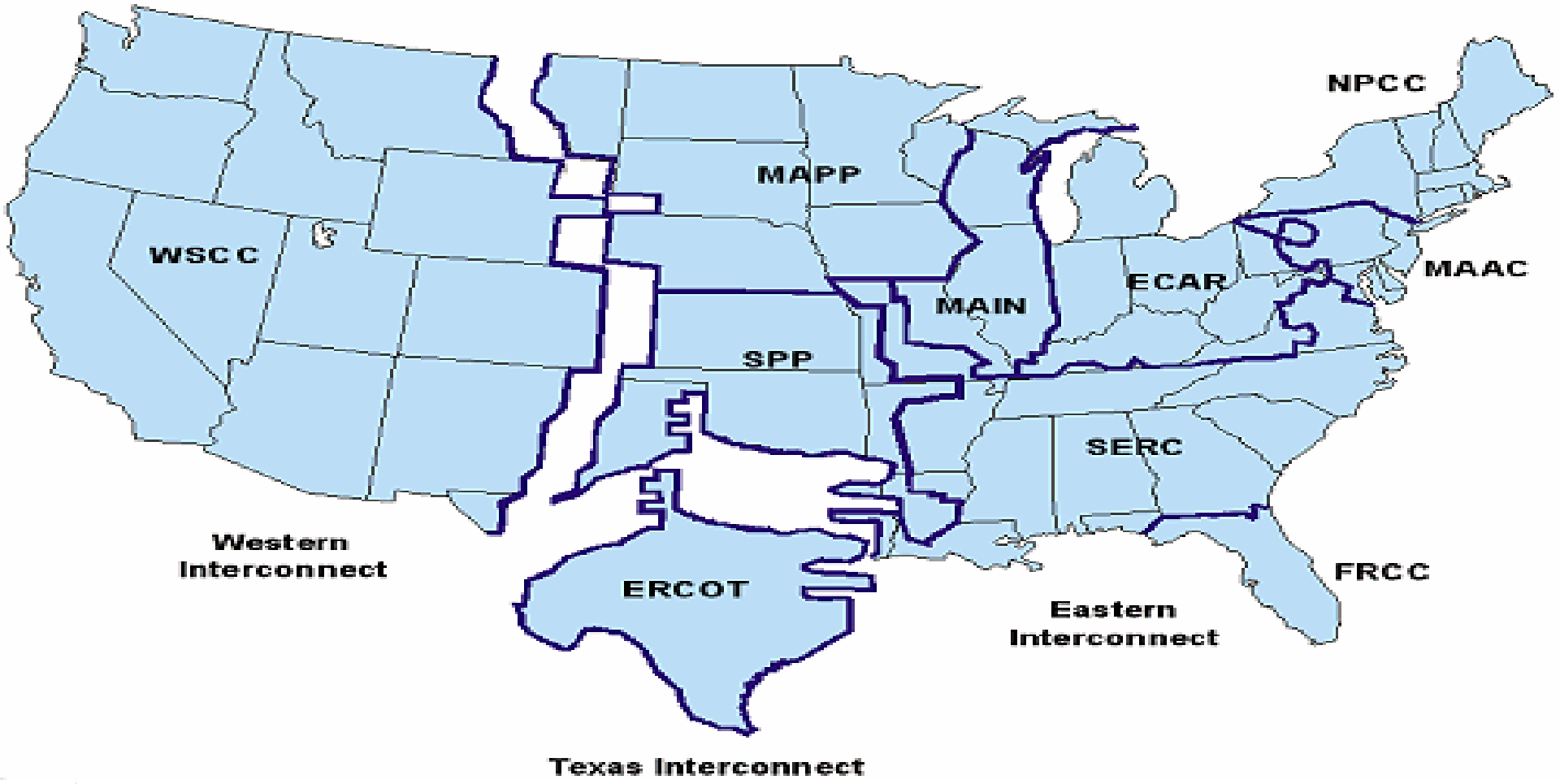


Some Plants Built to Serve In-state Load



Asymetrical Impacts and Benefits

System Interconnections



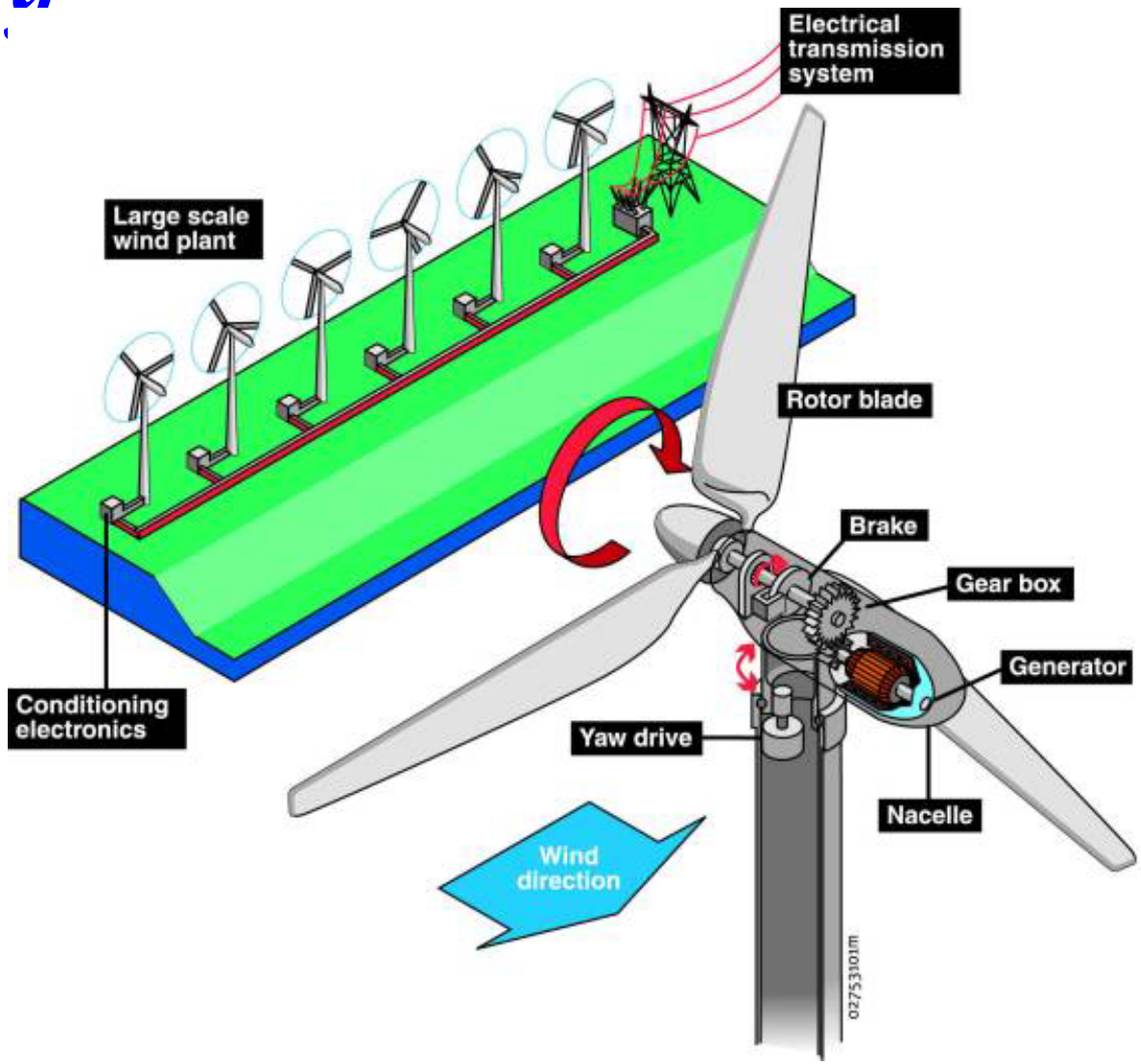
Effect on Power Plant Siting

- In a more regional industry, the beneficiaries of the power are often not the community hosting the power plant.
- The definition of "**need**" for a power plant is very different in this regional context.
- These, and other factors, are leading to many changes in power plant siting laws.

- WIND ENERGY

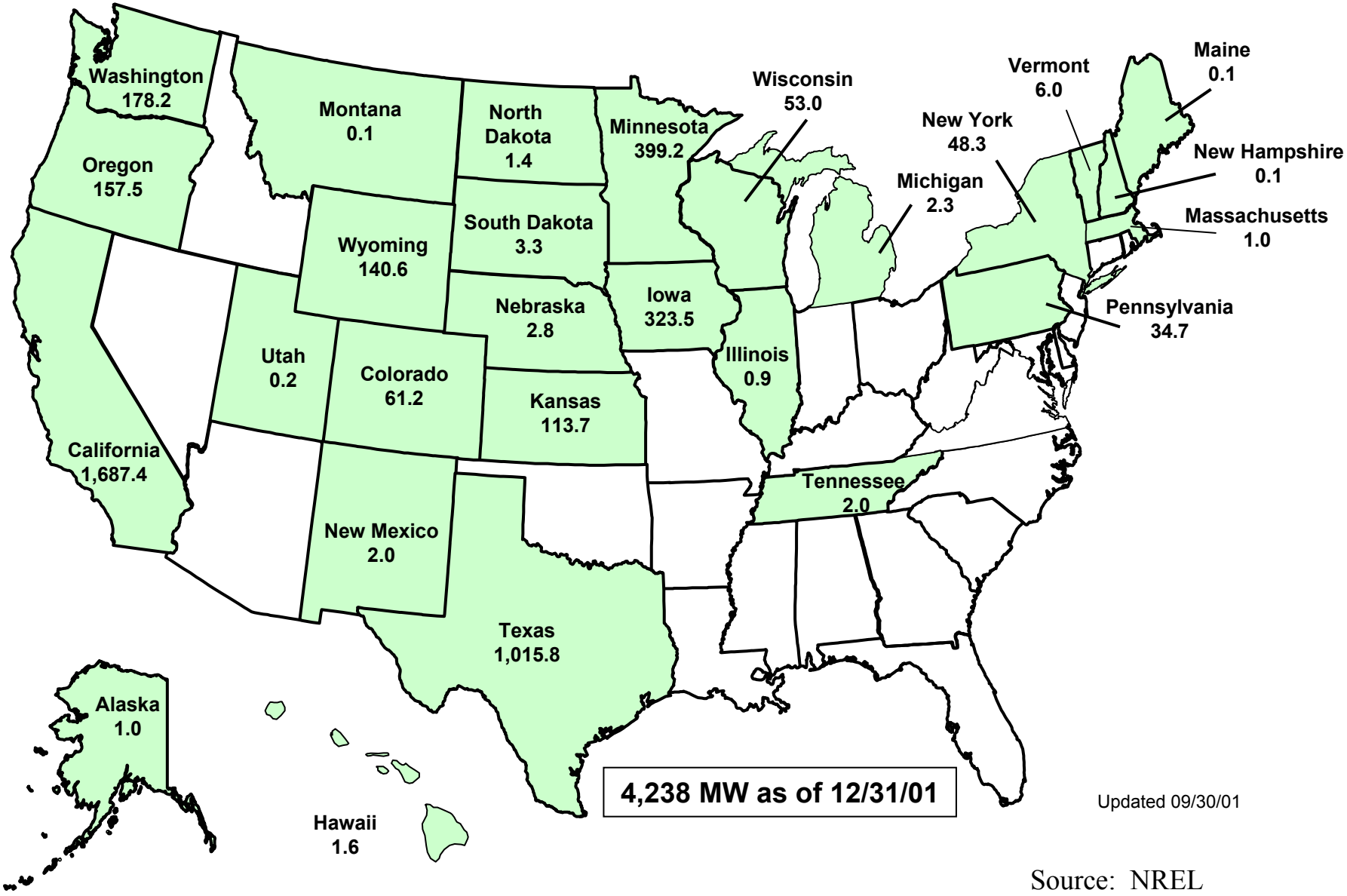
Utility Scale Wind Energy Technology

At its simplest, the wind turns the turbine's blades, which spin a shaft connected to a generator that makes electricity. Large turbines can be grouped together to form a wind power plant, which feeds power to the electrical transmission system.



Source: NREL

U.S. Wind Power - Expected by end of 2001 (MW)

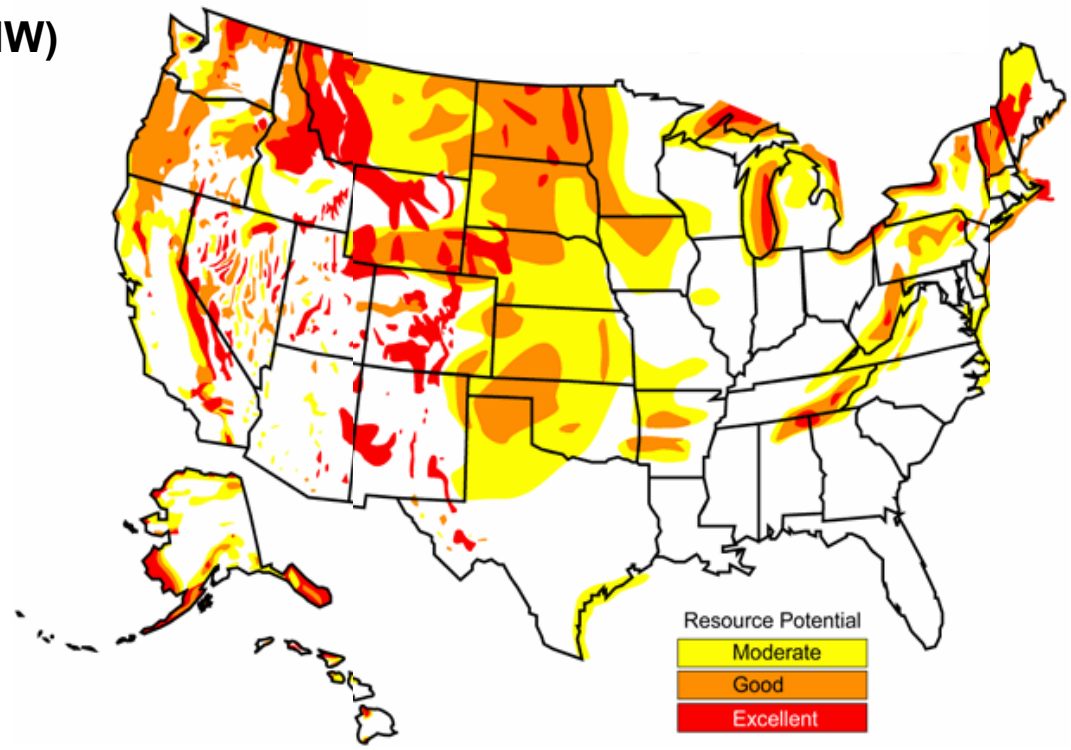


Source: NREL

U.S. Wind Energy Potential

Rank	State	Installed Capacity (MW)
1	North Dakota	1
2	Texas	188
3	Kansas	2
4	South Dakota	0
5	Montana	0
6	Nebraska	3
7	Wyoming	73
8	Oklahoma	0
9	Minnesota	272
10	Iowa	242
11	Colorado	22
12	New Mexico	1
13	Idaho	0
14	Michigan	1
15	New York	0
16	Illinois	0
17	California	1599
	Other	96
	Total	2500

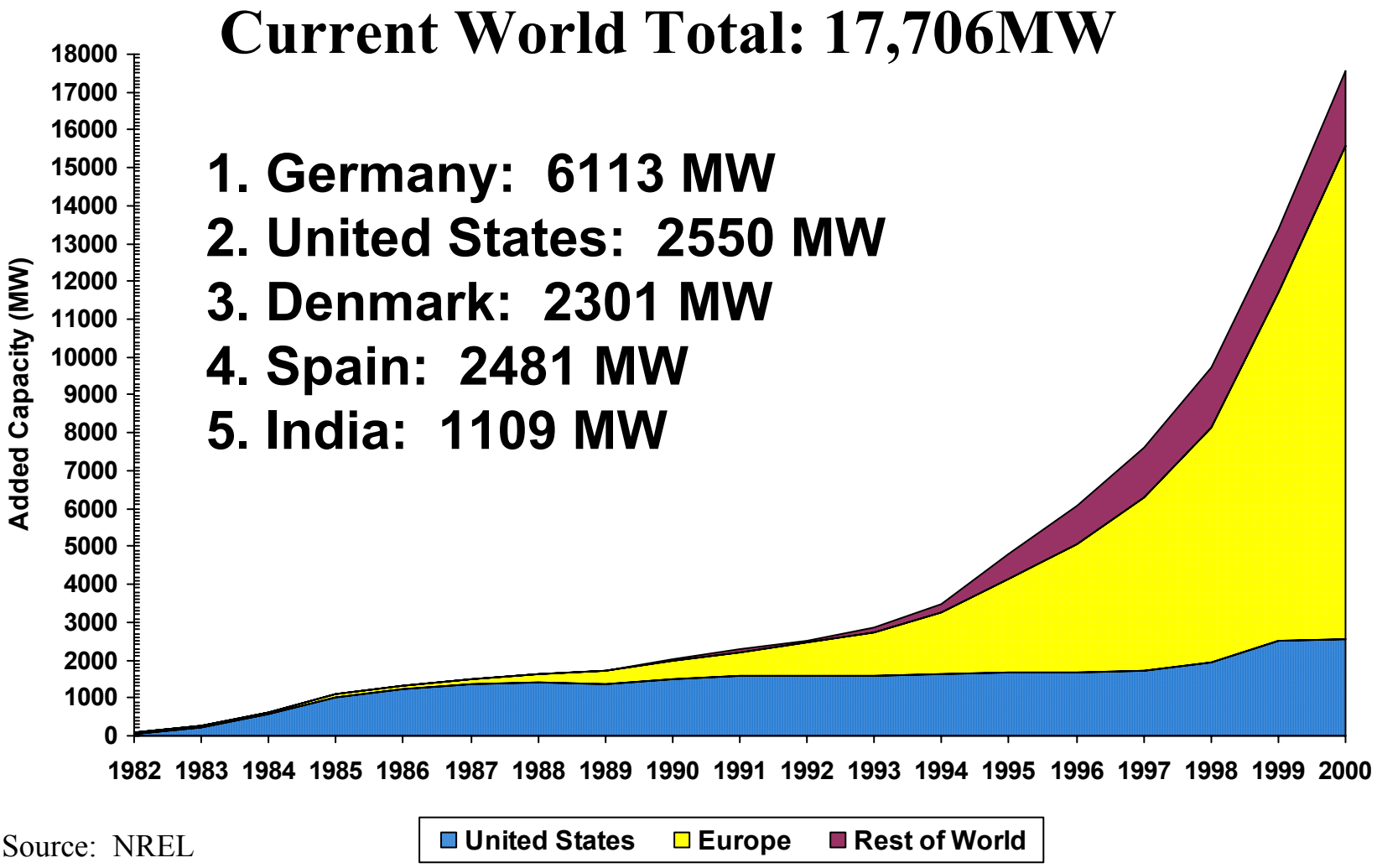
Source: AWEA



World Class Wind Potential

Germany's Potential: 100 GW
North Dakota's Potential: 250 GW

Large Scale Wind is Taking Off Worldwide



Source: NREL

Based on information supplied by International Energy Agency.

Utility Scale Wind Cost of Energy Trend

1979: 40 cents/kWh

2000:
4 - 6 cents/kWh

NSP 107 MW Lake Benton wind farm
4 cents/kWh (unsubsidized)

- Increased Turbine Size
- R&D Advances
- Manufacturing Improvements

2004:
3 - 5 cents/kWh

Source: NREL

Capital Costs

- **Approximate Installed Cost of Wind Energy Facility:**

  $1mm/MW

- **Approximate Range of Wind Energy Facility Capacity Factor:**

  30%-45%

Economies of Scale Drive Down Wind Cost

20 Years of Wind Technology Development

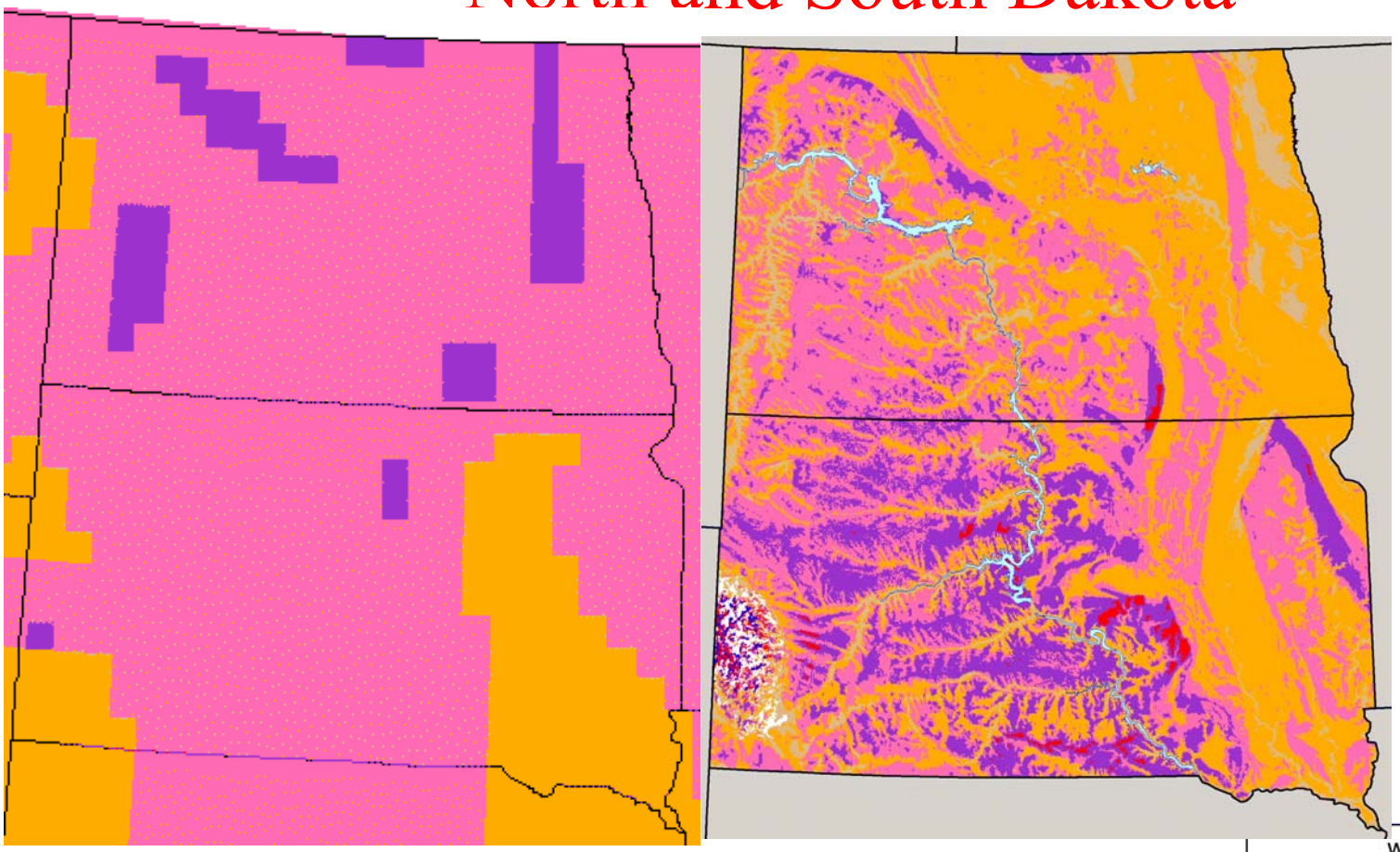
	1981	1985	1990	1996	1999	2000
Rotor (Meter)	10	17	27	40	50	71
KW	25	100	225	550	750	1,500
Total Cost	$65	$165	$300	$580	$730	$1,300
Cost/kW	$2,600	$1,650	$1,333	$1,050	$950	$790
MWh	45	220	550	1,480	2,200	5,600

Bottom Line: 1981-1999 = 49x the power, 11x the cost;
1999-2000 = 2.6x the power, 1.8x the cost

Source: NREL

Anemometers

Comparison of Digital Wind Map from 1987 U.S. Wind Atlas and New High-Resolution Wind Map North and South Dakota



1987

2000

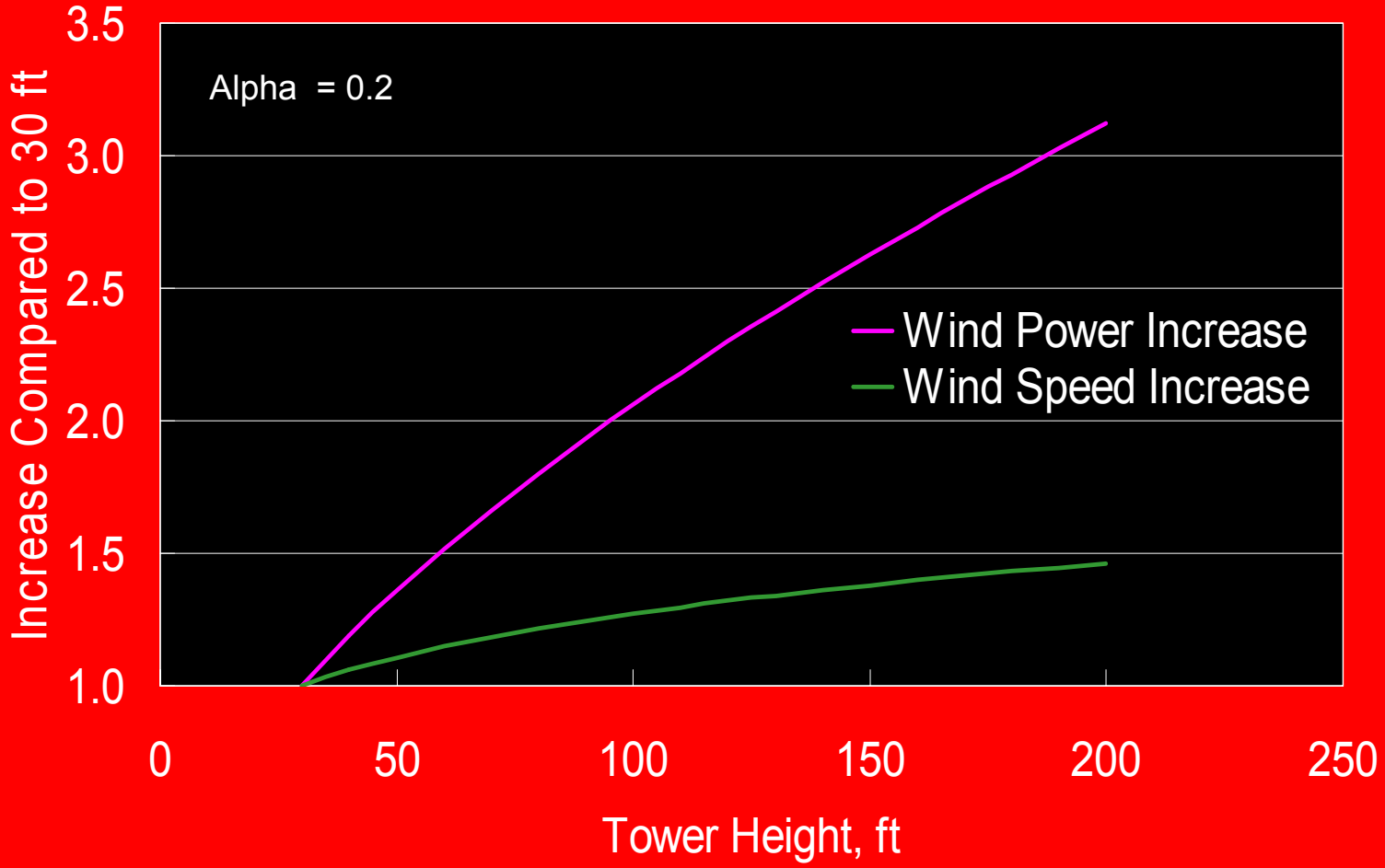
Source: NREL

Wind Power Classification

Wind Power Class	Resource Potential	Wind Power Density at 50 m W/m^2	Wind Speed[a] at 50 m m/s	Wind Speed[a] at 50 m mph
2	Marginal	200 - 300	5.6 - 6.4	12.5 - 14.3
3	Fair	300 - 400	6.4 - 7.0	14.3 - 15.7
4	Good	400 - 500	7.0 - 7.5	15.7 - 16.8
5	Excellent	500 - 600	7.5 - 8.0	16.8 - 17.9
6	Outstanding	600 - 800	8.0 - 8.8	17.9 - 19.7
7	Superb	800 - 1600	8.8 - 11.1	19.7 - 24.8

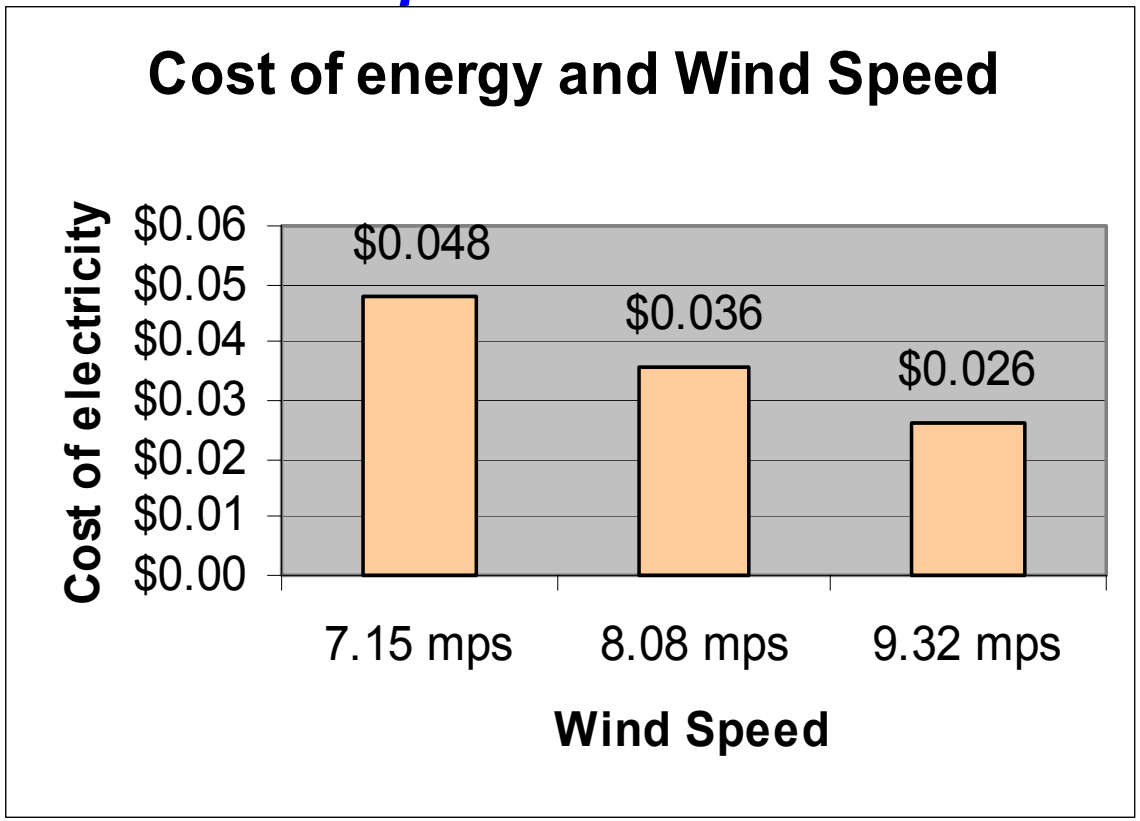
[a] Wind speeds are based on a Weibull k value of 2.0

Wind Speed and Power Increase with Height Above the Ground



Source: NREL

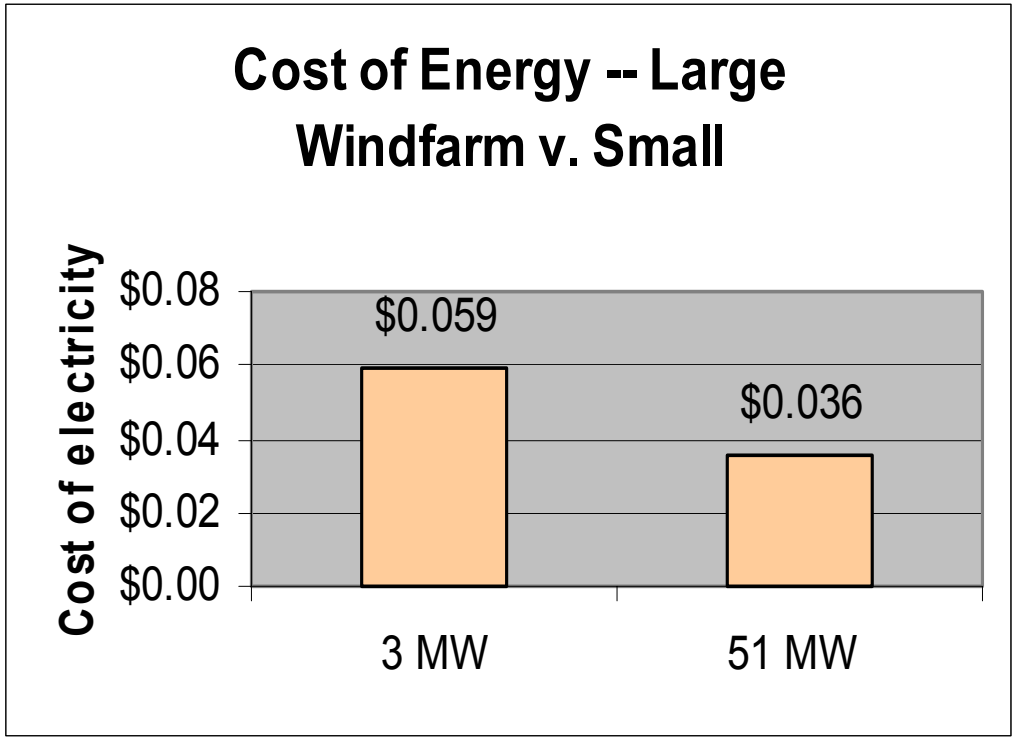
Acquiring Wind Least-Cost: Wind Speed Matters



Assuming the same size project, the **better** the wind resource, the **lower** the cost

Source: AWEA

Acquiring Wind Least-Cost: Size Matters



Assuming the same wind speed of 8.08 M/S, a large wind farm is more economical

Source: AWEA

Typical Wind Installation

- Involves towers/turbines at around 60 meters in height with cement base for support.
- Some anemometers at 200-350 feet high.
- Roads to access turbines.
- A building to serve multiple turbines and house maintenance vehicles.
- A building to host computer/monitoring equipment.

Siting Wind Plants

- Location is very important to where a wind plant is built.
  - Wind resource can vary a great deal with small changes in location
  - Location of nearby transmission
  - Proximity to loads
- Size of the plant affects its economics.

7 Steps for Building a Wind Plant

- Planning
- Permitting
- Financing
- Securing power purchase, transmission agreements
- Construction
- Operation
- Decommissioning

Planning

- Scout locations for wind site based on:
  - transmission lines
  - resource
  - political environment
  - wholesale market conditions and rules

Negotiate with Landowners

- Negotiation involves access to land for:
  - detailed wind resource assessment
  - construction
  - ongoing access during operation
- Negotiation also produces agreement on lease or royalty payments to landowner
  - typically in the range of $2,500 per turbine per year.

Permitting

- Federal and state permits are generally required.
  - FAA if structures exceed 200 feet (61 meters)
  - US Dept. of Fish and Wildlife if potential effects on endangered species.
  - Federal agencies may have to prepare an environmental impact statement (EIS).
  - States often must prepare a state EIS.

Principles for Siting

- Encourage early public participation
- Encourage/require early issue identification
- Provide adequate resources to state/others to perform review of applications
- Provide means for agencies to coordinate, perhaps by a single entity
- Have clear and coordinated timelines
- Incorporate state's environmental, land use other goals within process

Steps to Site a Wind/Other Plant

- Notice of Intent/Pre-Application
  - Crucial step, involve community, landowners
- Filing of Application by Applicant
- Siting board deems application "complete"
  - Statutory "clock" starts ticking, where applicable
- First hearing by siting board
  - Primary opportunity to raise contentious issues
- Additional hearings and draft orders

Typical Timing for Siting

- A 12-month process is typical, from completed application to final decision.
- A six-month process is becoming more common for uncontentious facilities.
  - Definition of what is contentious requires work
    - » Need to build new transmission lines?
    - » Adding on to an existing power plant? (greenfield/brownfield)
    - » Large or small facility?
    - » Resource type (gas, coal, wind?)
    - » Likelihood of community opposition

Typical Issues for Wind Siting

- Land use
- Visual effect
- Avian concerns
- Noise
- Construction impact

Land Use

- Will the project change the overall nature of the surrounding area? Will it disrupt established communities?
- Is the project compatible with land use plans, where such plans exist?
  - Some land use plans include wind resource mapping as part of the plan.

Visual Issues

- In general, permitting authorities ask:
  - Will the project substantially alter the project setting?
  - Will the project comply with local goals, policies, designations related to visual quality?
  - Will the project be in harmony with specifically-identified public preferences for viewshed/visual concerns?

Visual Issues/Considerations

- Spacing of turbines: newer turbines tend to be more distantly spaced than do older turbines.
- Turbine/anemometer lighting may be required by the FAA for tall towers over 200 feet.
- Location of turbines on slopes may be more visible from distances.
- Roads may also have a visual effect.

Noise

- Wind turbines make a low level of noise.
- Older turbines tend to make more noise
  - Often the result of "downwind" turbine passing the tower.
- Noise levels tend to be masked by the noise of the wind itself.
- Noise has not tended to be a major issue in wind facility siting.

Bird Issues

- Avian issues arise when wind sites are sited without regard to potential bird kills.
- The vast majority of bird kill problems have resulted from one wind farm -- Altamont Pass in California.
- The primary concern has been for raptors, studies indicate migratory songbirds are not at risk.
- Careful siting and project analysis can address many avian issues.

Case Study: Minnesota

- State has sited seven wind facilities ranging from 5 to over 130 MW.
- Mostly in the Buffalo Ridge area of the state.

Case Study: Minnesota

- Ch. 203 , S. 116C.697 requires:
  - Developers must acquire a site permit if facility greater than 5 MW.
  - Permits must be issued within 180 days.
  - Environmental review is part of process.
  - Includes procedures for notification of public.
  - Allows state to place conditions on turbine design and site layout.
  - Requires restoration of property upon decommissioning.

Case Study: Minnesota

- Avian issues dealt with through a study of impacts.
- Study of bird impacts halted upon determination of minimal impact. Study of bat impacts ongoing.
- Costs of these studies was shared among the project developers.

Case Study: Wisconsin

- Numerous small wind facilities in place.
- 1994 and 1998 legislation (Act 204, 1997) placed a priority on renewable energy and required utilities to acquire 50 MW of renewable generation.
- Act 204 increased definition of energy facilities requiring state review to 99 MW from 12 MW.

Case Study: Wisconsin

- Some wind proposals encountered significant opposition in Wisconsin.
  - Visual/aesthetic impacts
  - Impact on land values
  - Conflict with suburban growth
  - Lack of early publicity/education by project developers

Conclusions

- Wind facilities can prompt community opposition in some situations.
- Early education and outreach is critical.
- A siting process must include this early notice process, as well as ample opportunity for negotiation and flexibility between developer and community.

Wind Power and Economic Development

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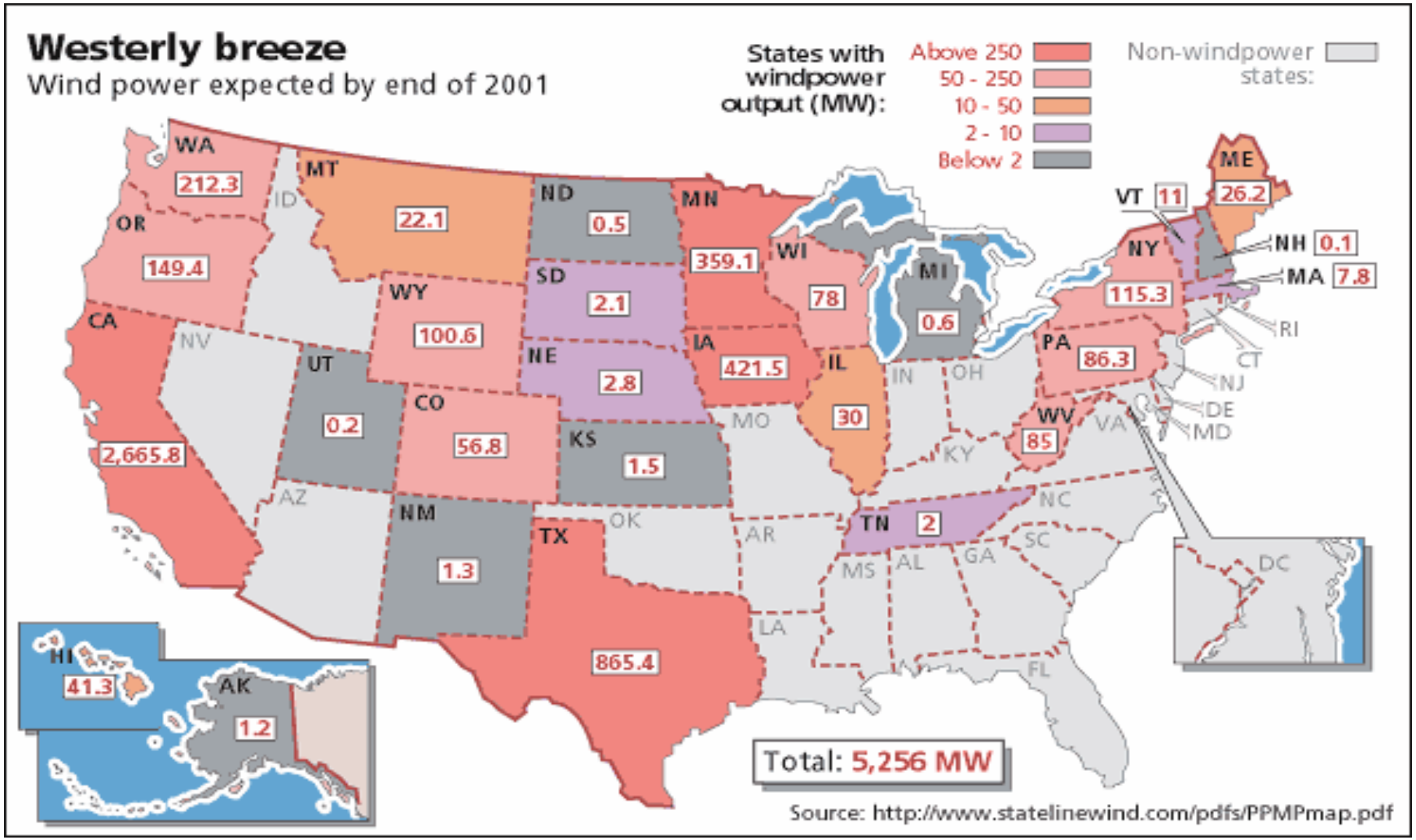
Overview

- Factors causing wind power to expand
- How the $$$ are generated for tax jurisdictions and landowners
- How much money is being generated?
  - State examples

Installed Capacity by End 2001



Wind is currently the world's fastest growing energy source.

- Factors:
  - economic development: landowner revenue & tax dollars generated
  - technological advances and declining cost
    - » (3-6 cents k/wh)
  - consumer demand (i.e., green markets)
    - » (KS, WY, CO, SD, OR, WA and more)

Sources of Economic Benefits

- Property tax revenue
  - being used for schools, hospitals, etc.
- Landowner revenue
  - ~ $2,000 per turbine per year
- Short term benefits
  - Construction jobs, local sales dollars
- On-going benefits
  - Operation/Maintenance jobs, tourist dollars

Property and Sales Taxes

- Property Tax Incentives
  - typically encourage large scale wind development
  - generating significant $$$ for tax jurisdictions

- Sales Tax Incentives
  - typically encourage small scale wind development

Landowner Revenue From Wind

- Developers typically pay landowners ~$2,000 per turbine, per year
  - some now up to $3,000
- $ amount depends on resource and lease
  - stronger the wind, higher the payments
  - annual payments or one up front
  - many lease agreements up to 30 years
  - footprint and roads ~ 1/2 acre each turbine

Minnesota Lake Benton Project

- Property tax revenue in 2000
  - Lincoln Co.:$721,000 from 155 MW
  - Pipestone Co.: $532,000 from 113 MW

- Landowner revenue
  - $2,000 per turbine per year on average
  - each 100 MW in MN expected to generate $250,000/yr. in lease payments to landowners

Minnesota (cont.)

- Short term benefits
  - Construction jobs, local sales dollars
    - » $1.5 million to MN firms that utilities and developers hired to build transmission, roads, etc.
  - 211 MW installed from 1997-1999=240 jobs

- On-going benefits
  - Operation&Maintenance jobs, tourist dollars
    - » rural MN, 61 new jobs in O & M, Admin and Sales

Wyoming and Texas

- Wyoming - Foote Creek Rim
  - $480,000 property tax in first year- Carbon Co.

- Texas - National Wind Power Site
  - ~ $400,000 annually for Pecos county
  - ~ $100,000 for school funds across TX

Different Property Tax Structures

- Range of property tax exemptions for wind; from zero to 100%
  - Kansas - 100% unlimited exemption for developers generates $0 in property tax
    - » FPL chose to give $300,000 annually for 10 years
  - OK - HJR 1020 tried to exempt wind from property tax for 5 years.

Conclusion

- More than half the states harvesting wind
  - $$$ for landowners and rural communities
- Database of State Incentives for Renewable Energy
  - http://www.dsireusa.org
- Contact NCSL
  - 303.830.2200 extension 318
  - www.ncsl.org

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OCTOBER 2000

VOL. 8, NO. 39

Tax and Landowner Revenues from Wind Power

By Matthew H. Brown

The United States is experiencing major changes in its electric industry that will affect every state, whether or not it opens its own markets to competition for retail customers. An interesting early result from the competitive electricity markets has been the popularity of renewable energy, such as wind, geothermal or biomass. Ninety-three percent of California's customers who switched electricity providers (2.1 percent of the population) chose a renewable energy product.

There has been a boom in the construction of wind power facilities.

Economic Effects of Wind Energy. One result of this new "green" market, and some state mandates for "green" power, has been a boom in the construction of wind power facilities. This boom provides revenue for rural landowners, and has been a new source of tax revenue and jobs for some rural communities. Most landowners receive quarterly payments from wind developers in compensation for wind turbines built on their property. For example, 10 turbines on a property would pay approximately $15,000 to $20,000 annually.

Given the space required between turbines and between rows, developers typically need 25 to 50 acres of land for each megawatt of turbine capacity. This translates to approximately $40 to $50 per acre. Generally, landowners sacrifice approximately 2 percent to 4 percent of their land—which includes access roads to service the turbines.

Developers pay property taxes based on the capital cost of the wind plants.

Tax Implications. Developers pay property taxes based on the capital cost of the wind plants. In general, these range from 1 percent to 3 percent of the value of the project. Like generators of many other forms of power, wind developers sometimes receive tax abatements over limited periods of time for a portion of the property tax liability. These abatements commonly last about 10 years. Minnesota offers a reduced tax for wind developments; developers pay taxes based on 25 percent of the project's value.

Jobs and Wind Development. The jobs created by wind energy facilities are helpful to communities, but not dramatic. Most developers hire a crew for approximately six to eight months during the construction phase of the job, at a rate of about 200 jobs per 75 megawatt (MW) project. These projects continue with a staff of approximately two people per 15 MW to 30 MW project to operate and maintain the facility. As wind facilities have become more reliable and efficient, the size of the staff needed has diminished.

In addition to the jobs from building and maintaining wind facilities, a number of turbine and blade manufacturers have located facilities in the United States. When Danish wind turbine blade manufacturer LM Glasfiber announced in spring 1998 its plans to begin manufacturing fiberglass turbine blades in Grand Forks, N.D., it sought more than 130 workers.

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Barriers to Wind Energy Development. Despite the professed interest of many customers in wind energy, it is important to note that wind can never be the only fuel supplying U.S. electricity needs. Because of technical limitations, it is unlikely to supply more than 10 percent to 20 percent of the energy needs of one region of the country without some significant changes in the way utilities run their power systems.

Wind will most likely complement more traditional means of generating electricity.

One of the critical issues is the cost of wind facilities. Although costs are a fraction of what they were 10 years ago, they are still marginally higher than the cheapest fossil fuel resources. Generally, the installed cost of larger, utility-scale wind turbines is $800 to $1,100 per kilowatt (kW). These compare to costs for a typical coal-fired plant of approximately $1,000 to $1,200 per kW and for a new gas-fired power plant of $300 to $664. These coal- and gas-fired plants also will tend to operate for many more hours each year because they do not depend on an intermittent resource for their fuel supply.

Policy Options. Several options exist for states seeking to encourage wind and renewable energy development:

Several options exist for states seeking to encourage wind and renewable energy development.

- *Disclosure and certification programs*—California, Connecticut, Illinois, Maine, Massachusetts, Montana, Nevada, New Hampshire, New York and Pennsylvania have programs designed to help electricity customers learn the fuel mix of—and, in some cases, emissions produced by—their electricity generators. This consumer education effort is under way in states that have initiated electric industry restructuring, and in some states that have not.
- *System benefit charges*—This charge is levied on customers' electricity bills with the revenue used to subsidize renewable energy and other programs in the public interest, such as consumer education programs and energy efficiency programs. All electricity customers pay this fee regardless of their provider. Most states that have electric industry restructuring legislation, including California, Connecticut, Illinois, Maine, Massachusetts, Montana, Pennsylvania, Rhode Island and New York.
- *Renewable portfolio standards* (RPS)—This policy requires electricity retailers to include a prescribed amount of renewable energy in the portfolio of resources that they sell. Connecticut, Maine, Massachusetts, Nevada and Pennsylvania have enacted these policies that range in percentages of required renewables between 0.2 percent to 30 percent, although the figure is commonly from 5 percent to 7 percent.
- *Property tax incentives*—In addition to an accelerated rate of depreciation for wind energy equipment, Minnesota has reduced property taxes for wind projects.

The most important economic effect of wind facilities appears to be as a new source of revenue for some rural landowners and as a new source of property value in rural areas that, in many cases, have not been able to attract new industry. Wind also can offer some limited job growth, although as plants have become more efficient during the past decade they also have required fewer people to maintain them.

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National Conference of State Legislatures

LEGISBRIEF

BRIEFING PAPERS ON THE IMPORTANT ISSUES OF THE DAY

JANUARY 2004 VOL. 12, NO. 5

Tax and Landowner Revenue from Wind Projects

By Leslie Kaas Pollock and Troy Gagliano

The wind power industry is growing tremendously.

The wind power industry is experiencing a tremendous surge in growth. The amount of wind-generated electricity doubled over the past five years in the United States, reaching nearly 4,700 megawatts (MW) at the end of 2002. That's enough to power more than 1.4 million average American homes. State policymakers are becoming more interested in wind power because it is a domestic source that can help states diversify their energy portfolios and protect consumers from volatile electricity prices. The expansion of wind power also is translating into significant economic development opportunities for many rural communities.

Many wind projects are generating tax revenue for counties, school districts and townships.

Local tax revenue. Many wind projects are generating tax revenue for counties, school districts and townships. Since the strongest wind resources are found mostly in rural areas, these often economically depressed locations are reaping the benefits. Local revenue takes many forms, from property and sales taxes to construction and maintenance jobs.

The largest source of local revenue from wind farms is property taxes, and the biggest beneficiary of this revenue is usually local school districts. Texas rural school districts have been infused with large amounts of money since commercial-scale wind development took off in West Texas in 1999. Upton County, home to two wind projects totaling 353 MW, received $3.6 million in revenue in 2002; 95 percent went to the McCamey School District. Two school districts in Pecos County received $4.7 million in 2002 from three different wind projects totaling 402.5 MW.

In Oregon, the Vansycle Ridge project and the Stateline Wind Energy Center (108 MW combined) paid $893,098 in taxes to Umatilla County in 2002. Of this total, approximately 60 percent goes to school districts, 20 percent to the county and local towns, and the remainder to small local districts, such as fire protection. Revenue is split similarly in Lincoln County, Minn., where 155 MW of wind from four different projects generated $471,822 in 2003. This money is split evenly (45 percent each) between the county and the school districts, with the remainder distributed to local municipalities.

County Property Tax Revenue from Wind Projects (2002)

Buena Vista, Iowa	$212,490
Gray, Kansas	330,000
Lincoln, Minnesota	471,822
Fenner (town), New York	150,000
Umatilla, Oregon	893,098
Upton, Texas	3,600,000
Pecos, Texas	4,700,000
Walla Walla, Washington	1,500,000
Carbon, Wyoming	373,535

Kansas and New York are payments in lieu of taxes. Iowa's amount increases to $1.3 million in 2007. Minnesota's amount is for 2003.

Revenue from wind farms can provide a significant boost to the local tax base. The 80 MW of

wind power produced in Worth County, Iowa, will generate approximately $500,000 in property taxes—an amount which adds approximately 9 percent to the total tax base of the county. In addition, the Prowers County, Colo., assessor estimates that property taxes paid on the 162 MW Lamar Wind Farm will increase county revenue by 13.5 percent annually.

Revenue from wind farms can provide a significant boost to the local tax base.

State Action

Creative Incentives. Counties and states are working to attract large-scale wind power development in a number of ways, including reducing or exempting renewable energy projects from property taxes. For example, a state law exempts the Kansas Gray County Wind Farm from paying property taxes. In a good faith agreement, the project owner agreed to make annual payments of $330,000 to Gray County in lieu of taxes. Similarly, the Fenner Wind Project in upstate New York benefits from a full property tax exemption. In order to help the town of Fenner cover costs associated with maintaining the project, the developer is paying $150,000 annually—an amount equal to one third of the town's tax revenue.

Rather than pay a lump sum to a local entity, some tax-exempt projects are spreading revenue around. One developer of a publicly owned (and thus tax-exempt) project in Washington paid a total of $511,000 to the state in 2003, which was redistributed throughout Benton County. Included in this amount is an annual wildlife mitigation fee paid to the state Department of Fish and Wildlife that is used to offset the harmful effects of the wind farms on local sagebrush habitat. In 2002, the year the project was built, the developer paid $1.2 million in taxes associated with the cost of construction.

Landowner Revenue. Wind projects also produce income for landowners who lease their land to developers. Landowners generally receive annual lease payments between $2,000 to $4,000 per turbine. The turbines are generally compatible with farming and ranching activities, occupying less than one acre each. Given that farmland in certain windy areas of Minnesota annually grosses approximately $300 an acre for corn and soybeans, it is easy to see how large scale projects can benefit rural landowners in areas with strong winds.

Wind projects also produce income for landowners.

Payments to landowners take various forms. Many developers begin by paying landowners during the initial phase of project development in order to reserve the use of their land. Developers also may offer minimum guaranteed payments to landowners. These minimums range from $750 per turbine per year at Storm Lake I in Iowa to $4,000 per turbine per year at Nine Canyon in Washington. Per turbine payments have been rising over the past few years and should continue to rise as more efficient and larger capacity turbines become more common.

Wind power is generating significant economic benefits for rural communities across the country at a time when it is greatly needed. Tax and landowner revenue associated with wind power development is breathing new life into these areas. For those states with lots of wind, legislators have it within their power to help attract new development to rural areas that have otherwise been hurt by recent economic downturns.

Wind power is generating significant economic benefits for rural communities.

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Wind Facilities Permitting

National Conference of State Legislatures

Innovations in State Policy

The wind energy industry is growing at the fastest rate of any major segment of the electric power industry. New wind power plants are springing up well outside the more traditional places where Americans have seen these facilities—parts of the east coast and the Midwest. The industry, now well beyond its infancy, is beginning to face a set of issues and barriers that are much more common to other segments of the electric power industry. Many of these relate to the objections of some citizens to having large wind turbines built in close proximity to, or in view of their homes.

Sometimes called NIMBY, or "Not In My Backyard" issues, the objections usually come to the forefront during the public hearings for siting and permitting the wind turbines and related equipment. These processes vary a great deal from one state or jurisdiction to another, but are crucial to the long-term future of the wind power industry. State legislatures have a great deal of influence over these state siting procedures through the enabling legislation that establishes them. This document offers a brief review of what is involved in building a wind farm, state siting procedures, and perspective on how to expedite those procedures while also taking into account the needs of local communities to have input into the siting and permitting process.

What Is Involved in Building a Wind Farm? What Is Being Permitted?

One reason the siting process is so important for wind developers is that they have relatively little flexibility in where they can build the wind farm. Small differences in the quality of the wind resource make a significant difference in the cost of energy from those facilities. According to the American Wind Energy Association in 2002, wind speeds of 7.15 meters per second produce a cost of energy of 4.8 cents per kilowatt-hour (kWh). A higher wind speed of 9.32 meters per second yields a cost of energy of 2.6 cents per kWh. Unlike natural gas-fired power plants that can be built wherever a pipeline can provide natural gas, a wind facility is best built where the best wind resources exist.

Typical wind farms involve several components.

- Anemometers, which are devices that measure wind speeds, are tall, narrow towers that range from 200 feet to 350 feet high.
- Towers and turbines are between 200 and 300 meters high; a small cement base is built around them.
- Developers may need to build roads to build the turbine and then to service the turbine once it has been installed.
- Developers erect a small building that serves as a maintenance facility for multiple turbines. Larger scale wind farms also will have accommodation for trucks that maintain the turbine.
- Another building hosts computer and wind farm monitoring equipment.

The process to secure permits for all these facilities varies from one state to another, and it also may involve federal permits. The Federal Aviation Administration must issue a permit if the structure will exceed 200 feet, as most wind turbines do. The U.S. Department of Fish and Wildlife becomes involved if the facility may have an effect on endangered species, and other agencies such as the U.S. Army Corps of Engineers may become involved if the facility is built offshore.

State processes vary, but typically require several steps.

1. A Notice of Intent, or preapplication, at which the developer serves notice to the state government, the local government and the community that it intends to apply to build a new wind facility.

2. An official filing by the developer.

3. A time at which the siting agency deems the application complete, meaning all property forms have been filed with the siting agency and all property information is included on those forms. Once the state agency deems the application to be complete, many states have a statutory time frame by which the siting authority must rule on whether it will issue a permit for the wind facility. Typical time frames are approximately 12 to 18 months; however, six-month time frames are becoming more common for facilities that are not controversial. Minnesota law, for instance, now requires that permits be issued or denied within 180 days of the filing of a completed application.

4. The siting authority holds an initial hearing and a subsequent hearing. Some of these hearings typically are held in the affected community, while others are held in the state capital.

5. The siting board issues a draft and, later, a final order.

The variation in state processes is significant. Some states give local governments considerable authority over permitting, while some have far more rigorous and resource-intensive processes than others. Some states do not require a permit for facilities below a certain size; Wisconsin does not require any type of permit for facilities below 99 megawatts (MW), for example.

Major Issues in Permitting

States encounter three primary issues in siting wind facilities: viewsheds, bird and bat populations, and noise.

Viewsheds are the landscapes that people see, whether they are mountain ridgetops, rolling hills and grasslands, or ocean views. Concerns about these typical landscapes are described below. In two of the most common cases, mountain ridgetops and offshore facilities, the concerns are relatively new; they have arisen as the wind industry has expanded into eastern U.S. markets.

- Mountain ridgetops have been particularly controversial throughout much of the east coast. Several states have laws that prohibit wind turbines from being built on mountain ridgetops. These ridgetops are attractive to wind developers, however, because the wind blows hardest and most consistently at the top of the mountains. North Carolina law spe-

cifically prohibits structures that protrude more than a specified distance above a ridgeline, but exempts windmills from this prohibition. North Carolina enacted its law in response to a condominium tower that had been built on a ridge. State officials now are arguing over the intent of the "windmill" exemption in the original law.

- Rolling hills and grasslands have been controversial in some states. Kansas, in particular, has faced opposition to windfarms that were proposed in the Flint Hills area of the state. The governor imposed a moratorium on building any wind facilities in this area as a result of the controversy. As with the excellent wind resources on mountain ridgetops, the native grassland area of Kansas also is host to excellent wind resources.

- Wind facilities proposed offshore have developed into a contentious issue in parts of the eastern United States. Wind resources offshore typically are far better than the wind resources built onshore in the eastern part of the United States. The most controversial of these wind facilities –the Cape Cod Wind Project–is off the shore of Cape Cod. The U.S. Army Corps of Engineers is responsible for issuing the permit to build much of this windfarm. Typical concerns are related to whether people will be able to see the wind turbines from the shoreline.

In general, permitting authorities ask three major questions about viewsheds:

1. Will the project substantially alter the project's setting and landscape?

2. Will the project comply with local goals, policies and designations related to visual quality?

3. Will the project be in harmony with specifically identified public preferences for viewshed/visual concerns.?

Effects of Wind Farms on Birds and Bats

The first wind farms were built in California, substantially before project developers, utilities or state government had a good understanding of the effects spinning wind turbine blades could have on bird and bat populations. The large Altamont Pass wind facility was located in an area with a substantial bird population, and has, in fact, been responsible for the majority of the wind industry's bird kills. Many of the birds killed in this area have been raptors, some of whom have been attracted to the small animals living near the wind turbines.

The effect on bird populations is an important part of the siting process but, unlike the early stages of the wind power industry, developers now have the tools to determine whether a particular site might be a problem for bird populations. It now is possible to conduct a site analysis before building a wind farm, and for regulators to take this site analysis into account when they consider whether to approve a project. One issue as yet unresolved is the number of acceptable bird or bat kills; almost all human activity affects bird or bat populations in some way. Bird and bat kills on windfarms are just more visible and geographically concentrated than, for example, the effects on bird or bat populations of air pollution or flying into buildings.

Noise

Wind turbines do produce some noise, and older wind turbines are particularly noisy. The noise frequently has resulted from wind passing by the tall tower that holds up the turbine blade. New wind turbines are much quieter than old turbines; experts measure typical noise levels from wind turbines at approximately 50 decibels. For comparison, whispering is approximately 20 decibels, and the typical noise inside a moving car is about 80 decibels. In general, noise has not tended to be a major issue for wind siting.

State Processes

State siting processes vary considerably, but generally fall into two categories: those that have a state siting process that subsumes a local process, and those that require local permits and very little in the way of state permits. Minnesota's process relies primarily on state permits and is designed specifically for windfarms. Laid out in state statute, the process requires the following.

1. That developers secure a site permit for any facility larger than 5 MW.
2. That permits be issued within 180 days of submission of a completed application.
3. That the state conduct an environmental review process, known as an Environmental Impact Statement.
4. That the public be notified and given an opportunity to participate in the deliberations about whether and under what conditions to issue a site permit.
5. That the state can place conditions on turbine design and turbine layout.
6. That the developer restore the property upon decommissioning of the facility.

Minnesota is one of only a few states that has developed a siting process specifically for windfarms and may serve as an example for other states.

Other states with local permitting processes have less state control over siting procedures. Some states, such as Washington, allow a developer to choose whether to use a local or a state-run siting process. Others, such as Pennsylvania, have a local process but are considering developing model permitting processes that local governments can follow at their discretion. In general, the most successful state siting processes that hve been most successful have followed three principles.

- Require early education of and outreach to the affected community.
- Allow ample time for negotiation between the developer and the affected community. This negotiation might touch on several issues, ranging from the layout and configuration of the windfarm to payments or other compensation offered to the community.
- Some kinds of facilities may not need to go through the same extensive siting process as others; large windfarms may deserve more attention than small-scale facilities, for example.

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STATE LEGISLATIVE REPORT
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Wind Power Development: Policy Options

By Troy Gagliano, Research Analyst

The U.S. wind industry grew significantly between July 1998 and June 1999. Power companies invested more than $1 billion to create more than 1,075 megawatts (MW) of new capacity, a 40 percent increase in the nation's ability to generate electricity from wind. Wind has become the world's fastest growing source of energy (although natural gas, coal and more traditional fuels still produce far more power). Factors contributing to this growth include supportive state policies, the public's demand for electricity generated from renewable sources, rapidly decreasing production costs and increasing competition among electric retailers. This report focuses on commercial wind farms, the tax and landowner revenues they can generate, obstacles to development, and policy options states can employ in order to address these issues. An important fact to bear in mind is that electric utility restructuring is not a prerequisite for the implementation of these polices. Many states that remain regulated have these policies in place.

An early and interesting result of retail competition is the number of utilities that are offering renewable—or "green"—products like wind-generated electricity, which is proving to be popular with many customers. In California, 93 percent of the people who switched electricity providers chose a green energy product. However, only 2.1 percent of all Californians have switched providers. In Pennsylvania, where the competitive market for residential customers is more robust and where green products are not subsidized, more than 20 percent of the customers who switched providers chose a green power product.

Cost

The cost of wind-generated electricity has decreased more than 80 percent since the early 1980s, making it the cheapest renewable energy technology available. In 1980, the United States had less than 10 MW of installed generation capacity at a cost of approximately 40 cents per kilowatt-hour. By the end

of 1999, installed capacity had increased to more than 2,500 MW and generation costs fell to between 4 cents and 6 cents per kilowatt-hour.

Location

Wind resources are abundant in many regions of the United States, particularly in the Midwest, sections of the East Coast, the Appalachian Mountains and the Pacific Northwest.

The majority of the wind power industry's growth is occurring in the corridor that stretches from Texas northward into Iowa and Minnesota. The greatest potential domestic wind resource is in North Dakota and South Dakota, an area often referred to as the "Saudi Arabia of wind power." A total of 18 states have established commercial wind sites; 32 new wind projects are being planned, with Colorado, Iowa, Minnesota, Oregon, Texas and Wyoming leading the way.

The majority of the wind power industry's growth is occurring in the corridor that stretches from Texas northward into Iowa and Minnesota.

Advantages

Wind-generated electricity is environmentally advantageous because it is a free, renewable and domestic source of power that emits no pollutants. By using wind power to supplement traditional power generating techniques, the United States can protect against variable natural gas prices and reduce its dependence on imported oil. Wind power is economically beneficial because it can create additional tax and landowner revenue for municipalities and property owners.

Tax and Landowner Revenue

Unlike the early construction of wind turbines that occurred in vast, uninhabited areas, new wind sites are built largely on occupied farmland. If a tract of land has strong winds blowing over it, landowners can contract with an energy service provider to develop a wind site. In exchange for the use of their property, landowners may receive royalty fees based on a percentage of the site's annual gross revenue (usually between 2 percent to 3 percent). For example, a wind site with an annual gross revenue of $2 million would provide the landowner $40,000 each year, based on a 2 percent lease agreement. These agreements can last for 30 years and pay landowners between $1,500 and $2,000 annually per turbine.

Participating landowners in Minnesota received a one-time, up-front payment for the use of their land; this payment option, however, is becoming less frequent.

The tax revenue implications of wind development also can benefit local governments. Developers of wind projects pay property taxes based upon the installed capital cost of the wind plant. Because wind projects are two to three times more capital intensive than a new gas-fired power plant, they can generate proportionately more property tax. The National Wind Power Site in Texas generates $100,000 annually for school funds throughout the state, and $400,000 annually for the local taxing jurisdiction. In California, wind developers pay approximately $11.5 million annually in local property taxes.

Obstacles

Two obstacles faced by the wind power industry are the intermittent nature of the wind itself and transmission issues associated with delivering the power to consumers. Electricity harnessed from the wind is not easily stored for later use; the best option is to feed it directly into the electricity grid. In many areas, however, the grid is nearly full due to inadequate transmission infrastructure. Efforts to expand capacity by constructing additional power lines can be quite expensive. In addition, building new power lines often faces strong opposition among people who live near a proposed line.

Obstacles faced by the wind power industry include the intermittent nature of the wind itself and transmission issues.

Some environmental concerns—such as the noise caused by some rotor blades, the visual impacts of the turbines, and the effects of turbines on birds—also are associated with wind power. When the first commercial facilities were constructed in the early 1980s, the interaction between birds and wind sites was not well understood. Consequently, some turbines were poorly sited in areas of high bird activity. During the last 20 years, however, researchers and developers have learned a great deal about turbine placement and bird behavior. By applying this knowledge, modern wind sites—like Buffalo Ridge in Minnesota—are believed to be less threatening to birds than are their predecessors.

Policy Options

Several policy options are available to states that wish to promote or advance wind power. These options include renewable energy portfolio standards, state renewables purchases,

systems benefit charges, production tax credits, tax incentives, and disclosure and certification programs.

The Renewables Portfolio Standard requires electricity retailers in a competitive market to ensure that a certain percentage of their total power generation is produced from renewable sources.

- *Renewables Portfolio Standard (RPS)*—This policy requires electricity retailers that operate in a competitive market to ensure that a certain percentage—commonly between 5 percent and 7 percent—of their total power generation is produced from renewable sources. Some states that have enacted this legislation include Arizona, Connecticut, Maine, Massachusetts, Minnesota, Nevada, Pennsylvania, Texas and Wisconsin.

- *State Renewables Purchase*—The purpose of these programs is twofold. First, they require the state to purchase a certain amount of its energy from renewable sources. Secondly, they ensure investments in renewable energy and energy efficiency in state-owned buildings. Arizona, Colorado, Hawaii, Oregon and Texas have adopted this measure.

- *Systems Benefit Charge*—This charge—based on either a kilowatt-per-hour-basis or as a flat fee—is added to the electricity bills of all customers. The resulting revenue is used to subsidize consumer education, renewable energy projects, energy efficiency programs and low-income assistance. Maine, Montana, Pennsylvania and Rhode Island have adopted this policy.

- *Production Tax Credit*—This option provides a tax credit (usually a few cents per kilowatt-hour) for electricity that is generated from wind power. These payments on production reward the actual generation of electricity rather than just the installation of equipment. A federal production tax credit of 1.5 cents per kilowatt-hour is valid through the end of 2001. If a state decides to provide this type of incentive, it must be careful to construct the law so that it does not rescind the federal tax credit.

- *Tax Incentives*—Iowa provides a state sales tax exemption for the total cost of wind energy equipment and all materials used to manufacture, install or construct wind energy systems.

- *Disclosure and Certification Programs*—These programs require electricity retailers to display on a customer's bill the mix of fuel sources that are used to generate electricity. The reasoning behind this policy option is to provide a sort of "truth in advertising" for

electricity retailers. Polls have shown that consumers are interested in green products and many are willing to pay a premium for them. Demands for green power may increase as a result of people who see the actual amount of energy that is generated from non-renewable sources. This effort is under way in states such as California, Colorado, Florida, Illinois, Montana and New York. Some of these states have restructured their electricity markets, while others have not.

Conclusion

U.S. wind power has grown tremendously since 1998 due to a steady decrease in cost, improved technological reliability and economic development potential. Although the obstacles of intermittence and transmission still exist, commercial wind sites are expanding throughout the Midwestern and Great Plains states. The main factor driving this expansion is the ability of commercial wind power to generate considerable revenue for landowners and tax jurisdictions. The several policies featured in this report are options that states are using to encourage the development of commercial wind power and other renewable energy technologies. Many of the states that have these policies in place have not restructured their electric utility industry.

U.S. wind power has grown tremendously since 1998 due to a steady decrease in cost, improved technological reliability and economic development potential.

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STATE LEGISLATIVE REPORT
ANALYSIS OF STATE ACTIONS ON IMPORTANT ISSUES

OCTOBER 2000 VOLUME 25, NUMBER 11

Commercial Wind Power and Bird Species

By Troy Gagliano, *Research Analyst*

Wind power is now the world's fastest growing source of energy. In 1999 alone, U.S. wind generation capacity grew by 40 percent, bringing the nationwide total to 2,500 megawatts (MW). The industry's surge in growth can be attributed to three main factors: consumer demand for renewable—or "green"—energy; the steadily decreasing cost per kilowatt-hour of wind-generated electricity; and the increasing reliability of the technology. Presently, 24 states and the District of Columbia have passed legislation to open their electric industries to competition. As a component of their restructuring legislation, many states require electricity retailers to guarantee that a certain percentage of the total power they sell is derived from renewable resources. In 1999 for example, Texas passed restructuring legislation that mandates the construction of 2,000 MW of new renewable energy by 2009, most of which will come from wind power. Even in states that have not restructured—like Iowa, Minnesota and Wyoming—developers are constructing hundreds of megawatts of wind power generation potential.

Commercial wind power generation has matured from its origins in California to a point where projects are operating in nearly 20 states. A large portion of this growth is occurring in the Midwest. As this industry expands, it is critical for legislators to be aware of the many state policy issues involved with the planning, siting and operation of wind farms. The interaction between birds and wind turbines is one of many crucial issues that must be considered.

Although environmental impact assessments were conducted at the first commercial wind sites, the unique interaction between birds and turbines was not clearly understood at the time. In the two decades following the construction of these wind farms, developers, manufacturers and scientists have learned a great deal about how to more properly site turbines and related equipment. By applying this knowledge, it is now possible for birds and wind farms to safely coexist in many locations. Legislators can play a vital role by ensuring that each of these stakeholders is included in the wind site development process from the outset.

Case Study—Altamont

The Altamont Pass Wind Resource Area, just east of San Francisco, Calif., is the largest of the early commercial wind sites. With approximately 5,000 turbines, it remains the largest in the United States. This site was chosen because of its abundant wind resource, access to existing transmission infrastructure and proximity to load centers. When Altamont was constructed in the late 1970s and early 1980s, developers and permitting agencies knew very little about the potential ecological effects of wind turbines. Consequently, Altamont is located precariously in a habitat used by a variety of protected raptor species like golden eagles, hawks and owls that prey on native ground squirrels and gophers.

Studies suggest that the most significant turbine-avian problems occur at the Altamont wind site. In 1989, the California Energy Commission—along with Solano, Alameda, and Contra Costa counties—sponsored an extensive study that determined that between 160 and 400 birds died annually from collisions with turbines. Other studies conducted throughout the 1990s estimate a range of between 0.02 and 0.15 bird deaths per turbine per year. It is extremely difficult to determine exact numbers of avian-turbine collisions because of the range of the data collection area and because predators often scavenge carcasses before they can be tallied.

Studies suggest that the most significant turbine-avian problems occur at the Altamont wind site.

Many observers believe that the magnitude of these problems is unique to Altamont, especially in regard to raptors. Studies conducted at other commercial sites indicate significantly lower avian fatalities. The other two large wind farms in California—Tehachapi, with approximately 3,500 turbines, and San Gorgonio Pass, with around 3,000—do not experience anywhere near the number of avian collisions that Altamont does. Newer commercial sites like Buffalo Ridge in Minnesota and Foote Creek Rim in Wyoming have not reported significant numbers of bird deaths. Possible explanations for this disparity include the existence of different bird species and prey in each area, unique regional topography and, perhaps, a safer arrangement of turbines at the newer sites.

Migrating birds can be susceptible to turbine collisions at some sites. This is of particular concern in states like Montana, North Dakota and South Dakota which have tremendous wind energy resources but lie on major migratory flyways. Heights vary among species, but the majority of nocturnal migratory birds fly at altitudes ranging between 1,500 feet and 2,500 feet when migrating. Since the largest turbines in use today stand approxi-

mately 240 feet tall from footprint to blade tip, collisions between migrating species and turbines should remain infrequent. In Midwestern states, waterfowl tend to migrate along main watercourses. Since wind sites in those states likely will be at higher elevations—as at Buffalo Ridge—it is hoped that contact can be avoided.

Depending on the situation, researchers may or may not perceive the sum of avian deaths at a site as a serious problem. When measuring the effects, researchers consider whether the number of bird deaths is "biologically significant," meaning whether a specific number of fatalities at a site are substantial relative to the total species population. If a few dozen or even 100 members of a species are killed annually at a site but millions inhabit the area, the ratio may not be considered biologically significant.

Severe penalties are associated with the deaths of protected birds.

Although protected birds are killed daily from a variety of causes without much public uproar, severe penalties are associated with their deaths. The U.S. Fish and Wildlife Service (USFWS), which has jurisdiction over the death of protected birds, has in the past held parties accountable for negligence in the electrocution of birds from contact with transmission wires. If the USFWS were to bring charges as a result of deaths at a wind site, it would be a challenge to determine the legally responsible party. Should it be the developers who position the turbines or the owner of the site? This has yet to happen because the USFWS believes that, overall, the wind industry is striving to mitigate the threat that turbines pose to birds.

Collisions With Other Human Constructions

The seriousness of avian-turbine collisions should not be minimized, but it is important to provide a sense of perspective. It is estimated that up to 80 million birds die annually throughout the United States from collisions with a variety of objects. Airports, towers, cars and highways all have considerable effects on avian species. Collisions with vehicles are responsible for more than 50 million bird deaths annually. An exact figure is not available for the number of deaths from turbine collisions, but it is widely thought that this number is nowhere near the number of deaths that result from collisions with other structures. It also is important to realize that all energy sources threaten birds to some degree. The Valdez oil spill in Alaska by itself killed approximately 500,000 birds. The 900 bald eagles that were killed by the spill represented 11 percent of the local population.

Micrositing Safeguards

During the past 20 years, the experience in the Altamont Wind Resource Area has alerted stakeholders to the importance of meticulously examining the habitat and the ecology of an area before beginning construction of wind sites. Researchers now can more astutely assess the potential effects of a site by understanding the migration patterns and the feeding, nesting and roosting behaviors of different species that use the same area. By combining this behavioral knowledge with topographic information that is specific to a proposed wind site and adjusting projects accordingly, the effects of wind farms on avian populations may be minimized.

If raptor activity exists in a proposed area, it would be wise to place turbines a distance away from the ridge to avoid collisions.

An example of a micrositing technique involves carefully choosing the placement of individual turbines. Ridges produce strong winds that are ideal for generating power. Many raptors, however, are soaring birds that use the updrafts that are created in these areas. If raptor activity exists in a proposed area, it would be wise to place turbines a distance away from the ridge to avoid collisions.

The Legislative Role

It is unlikely that legislators will face legislation specific to avian-turbine interaction, but it is a vital component of the general debate that they will need to consider. Because resource and environmental interests can be instrumental in delaying projects or preventing them entirely, it is imperative that these stakeholders be included in the planning process from the beginning. Legislators can be most effective by encouraging interaction and communication between state governments, permitting agencies and developers, and environmental groups, scientists and resource management groups. The collaboration of these stakeholders can help ensure that avian issues are addressed from the beginning and that the latest micrositing techniques are employed when a wind project is in the planning stages.

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Expanding Commercial Wind Power in Four States

By Troy Gagliano, *Research Analyst*

Nearly half the states have recently passed legislation to open the retail sale of electricity to competition. This change is motivated by the expectation that market competition will meet customers' demands for lower prices and higher quality of service. As part of this legislation, many states are requiring that a certain percentage of the total power that electricity providers sell come from renewable resources. In addition to these mandates, studies conducted by the National Renewable Energy Laboratory indicate a considerable demand among consumers for "green power" and, in fact, many people appear willing to pay a premium for it. Green power refers to energy that is derived from renewable sources like solar, geothermal, biomass and wind.

Presently, 24 states either are generating electricity from wind or are developing wind sites. This report focuses on factors that are encouraging and barriers that may impede the development of a commercial wind power industry in Texas, Wyoming, North Dakota and South Dakota.

With nearly 2,500 megawatts (MW) of installed wind-generating capacity, the United States ranks second worldwide. Of this total, 700 MW were installed in 1999 alone. Overall, the wind power industry in the United States has grown by 40 percent since mid-1998. The key factors contributing to this growth include the following.

- Strong consumer demand for clean, pollution-free power from domestic sources;
- The steadily decreasing cost and increasing reliability of wind power;
- State laws mandating the sale of electricity generated from renewable sources; and
- The production tax credit of 1.5 cents per kilowatt-hour offered by the federal government through December 31, 2001.

The cost per kilowatt-hour of wind-generated electricity has decreased from approximately $0.38 in 1980 to less than $0.06 today.

Some factors that encourage commercial wind power development in these states include legislative action, consumer demand, utility interest, economic development and air quality (see table 1). The main barrier inherent in expanding wind power, especially in North Dakota and South Dakota, is the issue of power transmission. These four states are comparable because they all share a similar assortment of domestic energy resources and because each has the potential to generate enormous amounts of electricity from the wind. Despite these parallels, only Texas and Wyoming have developed a significant wind industry. North Dakota and South Dakota have very little installed wind power capacity.

Table 1. Key Factors Presently Driving Commercial Wind Development

State	Legislative Action	Consumer Demand	Utility Interest	Economic Development	Air Quality
Texas	X	X		X	X
Wyoming		X	X		
North Dakota		X		X	
South Dakota		X	X	X	

Source: NCSL, 2000.

Table 1 illustrates the unique combination of factors at work in each state that are driving the expansion of commercial wind power. Texas has positioned itself to become the nation's leading generator of renewable energy as a result of restructuring legislation that mandates the construction of 2,000 MW of electricity from new renewable sources by 2009. The majority of this generation is expected to come from wind power. The Texas Legislature's decision was influenced by the economic potential of wind power, consumer demand and a need for improved air quality throughout the state. Although the governor and the public utilities commission in Wyoming support wind power, its development there is largely the result of utility ventures into the market in response to consumer demand in nearby Colorado and Utah.

North Dakota and South Dakota often are referred to as "the Saudi Arabia of wind power" because of their tremendous wind resource.

North Dakota and South Dakota often are referred to as "the Saudi Arabia of wind power" because of their tremendous wind resource. Just as in Wyoming, consumer and utility interest in green power in South Dakota are triggering the early growth of the industry. Commercial wind power in North Dakota is only beginning to be widely discussed, but a strong and demonstrated interest exists among rural residents in regard to the potential to generate income by leasing their land to wind project developers. Although neighboring

Minnesota and Iowa each has more than 240 MW of installed wind capacity, a substantial wind power industry has yet to take root in the Dakotas.

Domestic Resources

Each of these four states possesses domestic resources of coal, petroleum, natural gas and hydropower, but each uses these resources in differing quantities. North Dakota and Wyoming have important coal industries that generate significant income through export. South Dakota relies on hydropower for approximately 75 percent of its utility generation. North Dakota, South Dakota and Wyoming are net exporters of energy. In Texas, utility generation comes mainly from coal and natural gas with some use of nuclear power. Despite its substantial reserves of domestic fuels, Texas recently switched from being a net exporter of energy to a net importer in order to meet the growing demand for power in the state. More detailed information about each state's domestic fuel resources is included in the appendices.

Landowner and Tax Revenue

One principal issue driving the growth of commercial wind power is the revenue that such projects can create for individuals and municipalities. Unlike earlier generations of wind farms that are sited in mostly uninhabited areas, many new sites are placed on occupied farmland. Modern wind farms can provide tax revenue for local governments and royalties to landowners in areas where the projects are located. Each turbine occupies less than 1 acre of land and is compatible with other common land uses such as grazing, farming, and oil and gas exploration. Furthermore, as the wind industry gains a foothold in an area, turbine manufacturers may move in and create jobs. This happened recently when Vestas Wind Systems of Denmark announced it was moving its U.S. headquarters to Pueblo, Colorado. The company will build its first American factory here and employ as many as 600 people.

Unlike earlier generations of wind farms that are sited in mostly uninhabited areas, many new sites are placed on occupied farmland.

In exchange for the use of their property, landowners may receive royalties based on a percentage of the site's annual gross revenue. For example, a wind site with an annual gross revenue of $2 million would pay the landowner $40,000 each year, based on a 2 percent lease agreement. These agreements, which are typical for any type of utility-scale wind site, can last for 30 years and pay landowners from $1,500 to $2,000 annually per turbine.

Wind power also is economically beneficial to local governments. Developers of wind projects pay property taxes based upon the installed capital cost of the wind site. The National Wind Power Site in Texas generates $100,000 annually for school funds throughout the state and $400,000 annually for the local taxing jurisdiction.

In Wyoming, the Foot Creek Rim site provided approximately $480,000 in property taxes for Carbon County in the first year following its construction.

Environmental Issues

One of the major environmental concerns associated with the placement of wind turbines is their effect on bird species. Since the development of the first commercial wind farms in the early 1980s, researchers, developers and siting authorities have learned a great deal about how to place individual turbines so that the threat to birds is diminished. These so-called "micrositing" techniques consider many factors, including nesting, migrating and feeding behaviors of birds that inhabit the area, as well as geologic features of the site. Micrositing is discussed in more detail in appendix B because of the magnitude of wind power expansion that presently is occurring in Wyoming.

Of the four states analyzed, Texas is the only one where the legislature played a leading role in expanding the use of wind power.

In this report, the status of the wind industry in Texas, Wyoming, North Dakota and South Dakota is analyzed within the context of the following four factors: quantities of domestic renewable and fossil fuel resources, the status of electric industry restructuring, power transmission issues, and the political climate regarding wind power. Texas is discussed first because it best illustrates how influential a legislature can be in expanding commercial wind power. The appendix contains more detailed information about each state's experience with developing commercial wind power.

Texas

Of the four states analyzed, Texas is the only one where the legislature played a leading role in expanding the use of wind power. Electric industry restructuring legislation passed in 1999 that mandates the creation of 2,000 MW of new renewable energy by 2009. Legislators supported the bill because of the revenue that wind power can generate for communities through taxes and jobs and because emissions-free, wind-generated electricity will

help Texas meet federally mandated clean air standards. Consumer demand for utility investment in renewable energy also influenced the Legislature's decision.

Texas' wind power resource ranks second in the nation behind North Dakota. The state presently has approximately 190 MW of installed wind power generation capacity. Power transmission is not currently a problem in Texas but as the industry expands, upgrades to the system will be required.

Wyoming

Of the four examples discussed here, Wyoming currently is experiencing the greatest growth in wind power. The state ranks seventh nationally in wind resources. In only a few years, nearly 100 MW of wind power generation capacity has been constructed there. The Foote Creek Rim, located in southern-central Wyoming, is one of the largest commercial wind projects in the western United States.

Wind power in Wyoming has enjoyed political support, but utility companies and consumer demand are largely responsible for the growth of the industry. Utilities that operate wind projects in the region do so mainly to capitalize on the demand for green power in nearby Colorado and Utah. Nearly all the wind-generated electricity produced in the state is exported to this market.

North Dakota's wind resource is the greatest of any state in the United States.

North Dakota

North Dakota is a predominantly agricultural state where rural residents are expressing particular interest in the potential of wind development to generate revenue for individual landowners. In cities and small communities across the state, hundreds of people—including farmers, landowners and legislators—have attended meetings to learn about the economic benefits of harvesting the domestic wind crop. Many citizens are aware of neighboring Minnesota's success in earning profits from wind projects. Some developers also are working in North Dakota and South Dakota to help Native Americans identify economic development opportunities associated with wind power.

North Dakota's wind resource is the greatest of any state in the United States. At present, there is less than 1 MW of installed wind capacity in North Dakota, but this may soon

change. The Minnesota Legislature has required Northern States Power to add 425 MW of wind power to its resource mix in exchange for the right to store radioactive waste generated from one of its nuclear plants. Since the transmission system in Minnesota is becoming increasingly constrained, wind developers in North Dakota have proposed constructing and supplying up to 80 MW of this total.

The tax revenue that wind power can generate could help to replace any diminishing severance taxes.

Severance taxes associated with the extraction of lignite coal provide millions of dollars for the state each year. However, this industry may be threatened by the growing demand for cleaner-burning bituminous coal found in surrounding states. The tax revenue that wind power can generate could help to replace any diminishing severance taxes.

The most significant barrier facing the expansion of commercial wind power in North Dakota is the power transmission system. The system can presently transmit only a certain amount of electricity and adding any more could seriously threaten its stability.

South Dakota

Because of the state's small population and large supply of affordable hydropower, there has been no state-sponsored initiative to utilize wind power. Consumer demand and the declining cost of wind-generated electricity are the main contributors to the growth of the wind industry in South Dakota. The expansion of the industry in Minnesota also is piquing the interest of many South Dakota residents. The transmission constraints in South Dakota are similar to the limitations inherent in the North Dakota system.

Based on customers' willingness to pay, the East River Electric Power Cooperative earlier this year began signing up participants for its Prairie Winds Program. In less than two months, the cooperative received commitments from more than half the total participants required to operate the program.

Conclusion

The experiences of Texas, Wyoming, North Dakota and South Dakota illustrate different ways in which commercial wind power can evolve within a state. The experience in Texas is a primary example of how legislative actions can be influential in supporting statewide,

commercial wind development. Consumer demand from surrounding states appears to be the main force driving wind power expansion in Wyoming.

North Dakota presently has no commercial wind projects in operation, but citizens are demonstrating a great deal of interest in the tax and landowner revenues that can result from wind-generated electricity. South Dakota's wind industry is in its infancy, but one electric cooperative is taking its first steps to meet customer demands for green power. Developers have worked for years with Native American communities in both North Dakota and South Dakota to make wind power a source of economic development. The involvement of these communities is expected to play a significant role in the growth of wind energy in both states as well as others in the region.

Developers have worked with Native American communities to make wind power a source of economic development.

Appendix A. Texas

Restructuring Status

Through its recent restructuring legislation, Texas has positioned itself to become the nation's leader in the generation of electricity from renewable resources. In 1999, the Texas Legislature passed Senate Bill 7, which allows retail competition in the sale of electricity to begin January 1, 2002. The renewables portfolio standard (RPS) component of this legislation mandates 2,000 MW of new renewable energy generation to be constructed by 2009, the majority of which is expected to come from wind power. This RPS equals approximately 3 percent of the state's total electricity production. A noteworthy feature of the bill is its $50 per kilowatt-hour penalty for noncompliance. Such penalties help encourage and strengthen compliance with renewable energy requirements, but often are absent from state legislation.

Resources

With and an estimated gross potential to generate 1,190 billion kilowatt-hours (kWh) of electricity each year, Texas is second only to North Dakota in wind power resource. Excellent wind resources are found in the northern third of the state, in the panhandle, and along the Gulf of Mexico. At present, approximately 190 MW of installed wind capacity has been built, predominantly in the western section of the state. In 1996, the composition of utility generation in Texas was nearly 49 percent coal, 37 percent gas and 13 percent nuclear power. Despite its large domestic reserves, Texas recently began to import energy to meet the growing demand for electricity.

Transmission

Transmission in Texas presently is not a major concern, nor was it an issue in the consideration of Senate Bill 7. Enough capacity is available on the transmission system to accommodate the addition of several hundred megawatts of wind power. Expansion of the transmission infrastructure will be required as the industry develops during the next decade. It is presently difficult to predict the exact amount of transmission expansion that will be required, since the majority of the new wind power facilities have not yet been sited.

Political Climate

Several particular features of wind power made Senate Bill 7 attractive to legislators.

- One feature was the emissions-free nature of wind power. The air quality in parts of eastern Texas has recently deteriorated and the expansion of the wind power industry is one way to help Texas meet the clean air standards mandated by the federal government.
- The generation of electricity from wind turbines does not require large amounts of water used by traditional generation techniques. This is especially important in rural areas in which water is a precious commodity. In fact, rural areas often contain the best wind resources.
- The financial benefits that wind power development can provide for landowners and tax jurisdictions.
- The construction, operation and maintenance of wind farms will bring jobs into the areas where the projects are located.

An additional factor influencing this decision is the changing energy picture in the state. Texas is importing energy in order to support its growing population. The state's traditional fuel industries also are undergoing major changes. It has been suggested that 20 years ago a renewable energy proposition like Senate Bill 7 would not have been taken seriously in Texas. However many Texans understand that using the domestic wind resource diversifies the state's energy portfolio and helps protect it from fluctuations in the price of fossil fuels.

Appendix B. Wyoming

Restructuring Status

The state's public utility commission has held public hearings on electric utility restructuring but, because Wyoming has some of the lowest electricity prices in the United States, the state appears to be in no rush to move ahead on the issue.

Resources

Wyoming's wind resources place the state seventh in a national ranking. The state has an estimated gross potential to annually produce 747 billion kWh of wind-generated electricity. In only a few years, the wind power industry in Wyoming has developed significantly and the state now has nearly 100 MW of generating capacity located at Foote Creek Rim and nearby Medicine Bow.

Wyoming has led the nation in the production of low-sulfur coal since 1988. The state's low population and huge reserves of coal combine to make it a net exporter of energy. There are no nuclear plants in Wyoming and oil and gas constitute less than 1 percent of generating capacity. In 1996 coal was used for more than 96 percent of the state's net generation, while hydroelectric plants contributed 3 percent.

Transmission

Because of the remote nature of the Foote Creek Rim site, no transmission lines existed to connect the turbines to the power grid. PacifiCorp, which owns the largest project in the area, built nearly 29 miles of 230 kilovolt transmission lines from an existing substation to its wind site. According to PacifiCorp, no unusual siting issues were associated with the addition of these transmission lines and towers.

Political Climate

Although wind power in Wyoming benefits from the political support of the Public Utilities Commission and the governor, the legislature is not actively involved in its development. Instead, the power companies that operate in Wyoming are largely responsible for the growth of commercial wind power. Bonneville Power Administration owns approximately 18 MW and Public Service of Colorado owns 25 MW of installed capacity. Oregon-based PacifiCorp and the Eugene Water and Electric Board own 42 MW of installed capacity on the Foote Creek Rim. Two reasons for PacifiCorp's venture into wind power are

to capitalize on the high demand for green power in nearby Colorado and Utah, and to diversify the utility's energy portfolio. Nearly all of the wind-generated power in Wyoming is exported.

Micrositing

The Foote Creek Rim site experienced a small amount of environmental opposition that was overcome by employing proper siting techniques. The main environmental concern regarding this project involves the effect of turbines on bird populations. To ensure bird safety, the developer employed micrositing techniques. Micrositing is a process whereby developers pay meticulous attention to unique topographic and biological factors inherent at each potential wind site. This contrasts with more general siting that might identify only a few square miles of good wind resource versus individual turbine siting that considers the nesting, feeding, migrating and mating behavior of native species. Many pieces of distribution equipment, such as wires, are buried underground so that birds cannot perch on them. The fewer large, modern turbines in use at Foote Creek Rim generate just as much electricity as older wind farms that require the operation of hundreds of turbines. Hopefully the use of fewer turbines will minimize the threat that turbines can pose to birds. The blades on the larger turbines also have less rotations per minute than those on many smaller models. Research is currently under way to determine if blades of this type are easier for birds to identify and thus to avoid. If the proper amount of time and money are spent on siting, wind sites and avian species can safely co-exist.

Another concern usually associated with the construction of wind sites is their effect on the visual landscape. This was not a major concern in the Wyoming project for two reasons. First, some experimental turbines were placed in the area in the late 1970s. This perhaps made it easier for new turbines to be introduced and accepted. Second, due to the region's small population, local residents did not voice any "NIMBY" (not in my back yard) concerns.

Appendix C. North Dakota

Restructuring Status

In 1997, the North Dakota legislature formed a committee to investigate the potential effects of electric industry restructuring. No restructuring legislation was introduced in 1999, however, and the legislature will not reconvene until 2001.

Resources

North Dakota's wind resource ranks first among the 50 states, with a potential to generate 1,210 billion kWh of electricity annually from wind power. Presently, the state has only a few small wind projects with a total generating capacity of less than 1 MW, although Northern States Power (NSP) plans to develop up to 80 MW as part of its wind program. NSP, one of the region's largest power suppliers, has been required by the Minnesota legislature (its home state) to add 425 MW of wind power to its resource mix by 2001 in exchange for the right to store radioactive waste generated at its Prairie Island nuclear plant. Because Minnesota's transmission and distribution system is nearing capacity, developers in North Dakota have proposed building and supplying 80 MW of Minnesota's 425 MW requirement.

Roughly 90 percent of the electricity generated in North Dakota is derived from lignite coal. The coal industry contributes significantly to North Dakota's tax base. (In FY 1999, this industry generated more than $25 million in severance taxes.) The huge supplies of lignite located in the southern and western regions of the state far outweigh the population's demand and, as a result, the state is a net exporter of energy. The remaining 10 percent of electricity generation consists mostly of hydroelectric power, together with minimal petroleum and natural gas generation.

The lignite coal that is so plentiful in North Dakota burns less efficiently than other varieties. On average, coal mined in the United States has a heat energy value of about 22 million Btu per ton, an amount equivalent to the energy obtained from burning approximately 21,000 cubic feet of natural gas or 160 gallons of distillate fuel oil. The heat energy value of lignite coal is much lower, at only 13 million Btu per ton. The heat energy value of bituminous coal is higher than the national average, at approximately 30 million Btu per ton.

Many believe that North Dakota's lignite industry is threatened by the demand for the cleaner burning bituminous coal found in nearby Colorado, Montana and Wyoming. Because coal from these states yields more energy and fewer pollutants, many coal-burning utilities in North Dakota and the surrounding region that have traditionally used lignite are switching to bituminous coal. Considering the millions of dollars in tax revenue that lignite coal generates for North Dakota, economic consequences could result from declining demand. Commercial wind power has the potential to replace tax revenue for the state that may be lost by a reduction in coal severance taxes.

North Dakota has a high concentration of rural electric cooperatives and some of the lowest energy prices in the nation. Some contend that the addition of wind power may increase electric rates; however, others point out that because wind-generated electricity will mainly be exported to the "green market," it may not affect rates within the state. The green market consists of those consumers who are willing to pay extra for electricity that is generated from renewable, nonpolluting sources. New green power pricing and marketing programs have been established in nearby Illinois, Iowa, Minnesota and Wisconsin.

Transmission

The largest technical barrier facing the expansion of wind power in North Dakota is the inherent weakness of the power transmission system. There are two reasons why transmission is such a crucial factor not only in North Dakota, but wherever there is electricity. The first is that wind resources often are located in remote areas far from load centers (i.e., the area where the power is actually consumed). Second, turbines must be located in areas where there are somewhat steady winds and, ideally, near existing major power transmission lines.

It is important to consider the link between the transmission system and North Dakota's small population and low demand for electricity. The system there is unique because it is constructed specifically to accommodate mine-mouth generation; a process by which coal is mined and burned to create electricity that is then transmitted long distances over wires from the actual point of extraction. This system was built specifically to balance the amount of transmission with the amount of generation. The addition of wind-generated power at most connection points therefore would create an imbalance between transmission and generation. The physical limitations inherent in the system result from transmission of a large amount of electricity over hundreds of miles with few load centers along the way.

Under certain conditions, this system is cannot deliver even the existing generation to load centers throughout the state.

One way to strengthen the transmission system would be to have shorter lengths between the generation point and the load centers where the electricity is actually used.

The Western Area Power Administration (WAPA), a federally owned and operated utility, controls more than 9,000 miles of transmission lines in the upper Midwest and serves 15 western states. WAPA recently completed an interim study that analyzes how much continuous power can be added to certain points of the transmission system in North Dakota and South Dakota. The study determined that the Pickert substation near Finley, North Dakota, might be able to integrate up to 150 MW of wind-generated electricity without seriously threatening or damaging the system.

Political Climate

Although commercial wind power traditionally has faced stiff opposition in North Dakota, that climate is beginning to change. One catalyst is the potential economic benefits that wind power development can bring to a community. Coincidentally, the Pickert substation is located in an area that includes Griggs and Steele counties, which are facing an array of economic challenges. These two counties recently were included in the federal Empowerment Zone/Enterprise Community Program, which aims to stimulate economic development in the hardest-hit urban and rural areas by providing tax incentives, grants and loans to businesses that locate in, and hire workers from, such areas. Wind power provides an opportunity to create jobs and provide sustainable economic development by utilizing local resources.

Appendix D. South Dakota

Restructuring Status

Currently there is no formal investigation into restructuring the electric power industry in South Dakota.

Resources

South Dakota ranks fourth nationally in wind energy potential. Approximately three-fourths of the state has excellent wind resources that average around 15 miles per hour. The state has an estimated gross potential to annually produce 1,030 billion kWh of electricity from wind power. Nearly 80 percent of South Dakota's energy is derived from hydroelectric power that is generated from dams on the Missouri River. The remaining generation consists of 20 percent coal, with oil and gas totaling less than 1 percent. South Dakota is a net exporter of energy because of its substantial amount of resources and its small population.

Until recently, there has been little commercial effort in South Dakota to utilize the state's wind resource, but in one area of the state that is changing. The East River Electric Power Cooperative's (EREPC) Prairie Winds program will consist of a 1 MW wind site that will offer wind-generated electricity to participants by the spring of 2001. EREPC is a consumer-owned utility that provides transmission and power to 22 member systems in eastern South Dakota and western Minnesota. The utility has monitored the wind resource since the early 1980s, but wind power was not pursued then because it was not economically viable.

EREPC began signing up customers in June 2000 to participate in the program. Participants agree to pay $3.50 per month for one year for each 100-kilowatt block of wind-generated power. The goal is to enlist enough participants so that 2,000 blocks of wind power are sold. In less than two months, and with no media advertisements, the program signed more than 460 participants for nearly 900 blocks. In addition, the utility receives many calls from rural customers inquiring about the potential lease of their land to project developers.

Transmission

South Dakota's sparse population causes its electric transmission system to suffer limitations similar to those in North Dakota. The aforementioned WAPA study determined that two connection points in Watertown and New Underwood, South Dakota, are capable of handling the addition of up to 150 MW of wind-generated electricity. Some existing lines go southward into Nebraska, but no ties go east beyond western Minnesota. If South Dakota's wind power industry expands to hundreds of megawatts in the future, some entity will need to build transmission in order to sell power to likely markets in Chicago and other large cities to the east.

Political Climate

The early development of a wind power industry in South Dakota is being driven predominantly by consumer demand. After conducting studies of customers' willingness to pay for green power, EREPC concluded that wind-generated electricity was the most economic way to meet the demand. Due to the state's small population, its large supply of low-cost, domestic hydropower, and access to affordable coal in neighboring states, there has been no state-sponsored initiative to utilize wind power. Funding has not been used in South Dakota to create a wind industry because most surplus money in the state treasury is applied to relieving property taxes.

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State Legislative Reports

"State School Finance Litigation 1999: A Summary and an Analysis" (Vol. 24, No. 8) (ISBN 1-58024-043-7)	December 1999
"Improving Teacher Quality: NCTAF Policies" (Vol. 24, No. 9) (ISBN 1-58024-033-X)	December 1999
"State Crime Legislation in 1999" (Vol. 25, No. 1) (ISBN 1-58024-087-9)	January 2000
"Juvenile Justice State Legislation in 1999" (Vol. 25, No. 2) (ISBN 1-58024-092-5)	February 2000
"Current Trends in Teacher Policy" (Vol. 25, No. 3) (ISBN 1-58024-093-3)	March 2000
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"Tax and Landowner Revenues from Wind Power Development" (Vol. 25, No. 5) (ISBN 1-58024-101-8)	April 2000
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"Education Standards, Assessment and Accountability" (Vol. 25, No. 9) (ISBN 1-58024-120-4)	October 2000
"Expanding Commercial Wind Power in Four States (Vol. 25, No. 10) (ISBN 1-58024-121-2)	October 2000

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April 2002

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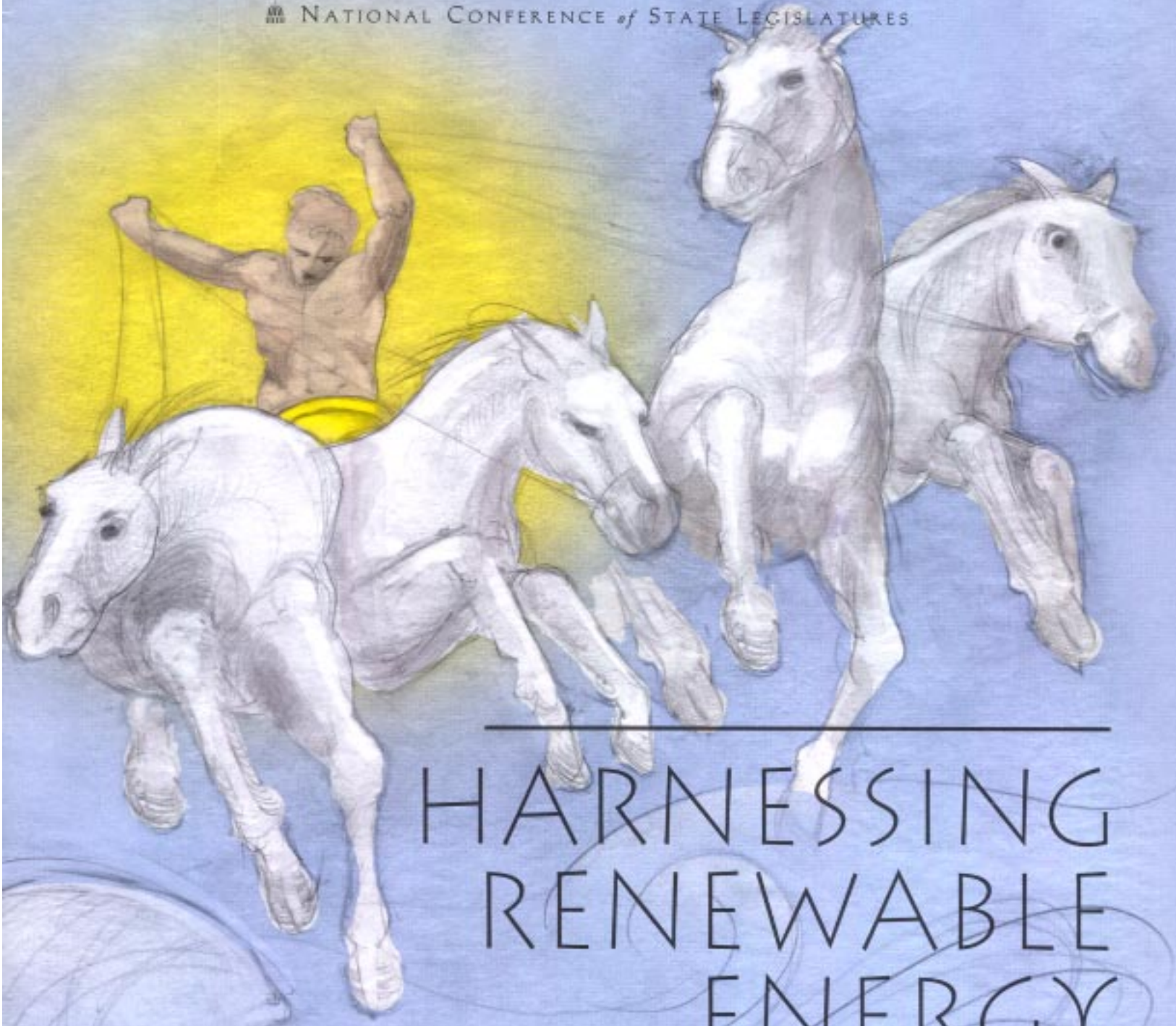


HARNESSING RENEWABLE ENERGY

ALSO INSIDE:

CALIFORNIA'S BUDGET BUST

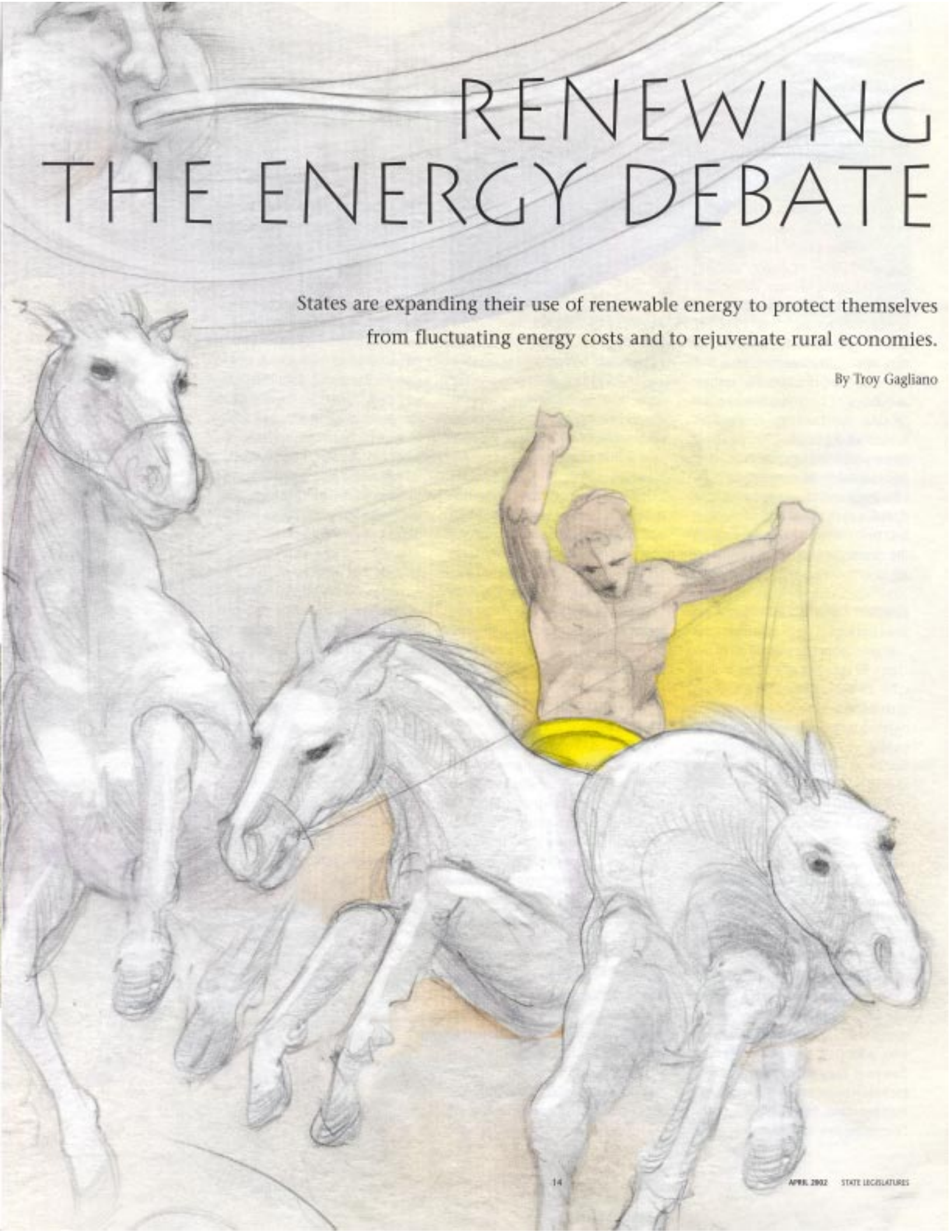
LEAVING PRISON FOR GOOD

PREPARING FOR A CRISIS

RENEWING THE ENERGY DEBATE

States are expanding their use of renewable energy to protect themselves from fluctuating energy costs and to rejuvenate rural economies.

By Troy Gagliano



Kevin Willert's family has farmed the Buffalo Ridge area in southwestern Minnesota for more 100 years, but now he has a new crop: the wind.

Willert heads a landowners' association that leases land to developers who build wind turbines to generate electricity. In return for the use of their property, Willert and his neighbors receive annual royalties based on the productivity of the turbines.

"The dollar amounts vary, but the most productive ones can each bring up to $3,000 a year," he says.

Not bad when you consider that soybean and corn annually gross around $300 an acre in this region. Each of the large, modern turbines occupies less than an acre and, according to Willert, is compatible with traditional land uses. "You can plant crops up to about 40 feet from the base, and they don't bother the cattle. My cows rub against them all the time," he says.

The wind turbines are also a benefit to the community—they've become somewhat of a tourist attraction. Willert describes the slender tubular towers as "more aesthetically pleasing" than what people envision. "People used to drive straight through the area, but now they stop to ask about the turbines," he says. "I'm not sure how many tourist dollars they generate, but it's enough that the local business people talk about it."

Wind, solar power and geothermal energy won't replace fossil fuels as the prevalent source of energy any time soon. But using renewable energy in tandem with traditional fuels can protect the nation's economy by extending the life of domestic fossil fuel resources. Renewables also enhance national security by reducing our reliance on the fuels we import from consistently volatile regions of the world.

Many states are expanding their use of renewable energy in order to diversify their energy and economic options. This balanced energy approach offers protection from unpredictable surges in fuel costs, as was the case in 2001 when natural gas prices quadrupled. In addition, states are interested in the revenue that renewable energy technologies can generate.

"States are leading the charge to develop domestic renewable energy resources," says P. J. Dougherty, national coordinator of the Department of Energy's Wind Powering America Program. He says lawmakers are interested in ways to protect consumers from high fuel prices and in creating economic development for rural communities.

HARNESSING THE WIND

The nation's "wind belt" blows across an area stretching from Texas to Minnesota to the Pacific Northwest and down through parts of the Southwest. Wind in North Dakota and South Dakota alone is so great that, theoretically, it could generate enough electricity to power the entire nation. Large-scale, commercial wind farms are operating in 22 states, and dozens of new projects are planned. California, Colorado, Iowa, Kansas, Minnesota, Oregon, Texas, Washington and Wyoming lead the way. Projects in New York, Pennsylvania and Vermont are tapping wind resources in the East. The capacity of the nation's wind power plants doubled from 1999 to 2001 (to nearly 4,300 megawatts), but they still produce only a very small amount of U. S. energy

The expansion of wind power has been a boon to struggling farmers and ranchers who can get annual royalty payments of between $1,500 and $2,500 for each turbine placed on their property. However the amount depends on the strength of the wind. Word of these lease agreements is spreading throughout many rural communities. Last year, the North Dakota State Energy Office held a series of meetings that focused on wind power and economic development. "In each town, the crowds got larger and larger," says Representative Scot Kelsh of Fargo. "Farmers are economically depressed, and this opportunity is good news to them."

Farmers who lease land to developers for wind turbines can plant crops up to 40 feet from the base of the machines.

Representative
Scot Kelsh
North Dakota

Willert suggests proceeding with caution, though, when developers come knocking. "Many landowners in Minnesota entered poor lease agreements because these are relatively new types of land leases. Landowners should organize, share information and get everything in writing. They have a lot to lose if they don't," he warns.

Large, commercial wind farms can generate a lot of property tax revenue for counties, too. The National Wind Power Site in west Texas annually generates around $400,000 for the county, plus an additional $100,000 for schools throughout the state. In its first year of operation, the Foote Creek Rim Project in southern Wyoming generated $480,000 in property taxes for Carbon County. In Minnesota, a 155 megawatt project provided Lincoln County with $721,000, while Pipestone County received $532,000 from a 113 megawatt plant in 2000.

Troy Gagliano specializes in renewable energy policies for NCSL.

CONSUMER DEMAND

"The economic development that wind power is bringing to some rural areas is exciting, but wind is also attractive to the general public," says Representative Tom Sloan of Kansas. "Electricity customers are demanding it because they see wind power not only as a free energy resource, but they also like the fact that it's free of pollutants," he says.

Representative Tom Sloan Kansas

Electric utilities in nearly 30 states now offer customers the option to purchase "green power," that is, electricity generated using renewable resources. This electricity is typically sold in blocks of 100 kilowatt-hours and costs between $2.50 and $5 extra. Customers seem willing to pay a premium to support renewables. In fact, these so-called "green pricing programs" in Colorado, Michigan and South Dakota have customer names on waiting lists until more turbines are built to meet the demand. Some utilities have built wind farms in southern Wyoming specifically to meet the demand for green power in nearby Colorado and Utah.

Representative Ellen Bard Pennsylvania

Pennsylvania customers have the option of choosing who they buy electricity from. Around 120,000 have switched electric providers. "Consumers have options in our state, and they are willing to pay for electricity from renewable sources," says Representative Ellen Bard. "When people are given the choice to purchase green power, they will. Pennsylvania proves that."

Over the years, the cost of wind-generated electricity has fallen consistently as the turbines become more efficient and reliable. The price per kilowatt-hour has gone from $.38 in 1980 to between $.03 and $.06 cents today, which makes it competitive with traditional fossil fuels. Modern wind turbines are large, sleek machines that stand nearly 200 feet tall and can generate a hundred times the amount of electricity of earlier models.

Mark Morgan has 34 of these turbines on his ranch in Big Springs, Texas. He says nobody complains about the visibility of the turbines or the noise. "We got accustomed to them fairly quickly. As far as noise, usually the sound of the wind itself drowns out the spinning blades. It's like the sound of traffic to people living in the city—after a while it's natural background noise." Visibility and noise however, are areas of concern when trying to site turbines in more densely populated areas in the Northeast.

BARRIERS TO OVERCOME

The largest technical barrier facing the wind power industry is the difficulty of transmitting electricity from wind farms to consumers. Many good wind resources are in sparsely populated, remote areas. Delivering power to cities that need it most can be diffi-

WHAT STATES ARE DOING

It's not only states involved in electric utility restructuring that are developing programs to expand the use of renewable energy. Many states that maintain a regulated power market are also encouraging the use of renewables.

Disclosure and certification programs—Twenty-eight states require electricity generators to show their customers, via their monthly bill, the different mix of fuels used to generate electricity. Some states also require the disclosure of emissions produced as a result of generating electricity from these sources.

System benefit charges—Fifteen states levy a special consumption fee (usually a fraction of a cent per kilowatt-hour) on all electricity consumers. This money can be used to support renewable energy, energy efficiency or low-income energy assistance programs.

Renewable portfolio standards—Eleven states require electricity retailers to include a specific amount of renewable energy in the total resources they use to generate electricity. Percentages vary among states, but the annual amount required is commonly from 5 percent to 7 percent.

Tax incentives—Many states offer a combination of property and sales tax incentives to encourage the development of renewables. Some also allow an accelerated rate of depreciation for the equipment used to construct and operate wind farms. Twenty states now have property tax incentives, and 12 offer sales tax breaks.

Net metering—Thirty-four states allow individual, grid-connected customers who generate electricity using a renewable energy system to receive credit from their utility for any excess electricity they generate. Special two-way meters can measure both a customer's consumption and production of electricity. When generation exceeds consumption, the meter essentially runs backward. Net metering can be particularly beneficial for small renewable energy systems.

USING RENEWABLE ENERGY TO LOWER AIR QUALITY VIOLATIONS

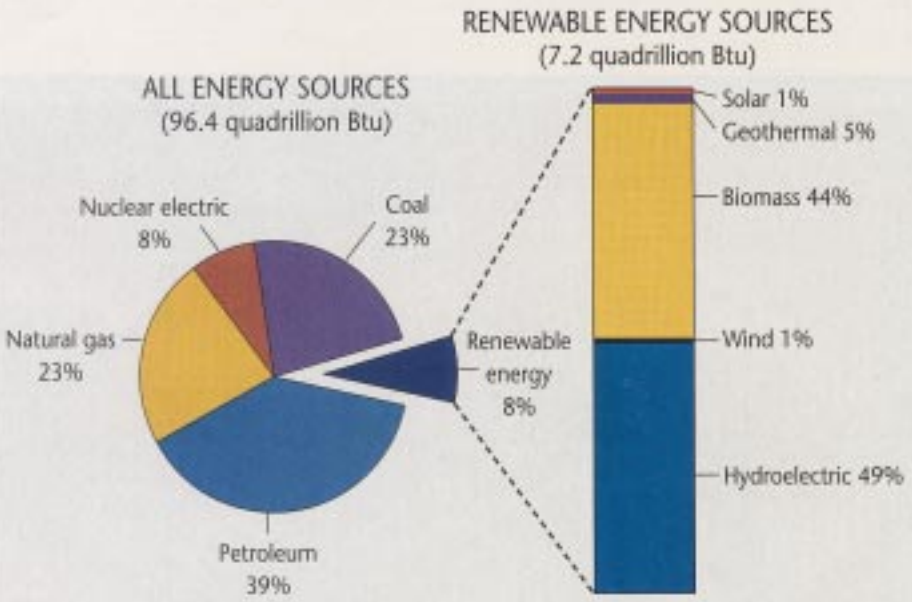
Supplemental environmental projects (SEPs) allow companies that violate air quality standards to receive a lesser penalty by investing in renewable or alternative energy. Money that states collect for these violations has traditionally gone directly into the state's general fund where it is used for a variety of purposes. States can use supplemental environmental projects to require that the money raised from penalties be used to alleviate the environmental condition the violation created.

In Colorado, a major commercial and industrial company is mitigating a violation penalty by purchasing wind energy from XCEL's Windsource program for five years at a cost that is 20 percent less than what the penalty would have been. Renewable energy in the state benefits because the utility must erect another turbine to meet this additional demand. The reductions in air emissions from this project are estimated to be:

- Total nitrogen oxide (NO^5) avoided—97 tons per year
- Total sulfur dioxides (SO^2) avoided—73 tons per year
- Total carbon dioxide (CO^2) avoided—3,640 tons per year

U.S. ENERGY CONSUMPTION BY SOURCE, 1999

From 1998 to 1999, electricity generated from wind power increased 50 percent and geothermal use increased 14 percent.



Totals may not equal sum of components due to rounding.

Source: Energy Information Administration, 1999

cult. "Once turbines are erected, the next challenge is to deliver the electricity out of North Dakota to markets like Minneapolis or Chicago. The trouble is that there are no existing power lines large enough to do that," says Representative Kelsh. In fact, the electricity transmission infrastructure in much of the country is woefully inadequate.

Expanding it is likely to be a contentious issue in the near future, not only for wind-rich states, but also in most regions of the country. Building power lines is an expensive endeavor that often faces strong opposition from people living near a proposed route.

The main environmental concern about wind farms is birds colliding with spinning turbine blades. When the first commercial wind facilities were constructed in California in the early 1980s, developers did not understand how to site them properly. During the last 20 years, researchers have learned so much about the interaction between bird behavior, topography and turbine technology that they now can greatly minimize the effects turbines have on birds. Today, wind farms average less than one bird death per turbine per year.

The threats that wind farms pose to birds can be minimized if turbines are placed with caution, says Karin Sinclair, avian projects manager for the Department of Energy's National Renewable Energy Laboratory.

"The wind industry has learned a lot over the last decade," Sinclair says, "but wind projects can still be hazardous to birds if they are sited irresponsibly.

"It's not about old turbines vs. new ones," she explains. "It's about placing them properly so that the risks are minimized."

Sinclair points to the Foote Creek Rim Project in Wyoming as an example of how wind farms and birds can safely coexist. "The turbines there are placed well away from the areas of high raptor activity and consequently, there have been no significant, negative impacts on raptors there like there have been at the older sites in California," she says.

In North Dakota, Kelsh says, there has been some concern about birds colliding with turbines. But he and others have made sure that wind industry advocates work closely with regulatory agencies and interest groups, like hunters and environmentalists, to alleviate any perceived threats. "Until recently, the U.S. Fish and Wildlife Service did not allow wind turbines on federally leased lands," says Kelsh. "They do now because they believe that the industry is siting projects appropriately. They also understand that the latest generation wind farms in Minnesota and Iowa are not nearly as threatening to birds as older wind farms are."

DIFFERENT STATE APPROACHES

Kansas and Texas provide examples of different approaches that states are taking to encourage the use of wind and other renewables. Texas has a "renewable portfolio standard" as part of its electric utility restructuring legislation that requires electricity retailers in the state to provide a certain amount of power from renewable energy resources. Under this law, Texas will surpass California as the top ranking state in use of

continued on page 20

GREEN POWER COMES INTO ITS OWN IN NORTH CAROLINA

This month North Carolina citizens get to choose electricity generated by such innovative, nonpolluting sources as sun and wind power. Consumers who are willing to pay an extra $3 to $5 per month can help support these 'green energy' projects within the state. The projects are sponsored by the state's two major utilities: Carolina Power & Light and Duke Power.

Through similar programs, more than a third of U.S. consumers can now choose green power. But North Carolina will become the first state to provide this option statewide. The energy consulting firm, Cardinal Energy, estimates the added charges could raise $10 million a year if 3 percent of the state's citizens take part in it.

Cardinal Energy sees the project as a good way to deal with concerns about coal-plant smog and the methane gas that is released from landfills and hog and poultry farms. Some of the green power will be generated by harnessing this gas to generate steam for power plants.

Research shows that 57 percent to 80 percent of consumers would pay a premium for renewable energy or environmental protection. North Carolina's green pricing program will become the newest among more than 85 utilities in 29 other non-deregulated states.

— Christie Rewey, NCSL

continued from page 17

wind capacity in the next few years. The Legislature chose to develop wind power because of the economic development potential of large wind farms, consumer demand for renewable energy and poor air quality in certain parts of the state.

HOT WATER HOPE

Another important source of renewable energy derives from naturally occurring, underground streams of steam or hot water. The best and hottest domestic streams are located in the West, but useful low and moderate temperature resources are spread throughout the country. Geothermal power plants in the western United States provide around 2,200 megawatts of electricity each year. It is estimated that currently identified sources could provide more than 20,000 megawatts, and those not yet discovered could provide five times that amount.

Using geothermal energy directly and for heat pumps can save considerable amounts of energy. Low-temperature streams can be used to heat residential buildings and greenhouses and for agricultural purposes, such as farming fish and drying crops. Geothermal heat pumps discharge heat into the ground in the summer and extract it for winter use. There are more than 500,000 such systems across the United States in homes, schools and universities, and the number is growing.

Since only the hottest streams can be used to generate electricity, there is great potential for geothermal power plants to produce electricity for the growing populations of western states. Some key transmission lines that run from the Pacific Northwest to southern California cross some of the nation's best and hottest geothermal areas. Geothermal energy is similar to wind power in that the best resources are located in a specific area and that additional transmission lines are required to transport the electricity it generates.

Benefits

- Geothermal plants generate tax revenue, can pay royalties to landowners and states for land use, and create construction and maintenance jobs.
- If maintained responsibly, geothermal resources can be reliable for many years.
- Geothermal power plants typically operate more than 95 percent of the time, compared to 60 percent to 70 percent for coal and nuclear plants.
- Geothermal power plants emit far fewer air pollutants than fossil fuel plants.
- These power plants are small, require no fuel purchases and are compatible with agricultural land uses.

Barriers

- Like wind power, using much of the best resources requires an expansion of the electricity transmission system.
- Although costs have decreased in the last two decades, exploration and drilling remains expensive.
- Detecting good geothermal areas is difficult and often leads to dry wells.
- Siting and permitting can be cumbersome, especially on federal lands.

Kansas, on the other hand, uses property tax incentives to lure wind companies. Florida Power and Light recently took advantage of a property tax break to construct a 105 megawatt wind farm near Montezuma, Kan., the first of its kind in the state.

Representative Sloan is glad to see wind power come to his state and believes that the tax breaks work. "Minnesota and Iowa have shown that wind is a cash crop. Mandates have been effective in other states, but we chose tax incentives as a way to develop our domestic wind energy resource. Our property tax incentive is working, and we expect it to encourage even more development," he predicts.

Although mandates can boost renewable energy, commercial-scale wind projects are taking root in states like Iowa, Oregon, Washington and Wyoming without the benefit of mandates or restructuring legislation. And lawmakers in North Dakota and South Dakota are going the way of Kansas with a variety of new laws that provide property, income and sales tax incentives to encourage wind developers to move into the state.

POWER FROM THE SUN

Although Sloan's state of Kansas can use its strong and consistent winds to generate electricity, it can also garner power from a much different technology.

The sun showers the Earth with a nearly infinite supply of energy. Photovoltaic technology (commonly referred to as PV) uses solar panels to convert light from the sun into electricity. Although the greatest amount of solar energy is spread across the southwestern United States, PV can be used almost anywhere because normal daylight is all it takes for such a system to operate effectively. Even rainy Oregon is set to install solar panels on the Capitol roof to power the floodlights that illuminate the Golden Pioneer statue atop the building.

One of the benefits of solar power is that sunlight is more widespread than wind or geothermal resources. Consequently, it can be tapped in remote and urban settings. The main obstacle to wider use of photovoltaics is its relatively high capital cost. Although costs have declined by a tremendous amount in the last 20 years, PV-generated electricity still runs between $.15 and $.30 per kilowatt-hour; considerably higher than electricity generated from other sources because the equipment is costly when compared to the amount of power it can generate.

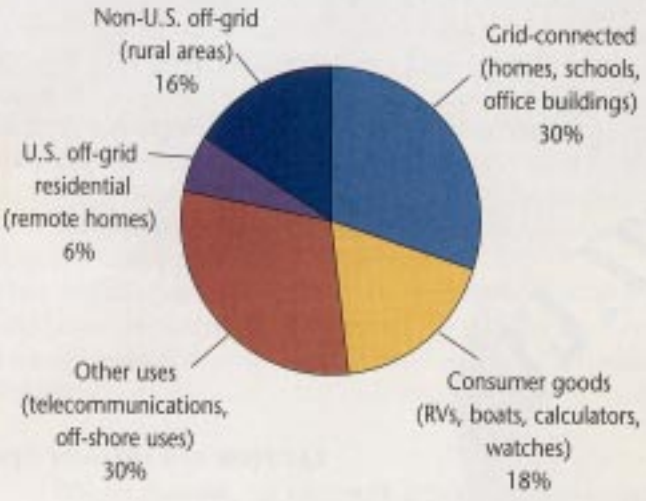
The mobility of PV systems, however, makes them suited for a variety of uses. Solar panels have been used for years to light road warning signs, streetlights and billboards. Farmers also use them to pump groundwater, aerate fishponds and power electric fences. In addition, PV panels are used in more remote areas to power communications stations, navigation buoys, offshore drilling platforms and emergency telephones.

Some customers in urban areas are using solar systems to help protect against volatile energy prices and disruptions in power supply. Programs in New York and California that help customers purchase PV systems have been wildly successful over the last two summers. One promising application for PV is its potential to generate power for the electricity grid during times of high demand. Electricity use is greatest in summer afternoons and early evenings, exactly the same time that solar radiation is greatest.

Solar power is gaining a niche as a small-scale, highly mobile way to generate electricity. In many respects, it competes in a completely different market from fossil fuels and wind power. Chicago and Las

SOLAR ENERGY USES IN 1999

Many people incorrectly believe that solar power is used mostly in remote homes, when in fact this made up only 6% of its overall use in 1999.



Note: The power grid is the system for generating, distributing and transmitting electricity. Off-grid refers to an area beyond the reach of power lines.

Source: NCSL from PV Energy Systems Inc. data, March 2001

Vegas provide examples of how valuable PV can be when electricity is unavailable or simply too expensive.

Solar systems provide some power to many Chicago schools, transit facilities and museums throughout the year. As a result of the 1995 heat wave that left hundreds dead, the city began using this technology as a crisis management tool. Solar panels were installed on some schools to provide electricity for cooling in the event of future brownouts or blackouts triggered by heat waves. Schools in lower income neighborhoods were chosen because many people living there do not have air conditioning. These facilities will serve as "cooling centers" for citizens in the event of another crisis.

Add solar panels to the list of interesting things to spot along "the Strip" in Las Vegas. In the mid-1990s, the city constructed bus stop shelters along its famous boulevard, but forgot to include security lighting. Although electricity is easily available—in some cases underground wires are less than 50 feet away from the shelters—the local utility, Nevada Power, decided to rely on solar panels for lighting because they were cheaper than digging up the street and laying power lines.

Although solar energy remains the power source of choice for those living beyond the reach of power lines, remote residential applications constitute only a small portion of total use.

THE WAVE OF THE FUTURE

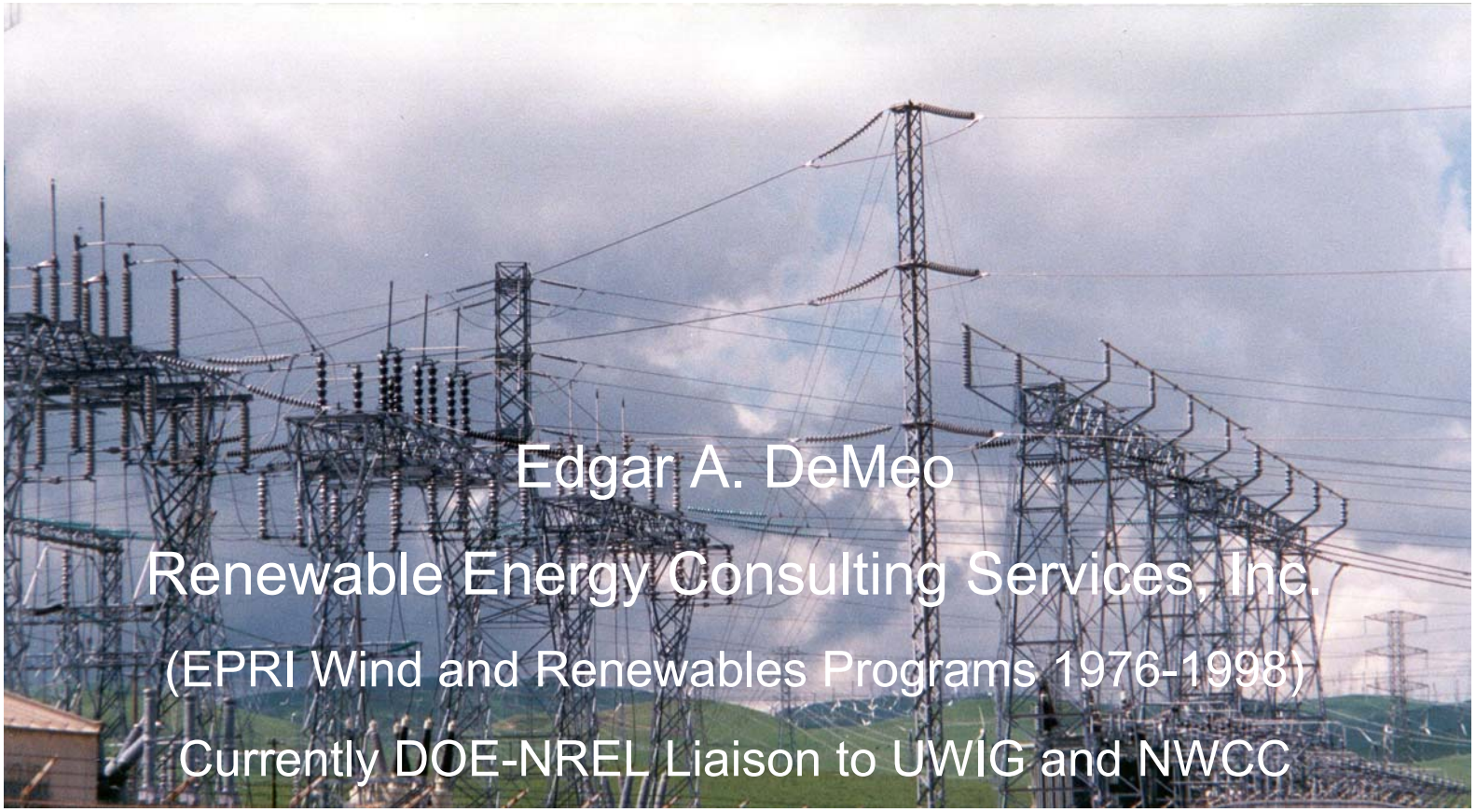
Kansas Representative Sloan says the public doesn't need to be coaxed to use power generated from renewable resources, but more has to be made available. "Public opinion polls show that citizens overwhelmingly support it," he says, "because it's cost-effective and can be used in concert with traditional fossil fuel plant operations."

Photovoltaic technology (PV) uses solar panels to convert light from the sun to electricity. PV can be used nearly anywhere because normal daylight is all it takes for a solar system to operate effectively.

State lawmakers need to consider incentives to stimulate electricity generation from renewable resources, he says, which is not only popular with the public, but can be beneficial to rural landowners and increase energy self-sufficiency.

"Legislators and regulators can provide minimal or no-cost incentives to individual landowners, utility managers and other interested parties to invest in renewable technologies that enhance a state's energy self-sufficiency," Sloan says. "It's something we all have to look at."

Wind Power Development Issues from an Electric Power Perspective: Electrical and Institutional



Edgar A. DeMeo

Renewable Energy Consulting Services, Inc.

(EPRI Wind and Renewables Programs 1976-1998)

Currently DOE-NREL Liaison to UWIG and NWCC

Wind Power's Natural Characteristics

- ***Remote:*** Wind resources often distant from major markets
- ***Variable:*** Plant output varies with variations in the wind
- ***New:*** Operators more comfortable with established power technologies

Key Issue: Should wind be disadvantaged by its natural characteristics ?

Characteristic: Remote
Key Issue: Transmission is Required

- Is there a nearby transmission line? **YES**
- Is capacity available?
  - contractually or in actuality
- How can access be obtained?
- Firm transmission rights: underutilized by wind
- Non-firm rights: can be curtailed, may be OK for wind, often not available long-term
- Is there a middle ground: flexible-firm?

Characteristic: Remote
Key Issue: Transmission is Required

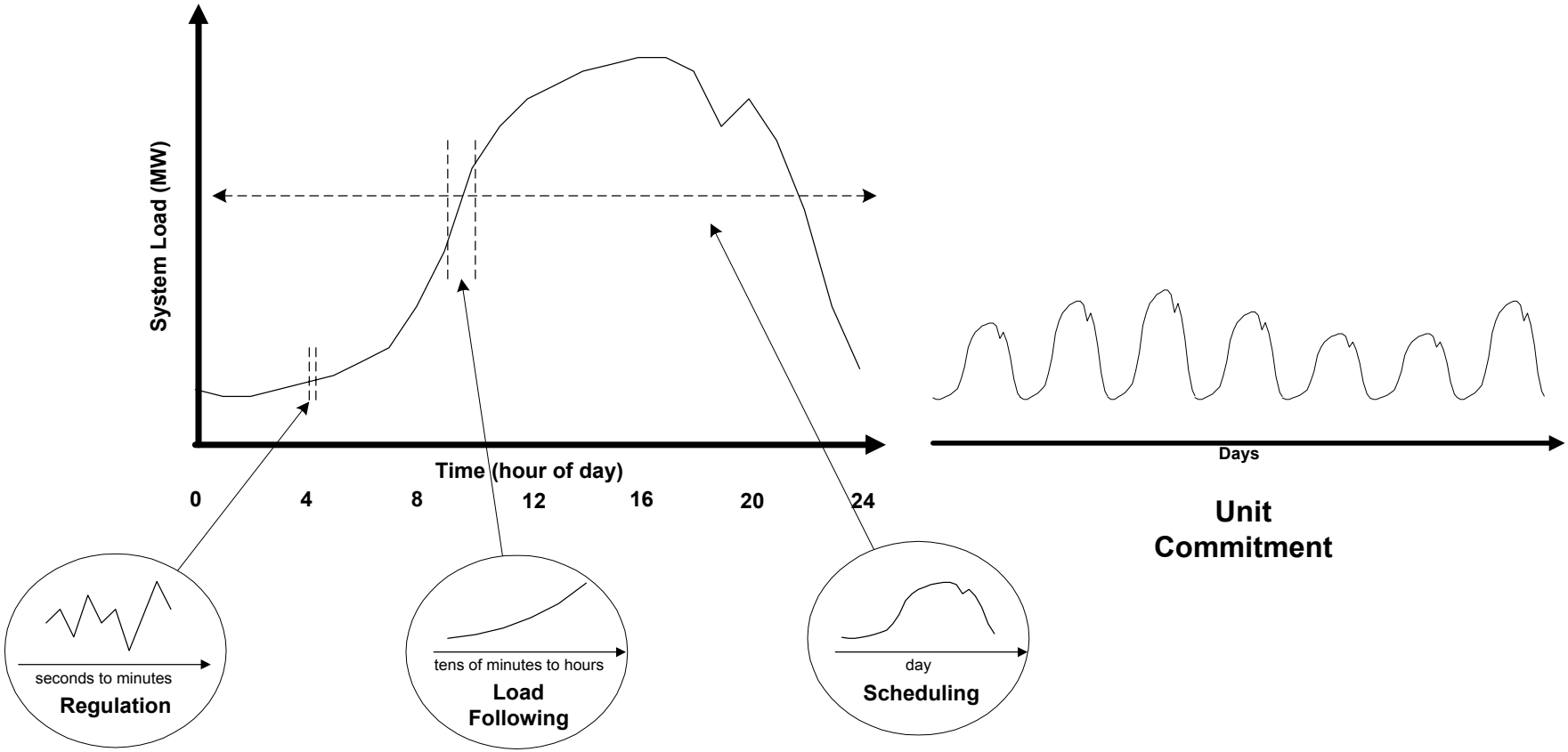
- Is there a nearby transmission line? **NO**
- Siting and approval process - can be complex, contentious and lengthy
- How are costs allocated? - to the wind plant (e.g., PJM) or to the overall system (e.g., TX)
- Will the return on investment be adequate?

Key Policy Issue: Is the transmission system a common carrier operating in the public interest ?

Characteristic: Variable
Key Issue: Controlled by Nature, Not Operators

- Power-system operational impacts
  - System stability -- sub-second timeframe -- historical concerns but problems unlikely
  - Regulation -- seconds to a few minutes -- similar to variations in customer demand (loads)
  - Load-following -- tens of minutes to a few hours -- usage follows predictable patterns, wind less so but this may improve
  - Scheduling and commitment of generating units -- one to several days -- wind impacts unclear

Time Frames of Importance



Questions in Control Area Operations Context

- Frequency control: *Do wind plants make it more difficult to regulate "frequency"?*
- Regulation: *Can wind plants affect or increase the area control error (ACE)?*
- Load following: *What happens if wind plant output decreases in the morning when load is increasing?*
- Scheduling: *How can committed units be scheduled for the day if wind plant output cannot be predicted? What happens if the wind forecast is inaccurate?*
- Committing generating units: *Looking out over the next several days, how should wind plant production be factored into deciding which generation units need to be available? Is the effective amount of reserves influenced?*

Possible Cost Impacts

- Committing unneeded generation increases cost
- Scheduling unneeded generation increases cost
- Allocating extra load-following capability increases cost
- Increased cycling operation increases maintenance costs
- Violation of system performance criteria can increase cost
- Most of these are reflected in ancillary services costs
- UWIG operating-impacts study attempting to quantify through actual utility case studies
- Incremental cost added by wind's variability: is it ~0.1¢/kWh or ~1¢/kWh?

Related Market Issues

- Bidding into energy markets
  - Penalties for differences between actual and bid
  - Northwest: 5% band, severe punitive penalties
  - Texas: no penalties within 50% band
- Improved wind plant forecasting will help
  - Relaxing penalties will help more
- Basis for penalties: encourage orderly operation, minimize gaming
  - Wind characteristics not considered?

U.S. - European Contrast

Europe: Wind power is environmentally preferred. How can we best accommodate it within the existing power system?

U.S.: How can we integrate wind into the existing system with minimal impact on conventional system operation?

Interconnection Impacts

- Key concerns: safety of people and equipment; integrity of overall power system
- Electrical requirements well understood
- New generator generally pays for impact assessment and interconnection equipment
- Upgrades to distribution system if needed: Who pays - generator, utility, society?
- Issues can be more significant for small turbines

The Environmental Perspective on Wind and State Policy

Mark MacLeod
Director, Special Projects

Steps in the Process

1. What is the goal? (Advocate)

2. Getting it adopted (Legislature)

3. Successful implementation (PUC)

Why is the Environment an Electric Utility Issue?

- power plants emit 20% - 80%

  of certain pollutants
- studies predict that competition will increase production and emissions from older plants
- 75% of population lives in, or next to, areas with unhealthy air
- Texas population will double in next 50 years

Why, part II

- meet energy needs while maintaining public health
- continue recent progress from Integrated Resource Planning
- strong public support for renewable energy
- public understands clean air is a public good

Why The Market Alone Will Not Provide A Substantial Amount of Renewable Energy

Who Pays	Impact on Monthly Residential Bill
Voluntary Green-pricing Only (5% residential take rate)	$ 63.40
Voluntary Green-pricing Only (2% residential take rate)	$ 158.50

Disclosure of environmental impacts of electricity generation

Electricity Facts

Generation Price

Average price (cents per kWh) for varying levels of use Prices do not include regulated charges for delivery service

Average Monthly Use	250 kWh	500 kWh	1000 kWh	2000 kWh
Average Generation Price	5¢	4.5¢	4¢	3.5¢

Your average price will vary according to when and how much electricity you use. See your most recent bill for your average monthly use and Terms of Service or your bill for the actual prices

Contract

See your contract or Terms of Service for more information

- **Minimum Length**: 2 Years
- **Price Changes**: Fixed over contract period

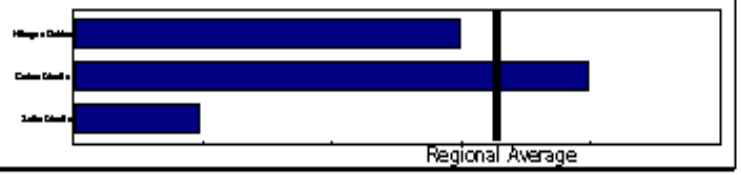
Supply Mix

We used these sources of electricity to supply this product from 6/96 to 5/97

Coal	30%
Natural Gas	20%
Nuclear	15%
Hydro	10%
Solar, Wind, Biomass	20%
Waste Incineration	5%
Total	100%

Air Emissions

Nitrogen oxides (NO_x), sulfur dioxide (SO_x), and carbon dioxide (CO_2) emissions relative to regional average



How it all began

- Environmental Defense established outline of issues in July and August
- Met with PUC Commissioners in Sept.
- Began discussions with Utilities and Industrial Customers in October
- Increased presence with Legislature as session began

Why Deal with Environmental Defense

- We wanted to be part of the deal
- We had the authority to sign onto a deal
- We said we would not renege on a deal
  - pointed to California experience
- We had clear goals but were flexible about design
  - system benefit v. portfolio standard

- What Environmental Defense could offer:
  - *a public interest group that would state that the bill provides benefits to residential customers because it improves their environment and protects the public health*

Staying on Message

- *If it isn't an environmental issue, we don't talk about it*

What the Legislature Cared About

- What will it cost
- Who is against it and why
- Prove to me it will work
- Help me build a case

Are you going to support my bill?

Ways to Provide Renewable Energy

1. **Establish a Renewable Energy Fund**

    - assign a charge per Kwh of electricity sold
    - distribute fund through an auction basis
    - only pay the money if energy delivered
    - insulates ratepayers from risk of bad projects
    - encourages competition within renewable industry

2. **Mandatory Portfolio Standard**

    - assign responsibility to companies to achieve the standard
    - reporting and accountability
    - penalties for noncompliance
        - penalty used to purchase renewable energy

3. **Variations on the mandatory standard**

    Trading - if company does not want to build or sell some or all of its renewable energy requirement it can buy excess renewable energy credits from others to meet the standard

    State Renewable Pool - if company does not want to build or sell some or all of its renewable energy requirement it can pay into a state fund that will purchase renewable energy

Renewable Energy Program

- Provides 2000 MW of additional capacity to be phased in by 2009
- PUC will allocate requirements to REPs, Municipals, and Cooperatives
- Capacity is only eligible if it performs consistent with industry standards and is on appropriate sites
- Can fulfill obligation with renewable energy credits

Principles

- Educate
- Keep it as simple as you can
- Make the cost of noncompliance greater than the cost of compliance
- Be reasonable

Difficult Issues

- Carve outs for specific technologies
- Definition of renewables
- What about existing resources
- To whom does the program apply?
- How do you measure performance?

Success

- Texas will develop well over twice as much new renewable energy as required by the first due date
- 1st proven success of the Act
- Cost is less than new natural gas generators
  - production tax credit
  - economies of scale
  - natural gas prices
- Value of wind as the “bonds” of a fuel portfolio is demonstrated
- Renewable energy is a significant part of utilities image advertising

Conclusion

- renewable energy will only overcome barriers and achieve its potential with affirmative state policy
- effective programs can be designed that tap into the power of markets to lower costs
- careful design leads to program success

State Policy Options for Developing Wind Power

Troy Gagliano/Matthew H. Brown

National Conference of State Legislatures

303.830.2200

contact us at: matthew.brown@ncsl.org or troy.gagliano@ncsl.org

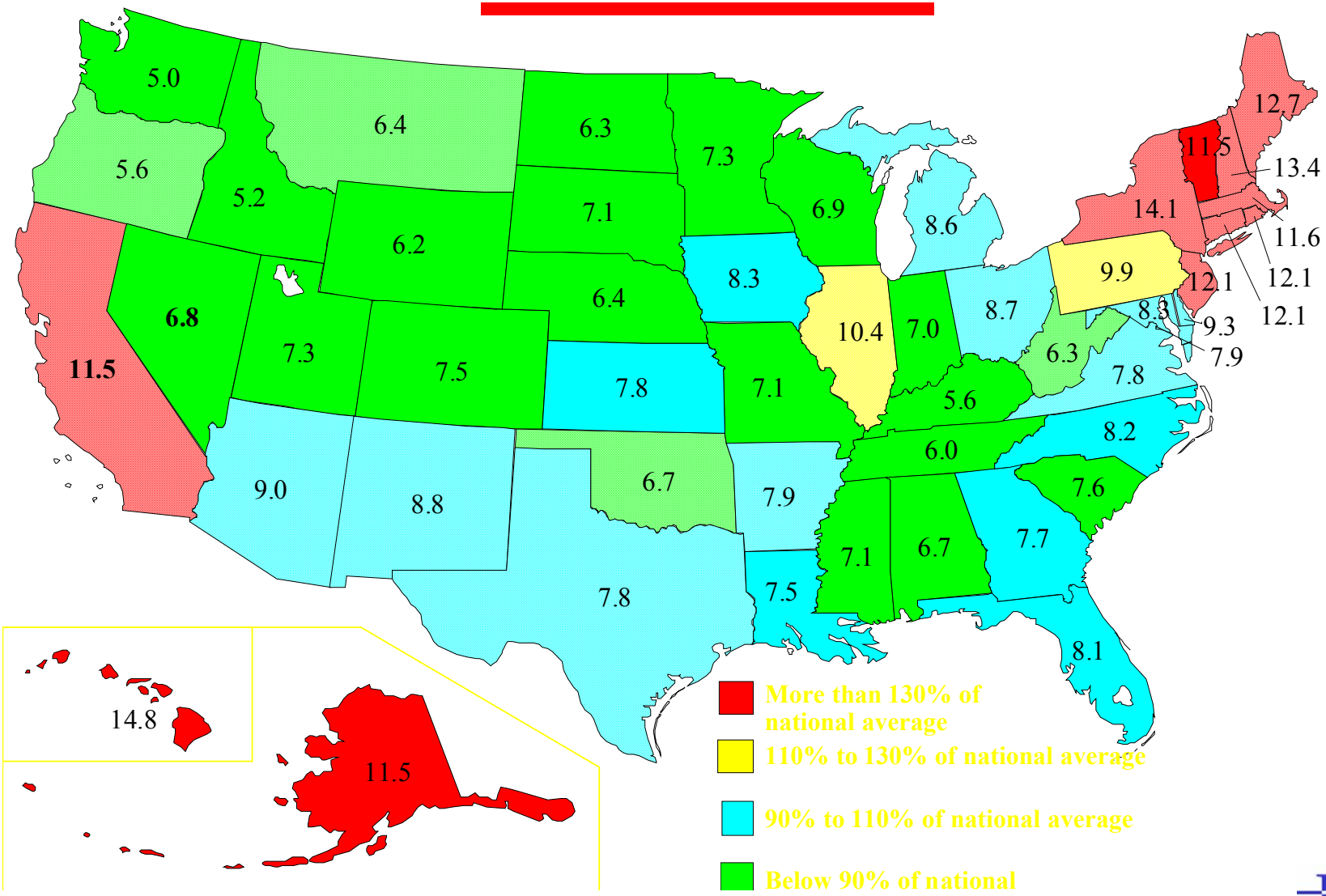
Introduction

- Factors helping wind power expand
- Landowner Royalties and Tax Revenue
- Policy Options Available to States
  - Property and Sales Tax Incentives
  - Net Metering
  - Systems Benefit Funds
  - Renewable Portfolio Standard
  - Disclosure and Certification

Remember Two Things!

- Wind is *one weapon* in an arsenal to combat electricity price spikes. These policies can be seen as helping establish a kind of insurance against high electricity prices.
- To get this part of an "insurance policy" against high electricity prices, states may need to consider policies supportive to wind.

Electricity Prices Compared to National Averages

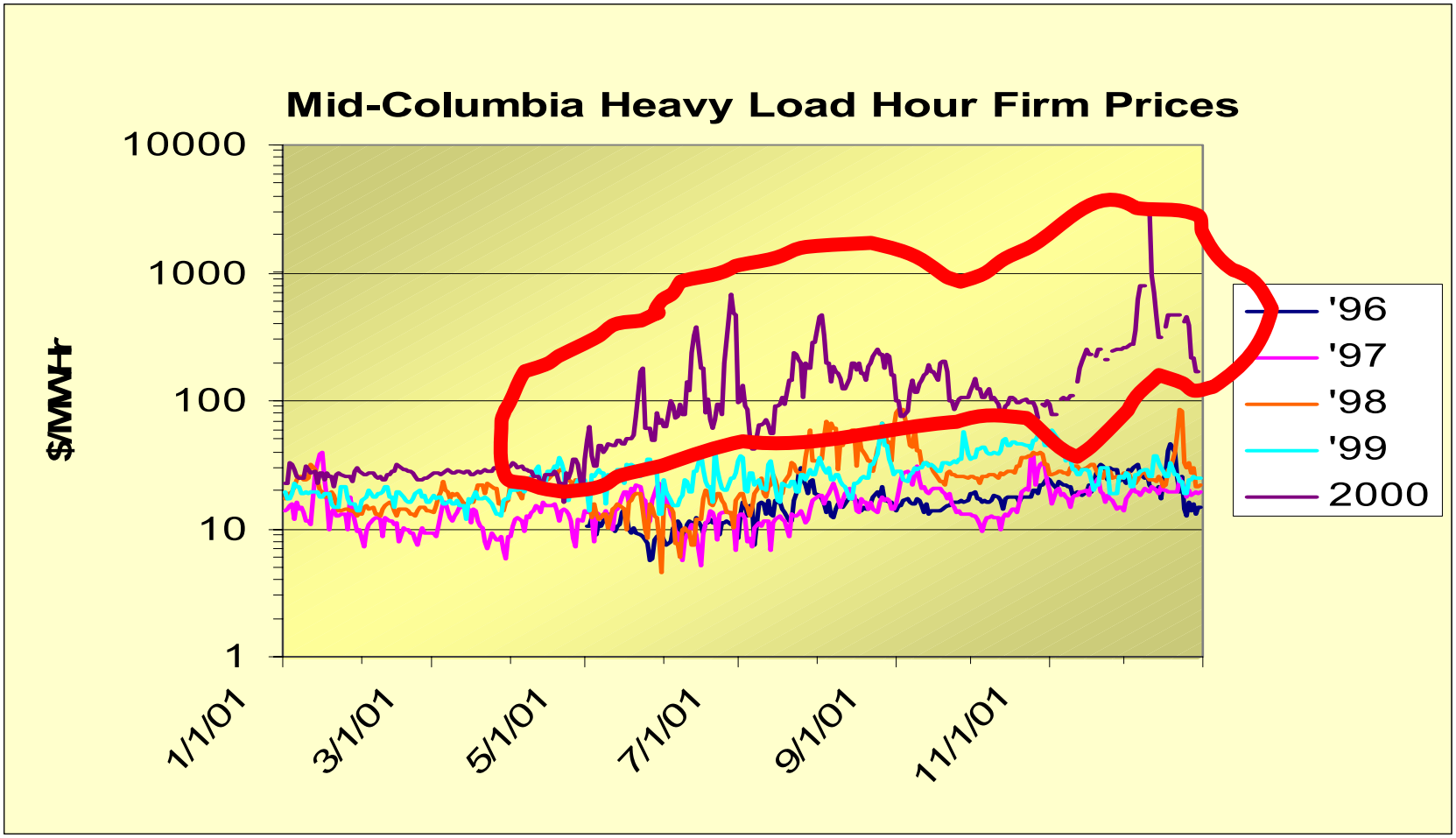


Source: EEI Statistical Yearbook Advance Release

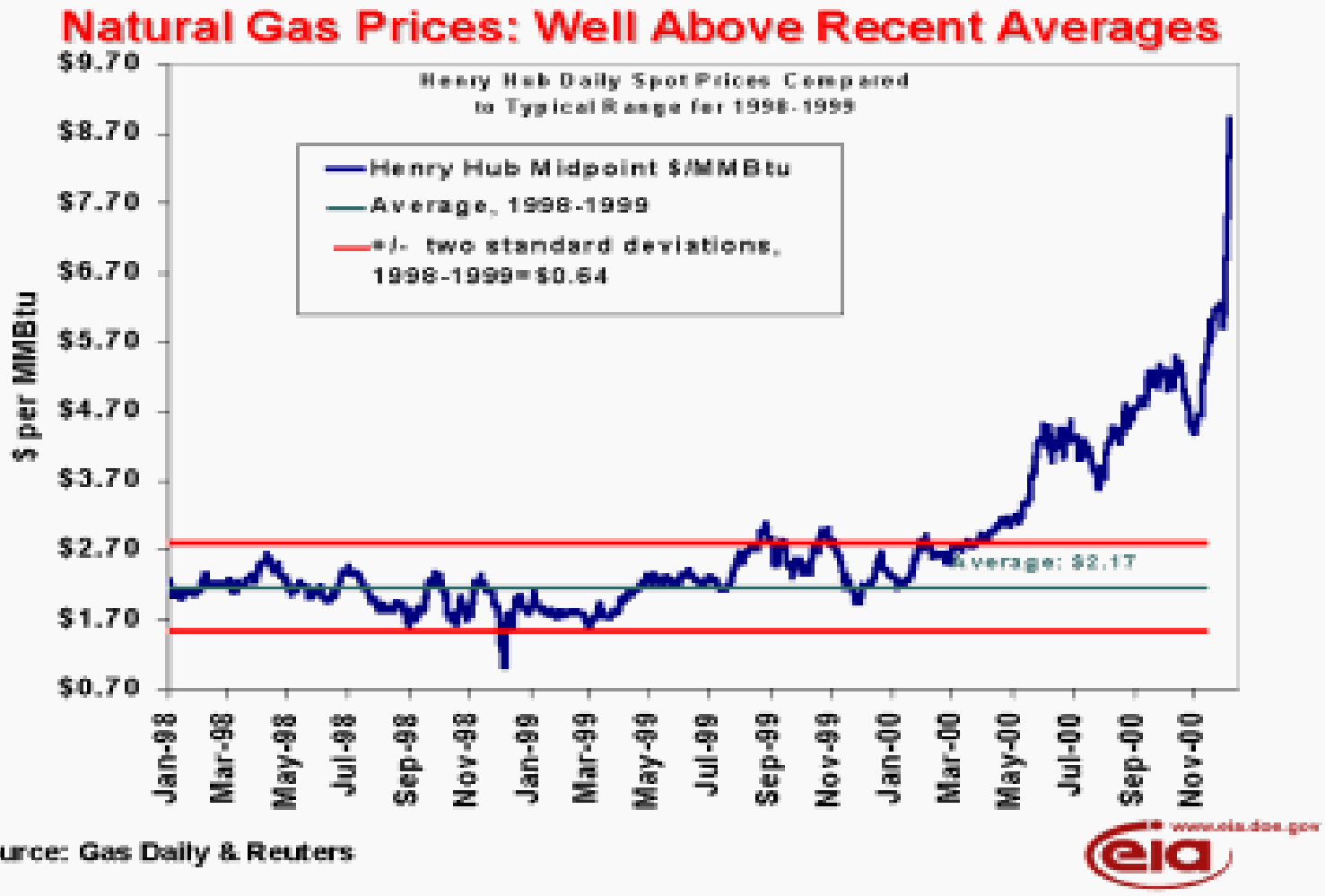
Cross Hatch indicates restructuring

EEI

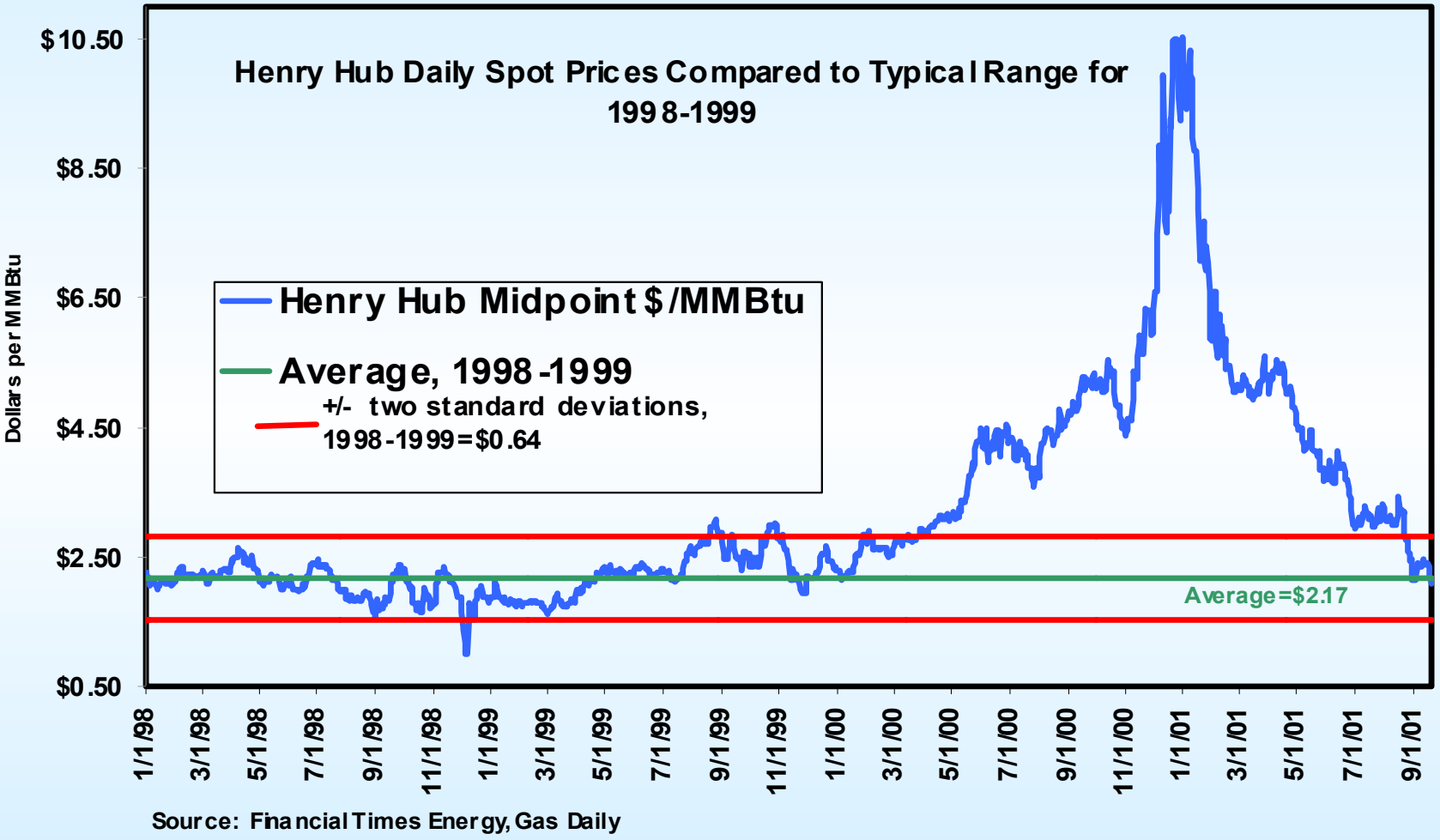
Wholesale Electricity Prices Last Year in the West



Natural Gas Prices, 1/98-11/00



Natural Gas Spot Prices in September 2001 Are Within the 1998-1999 range

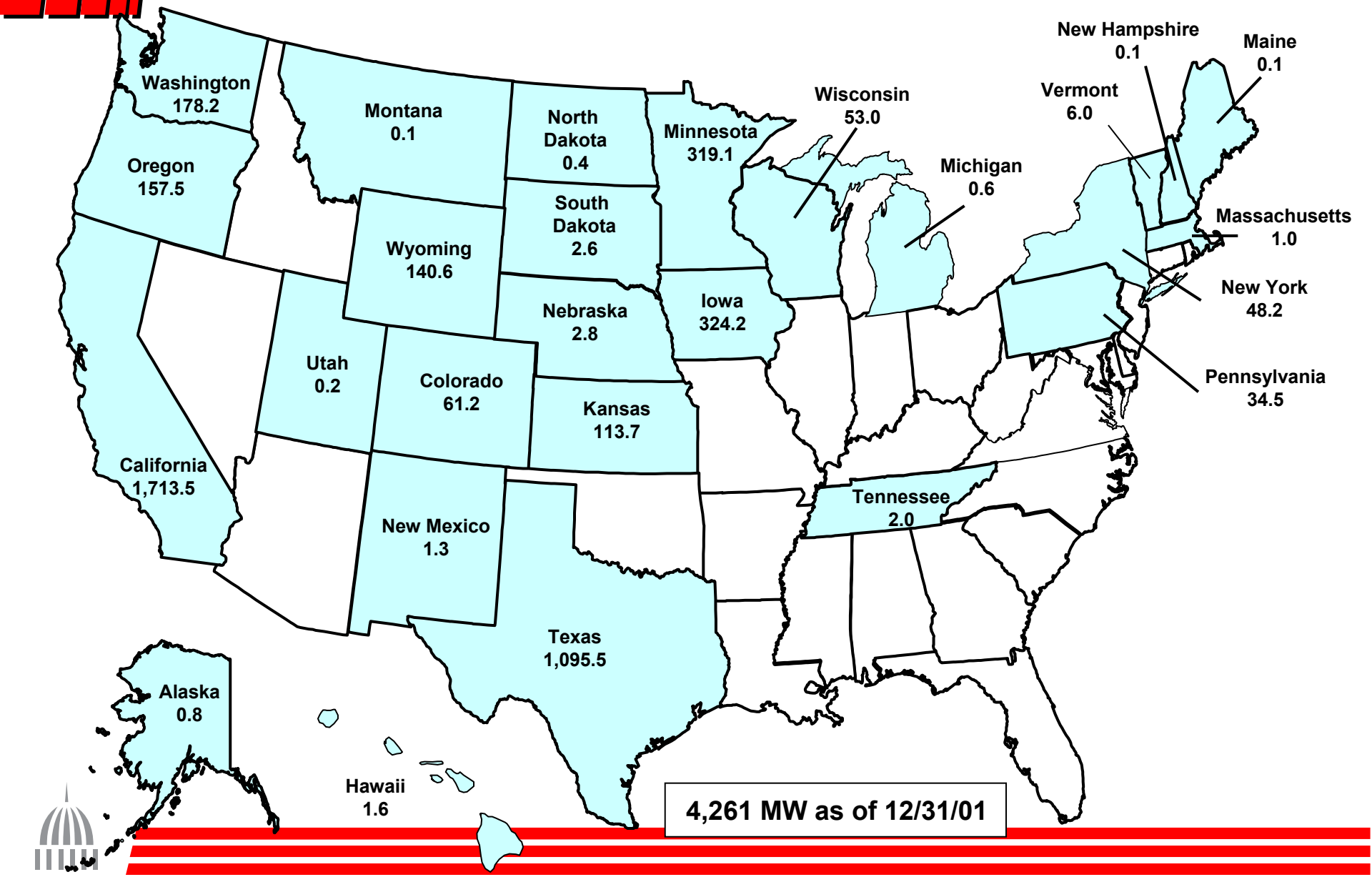


Source: Financial Times Energy, Gas Daily

Wind is currently the world's fastest growing energy source.

- Factors:
  - declining cost (4-6 cents k/wh)
  - technological advances
  - revenue for landowners & tax jurisdictions
  - consumer demand

United States Wind Power Capacity (MW)



Landowner Revenue From Wind

- Developers typically pay landowners ~$1,500-$2,000 per turbine, per year

- Amount depends on resource and lease
  - Annual payments or one up front
  - Many lease agreements up to 30 years
  - Footprint and roads ~ 1/2 acre each

Review of Policies

- Large-Scale Commercial Generation
  - Property Tax Incentives
  - Renewable Portfolio Standard
  - Disclosure and Certification
  - System Benefit Funds
- Small-Scale Generation
  - Sales Tax Incentives
  - Net Metering
  - System Benefit Funds

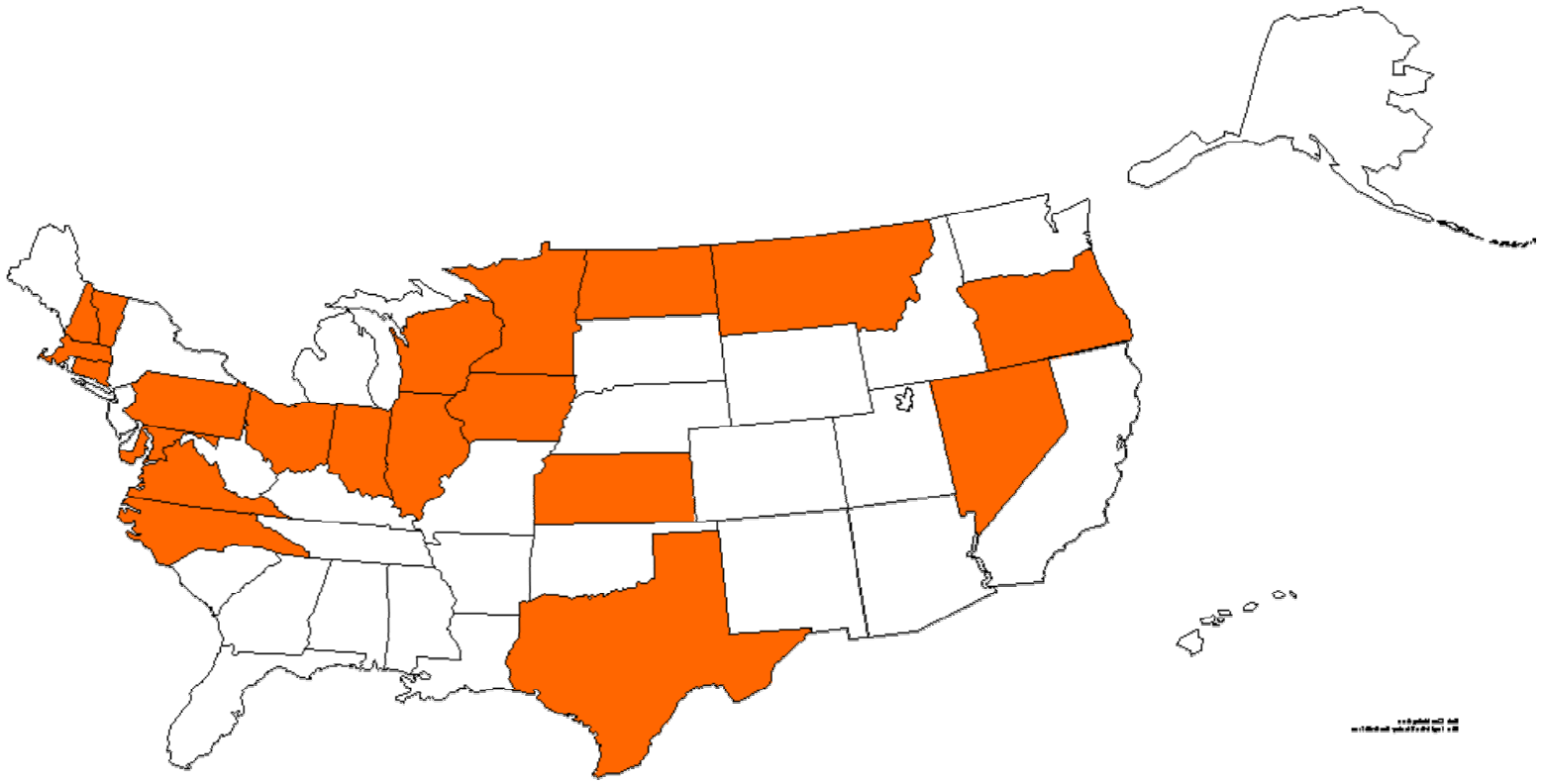
Property and Sales Taxes

- Property Tax Incentives
  - Encourage large scale wind development
  - Can generate significant $$$ for tax jurisdictions
- Sales Tax Incentives
  - Encourage small scale wind development

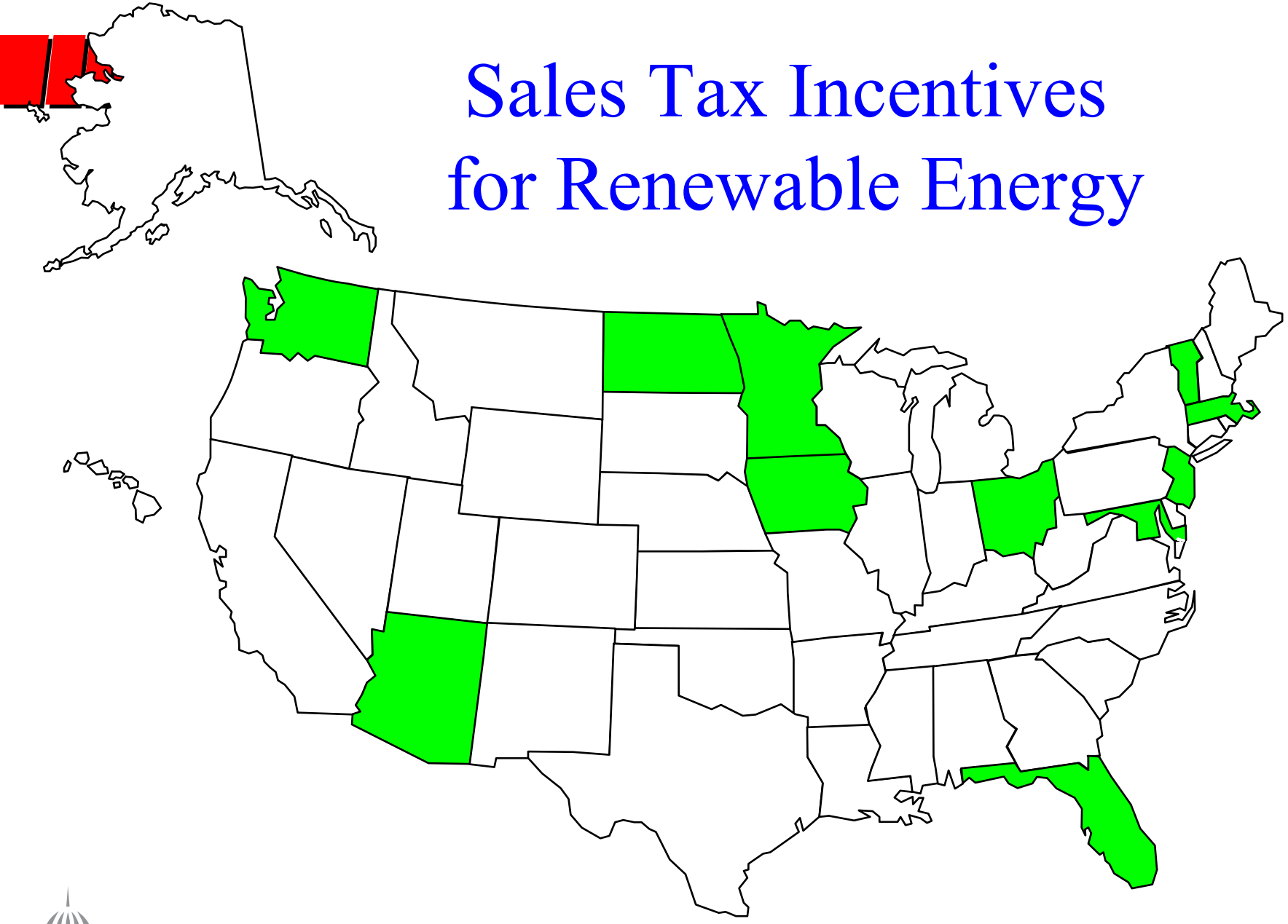
Property Tax in Different States

- Wyoming - Foote Creek Rim
  - $480,000 property tax in first year- Carbon Co.
- Texas - National Wind Power Site
  - ~ $400,000 annually for Pecos county
  - ~ $100,000 for school funds across TX
- Kansas - 100% unlimited exemption for developers generates $0 in property tax

Property Tax Incentives for Renewable Energy



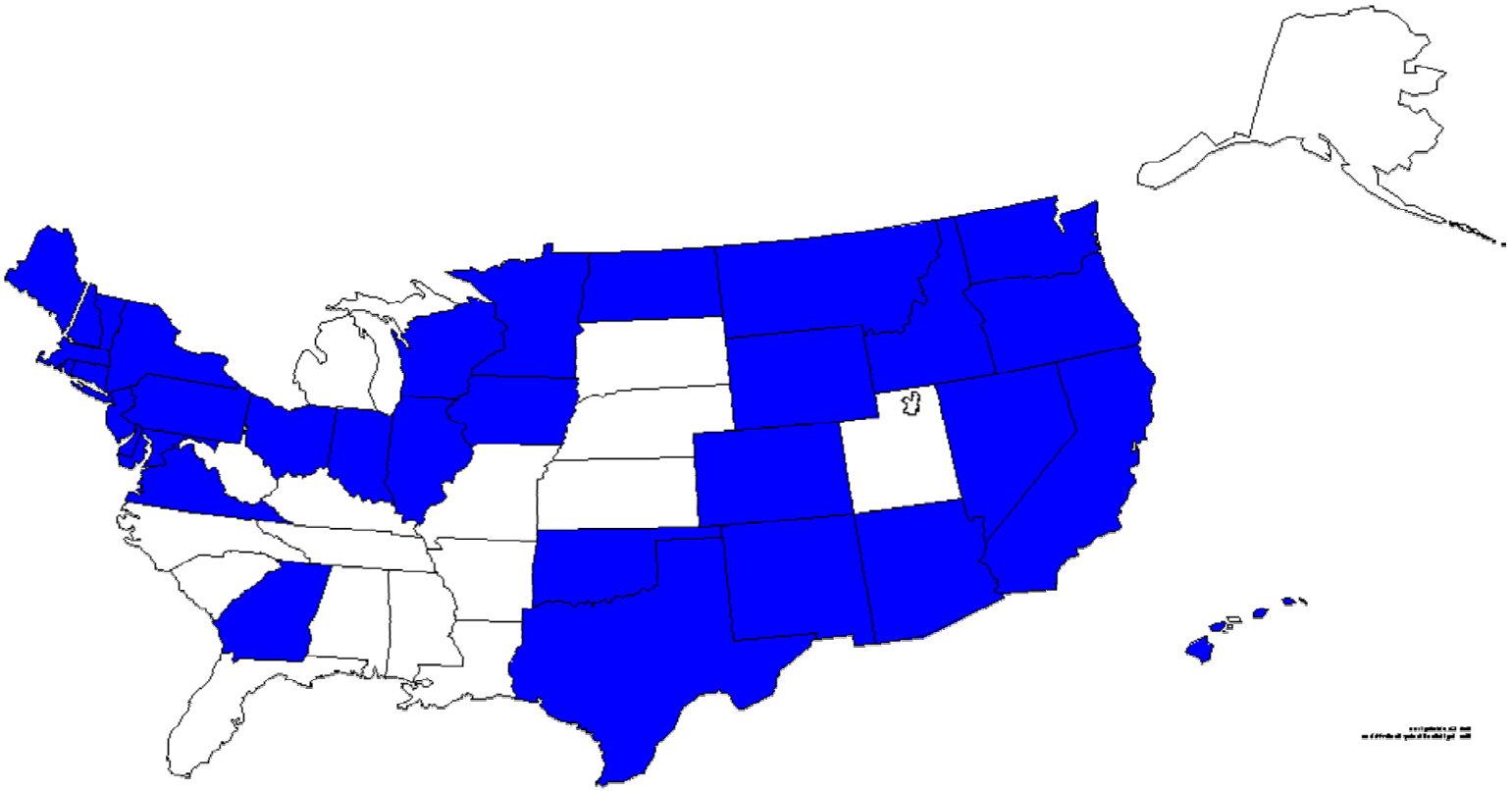
Sales Tax Incentives for Renewable Energy



Net Metering

- Definition
  - Allows small scale renewable generators to receive credit for power they generate
  - Essentially "run the meter backwards"
- Encourages small scale generation
  - Usually a cap placed on size of system (typically 25kw to 100 kw)

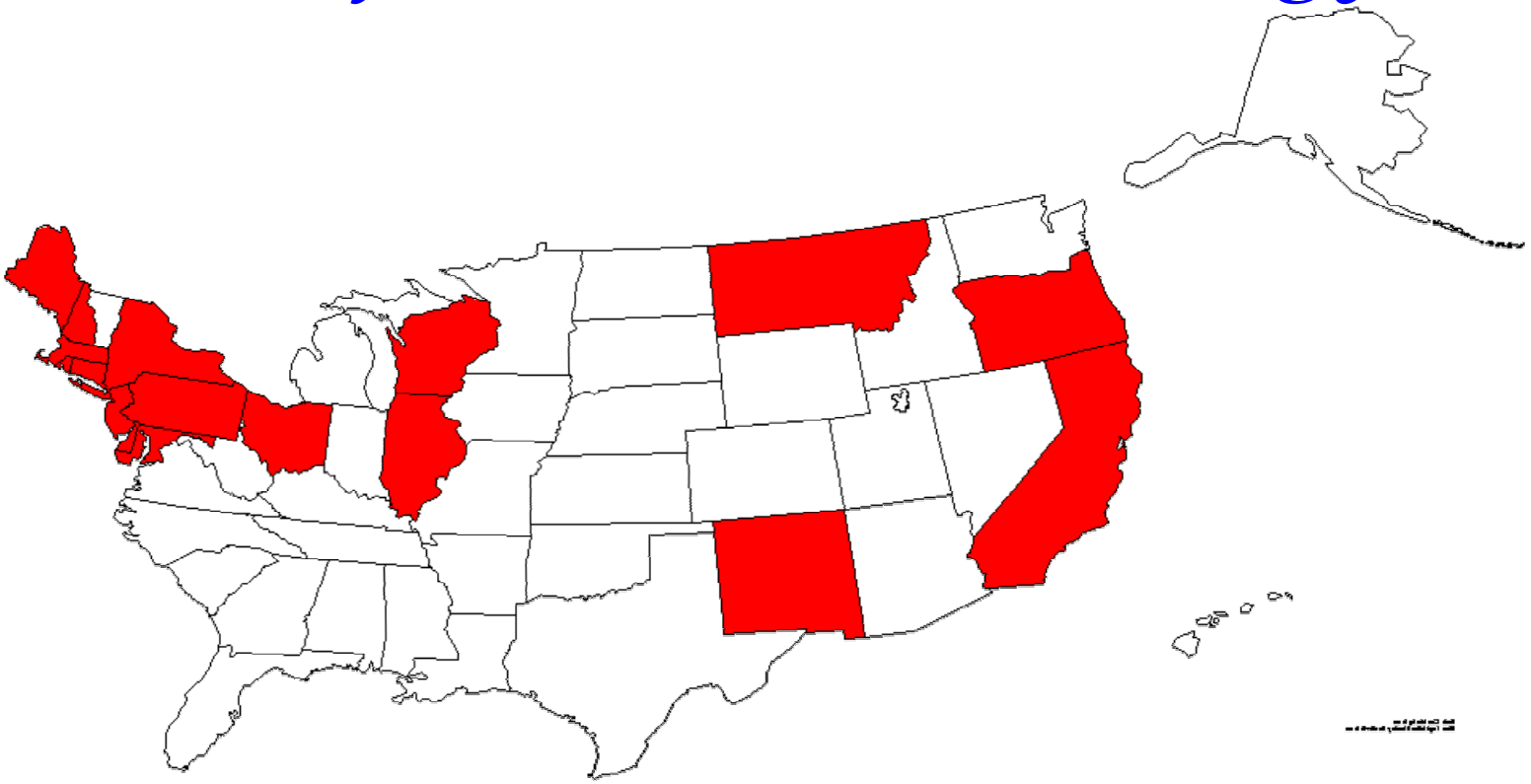
Net Metering Programs



Systems Benefit Funds

- Definition
  - A fee paid by all electricity consumers used to fund renewable energy, energy efficiency, low-income energy assistance or R&D
- Funds administered by utility or other entity
  - avoid co-mingling with state general funds
- Uses: fund rebate programs, grants and low or zero interest loans for purchase of renewable energy systems

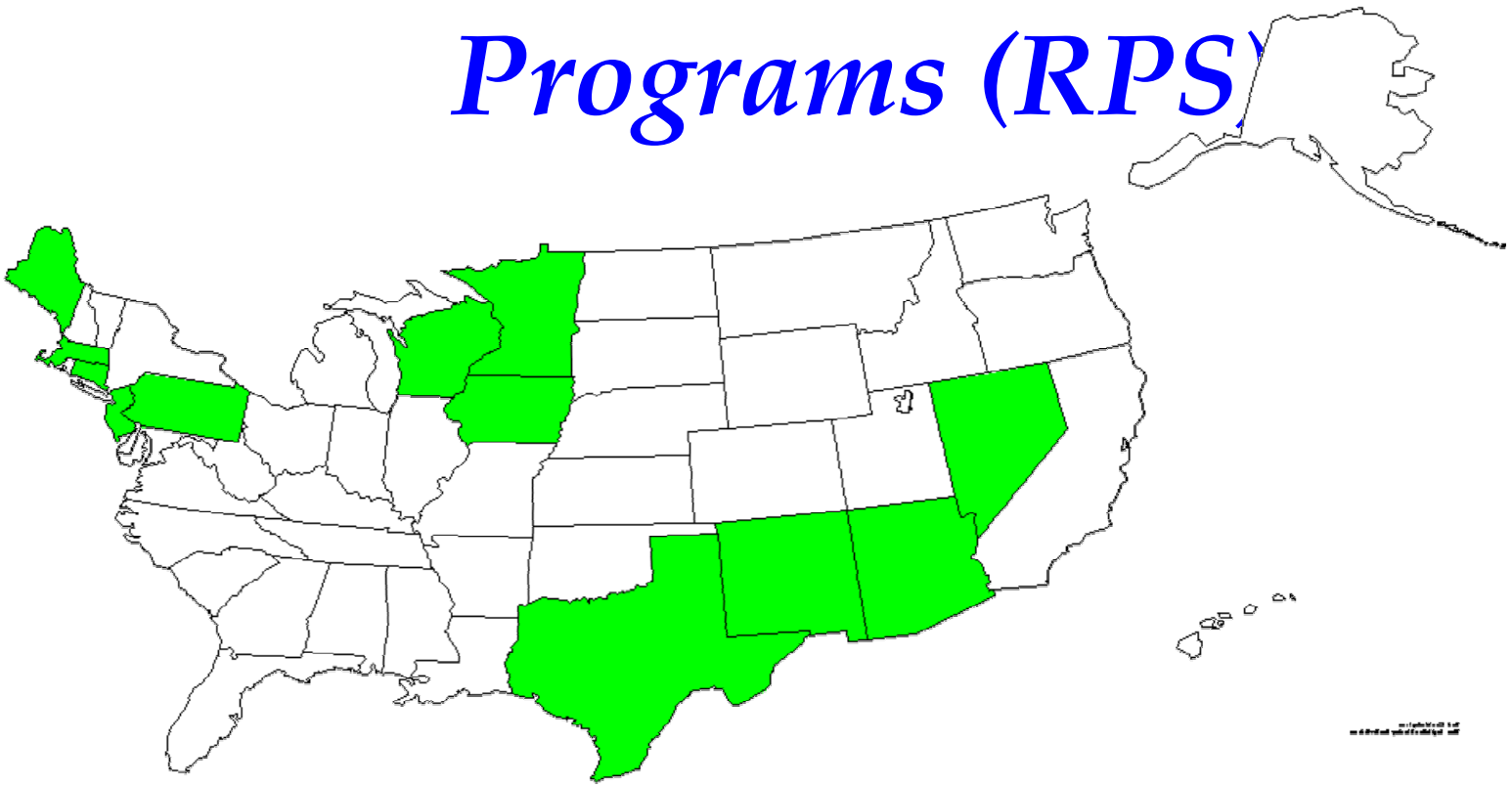
Systems Benefit Funds for Renewable Energy



Renewable Portfolio Standard (RPS)

- Definition
  - Requires all electricity retailers in a state to provide a specific amount of total power from renewable energy (commonly 5-7 percent)
- Achieves specific renewable energy targets
- Well suited to large scale wind power (>50 kw)

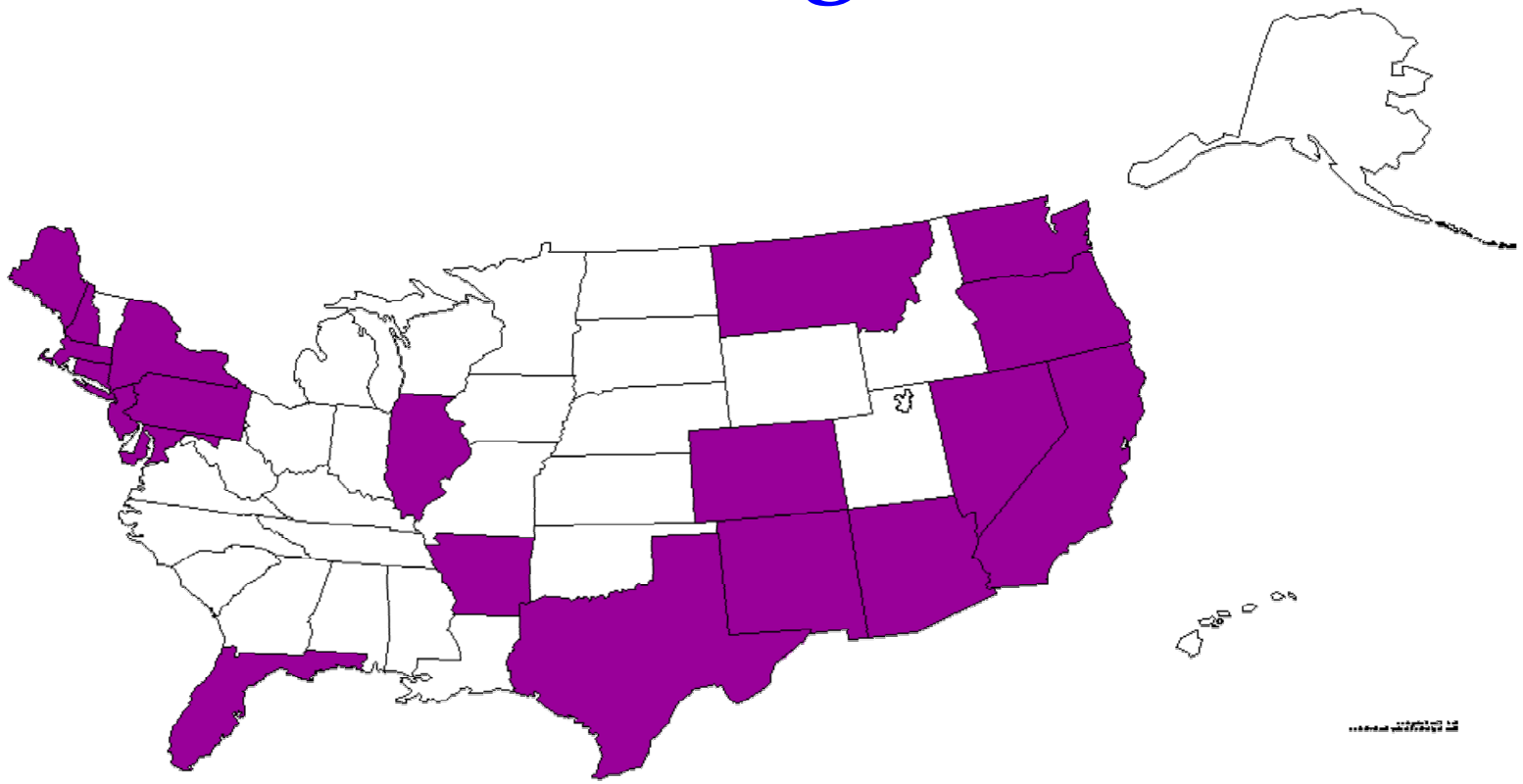
Renewable Portfolio Standard Programs (RPS)



Disclosure and Certification

- Definition
  - Fuel sources used to generate electricity are revealed on customer's bill
  - Some states also include emissions
- Educate consumers
- A sort of "truth in advertising" for electricity providers

Disclosure & Certification Programs



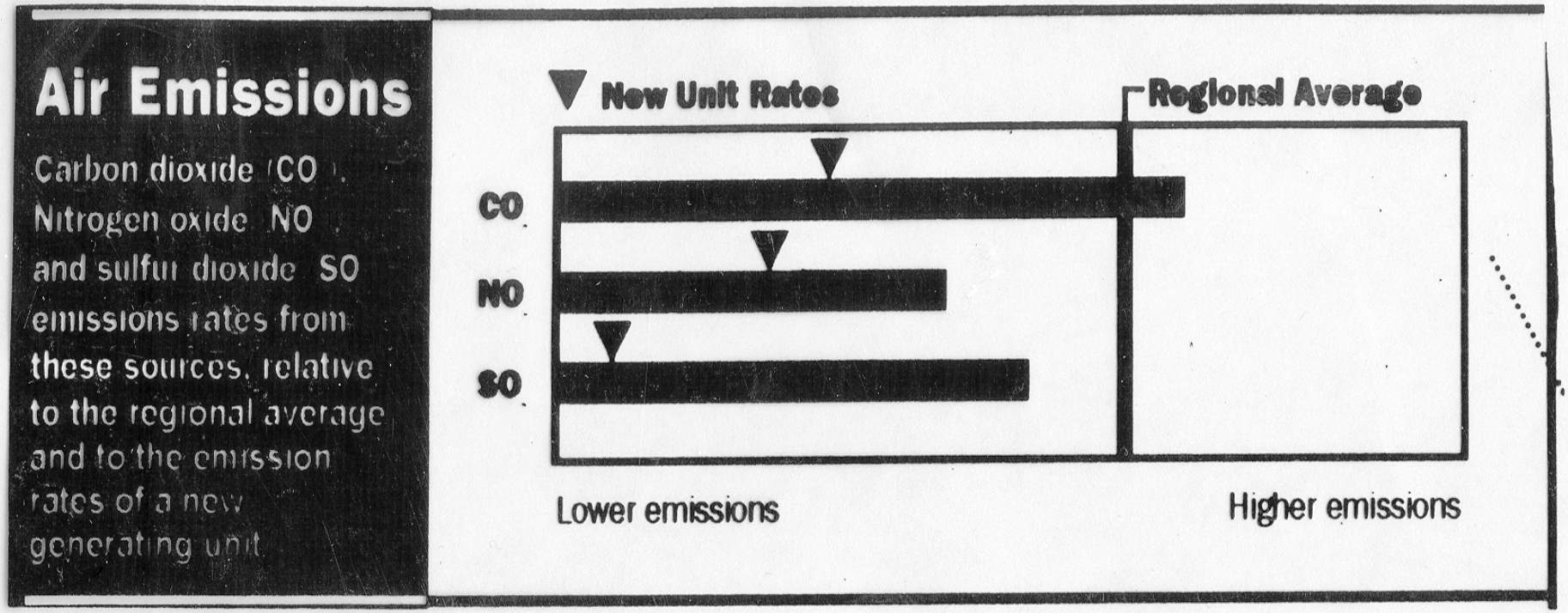
Review of Policies

- Large-Scale Commercial Generation
  - Property Tax Incentives
  - Renewable Portfolio Standard
  - Disclosure and Certification
  - System Benefit Funds
- Small-Scale Generation
  - Sales Tax Incentives
  - Net Metering
  - System Benefit Funds

Conclusion

- Restructuring not a prerequisite
- More than half the states harvesting wind
  - $$$ for landowners and rural communities
- Database of State Incentives for Renewable Energy
  - http://www.dsireusa.org
- Contact NCSL
  - 303.830.2200 extension 318 for Troy Gagliano or x183 for Matthew Brown
  - www.ncsl.org

Sample Air Emissions Disclosure



Status of Avian-Wind Turbine Interaction Issues

Energy Institute 2001
Power Markets and Wind Energy Issues
October 18, 2001

Karin Sinclair, Sr. Project Leader

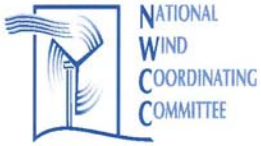
National Wind Technology Center

Why is there a concern for birds?

- The potential impact of wind turbines on birds, including resident, breeding and migratory species, has frequently been a concern at both proposed and existing wind power sites.

- The concern is driven by two primary factors: possible litigation over the killing of even one bird if the species is protected by the Migratory Bird Treaty Act and the Endangered Species Act, and the effect of avian mortality on bird populations.

National Wind Coordinating Committee (NWCC) Resource Document*



Avian Collisions with Wind Turbines:
A Summary of Existing Studies and Comparisons to Other Sources of Avian Collision Mortality in the United States

August 2001

Wallace P. Erickson
Gregory D. Johnson
M. Dale Strickland
David P. Young, Jr.
Karyn J. Sernka
Rhett E. Good

Western EcoSystems Technology Inc.

WEST, Inc.

**This document is being released as a Resource Document for educational and informational purposes. The document has been reviewed and approved by an NWCC working group with relevant experience; but, by choice of the NWCC, has not been carried through the full NWCC consensus process. Publication does not presume that all members have reviewed the content of the document.*

Estimates of annual avian mortality in the United States:

- Vehicles: 60 – 80 million
- Buildings and Windows: 98 – 980 million
- Powerlines: tens of thousands – 174 million
- Communication towers: 4 million – 50 million
- Wind Generation Facilities: 10,000 – 40,000

Relative Impact from Wind Turbines

- Annual avian collision mortality from all sources is estimated at 200-500 million
- Impact from wind turbines estimated at 0.01 percent to 0.02 percent (1 or 2 out of every 10,000) avian collision fatalities.
- For comparison, communication tower fatality estimates make up 1 – 2 percent (1 or 2 out of every 100)
- The low estimate of buildings/windows would comprise 25 to 50 percent of the collision fatalities.

Raptor Fatality Estimates
Based on Studies Conducted to Date

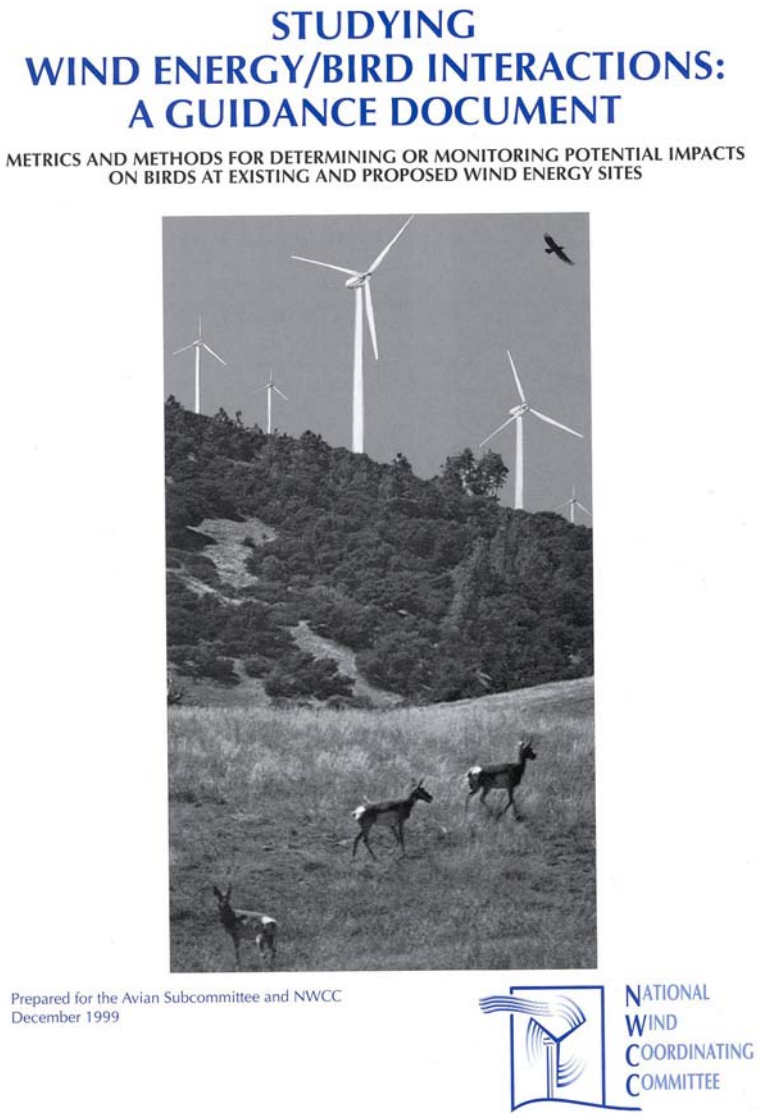
Estimated Mean Raptor Fatalities/Turbine/Year (2001)	
Outside California	0.006 (1,018 turbines)
California	< 0.048
Total U.S.	0.033 (9,148 turbines)

Source: Table 4

Permitting decisions should assure necessary environmental protection and respond to public needs. This NWCC document provides information on various permitting issues which should be addressed.

NATIONAL WIND COORDINATING COMMITTEE

National Wind Technology Center



Assessing the suitability of a proposed wind farm site with regard to avian concerns is an important component of overall site evaluation. This NWCC document provides guidelines for conducting avian assessments.

General Findings

There is no reason that avian issues should be a concern in future wind farm development; any potential problem should be identified and dealt with before micrositing occurs.

Layout of Foote Creek Rim windfarm is an example of using micrositing to minimize avian impacts.

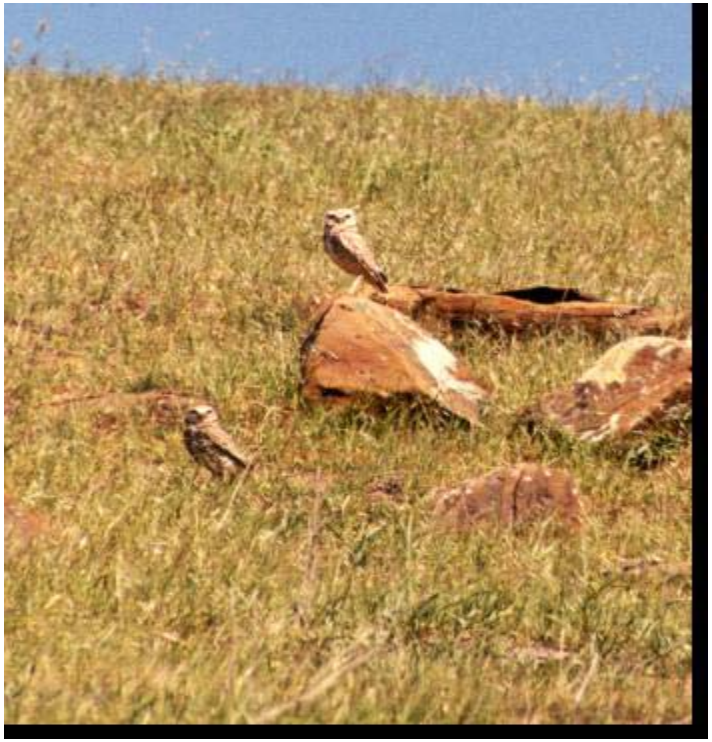
Summary of Findings

No biologically significant impacts can be found in the Tehachapi, CA, San Gorgonio, CA, Buffalo Ridge, MN or Foote Creek Rim, WY windfarms.

Preliminary data suggests no significant issues are likely in the Searsburg, VT or Ponnequin, CO WRAs.

Raptors are higher risk species

Golden Eagle



Burrowing owls

Concerns at Altamont

Results of studies to date suggest the most significant avian wind-turbine interaction problems are in the Altamont WRA.

Fatalities are not likely caused by perching but rather due to topographical factors and perhaps presence of prey.

Red-tailed Hawk

Topographical features, turbine location, and perhaps prey play a key role in bird-wind turbine interactions

Impact Avoidance

- **SITING IS THE KEY!!**
- **Avoid building another Altamont.**
- **Assess the site for suitability BEFORE construction.**
- **Easier to develop safe site than retrofit a problem site.**
- **Monitor post construction to be able to respond quickly if necessary.**