Accelerating Wind-Power Development in Nebraska

Status, Recommendations and Perspective
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Summary

Wind power is entering the mainstream of electric power generating options. Over 25,000 MW of wind generation is now operating worldwide. The great majority of this is in Europe, in response to strong public demands and resulting policy initiatives that encourage the deployment of wind and other clean renewable energy technologies. In the United States, over 4,500 MW of wind generation is operating as of the end of 2002. Over 1,000MW of new wind generation has been installed in the last two years in the U.S., and the majority of this is located in the windy central region of the country from the northern Great Plains to Texas.

Although the wind energy resources in Nebraska are among the best in the country, very little of this recent wind development is located in Nebraska. There is one, pioneering commercial wind installation in the state, a 10.5 MW plant in Kimball built by the Municipal Energy Agency of Nebraska (MEAN); but over the past several years in the states surrounding Nebraska, wind plants sized in the hundreds of MW have been built or are now in the construction phase.

The primary reasons for this difference are that, (a) unlike other nearby states, Nebraska has not enacted any policies to encourage wind development; and (b) public ownership of the electric power system in the state precludes access to a federal wind incentive – the wind energy Production Tax Credit (PTC) – that is available throughout the country. While wind power costs have progressed to the point where some prospective projects are cost effective without any incentives, wind project developers have focused their attention in states that present a more favorable business climate for their activities.

In recognition of this situation, Nebraska's Governor Johanns has sought means to bring wind power – and its associated economic development and environmental benefits – to the state. Consequently, the Nebraska Energy Office is pursuing measures to improve the opportunity for wind development in the state. Toward this end, Renewable Energy Consulting Services, Inc. was engaged to help develop approaches for encouraging wind within the state's electric utility sector.

In the course of this project, undertaken in November and December of 2002, meetings were held with a number of Nebraska stakeholders from the electric power, environmental, state and local government, and tribal sectors, as well as from the general public. These interactions and earlier work with the Governor's Wind Energy Task Force indicate clearly that Nebraska citizens in general are strongly supportive of efforts to encourage and develop wind power in the state.

As requested by the Nebraska Energy Office, wind development was considered in the context of four different types of electric utility entities: large public power

district, one or more smaller municipal utility systems, rural electric district, and Native-American jurisdiction. The objective was to recommend approaches that could be taken within the existing framework to move wind forward, and then to develop recommendations on measures the state could pursue to accelerate wind development in the state.

Wind in the Current Electric Power Framework: The large public power districts will evaluate prospective wind projects on the basis of cost comparisons with conventional alternatives. The aim is to select the least cost option, with costs measured in conventional, direct terms. Non-monetized benefits and impacts, or externalities, are not considered. By statute, this is the procedure required for approval by the state's Power Review Board, which must approve any electric power project in the state before construction can proceed. Fortuitously, the Omaha Public Power District (OPPD) has just conducted an evaluation of this type, which provides a credible base case for wind plant consideration. Reasonable variations from the OPPD base case can result in selection of wind as the least cost alternative today for a number of projects; there are indications that this is beginning to occur. If one or more of the acceleration measures summarized below comes into play, then considerably more wind generation can be incorporated into the large public power district generation mix.

The smaller municipal systems and rural electric districts will find it more difficult than the larger utilities to satisfy the current least-cost criterion that the PRB must apply. This is so because the size of wind projects appropriate to their needs would generally be smaller, leading to higher wind energy costs. These smaller utility entities could move forward by pursuing joint projects, thereby aggregating electrical load and pooling assets like attractive plant sites, power plant operating experience and financing capability. The rural electric districts are not likely to pursue a wind project independently, because these entities have no history of power plant ownership and operation. Instead they are much more likely to participate in joint projects. Tribal entities may also benefit from joint pursuit of wind projects with a wholesale electricity provider or one of the smaller utility entities.

A number of smaller municipalities would prefer to start small with wind in order to minimize their risk exposure – even though higher wind energy costs would result. These communities would be assisted greatly in such an endeavor if the PRB were given latitude to override the least-cost requirement in the event that a community wished to pursue a small project to obtain public benefits that aren't currently reflected in direct costs. This would require a statutory change.

Policy Options for Consideration: Several policy options for Nebraska are presented that would accelerate the introduction and use of wind power in the state. All but one of these are likely to be revenue neutral with respect to the state's budget. The first is to **generalize the least cost statute** that governs the

PRB's decision process. This would allow consideration of currently non-monetized benefits of clean renewables like wind power; including, for example, cleaner air and water resulting from emissions reductions, reduced health risks and costs, fuel diversity and energy security, and economic benefits from developing and utilizing an indigenous resource as opposed to exporting dollars to import fuels. While these benefits are difficult to quantify, even a very small allowance for them would often be sufficient to tip the scales in favor of wind. With respect to budget impacts, this measure would have no impact on state or local revenues. Initially, it might result in a small but nearly imperceptible increase in local electricity rates; but in the longer run the net economic impacts are likely to be positive as the expected benefits materialize.

The second option is to **allocate transmission costs for new wind plants over the entire transmission network in the state.** This would reduce the effective capital cost of wind plants when comparing with conventional alternatives – perhaps by about 5% – and is similar to a provision already operating in Texas. This measure would have no impact on state or local revenues, and would have a negligible impact on electricity rates throughout the state.

A third option is to enact a **sales tax exemption for renewable generation**. This also would reduce the effective capital cost of a wind plant by about 5% and ease the least-cost burden. Electricity rates would not be affected, but there would be a resulting loss in state revenue. If 600 MW of wind generation were built over a ten-year period – which is about 10% of the state's generation – then the revenue loss would average approximately $3 million per year.

A fourth option is to institute a **state production incentive for wind power**. At a level of 1¢/kWh over a 30-year plant life, this would compensate for the inapplicability of the federal PTC in Nebraska. If 600 MW of wind were then installed in the state, this would require revenue at peak of about $18 million per year. However several options exist for reducing and even eliminating this impact on state revenues. First, any payments received from the federal Renewable Energy Production Incentive, or as a result of tradable federal tax credits that might materialize in the future, could be applied to offset the proposed Nebraska incentive. These measures are highly uncertain, however. A more attractive and reliable option would be for the state to offer green tags to those wishing to purchase the environmental attributes of wind energy. Markets for these tags are being established today, and green tags are being sold at prices in the range of 1 to 2¢/kWh of generated electricity. Hence it is likely that Nebraska can finance a production incentive entirely through the sale of green tags, thus avoiding any negative impact on state revenues.

It is important to remember that some wind projects are likely to make economic sense in Nebraska today without any incentives. Therefore, those wishing to pursue projects on their own without participating in, or waiting for, any incentive

program should be allowed the flexibility to operate outside of the framework of any incentive program that might be enacted.

One other incentive program that has been highly successful in other states is the Renewables Portfolio Standard (RPS), which specifies that a specific portion of retail electricity supply must come directly or indirectly from renewable sources in conformance with a specified time schedule. It is likely that an RPS could work well for Nebraska, but there is clearly a strong distaste for mandated programs in the state. Consequently the chances of legislative success are lower for this incentive option than for the others discussed.

Overall Perspective: Nebraska has a unique government-utility opportunity to develop wind power for the benefit of its citizens and the U.S. as a whole – unique because Nebraska is the only state where the electric power infrastructure is essentially all publicly owned. The Governor and a number of the state's legislators have shown leadership in articulating this opportunity. In response to public support for clean renewables like wind, some of the state's smaller utilities and their statewide energy agency have taken pioneering steps. The time is now right for the legislature as a whole and the state's larger utilities to pick up the ball and bring their considerable resources and experience to the table with the Governor in order to realize the vision that so many in Nebraska have expressed.

Introduction

Wind power is becoming a mainstream electric-power option worldwide. Over 25,000 MW of wind-electric generation equipment is now operating, with some 4,500 MW located in the United States. Of that 4,500 MW, nearly a quarter exists in the states surrounding Nebraska; but to date only 15 MW of wind generation has been installed in Nebraska. Since Nebraska's wind energy resources are among the best in the nation, it is natural to ask why so little wind development has occurred so far in the State.

In recognition of the State's low level of wind activity, and driven by a concern that an important opportunity for local economic development and environmental improvement may be slipping away, Nebraska's Governor Mike Johanns has asked the Nebraska Energy Office, the State's electricity providers, and other interested parties in the State to examine and recommend means for realizing wind's potential in Nebraska – consistent with sound business and public-policy principles.

As a part of efforts to examine wind power for the State, the Nebraska Energy Office, with the financial support of the U.S. Department of Energy, has contracted with Renewable Energy Consulting Services, Inc. to assist in the development of practical approaches to accelerating wind-power expansion in Nebraska. The results of the contracted effort, conducted primarily in November and December of 2002, are reported in this document.

Objectives

The project's overall objective is to develop several approaches to stimulate the use of the state's wind energy resources for electricity production, either for in-state consumption or for sale to others; and to develop recommendations on actions that would improve the chances of successful wind power development.

Four distinct models for the development of wind energy were to be prepared:

- **Native American/Tribal Model.** This model envisions one or more Native American Tribes based in the state becoming producers of wind energy for on-reservation use and for sale.
- **Large Public Power District Model.** This model envisions a large, primarily generation-only utility developing wind resources for in-state consumption as well as export.
- **Single Rural Electric System Model.** This model envisions a typical rural utility with no generation experience developing wind resources for customer use as well for sale to others.
- **Multiple Small Municipal System Model.** This model envisions several small, geographically dispersed municipal systems developing wind resources, that may or may not be nearby, primarily for local consumption.

For each of the above situations, the following issues were to be addressed:

1. Financing methods for wind resource development.
2. Statutory issues that may need to be addressed to foster wind resource development.
3. Any governance issues that might arise.
4. The impact of the National Energy Bill provisions now under consideration by Congress.
5. Any issues related to non-customer consumption of wind-generated power such as power sales to other utilities in the state or for export.
6. Cost analysis of each model, including identification of any methods to "close the gap" between traditional generation sources and energy produced from wind.
7. Identification of potential problems or barriers that may be encountered with each model.

Approach

Two workshops were a central part of this work. At the first, held November 12 in Lincoln, a wide-ranging discussion took place on wind power's status and issues, worldwide, nationally and locally. About 25 Nebraskans from differing perspectives offered inputs and feedback on wind power's prospects, promise and challenges. At the second, held December 13 in Lincoln, we discussed specific issues associated with each of the four deployment modes listed above. Appendix A includes the agendas for these two meetings and a list of workshop participants. In addition, a follow-up meeting was held on December 20 in Lincoln with two representatives of tribal interests.

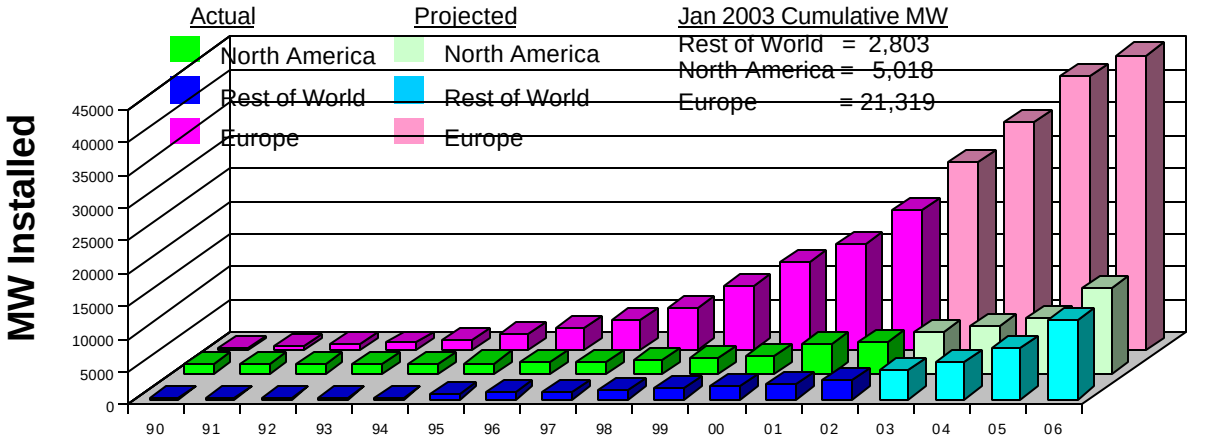
Meetings were also held with senior management representatives of OPPD and NPPD on December 12. Some members of the NPPD Board of Directors also participated. In addition, a December 20 meeting with Governor Johanns and top managements of Nebraska energy firms provided important insights.

Past experience gained in Nebraska over the past two years as a participant on Nebraska's Wind Energy Task Force, assembled in Fall 2000 at the request of the Governor, was also helpful in developing insights and conclusions. Experience with Nebraska's electric utilities and many other U.S. utility programs in renewable energy during 25 years of related project and program management at the Electric Power Research Institute also provided important relevant background.

The inputs obtained from Nebraskans over the past several months, coupled with reflections based on relevant past experience and the more-recent Nebraska interactions, form the basis for this report and it's recommendations.

Wind Power Status Summary

Wind power deployment and use has been expanding at annual growth rates above 20% over the past decade. Over 25,000 MW of wind are currently in service worldwide, and similar growth rates are projected for the next several years. The great majority of this generation is located in Western Europe, driven by public attitudes that strongly favor emissions-free energy devoid of waste-management issues and concerns about fuel availability and accidental or intentional disasters. Figure 1 shows wind power's deployment history and future projections over the period 1990 through 2006.



Sources: BTM Consult Aps, March 2001
Windpower Monthly, January 2003
National Renewable Energy Laboratory

Figure 1: Cumulative Installed Wind Power Generation

Europe

The substantial actual and projected growth of wind in Europe is driven primarily by commitments to reduce greenhouse-gas emissions. The European nations have subscribed to the 1997 Kyoto Protocol, whereby developed countries are to reduce their greenhouse gas emissions to levels at least 5% below 1990 levels by 2010. Also in 1997, the European Union adopted a target to obtain 12% of its total energy supply from renewable sources by 2010 – double the amount obtained in 1997. A substantial portion of this new renewable energy is to be supplied by wind power, resulting in aggressive wind power expansion goals in most of the European countries. In general, national wind power goals set by the Europeans over the past decade have been routinely exceeded. Germany alone

has over 10,000 MW of wind power installed. And Denmark, with a goal of 50% of its electricity from wind power by 2030, has already achieved over 15%.

United States

Modern U.S. wind power development began in the early 1980s in California. The industry experienced substantial ups and downs and many growing pains through the 1980s and early 1990s, but by the mid 1990s was showing signs of maturity. Since that time, although many of the California plants continued to operate, the great majority of U.S. wind development has occurred in states other than California. This has been due primarily to policy initiatives adopted in other states to encourage wind power growth, as discussed in a subsequent section of this report. Today, wind power is on the threshold of the electric power mainstream in the U.S., and most would agree that it has passed that milestone in Europe.

The early California wind development was driven by a combination of federal and state incentives for wind and other renewables. These expired in the mid 1980s, which resulted in a substantial lull in new installations and a major shakeout of the wind industry. Since the mid 1990s, a federal production tax credit (PTC) for new wind installations has been available – though not continuously – to wind facility owners that pay income taxes. This credit amounts to about 1.8¢/kWh today, payable for the first ten years of plant operation. Over a thirty-year plant life, this is equivalent to about 1¢/kWh for the full operating lifetime.

The U.S. Congress generally approves this incentive for two or three years at a time, and its extension is always uncertain. This results in recurrent peaks and valleys in new wind power installations, and complicates business expansion plans for the wind industry. The PTC is currently scheduled to expire at the end of 2003. It enjoys widespread bipartisan support in the Congress and is included in the Bush Administration's National Energy Strategy.

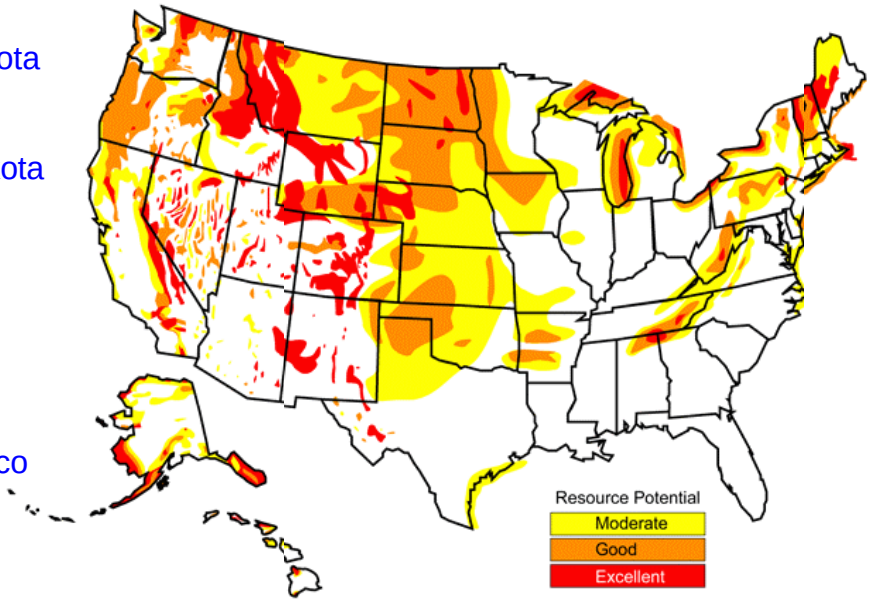
Most legislators view the PTC not as a subsidy for wind power, but instead as compensation for the many hidden subsidies for conventional energy sources. This issue is discussed in greater detail in a later section. Extension of the PTC was included in the 2002 National Energy Bill that failed to emerge from the last Congressional session. Again this year its fate is uncertain, but obtaining an extension is a very high priority of the wind industry and many other supporters within the energy and environmental communities.

U.S. Wind Resources

Figure 2 describes wind resources in the U.S. Much of the country, with the exception of most of the Southeast, has developable wind resources. The central part of the country is especially rich in wind power potential. The developable wind potential of each state has been estimated by the U.S. DOE in a study published in 1991.[1] Rankings for states with substantial wind resources,

taken from the 1991 study, are shown in Figure 2. In aggregate, from a resource availability standpoint, these states could provide from wind power several times the entire U.S. electricity consumption. California, the focus of early U.S. wind development and still the state with the most wind generation in operation, ranks relatively low. In contrast, Nebraska ranks near the top of the list. In fact, Nebraska's estimated wind power potential is nearly twice that of the entire country of Germany, which, at over 10,000 MW, has more operating wind power generation than any other country.

Rank	State
1	North Dakota
2	Texas
3	Kansas
4	South Dakota
5	Montana
6	**Nebraska**
7	Wyoming
8	Oklahoma
9	Minnesota
10	Iowa
11	Colorado
12	New Mexico
13	Idaho
14	Michigan
15	New York
16	Illinois
17	California



*Germany's Potential: 100 GW

Nebraska's Potential: 180 GW

*Highest installed wind capacity in the world.

Figure 2: United States Wind Resources

U.S. Wind Generation

Figure 3 shows U.S. wind power installation totals by the end of 2002. Several of the states surrounding Nebraska have seen significant wind growth over the past five years, in general encouraged by one or more state policies enacted to promote renewable energy development. Most of Nebraska's total is attributed to a 10.5 MW plant in Kimball. The Dakotas, with some of the very best wind resources in the country, have been slow to embrace wind. However, North Dakota has recently become very active in wind and its legislature has enacted several measures to encourage wind development. And most recently, following the 2002 elections, the new governor of South Dakota has indicated a strong

interest in pursuing measures to bring wind to his state. As a result, significant new development is expected over the next several years in those states.

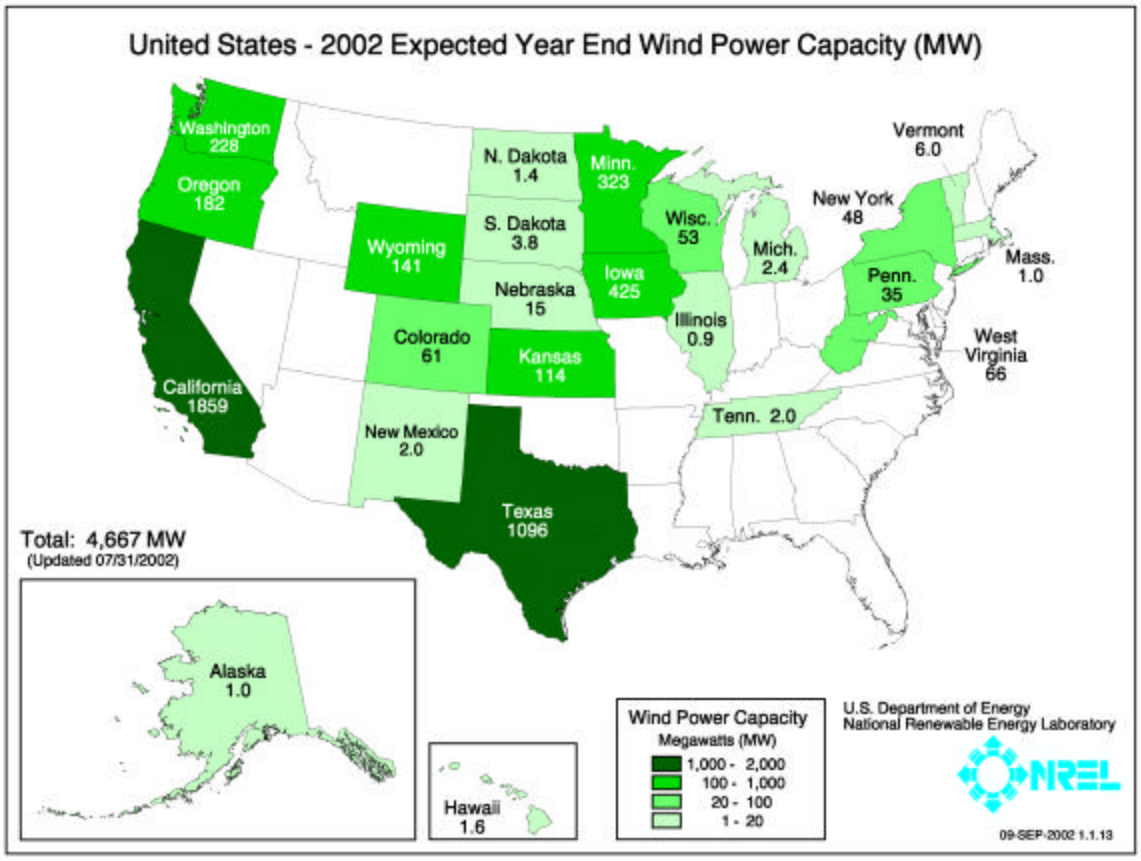


Figure 3: U.S. Wind Power Generation Through December 2002

Figure 4 shows projected U.S. wind generation totals by state through the end of 2003. Some of the state totals are optimistic in that several new projects have slipped as a result of the general economic downturn in the country. Nevertheless, additions in excess of 1,500 MW are expected. Nebraska is expected to add a few new MW of wind, but the surrounding states, including the Dakotas, are projected to add far more.

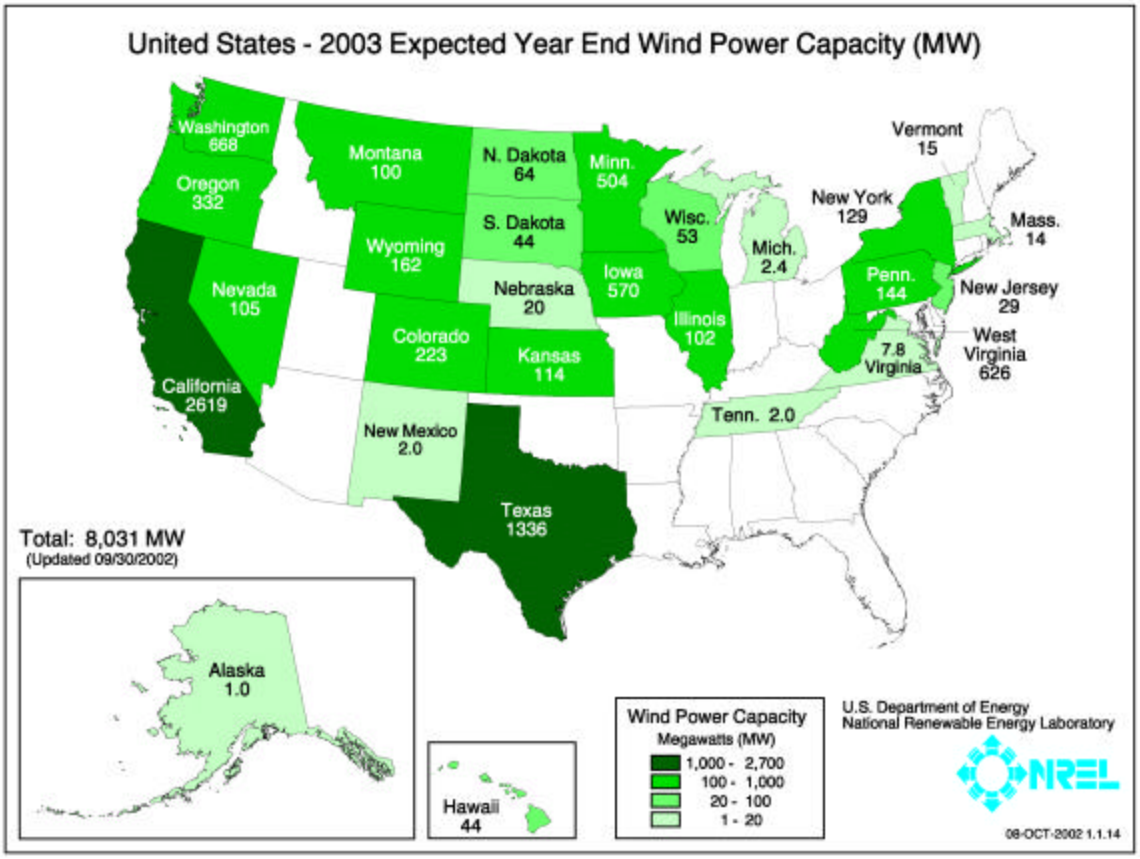


Figure 4: U.S. Wind Power Generation Projected Through December 2003

Nebraska

Nebraska's three largest utilities, Nebraska Public Power District (NPPD), Omaha Public Power District (OPPD) and Lincoln Electric System (LES) are all carrying out field evaluations of wind plants in the 1 to 2 MW size range. The NPPD project, located in Springview, is part of the DOE-EPRI Wind Turbine Verification Program (TVP), and has been conducted jointly with a number of smaller Nebraska utility entities. As part of the TVP, it is very well documented.[2]

The Municipal Energy Agency of Nebraska (MEAN) installed a 10.5 MW project in Kimball in the summer of 2002. This pioneering project is the first commercial wind plant in the state. MEAN's project application successfully navigated the Nebraska Power Review Board's evaluation process, which requires verification that a project offers the lowest cost means of serving the identified need. Some of the energy from this project is blended into MEAN's wholesale energy mix. The remainder is being purchased by a number of communities around the state that have elected to pay a small premium in recognition of the environmental benefits resulting from the project.

Wind Power Characteristics

Wind power is different in many respects from conventional electric power technologies. Some of it's differences are beneficial, and some of them present challenges. This section discusses wind's characteristics, as well as its impacts on and contributions to utility system operation.

The Nature of Wind Power

Wind power's appeal stems largely from its naturally emissions-free generation of affordable electricity, which is discussed in more detail later in this section. Wind has three other natural characteristics that present hurdles to its introduction.

First, it tends to be ***remote***. The best winds are often found in locations that are distant from major electricity markets. This is not surprising, since windy areas have generally been avoided for urban and suburban development. As a result, delivering wind-generated electricity to market usually requires transmission lines. Occasionally, these will already exist with sufficient capacity to accommodate the new wind generation; but more often, new transmission facilities will be required, adding cost to the installation. New conventional generation may also require new transmission, but generally to a lesser degree because new conventional plants needn't be as remotely located as many wind plants.

The siting of new transmission facilities is a highly contentious process. Many people see new lines as an unwelcome intrusion with little if any benefit to them. This opposition works against transmission upgrades in general, but can be especially problematic for wind power because of its above-average requirement for new lines. In fact, the delays associated with siting and permitting transmission for a wind plant will often be far more detrimental than the additional cost. In general, transmission associated with a wind plant may contribute 5% or less to the total cost. This raises the least-cost hurdle, but doesn't necessarily make it insurmountable. On the other hand, uncertainty about approval for construction of a needed transmission line and the associated barrier to market access can easily kill a prospective project.

Second, the power output of a wind plant is ***variable***. The power rises and falls as the winds increase and decrease. When there is no wind, the plant produces no energy. While the ability to predict the wind for one-to-two hours is becoming quite good, next-day predictions are generally not reliable. Utility system operators attempt to optimize the operation of the total electricity network so that total operating costs are minimized. They are generally quite successful at this, in part because they know the characteristics of each of their conventional generating plants and can exercise a very high degree of control over these plants. In contrast, the wind plant is controlled by nature and not by the

operators. This adds difficulty and cost to the job of maintaining instantaneous balance between total system generation and total system consumption.

The incremental operating costs stemming from the variability of wind plant output have been the subject of extensive study over the past two years. Some claims had been made that these extra costs would exceed the value of the wind energy, and other claims suggested the extra costs would be negligible. The most rigorous work to date on this issue has been conducted by Electrotek Concepts, Inc., under the auspices of the Utility Wind Interest Group (UWIG). This study evaluated the operating-costs impacts of about 4% wind plant penetration into a real utility system in the upper Midwest.[3]

The primary result of the work – which is conservative in the sense that the wind plants' impacts were probably overestimated – is that the aggregate operating costs impact is under 2 mills per kWh ($2/MWh) of wind-generated electricity. This is not negligible, relative to typical wholesale energy costs of $20 to $30/MWh, but it is also not a major concern. These costs are expected to increase with higher penetrations of wind, but not excessively. A more recent study by PacifiCorp, an electric utility in the Northwest with significant wind on its system, estimates these costs to be about 5 mills per kWh with wind penetration at 20%. Of course these results are highly utility-specific; but they do suggest strongly that concerns about major erosion of wind's value because of increases in overall system operating costs are unfounded.

Third, relative to generating options common in the electricity sector, wind power is ***new***. This places wind at a natural disadvantage because the people who plan and operate the electricity network would much rather deal with options that are well known and clearly understood. This is not a criticism, because these people have a primary responsibility to provide reliable electric power. The current system has worked very well for many years, and there is natural reluctance to change it.

Hence if a change is desired, such as displacing some conventional generation with energy from a clean renewable source like wind, then the people responsible for the power system need to be offered some incentive for responding to this desire as compensation for the perceived risks of the new course of action. Providing incentives for desired behavior, or penalties for undesirable behavior, is one of the primary functions of public policy.

Wind Power's Benefits

Wind power should be encouraged only if it offers positive benefits relative to conventional alternatives. There is widespread agreement that wind does indeed offer significant benefits. These benefits have been described in detail in many publications and forums,[4] and are summarized briefly here.

First, wind power is economical in many situations. In some cases, it has been determined to be the lowest-cost energy available. In these cases, it offers direct cost savings. In other cases, conventional generating sources may offer lower direct costs; but wind plant costs have dropped sufficiently over the past decade that their costs are almost always in the competitive range when bid into utility electric power solicitations.

Second, wind power offers substantial environmental benefits. Unlike conventional power plants, wind plants produce no air or water pollution of any kind; and there is no waste stream to manage. Consequently, displacement of conventional energy with wind energy reduces environmental degradation and associated health risks, and can reduce the production of plant wastes such as spent nuclear fuel that lead to safety and security concerns and long-term storage costs and risks that are as yet unknown.

Wind plant operation also produces no carbon dioxide or other greenhouse gases. In contrast, coal power plants, such as those responsible for approximately 60% of Nebraska's electricity production, have the highest carbon-dioxide production rates of any electric power plants. It is only a matter of time before carbon emissions become curtailed or penalized by public policy measures in this country. Europe and much of the developed world – except for the U.S. – are already taking steps to reduce their atmospheric carbon emissions, and some states in this country have instituted policies with this objective.

Third, to the extent it is used, wind power offers fuel diversity and energy security. Over the past several years, the risks associated with heavy reliance on one or two fuel types have become clear. And disruptions in the supply of any major fuel have repercussions throughout the entire energy sector. Wind energy can't be interrupted at the whim of some foreign dictator.

Fourth, wind power development brings a number of economic benefits – many of which accrue to rural regions. The construction, operation and maintenance of wind plants bring jobs. The construction jobs – generally 1 to 2 per MW of wind generation – tend to be filled primarily from outside of the region, but bring business to the local service industry. Operation and maintenance jobs – generally 3 to 5 per 100 MW – tend to be filled by local individuals. Some of the construction needs, such as concrete foundations, towers, road work and electrical work, are served by the local service industry. In addition, substantial property tax revenues – generally about $500,000 per 100 MW annually – are provided to the local community. These payments either reduce the property taxes of local residents, increase funds available for local community infrastructure needs, or provide a combination of both.

In Nebraska, utility entities don't pay property taxes, so this last benefit may not apply. However, in two other states without property taxes on wind plants, local

communities still receive substantial annual payments in lieu of taxes. Kansas exempts wind plants from property taxes as an incentive to attract wind development. However, private wind developments to date in that state are providing substantial voluntary payments to the local community to enhance local acceptance of their plans. And in Minnesota, wind plant owners provide communities a revenue stream that is tied to annual energy production. Originally, these plants paid property taxes; but the communities were concerned that over time the plants would be depreciated and the corresponding tax revenues would diminish. Hence the new arrangement was negotiated in 2002 to ensure a stable revenue stream.

Through one of these approaches, or some other variant, Nebraska communities could also receive revenue streams from wind plants in lieu of property taxes. As a result, it may be possible to ward off potential opposition to wind development in rural Nebraska arising from concerns that the plants would be benefiting primarily the eastern-Nebraska population centers.

One additional economic benefit would accrue to farmers and other individuals who provide easements for placement of wind turbines and access roads. In other states, these individuals are generally receiving royalties of 2 to 3% of gross revenues from electricity sales. The resulting payments are in the range of $2,500 to $4,000 per MW per year. These payments far exceed the revenue that the affected land could generate from traditional farming or grazing activity.

Projected economic benefits from wind development in Nebraska have been described in detail in Strong Winds, a report produced in 2001 by the Union of Concerned Scientists.[5] In addition, a report produced recently by the National Wind Coordinating Committee discusses economic development impacts that have actually resulted from specific existing wind installations in three states (Minnesota, Oregon and Texas).[6]

Electricity-System Integration Challenges

As discussed above, wind power's natural characteristics lead to substantial challenges with respect to its acceptance by power-system planners and operators. As described earlier, the impacts of wind's variability on system operating costs are turning out to be considerably less significant than operators had originally expected; but a great deal of education and experience are required before that message will enjoy wide acceptance.

A related concern of system operators who are unfamiliar with wind plant operating characteristics is a fear that the output of a wind plant will change from full power – say 100 MW – to zero in one second or less, causing a huge transient impact on the system. Practical experience with many wind plants to date has alleviated this fear. Wind plant output simply does not change as rapidly as this. Even a single wind turbine has sufficient mechanical inertia to damp rapid changes in the wind. More importantly, a wind plant generally

consists of a number of turbines, and the spatial variations in the wind over the area of a typical plant are sufficient so that variations in output from the entire plant are much less pronounced than those from a single turbine. Hence the plant output shows substantial smoothing relative to output from a single turbine.

As an additional consequence of this fact, wind plants will have no unique adverse impact on power system stability. System stability can be upset by abrupt events that happen within a small fraction of a second, such as a sudden outage of a major power plant, loss of a transmission line, or abrupt connection of a large electrical load like an arc furnace in a steel mill. Abrupt events such as these simply will not occur with a wind plant, unless its connection to the electrical grid suffers a fault. In such a case, the wind plant is no different from a conventional power plant.

As with the issue of operating-cost impacts, this fear of abrupt changes in output will be alleviated only with considerable experience and education.

Another integration challenge is the issue of generation-capacity allocation, or the degree to which wind can be expected to help accommodate system load growth and maintain system reliability. Wind's variability and relative unpredictability over longer periods reduce its ability to contribute to these needs. This concern is sometimes waved as a red flag to discredit the technology. However, it is not uncommon for conventional power plants to be out of service for one reason or another during peak load hours. This fact is never used as criticism of conventional power technology.

Nonetheless, I believe wind power in the early stages should be used primarily as an energy displacer rather than as a means to cover load growth. Over time, operators will learn how to use wind power to increase system reliability, for example through synergies with hydroelectric plants or through advancements in storage technologies. Efficiency measures and emerging markets for demand reduction measures will also serve to reduce peak loads. But in the meantime, wind's environmental and economic benefits will accrue even if wind is used only as an energy displacer.

Public Attitudes and Policy Impacts

Many surveys of public opinions on energy choices have been conducted over the past several years. Invariably, these polls uncover significant public preferences for clean, renewable power whenever it is physically possible to deploy such options. These preferences have strongly influenced public policy in some regions – most notably in Western Europe.

Western Europe

Concerns about the negative environmental impacts of electricity generation have been effectively articulated in Europe for many years. Forest degradation in Germany has been linked to coal combustion emissions. And the Chernobyl nuclear reactor accident, which resulted in radioactive fallout over much of Europe, deeply frightened Europeans about the risks of nuclear power. And more recently, the western European nations have become concerned about the threat of global warming. These nations have become supporters of the Kyoto protocol, and they are all taking significant action to reduce their carbon emissions. Most have developed strategies for meeting the 2010 goal of reducing carbon emissions to levels 5% below those of 1990. These steps are being taken because a large segment of the public has expressed concern for their natural environment. This concern has been translated into public policies that encourage the use of renewable energy options like wind power, as well as energy efficiency measures.

Germany's leading role in wind power has been discussed earlier. Wind deployment in Germany has been driven by a law that guarantees favorable purchase rates for wind-generated electricity. Utilities must buy this energy at 90% of the *retail* electricity rate. This incentive is so favorable that some wind plants have been installed in locations that have marginal wind resources. In mid 2002, the total installed wind generation in Germany surpassed 10,000 MW, even though Germany's developable wind resource base has been estimated at about half that of the state of Nebraska. Other European countries with favorable policies for wind power include Denmark, Spain, Holland and Great Britain.

The European utilities are as concerned about the impacts of wind's variability as utilities in the U.S. But they are learning how to deal with it – and with far greater wind contributions in some regions than have yet been seen in America. The prevailing attitude of the informed general public and political leaders with respect to wind power seems to be along these lines: *We understand that wind power is different and presents challenges to operation of the electricity system, but we want clean energy. So let's determine how best to incorporate wind and operate the system in ways that accommodate its characteristics*. The electric utility managements, whose natural instincts would tend to resist change, seem to have adopted this approach as well in light of the prevailing public view. This has been made possible because the laws and incentives that have encouraged

wind deployment also ensure that the utilities are not penalized financially. For example, the favorable payments for wind-generated electricity are recovered in rates paid by all customers, and transmission and distribution system upgrades necessary to accommodate wind plants are often paid for with public funds.

United States

While the Europeans have developed a focused environmental consciousness, attitudes in the U.S. seem more diffuse. Clearly there are pockets of strong environmental concern in the U.S., but there are also vast regions of this country that view environmental issues as far removed from their daily lives. A great many Americans have never been close to a nuclear accident or polluted air, and global warming and rising oceans don't have much impact on people that live a mile above sea level – unlike the Dutch, for example, who already live below sea level. Hence concerns about electric power impacts on the environment aren't expressed as coherently in America as they are in Europe.

Remarkably, however, there is substantial concern about these issues in the U.S. – sometimes latent. Many surveys have been conducted throughout the country on these issues, and invariably they reveal a preference on the part of the general public for clean renewable electricity and energy efficiency measures.

General

In response to these public preferences, many states have instituted public-policy incentives for wind power and other renewables. Figure 5 summarizes current incentive programs by state. The specific programs are described in detail elsewhere,[7] so will only be summarized here.

Eleven states have renewable portfolio standards (RPS). An RPS requires that a specified portion of electricity generators' output must come from renewable energy sources. Often this portion must increase with time until some specified level is achieved. In addition, fourteen states have system benefits charges (SBC), which are small surcharges paid by all retail electricity customers as an increment to their electricity bills. These funds are generally administered by the state, and support programs in renewable energy, energy efficiency and low-income or lifeline electricity assistance. Several states have both of these incentives.

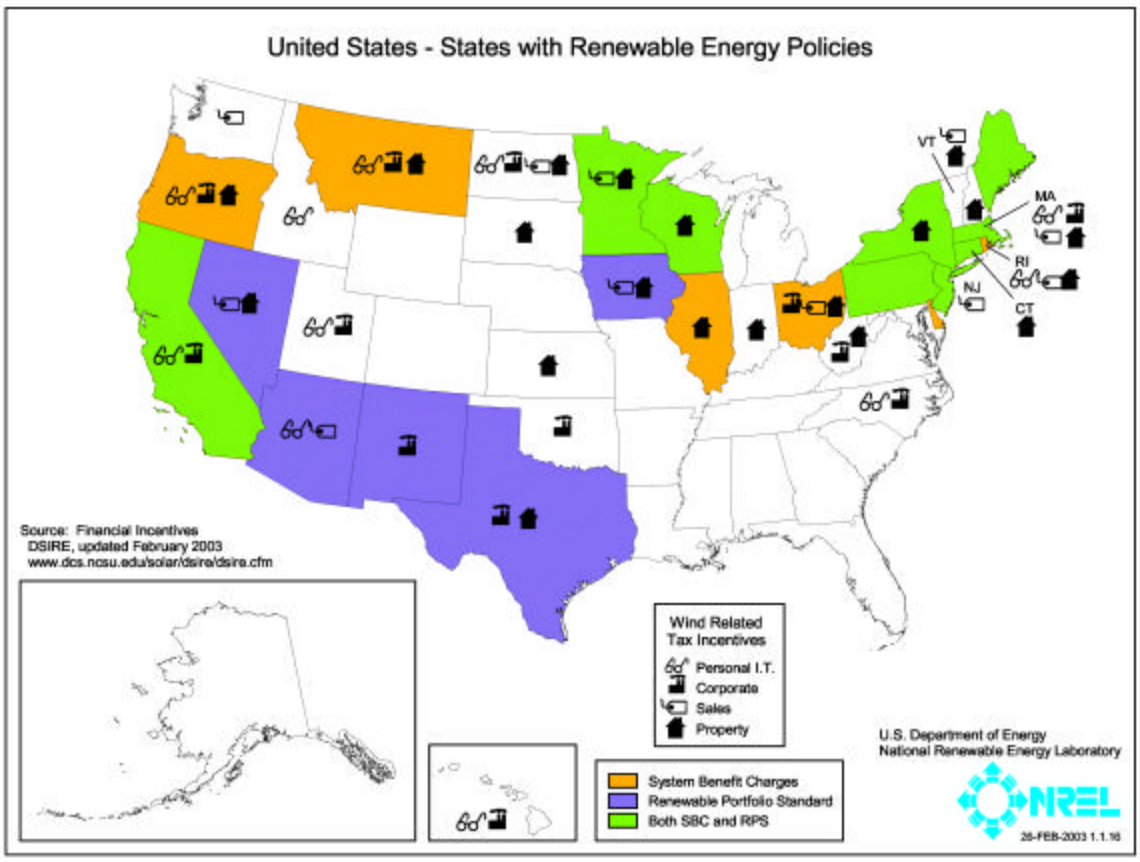


Figure 5: Renewable Energy Policies in the United States

Some of these states and many others have other incentives for wind and or other renewables, including property tax exemptions, sales tax exemptions and income tax incentives.

Figures 3,4 and 5 show clearly the impact of state policies on wind power growth in a state. In most cases, the states with significant wind development are those that have established one or more incentives for wind development.

Texas

Texas provides a particularly illuminating example. Its primary incentive is an RPS, whereby some 2,000 MW of new renewables is to be installed between 1999 and 2009. Retail electricity suppliers in the state are required to either generate or purchase a specified amount of renewable electricity, or purchase renewable energy credits from another supplier that has exceeded its quota. In part because wind developers offered attractive bid prices for wind energy in Texas, program implementation is well ahead of schedule. Over 1,000 MW of new wind had already been installed by the end of 2002.

The Texas RPS became law because of strong and widespread support. Although the state's investor-owned utilities had historically been opposed to mandates such as an RPS, their views were altered by a survey process carried out in the late 1990s. This process, called Deliberative Polling,™ consisted of a carefully conducted program of customer education and opinion polling. Each of the major utilities in the state conducted its own exercise with some 200 customers chosen at random to provide a representative sample. The utility managements were surprised by the strength of their customers' support for clean renewable energy and energy efficiency, irrespective of such factors as occupation, educational background, age, or residential location. These utility managements deserve substantial credit for proactively seeking customer input and then reflecting that input in their plans and actions. The results of this polling process have had a major impact on the level of support for renewables among state legislators and utility regulators, as well as the utilities themselves.

Nebraska

With respect to Nebraska, the most striking feature of Figure 5 is that no incentives for wind have been established. This explains to a large degree why there has so far been so little wind development in the state. Colorado and Wyoming, also within the windy central region of the U.S., also have no incentives, but they have active public utility commissions that have worked hard to encourage the introduction of wind. Colorado's utility commission recently required the state's major utility to proceed with a new 162 MW wind plant, based on their finding that the wind plant offered the lowest cost bid into an all-source solicitation by the utility. In addition, a grass roots effort has been active in the state for several years successfully promoting a green-priced wind product offered by that same utility.

Nebraska's citizens have expressed strong support for renewables and energy efficiency in several ways. A formal poll of 500 randomly selected Nebraska voters conducted a year ago by the Mellman Group found that over 70% favor requiring power companies to generate 20% of their power from renewable sources, while only 15% would oppose such a requirement.[8] And 70% preferred renewables and efficiency to additional oil drilling. Furthermore, support for these positions was strong regardless of political party affiliation.

Recently, the citizens of Imperial Nebraska decided to buy wind energy from MEAN's Kimball project to serve a portion of their community's electricity needs. The decision was based on a survey in which citizens were asked if they would be willing to pay a premium for wind energy; and if so, would they be willing to pay 1%, 2% or 3% more. For the average residential customer, 3% would be about $1.35 per month. Of those responding, nearly two-thirds (65%) were willing to pay a premium; and of these, nearly two thirds (62%) were willing to pay 3% extra.[9]

These results from Imperial were discussed at the December workshop. The overwhelming sense of the discussion was that similar results would be expected in most communities. In fact, workshop participants from West Point and Wood River commented that similar processes had been carried out in their communities with similar results.

In contrast, the management of the Lincoln Electric System (LES) has questioned the sincerity of its customers' interest in wind power. In response to customer input, LES has installed two wind turbines near downtown Lincoln, and is offering the energy from these machines as a voluntary green-priced product. LES is having difficulty achieving full subscription to this program. But the reality is that, of the over 100 green-priced products offered by utilities around the country, LES' is one of the weakest. The reasons are that (a) the cost of energy from the project is excessively high because it is located in a poor wind area and, owing to small size, achieves no scale economies; and (b) this excessively high cost burden is being placed on the shoulders of a small portion of the customer base. These people feel so strongly about clean energy that they are willing to pay a premium per kilowatt-hour that in most cases exceeds the retail cost of conventional energy. The LES green-product program also requires a three-year commitment of participants, which breaks one of the cardinal rules of successful green-pricing programs: easy in, easy out.

Extensive experience across the country indicates that most people are willing to pay a bit more for clean energy, but not a great deal more. If LES' customers were asked if they, as a community, would each be willing to pay a few cents a month extra for wind, there is little doubt that the response would be positive. LES would then have justification to add more wind generation, and to locate it in areas with better wind resources that could reduce the wind energy cost by at least 50%. Lincoln's residents would very likely provide a response similar to that described above from the citizens of Imperial.

So far, public preferences have not been reflected in public policies to encourage wind development in Nebraska. This implies that the general public's voice in the state legislature is not as strong as those of entities that prefer the status quo with respect to Nebraska's energy sector.

The Basis for Incentives

Ideally, a society or a political jurisdiction establishes incentive programs to encourage behavior that is agreed to be beneficial to society. Tax policy offers a particularly effective means for implementing incentives. The previous section has discussed the federal Production Tax Credit (PTC) for wind power and various other incentives enacted by individual states. This section discusses the basis for these incentives in more detail.

Recognition of Non-Monetized Benefits

The environmental benefits of wind power and other clean renewables are well accepted on a qualitative basis. Very few would dispute the health and aesthetic benefits of clean air and water. The importance of energy security is also not questioned, particularly in light of threats to international supply lines for fuels. And periodic shortages of particular fuels, such as natural gas and even water for hydroelectric plants, have underscored the importance of fuel diversity. But there is very little agreement on how to quantify these benefits so that they can be credited to a clean source like wind or debited against sources that pollute like coal. Hence one basis for an incentive is to provide a proxy for these non-monetized benefits in some amount that is not intended to be precise but is generally agreed to be reasonable.

Natural Resistance and Perceived Risks

Trying out a new technology or a new product always involves some risk – real and perceived. We are familiar with the current product or approach and know what to expect. The new product may offer some attractive promises, but hidden surprises may also emerge. Hence we generally need some incentive to make a change – perhaps a lower price or a rebate. It's a bit like the free sample and discount coupon for a new shampoo that gets delivered with the morning newspaper.

Embedded Subsidies for Conventional Fuels

Embedded assistance to conventional fuels provides a particularly strong basis for wind power incentives. The reality is that a new power technology like wind doesn't compete on a level playing field, since all conventional energy forms receive subsidies of one sort or another. These subsidies don't appear in customers' energy bills; instead they are more likely to appear in their tax bills. Nuclear power receives a subsidy in the form of liability limitation through the Price-Anderson Act. It's unlikely that many nuclear plants would exist without that protection. And what would such liability insurance cost if utilities had to obtain it from private insurers? Also, what will it really cost to deal with nuclear waste in a secure manner? And how much has the country spent so far in tax dollars to develop a nuclear waste repository? With respect to coal, it's undisputed that coal is a major contributor to acid rain and lake acidification. But

the associated costs aren't yet fully included in the bill for coal electricity. The detrimental health impacts of large-scale coal combustion are also becoming increasingly clear, but increased health costs are not part of that bill either.

And what about oil? Admittedly this is not a principal electricity fuel in most parts of the country, but it illustrates the extent to which our society subsidizes conventional energy. Those who invest in oil production get depletion allowances that help to reduce oil's costs. But far more significantly, how much do we spend as a society to ensure the flow of affordable oil? We fought a war in the Middle East in 1990 for exactly this purpose, and we seem to be gearing up for a repeat performance in a different guise. Apart from these wars, on a day-to-day basis, how much of our Defense Department budget applies to protection of oil access? Estimating that amount is a difficult task, but most people queried feel that 10% is on the low side. The Defense Department's budget is over $300 billion per year, or about $800 million per day. At 10% for oil protection, that's $80 billion a day. We use about 20 million barrels of oil a day in this country, so the oil-access-protection cost with the above assumptions is about $4 per barrel – a subsidy of about 15 to 20% depending on the current price of a barrel. We don't pay this at the gas pump. We pay it in our income taxes.

Some people say that we should simply wait to deploy wind power until it reaches price parity with conventional power. That view is ignorant of the embedded subsidies for conventional fuels just described. In some cases, wind has already achieved price parity in conventional terms, and in a great many more cases it would be the preferred choice economically if *all* costs were considered. Waiting for price parity in conventional terms would rob society of substantial benefits that can begin to accrue immediately.

Impediments to Wind Development in Nebraska

Earlier sections have discussed a number of impediments to the introduction and expansion of wind power, both in general and in Nebraska. Taken together, these impediments present wind with a formidable challenge in the state. In addition to wind's natural characteristics discussed earlier – remote, variable and new – that impede its development everywhere, the Nebraska situation presents several additional impediments that are summarized in this section.

Statutory

By statute, all applications for new commercial electric power projects in the state must be brought before the Power Review Board (PRB). The PRB must choose from alternatives on the basis of *least cost* in conventional terms. There can be no allowance for non-monetized benefits or for hidden subsidies of the type described in the last section. Hence a utility, municipality or a community wishing to pursue a wind project based on the belief that it is the preferred choice when all factors are considered cannot do so unless it can demonstrate price parity in conventional terms.

Historical Practice

Except for a small amount of self-generation owned by individual entities for their own use, all generation and other electric-utility facilities are publicly owned in Nebraska. This is not a statutory requirement, but it has become standard practice. Independent power producers have not challenged this tradition because of the realization that any power facility they might build in the state could be condemned and taken over by the local utility district.

In other states, independent power producers have carried out much of the wind development, primarily because they are generally more comfortable and experienced with wind power. Many utilities prefer to buy wind electricity through a power purchase agreement, and leave the business of building and operating the plant to a third party. By historical precedent, this option appears to be precluded in Nebraska, which removes from consideration an avenue for wind development that has been very successful in other states. Perhaps of greater importance, it precludes access to the federal PTC, which by itself could make many Nebraska wind projects competitive on a least cost basis in conventional terms today.

Another historical factor that makes wind introduction difficult in the state is that current electricity prices are among the lowest in the country. This is a credit to the state's electric utilities, which have placed primary emphasis on providing low-cost electricity.

Weak Communication Links

An earlier section discussed public preferences for wind and other renewables in Nebraska and the minimal degree to which these preferences have so far affected public policy and utility choices. Commentary at the November workshop suggested that, although retail customers – i.e., consumers – have expressed a clear desire for clean, renewable energy, wholesale customers – i.e., power distribution entities that buy bulk power from the large generating utilities and then distribute it to retail customers – are not supportive of renewables. It appears that the larger utilities are in touch with their wholesale customers, but that the link between retail customers (the general public) and the large utilities in the state is weak. It is likely that the status quo will prevail unless that link is strengthened.

The major utilities do have boards of directors that are elected by the public. However, the sense of the workshop discussions was that these boards are influenced to a far greater extent by utility management than by public desires and concerns.

In contrast, the smaller municipal utilities seem to have a closer connection with their local citizens. The local city councils have significant influence on these utilities; and the city councils, by their very nature, are influenced substantially by the views of local residents.

Nebraska's major utilities have a legacy – established over many years – of excellence in providing reliable, low-cost electricity; and, looking back 20 to 30 years ago, of providing leadership in the electric power business. As one example, the Nebraska utilities played a lead role in developing the research agenda of the Electric Power Research Institute, a national utility research organization, during its formative years. As a result, consumers have been content to leave the job of supplying power to the utilities, without giving the process much thought as long as the lights stay on. Substantial evidence exists that consumers and the larger utilities in Nebraska have lost touch with each other to a large degree. Reestablishing a productive connection is not an easy task. It is always difficult for individuals – even groups of individuals – to have an impact on large organizations, so it is relatively easy for the large organizations to maintain the status quo.

Is the situation different in other states? In most cases it is, because in other states consumers have a stronger voice in the power-supply arena – expressed through their public utility commissions. The investor-owned utilities in those states are also not likely to serve as change agents, but when the public desires a change from the status quo, the utility commission hears this and carries the message – with some clout – to the utilities.

At the November workshop, we discussed means for improving the connection between consumers and the major utilities in Nebraska. The key question is who

should take the initiative: the customers or the suppliers? The sense of the discussion was that the primary responsibility lies with the supplier. As mentioned above, it is difficult for individuals to have an impact proactively on a large organization, and they generally are silent unless they are really unhappy. Consumers in Nebraska are generally not displeased with their electric power situation, and they probably spend little time thinking about it. People generally have more immediate concerns in their lives. But that doesn't mean they wouldn't like to see some things changed. However, to find out what's on consumers' minds, someone needs to ask.

Most purchased products come with a return-mail card from the supplier asking lots of questions about preferences. Product suppliers use this information to modify their products and design new products that satisfy people's needs and desires. But individuals would be highly unlikely to contact one of these suppliers on their own. In addition, many product manufacturers conduct focus groups and other elaborate procedures to understand what people want. They do this because they know that people have choices in the marketplace, and they want their products to be chosen. In Nebraska – and in many other places in this country – people don't have a choice of electric power supplier. Instead, an implied contract exists between the local utility and its customers through which the utility enjoys sole-supplier status in return for meeting its customers' needs. Hence the utility should work proactively to understand the desires of its customers. This is particularly important in Nebraska, where the public owns the electric utilities and where there is no public utility commission to articulate and enforce public desires.

Conservative Policy

As discussed in detail in an earlier section, Nebraska has no public policies that would provide incentives for wind development, even though public opinion tends toward strong support for such policies. Historically when such policies have been introduced in the legislature, they have not been successful. It appears that utility managements have a stronger voice in the legislature on electric power issues than the electorate. As a result, the decision-making process tends to favor the status quo.

Candidate Approaches for Nebraska Wind Development

One of the key objectives of this project is to develop recommendations for moving wind forward in Nebraska. Some of the recommendations take the form of actions that could be carried out now within the framework of existing policy and requirements. Others are in the form of policy changes that would encourage wind plant development in the state. Recommendations that could be carried out now are presented here, and those associated with policy changes are developed in greater detail in the next section. The recommendations are in some cases specific to the type of utility entity, so they are categorized here in terms of the four major utility types identified in the introductory section. Where applicable, the issues identified in that section will be addressed.

These recommendations are based on an understanding of the technical, institutional and political framework of the electric power sector in Nebraska developed over the past two years. They have also been heavily influenced by the meaty and open discussions that took place during the meetings held November 12, December 13 and December 20 in Lincoln. Insights shared and questions raised by the participants at those meetings are very much appreciated. Interactions with senior management representatives of some of Nebraska's larger utilities have also played a strong role in shaping these recommendations.

Large Public Power District

Several of the larger utility entities in Nebraska are conducting field trials of large wind turbines to obtain first-hand experience with the technology and obtain performance and cost information that will be helpful in formulating future wind power plans. These utilities pride themselves on their success in providing electricity at some of the lowest costs in the nation, when considered in direct terms (i.e., without consideration of any externalities). Their traditional approach to consideration of wind (or any other power option) is to compare its expected wholesale energy costs to the utility's best estimates of market prices for wholesale electricity over the life of the wind plant.

This comparison can be carried out with precision, but any conclusion reached contains a high degree of subjectivity. The main reason for this is that assumptions need to be made about the escalation rates of conventional energy over periods of 15 to 30 years. If the assumed rate is too high, then wind would be favored in the comparison; if too low, then the conventional option would be favored. High escalation rates might result from disruption of conventional fuel supplies or a trend toward depletion, or from recognition of environmental concerns. Low escalation could result from major new discoveries of fossil resources. The problem is that no one can know what is "too high" or "too low." Hence an estimate is made based on a number of judgment factors. And the decision to choose wind or another option can be strongly influenced by the

nature of the judgments applied. Nonetheless, utility generation planners do the best job they can with this process, and this is very likely how a decision on addition of wind power will be made in the larger utility arena. I believe this is a logical and defensible approach.

As discussed above, until wind becomes a generally accepted generating option, planners will apply a risk factor in the selection process. As a result, simple cost parity with the prevailing set of assumptions would be unlikely to lead to a decision in favor of wind. Wind would need to show some significant cost advantage (or some compensating incentive would need to be available – as discussed more thoroughly in the next section).

Fortunately, a comparative analysis of the type described here has recently been carried out by the Omaha Public Power District (OPPD), and has recently been published by the utility.[10] I believe this is a credible, carefully done analysis, and that it serves as a solid base case for consideration of new wind generation. Several variations from the base case can then be considered as potential approaches for encouraging wind.

The OPPD analysis considers the addition of 400 MW of wind to the OPPD system, presumably with four plants of about 100 MW each. Reasonable assumptions are made for wind plant capital and operating and maintenance (O&M) costs, and for transmission interconnection costs and financing costs. The plants would be financed with revenue bonds, and the wind plant costs are expressed in terms of $/kW-year to cover the annual capital and O&M charges. This amount is combined with the projected annual wind energy production to yield a wind energy cost in ¢/kWh. The value of the wind energy is estimated by calculating an annualized average market price for wholesale electricity. A capacity value is added, based on 10% of installed capacity and values determined historically using established practice within the Mid-Continent Area Power Pool (MAPP). Table 1, in the column identified as Base Case, shows selected input data and results from the analysis. The study considered locations close to Omaha – with marginal wind resources – and locations elsewhere in Nebraska with better wind resources. Table 1 shows results only for the better wind resource locations, based on the belief that plant siting in a marginal resource location is not justified.

Table 1 shows that, for the base case assumptions used in the study, wind energy is close to parity with wholesale energy prices. The gap between wind energy cost and wholesale energy value is slightly over $2.4/MWh (or 2.4 mills/kWh). If the federal PTC – worth about 1¢/kWh – could be applied in Nebraska, the energy value would actually *exceed* the wind energy cost by about 7 mills/kWh, and wind would be a hands-down winner. Again, it's no surprise that wind is going forward in the windy states surrounding Nebraska, where the PTC can be applied. But even a small change in input assumptions could change the calculated gap value substantially. For example, some assumption

has been made about escalation of wholesale energy costs over the life of the wind plant. The study does not provide visibility into that assumption, but a small increase in assumed fuel escalation rate or a small surcharge for environmental considerations could easily erase the gap.

Table 1: OPPD Wind Evaluation

	Base Case	Option 1	Option 2	Option 3	Option 4
Turbine Costs ($/kW)	**847**	**847**	**847**	**847**	**847**
Transmission Costs ($/kW)	**65**	**65**	**20**	**0**	**20**
Annualized* Capital Costs ($/kW-yr)	**63.1**	**63.1**	**60.0**	**58.6**	**60.0**
O&M Costs ($/kW-yr)	**29.0**	**29.0**	**29.0**	**29.0**	**29.0**
Capacity Factor (%)	**36**	**40**	**40**	**40**	**40**
Wind Energy Cost ($/MWh)	**29.18**	**26.29**	**25.40**	**25.00**	**25.40**
Energy Value ($/MWh)	**26.74**	**26.74**	**26.74**	**26.74**	**26.13**
Cost - Value Gap ($/MWh)	**2.44**	**-0.45**	**-1.34**	**-1.74**	**-0.73**

Option 1: Capacity Factor increased to 40%
Option 2: 40% Capacity Factor and reduced transmission cost
Option 3: 40% Capacity Factor and zero transmission cost
Option 4: Same as Option 2, except with no capacity credit

*capital cost recovery factor: 6.921%

Other more tangible variations could also make wind the preferred choice. For example, a better wind site could be chosen. Recent experience at the NPPD Springview wind plant points toward capacity factors in excess of 40%, and there is evidence that even better sites have been identified in the state.[11] The Option 1 column in Table 1 shows the impact of increasing capacity factor from 36% to 40%. This increase results in an increase in plant energy production by a factor of 40/36 or 10/9, which in turn decreases the wind energy cost by a factor of 9/10. This change alone would reduce the gap to a negative value, indicating that the energy value exceeds the wind energy cost – in this case by about one-half mill/kWh. Hence siting the wind plant in one of Nebraska's best locations

would by itself make wind the preferred selection using the assumptions employed in the OPPD analysis.

The OPPD analysis considered a range of transmission costs. Based on engineering estimates for actual transmission upgrades and interconnection costs, the study assumed values of $20 and $65 per kW of installed wind generation for a plant sized at 100 MW and located, respectively, near Omaha or at a more distant location with better wind resources. The Base Case in Table 1 uses the $65 estimate. However, evidence exists that some wind plants in high wind locations could actually be interconnected to the existing transmission network at costs near the low end of this range.[11] Option 2 in Table 1 shows results based on a lower transmission cost of $20/kW. In this case, the wind energy value would exceed its cost by about 1.3 mills/kWh.

One measure under consideration elsewhere for the encouragement of wind development – and discussed more fully in the next section – is to consider wind transmission costs as part of the cost of the overall transmission network and not part of the wind plant cost. This approach is actually in place in the state of Texas, and applies there to all new generation – not just wind. Option 3 in Table 1 shows results under this assumption. In this case, wind's value exceeds its cost by about 1.7 mills/kWh.

The OPPD analysis allocates a capacity-credit payment to wind based on historical experience within the MAPP region. The amount used, $0.61/MWh, corresponds to $15/kW-yr with wind receiving credit for 10% of nameplate rating, and is levelized over the plant lifetime. Option 4 in Table 1 considers the case where Option 2 is modified by eliminating any capacity credit for wind. Even in this case, the wind plant is the preferred option.

To summarize the large public power case, it appears that wind can be selected on the basis of least-cost analysis today, provided that suitable sites are identified. The larger utilities are likely to have access to these sites, perhaps through a cooperative arrangement with a local municipality or rural electric district. The selection of wind will be aided if nearby transmission access can be arranged, or if transmission costs are not allocated entirely to the wind plant.

Small Municipal Utilities

The participants in the November and December workshops included representatives from municipalities and their utilities covering a wide range of sizes. It became very clear from the discussions that these communities are likely to pursue a range of different approaches when considering wind power. No single model will be applicable in the municipal arena.

It also became clear that, with respect to many of the factors that might impact a wind deployment strategy, small municipal utilities and rural electric districts are similar. Hence much of the material in this sub-section applies to the rural

electrics as well. Factors specific to the rural electric districts are discussed in the next sub-section.

As discussed in an earlier section, support for wind power development appears to be strong in regions served by municipal utilities, and a number of these communities have begun to act on that support. Key factors that need to be considered when developing a local action plan include such items as these:

- Project size, location and ownership
- Project economics and financing
- Local benefits and impacts
- Local energy consumption and energy export
- Initiation and decision processes

Size and Location: Project size and location have a strong impact on capital requirements and the cost of generated wind energy. Larger plants generally show economies of scale, since lower prices can be negotiated for larger quantities of equipment; and design, engineering, interconnection and financing costs can be spread over a larger base. The unit cost of a 1 MW plant will probably be about 50% higher than that for a 50 MW plant. On the other hand, the larger plants will require a larger capital outlay.

Plant location will affect the wind resource available. Unless a huge premium in transmission is encountered, it will be preferable to opt for a location with excellent winds, even if it is somewhat distant. Assuming comparable plant costs, a high wind location with a 40% capacity factor will yield wind energy costs that are half those from a location with a 20% capacity factor. Some communities, both in Nebraska and in other states, have opted for local sites on the theory that residents would be more supportive of a visible project. While this view may be valid in some cases, recent extensive experience indicates that community support is not strongly influenced by location – particularly when it is made clear that the community's cost arising from the wind plant can be substantially less if a more energetic site is chosen.

Table 2 illustrates several of these factors. To make comparisons simpler, the table entries are based on assumptions that (a) a 50 MW plant will have a total capital requirement of $1,000/kW, and (b) the O&M cost for a plant of that size in a good wind location will be 1¢/kWh. These are reasonable numbers, based on current experience. The cost/kW scaling factors shown in the second row of the table derive from practical experience and from estimates given in several recent publications.[12] Similar scaling factors apply to O&M costs. The plant costs are translated into annual capital requirements using a cost recovery factor of 7%, which is applied to the plant cost. This number would be substantially higher for plants owned by private developers or investor owned utilities. In the OPPD evaluation discussed above, the assumed cost recovery factor was 6.921%.

Table 2: Energy Costs for Different Plant Sizes and Wind Resources

Plant Size (MW)	1	5	50	200
Cost/kW ($)	1500	1300	1000	900
Plant Cost ($M)	1.5	6.5	50	180
Cost Recovery Factor (%)	7	7	7	7
Annual Capital Cost ($/kW-yr)	105	91.0	70.0	63.0
Energy Production @ 20% CF (kWh/kW)	1752	1752	1752	1752
Energy Production @ 40% CF (kWh/kW)	3504	3504	3504	3504
Annual Capital Cost in ¢/kWh @ 40% CF	3.0	2.6	2.0	1.8
O&M Cost @ 40% CF (¢/kWh)	1.5	1.3	1.0	0.9
Total Energy Cost @ 40% CF (¢/kWh)	4.5	3.9	3.0	2.7
Total Energy Cost @ 20% CF (¢/kWh)	9.0	7.8	6.0	5.4

Project Economics: Table 2 shows clearly the economic advantage of larger size projects. The energy costs from a 1 MW project will be about 50% higher than those from a 50 MW project, and increasing project size from 50 to 200 MW will reduce energy costs by about 10%. The advantages of a site with strong winds are also apparent. While winds near urban areas might produce capacity factors near 20%, well-chosen rural sites can produce twice as much energy leading to a halving of energy costs.

Despite these economies of scale, some of the workshop participants indicated that small municipalities would prefer to start small with wind and get initial experience with a smaller capital outlay. Under current statutes, however, such a project would need to receive approval from the Power Review Board (PRB). Since a project of small size would not be economically competitive, approval from the PRB would be unlikely.

Two courses of action could be pursued to overcome this hurdle. The simplest would be to join forces with other municipalities and/or with a rural electric district to build a larger, joint project that achieves some economies of scale. Teaming with a rural electric district may also offer the advantage of a more energetic wind

site, since these are more likely to be in rural electric territory than in an area served by a municipal utility.

The second course of action would require a statutory change. The statute governing the actions of the PRB could be changed to allow a municipality to pursue a small project at its discretion should it desire to obtain early experience without excessive financial exposure. An appropriate upper limit could be established for such projects – perhaps in the range of 10 to 20 MW.

Project Financing and Ownership: Financing would normally be done by issuing bonds. The project would be owned completely by the municipality or municipalities pursuing the project. The project would not pay property taxes, and the site occupied by the installation would be taken off the tax rolls. Sales tax would be paid to the state on project hardware.

If a project is to be financed with revenue bonds, then the city council's approval for issuance is all that is required. Another option would be to issue general obligation bonds, but this would require approval of registered voters in the community. However, financing costs are lower for these bonds. This suggests another avenue for satisfying the least-cost hurdle with the PRB. In most cases, citizens would not be asked to approve a bond issue for a power plant. Instead, the utility management proposing the new plant would seek approval for revenue bonds from its board of directors or its city council, whichever has jurisdiction. In the case of a new wind plant, which is likely to enjoy widespread support from the community, approval for general obligation bonds may be relatively simple to obtain. If successful, then the lower financing costs associated with these bonds can help in overcoming the least cost hurdle.

Discussion at the November and December workshops indicated a strong sentiment in Nebraska in favor of public ownership of power generation. As discussed earlier, Nebraska has no statute requiring this; but the tradition of public ownership appears to be firmly established. And potential private developers of power projects have traditionally shied away from Nebraska because of the fear of public condemnation and takeover of any facilities they might build in the state. Nonetheless, partial private ownership may be advantageous in some cases. For example, a municipality could team with a private developer, provide a majority of project funds through a bond issue and maintain controlling ownership, and offer a minority ownership stake to the developer. The developer could then receive the federal PTC based on its portion of ownership, reducing the effective energy cost from the project. This reduction could help overcome the PRB's least-cost hurdle. And the developer would have some protection against condemnation because that action would arrest the PTC revenue stream. If the developer's ownership position were 49%, then the effective PTC would be about 0.5¢/kWh over the plant life. This credit might bring a plant sized at about 20 MW into the competitive range.

Benefits and Impacts: Local benefits from a wind project, as discussed in an earlier section, will need to be evaluated. These are often difficult to quantify, and sometimes depend on the personal values and judgment of the members of the city council. Many small wind projects in other states have been pursued because the city council believed that the project was "the right thing to do." In Nebraska, in the case of electric power projects, the city council can be trumped by the PRB. One key question is whether a municipality ought to have the right to take some action if its citizens feel that action is prudent.

On the other side of the ledger, care should be taken to ensure that a wind project would not produce unmanageable negative impacts. Siting needs to be carried out with care so that potential wildlife or other environmental impacts are avoided.[13] The wind industry has considerable experience along these lines, so this should not be difficult. In addition, there have been occasional anecdotal inferences to costs associated with damage to roads and other local infrastructure stemming from wind plant construction. Attempts to pin down and quantify such impacts have so far been unsuccessful, so it is unlikely that they represent a serious problem. Nonetheless, a community should be mindful of this possibility and obtain assurances from the plant construction firm that any problems of this type will be rectified at the firm's expense. Such agreements have been obtained without difficulty in connection with many projects elsewhere.

Experience with Local Generation: Two other factors that will bear heavily on the prospects for a local wind project are (a) whether or not the municipality generates any of its own electricity or has prior experience with power generation, and (b) whether or not the municipality's contract with its primary power supplier has an all-requirements provision or other restrictions on the allowed amount of local generation. Often these two considerations will be coupled. If the municipality has no experience with power generation, then it is unlikely to pursue a local wind project. If such a municipality wants to be involved in wind development, then it should consider teaming with other municipalities that collectively have the needed experience. Alternatively, it could team with its primary power supplier, and could even initiate a joint project with that entity.

If an all-requirements provision is in effect –these are common in the case of communities that don't have local generation – then an exception would need to be obtained. Of course, this problem could be sidestepped if the project were pursued jointly with the wholesale supplier. In at least one case, the wholesale supplier (Tri-State G&T) already allows its wholesale customers to purchase or generate up to 5% of their needs from renewable resources. However, if this option is chosen, then substantial penalties apply if a portion of this 5% is later required of the wholesale supplier.

Some municipalities in Nebraska that generate a portion of their local power needs with locally owned generation also own diesel backup units. These are

generally not heavily used, but would be available to firm up the variable output from a wind plant. This flexibility could be very helpful in avoiding any penalties of the type just described.

Energy Export: The potential for export sales form a local project would also be affected by an all-requirements provision. If the wholesale supplier has granted an exception, then export of energy outside of the local community would place that community in competition with the wholesale supplier. This would likely jeopardize the exception.

Project Initiation and Decision Process: In a small municipality, it appears that a project like a new wind plant can be initiated in a number of ways. Individual citizens can propose the idea and be heard. A member or members of the city council, as well as city employees or management, can take the initiative. In general, the sense of those participating in the November and December workshops was that anyone with a good idea can present it to the community and to the city council and receive due consideration. The actual decision to move forward or not would be made by the city council. That body could also authorize the issuing of revenue bonds for project funding, unless the community preferred to pursue financing through general obligation bonds, as discussed above.

Rural Electric District

Much of the above discussion for municipal utilities applies to rural electric districts as well. However, several major differences exist. The major distinction is that none of the rural electric districts own generation. They serve as distribution utilities, and buy all of their electricity from wholesale suppliers like NPPD and MEAN. Hence they have no experience with electricity generating equipment, and a decision to build, own and operate a wind plant would require a substantial change in mindset. Consequently, it seems much more likely that a rural electric district wishing to pursue wind development would do so through a joint project with a power-generating municipality or with one of its wholesale suppliers.

Rural electric districts can bring critical elements to a joint wind project. First, they are much more likely to have an attractive wind site in their service territory than most municipalities. They may even have better access than most wholesale suppliers. Second, their member-owners are likely to include farmers and ranchers who would welcome wind development on their land in anticipation of a revenue stream from wind-generation royalties. And third, these entities would likely bring strong grass-roots support for a wind project because of the very close connection between the local residents and the utility district managements and boards.

The rural electrics also differ in electrical characteristics from most municipal systems. They tend to have low customer densities, and, as a consequence,

long distribution lines with minimal excess power handling capability. In some cases it may be possible to connect a small number of wind turbines directly to the local distribution network, but in most cases upgrades or new lines would be needed. These electrical considerations need to be taken into account when considering wind projects in rural regions.

Native American Jurisdiction

Native American nations in several states are pursuing the development of wind power, both for local consumption and export. The Rosebud Sioux in South Dakota are the furthest along, with installation of a single-turbine wind plant scheduled for early 2003. Since tribal nations don't pay taxes to the U.S. federal government, they, like Nebraska's utilities, are not eligible for the PTC.

The material discussed above on project size and location applies equally well to Native American wind development. Project economics will be strongly affected by size, and even more so by the quality of the local wind resource. Tribal projects are likely to be small, at least initially, so that experience with the technical and business aspects of wind development can be gained without excessive risk exposure. Competitive economics will be difficult to achieve with small projects, so it is especially important to seek the best available wind sites. However, a tribal entity wishing to move ahead with wind power does not need the approval of the PRB.

The Rosebud Sioux have improved the economic competitiveness of their wind project in two ways. First, they have applied for and received some federal grant assistance. Second and more significant, they are selling green tags. Others outside of their territory are buying the environmental attributes of some of their wind energy at prices in the range of 1 to 2¢/kWh. Information about their green tag program is available at www.nativeenergy.com/123.

Three tribal nations exist within the boundaries of Nebraska: the Omaha nation in the eastern part of the state, the Winnebago nation just northwest of the Omaha, and the Santee nation in the north central region. The Winnebago nation has taken some solid steps toward quantifying its wind resources, primarily through a U.S. DOE anemometer loan program. Evaluation of prospective sites in the Omaha and Santee regions would need to be carried out before any serious development could be undertaken in those regions. The federal anemometer loan program is available to assist with evaluations in all of these regions.

Information available to date suggests that eastern Nebraska does not have the best wind sites, but that north central Nebraska, where the Santee nation is located, is rich in strong winds. This suggests that eastern Nebraska tribal entities wishing to pursue wind should consider joint development or other approaches to gaining access to high-wind north central locations.

One issue that has been raised by private developers with respect to business arrangements with tribal entities is concern over durability of contract terms. These terms would be negotiated with the tribal council. Tribal councils are reelected every year, and can change complexion drastically from year to year. Apparently it is not unusual for a newly elected tribal council to reject an agreement approved by an earlier council, so a wind plant developer can't be assured that his multi-year contract will remain in force. However, according to representatives of the Winnebago nation who participated in the December meetings, an agreement with a tribe can specify the operative jurisdictional entity, and this entity could be a U.S. court. The Winnebago nation has also taken steps to improve year-to-year continuity in their tribal council through three-year terms with only one-third elected each year.

In recognition of the contract durability issue, the Rosebud Sioux project is being administered through an independent entity that the tribe owns and that has been purposely placed under the jurisdiction of a U.S. court.

Prospective Policy Options and Incentives

Previous sections of this report have discussed the logic behind incentives to encourage the introduction of new energy technologies and mitigate the associated risks. The impact of public policy on wind deployment in other states has also been discussed. This section offers several options for policies and incentives that may be applicable in Nebraska should the state decide to encourage in-state development of wind power.

Generalize Least-Cost Statute

Applications for new electricity generation facilities and transmission lines are brought before the Nebraska Power Review Board (PRB). As stated in the operative statute, the PRB can approve an application only if "(1) the application will serve the public convenience and necessity, and (2) the applicant can most economically and feasibly supply the electric service resulting from the proposed construction or acquisition, without unnecessary duplication of facilities or operations." Traditionally, economic comparisons of alternatives have been made strictly on the basis of direct costs in conventional monetary terms. Indirect economic impacts, or externalities, are not considered.

As discussed in an earlier section, wind power will in many cases offer benefits that aren't included in a direct-cost comparison, and that often are difficult to quantify. These include emissions-free generation, leading to cleaner air and water; reduced health risks and costs; fuel diversity and energy security; and economic benefits from developing and utilizing an indigenous resource rather than exporting dollars to import fuel.

In some cases, it will be possible to choose wind strictly on the basis of direct-costs comparison – even without consideration of wind's additional benefits. In other cases, the additional benefits could tip the scale in favor of wind, even without rigorous quantification. This could happen if the PRB were given latitude to consider proposed additional benefits during its deliberations, or if the traditional least-cost requirement could be overridden by a community's or district's desire to select a clean energy source such as wind.

A variation on this option would be to allow the addition of some fraction of clean renewable generation – perhaps 10% of installed capacity –outside of the least-cost requirement. As protection against excessive costs, a cap could be set on any premium – perhaps 10% of prevailing wholesale energy costs. 10% is easily justifiable in light of early market prices for green tags in the vicinity of 1 to 2¢/kWh. Such prices indicate that some classes of buyers value the environmental benefits of renewables at 25% or more of current wholesale market prices of 3 to 4¢/kWh.

Allocation of Transmission Costs

Traditionally, if a new transmission line or an upgrade to existing facilities is required to assure reliable interconnection of a new power plant, the costs associated with those new transmission facilities are added to the capital cost of the proposed power plant. As a result, meeting the least-cost requirement becomes more difficult. In most regions of the country, including Nebraska, this is the applicable cost-allocation procedure. However, in at least one state, Texas, the costs of such a new transmission facility are not considered to be part of the new plant's cost. Instead the new transmission facilities are considered part of the overall transmission network, and the additional costs are spread out over all customers of that network. In the end, those customers pay the costs associated with the new transmission in both approaches; but in the Texas approach, the capital cost of a proposed new wind plant is not burdened with the new transmission component.

If Nebraska wishes to facilitate wind power's growth in the state, it could adopt the Texas approach with respect to transmission associated with new wind plant interconnection. How much extra would this cost Nebraska's ratepayers? Consider the following example.

Assume 600 MW of new wind generation were installed in the state (about 10% of current installed generating capacity). In round numbers, this would represent an investment of about $600 million, and about 5% of this, or $30 million, would be for new transmission facilities. If instead no wind were installed and the equivalent additional energy were generated with new conventional facilities, then those facilities would require some new transmission as well. In theory, those new conventional plants could in general be sited closer to major load centers than the wind plants, so their incremental transmission costs might be less. If these were $10 million, then the additional transmission costs resulting from wind generation would be $20 million. The annual carrying costs on this investment might be about 10%, or $2 million.

Hence the impact on the average retail customer (of which there are about 900,000) would be about $2 per year at its peak. Actually, this impact would ramp up in the early years as the installed wind generation increased, and would ramp down in later years as the investments were paid off. In summary, the impact on the average ratepayer would be minimal. In terms of incremental cost per kWh sold in Nebraska, the impact would be less than one-hundredth of one cent at its peak.

Renewables Portfolio Standard

The renewables portfolio standard (RPS) was described in an earlier section. As of December 2002, 11 states had adopted an RPS – three of these in 2002. Several additional states are actively considering an RPS as part of their 2003 legislative agenda. The Nebraska Unicameral Legislature has considered an RPS for a number of years, but it has been consistently rejected. Considerable

opposition to mandates is apparent in Nebraska, and many view an RPS as a legislative mandate.

One can view an RPS largely as a proxy for externalities quantification. Those who support an RPS are saying something along these lines: We know that conventional energy sources pollute and cause health risks – near term and longer term – and we know that clean renewable generators will mitigate these risks. We don't know how to quantify the cost impacts of these risks, but we know they are not zero. Rather than attempt the calculations, we choose instead to decide that a portion of our new generation be renewable, so that over time we will be reducing the health risks related to our electric power system. We don't know if we're moving fast enough or too fast, but we are at least going in the right direction. And we can modify this policy as we gain more information and experience.

The beauty of an RPS is that it forces the renewables and their suppliers to compete against each other. Those that can meet the requirements at the lowest costs will be chosen. And over time the probability is high that any direct-cost differential between renewable and conventional generation will diminish and perhaps be eliminated.

Sales Tax Exemption for Renewable Generation

The Nebraska state sales tax varies from county to county, but averages about 7% on equipment. The cost of a typical power plant is about 70 to 75% equipment, so the sales tax on the plant would generally be about 5% of the capital cost. Exemption of renewable generation from this tax would thus result in an effective cost reduction for renewables of about 5%, reducing the least-cost hurdle. This would be roughly comparable to spreading the transmission interconnection costs over the transmission network as opposed to adding them to the plant cost.

One drawback with this approach is revenue loss to the state, since the sales tax would not be collected. Loss of this "lump sum" amount by the state is likely to cause substantially more disruption than the imperceptible increases in energy bills that would result from the transmission-costs-spreading approach. If 600 MW of wind generation were built over a period of ten years, then about 5% of $600 million, or $30 million, would be forgone by the state over that same ten-year period.

State Production Incentive for Wind Power

As discussed earlier, the Federal Government provides a production tax incentive (PTC) for wind energy. This incentive is available to entities that pay federal income taxes, and is thus not available to essentially all power generators in Nebraska. The PTC is currently worth about 1.8¢/kWh for the first ten years of plant operation, which is equivalent to about 1¢/kWh over a 30 year operating

lifetime. But Nebraska could offer its own production incentive for wind generation installed in the state. This would require revenue from the state.

Suppose the state were to provide wind plants an incentive of 1¢/kWh for 30 years. If 600 MW of wind were installed (neglecting the ramp-up and ramp-down effects described above), and if the average plant operated at a 35% capacity factor, then the amount of energy produced each year would be (600)x(8760)x(0.35) MWh, or 1,840,000 MWh. The 1¢/kWh incentive equates to $10/MWh, so the revenue required would be $18.4 million. At over $10 per capita annually, this is not inconsequential.

How could this amount be reduced? There are several possibilities. First, it could be reduced by any amounts received from the Federal Renewable Energy Production Incentive (REPI), which is intended to provide a benefit for public power similar to the PTC. Historically, this has been less than reliable, since the REPI is subject to annual appropriations. Second, it could be reduced by any PTC payments arising from tradable tax credits. As discussed earlier, such tradable credits could be used by entities such as public power that do not pay federal taxes, and would thus make the PTC available in Nebraska. Such credits were a part of the 2002 Federal Energy Legislation, but their fate at the moment is unknown.

Another approach for reducing costs to the state would be for the state to sell green tags based on wind energy generation in the state. Early markets for these products are being established, and mechanisms are in place to ensure the integrity and credibility of these markets. One established seller of green tags is the Bonneville Environmental Foundation (BEF) (www.bonenvfdn.org or www.greentagsusa.org). This organization sells green tags to individuals or entities that wish to offset their own use of conventional energy with clean energy production somewhere else. The current price for BEF green tags is $20/MWh (2¢/kWh). BEF uses its net proceeds to subsidize energy costs from clean energy sources such as wind plants – in other words, to buy the environmental attributes of renewable energy in an amount equal to the aggregate of all green tag purchases by its customers. Theoretically, BEF could provide some of its funds to Nebraska, helping to fund a Nebraska wind production incentive. Or Nebraska could offer it's own green tags – perhaps at a lower price than BEF. Or Nebraska could work through several green tag marketers, shifting much of the administrative burden to them, and getting the benefit of competition and more net revenue per unit of green-tag selling price.

Customers are actually paying 2¢/kWh for green tags today. It seems reasonable to expect that Nebraska could sell green tags for 1¢/kWh and perhaps more, and thus fund a state production incentive. One suggestion is to offer these tags to entities in the Northeastern region of the country as a proactive measure to reduce pollution from Midwestern coal plants that is carried by the prevailing atmospheric currents to the Northeast. Citizens of the

Northeastern states have long been upset by the impacts on them of Midwestern coal consumption, and have just initiated a lawsuit for relaxing the clean air rules. Nebraska could initiate positive action to reduce coal plant emissions by facilitating displacement of some coal combustion with wind-generated electricity, and by offering Northeasterners the opportunity to help themselves by helping Nebraska move forward with wind deployment.

In addition, several of the Northeastern states have system-benefits-charge (SBC) programs that are funded by a surcharge on electricity bills. These SBC programs – sometimes administered by the state energy agencies – could be approached as major customers for Nebraska green tags, with the logic that the Northeastern states may receive more environmental benefits from wind generation in Nebraska than from wind nearby.

Maintaining Flexibility

It is highly likely that some Nebraska wind development projects will clear the least-cost hurdle on their own without any assistance from incentives. Those pursuing such projects should have the freedom to do so independent of any incentive program the state may establish. These entities would then be free of any administrative burden of an incentive program, and would be free to negotiate their own terms with developers, equipment suppliers, and buyers of wind-generated electricity and environmental attributes.

Conclusions, Recommendations and Perspective

In the light of Nebraska's indigenous wind resources, economic and environmental concerns, public opinions and recent activity of the state's electric power sector, a number of conclusions have been drawn that lead to several recommendations. Where appropriate, some personal perspective is offered on these conclusions and recommendations.

The Opportunity and Nebraska's Response To Date

Nebraska's wind energy resources are substantial – among the best in the nation. They offer the potential for productive investments in excess of a billion dollars that can benefit the state's economy – particularly in rural regions – and improve the quality of the natural environment for current and future generations. Electricity generated from Nebraska's winds offers promise both for in-state use and for energy exports. To date, the state has been slow to move on this opportunity, and it may be slipping away as nearby states move forward with incentives to encourage their own wind plant development.

Perspective

Nebraska's Governor and a number of the state's senators have tried to encourage wind development over the past several years. Public opinion, when it is sought, appears to be strongly in favor of Nebraska wind development, particularly when it is made clear that the incremental electricity costs of wind relative to conventional electricity costs, if any, are small. Some of the smaller municipal utilities have been responsive to their customers' wishes with respect to wind power, and their umbrella organization, MEAN, has pioneered the first significant wind project in the state. But the larger utilities have in general been reluctant to branch out from their courses established over the past several decades.

In general, electric utilities should not be expected to serve as agents of change. They have a primary responsibility to provide reliable electric power, which makes them reluctant to make significant changes in a system that is operating well. So change needs to be directed from outside. Generally this is done through public policies, put in place by elected officials responsive to their constituents. In most states, policies affecting the electric sector are formulated by legislatures, public utility commissions, or some combination of both.

Oversight for Nebraska's electric utility entities is provided either by town or city councils – in the case of municipal utilities – or by elected boards of directors – in the case of the larger public power districts and rural electric districts. The smaller municipal utilities and the rural electric districts appear to be generally responsive to their customers' desires for sensible change.

In the case of the larger utilities, however, it appears that the ability of customers to influence change, even though they are the owners of the systems, is strongly limited. In theory, the people's avenue to utility managements is the elected boards. In practice, however, the boards have a much stronger link with utility managements than to their electorates, so the managements' message of staying the course – often with solid logic – gets much more air time than messages from the public that may have merit but generally are not as focused.

In other states, these public desires find their way into legislation or rulings of the public utility commission. In Nebraska, it seems that the legislature tends to defer heavily to utility managements on electric power matters, so the message about staying the course tends to prevail. And the public utility commission in Nebraska does not have jurisdiction over the electric sector. Hence the public has very little influence on long-term strategy for electricity supply in the state. This explains why Nebraska has in general been slow to try a new power source like wind, and why it is the only state in the Great Plains wind belt that has no policies in place that might encourage early use of this new power source.

Recommendation

Nebraska's major utilities should carefully poll the opinions of their owners to reliably determine attitudes about electricity choices for the future. This polling should be coupled with an objective, dispassionate education effort to enhance public understanding of electricity options and issues. An efficient model process of this type has been developed and used elsewhere, primarily Texas, and should be carefully considered for use in Nebraska. The findings of this survey process should then be reflected in generation-addition plans of the utilities, and in the utilities' interactions with the legislative process.

Incentives for Wind Power Introduction

In many circumstances, wind energy has reached price parity with conventional energy. However, as a general rule, a new product is not selected because of price parity. A new product always carries with it some perceived – and perhaps real – risk. Consequently, some incentive is needed to influence the selection decision. In recognition of this, many states have enacted some form of incentive for wind power introduction. Nebraska has so far chosen not to do this.

Perspective

Earlier sections of this report have discussed the benefits offered by wind power in addition to economical energy, including pollution reduction, fuel diversity and security, and rural economic development. In view of these benefits, a strong case exists that incentives for wind power introduction are warranted.

Some have expressed the view that Nebraska should simply wait until wind power costs come down to those of conventional power. However, this view is misinformed, because it ignores the benefits just mentioned and would delay the realization of those benefits in Nebraska. Of equal importance, it also ignores

the substantial hidden incentives that all Americans pay for conventional energy – payments that are made primarily in our tax bills rather than as part of our energy bills. This view is simply another excuse to avoid change.

Recommendation

Nebraska's Unicameral Legislature should give thorough consideration to policy options that can encourage development of the state's wind energy resources. The apparent, strong public support for clean renewable energy in the state should be verified in a manner such as the polling process discussed above, and then sensible incentives reflecting that support should be implemented.

Incentives and Revenue Neutrality

Several candidate incentives for wind power development have been discussed in the previous section. Some of these, such as a sales-tax exemption, may result in revenue loss to the state, and thus will face hurdles – particularly in today's budgetary climate. Others, such as spreading transmission costs and broadening the Least-Cost Statute, may have small or even negligible impacts on citizens' utility bills, but will not impact state revenues. And one incentive option discussed has the potential for a significant accelerating impact while maintaining revenue neutrality. This option is the wind-energy production incentive, funded by the sale of green tags.

Perspective

The green tags option has substantial potential for the state. As discussed earlier, these tags would provide a valuable product for states East of Nebraska, and thus represent a source of revenue from other states. Of course Nebraskans could buy the tags as well, but their primary value to the state would come in the form of an export product.

In devising incentive programs, it is important to remember that some prospective wind projects in the state are likely to make economic sense in conventional terms without the benefit of any incentives. These should be allowed to proceed on their own outside of any state incentive program, should the project developers prefer that option.

Recommendation

A suite of incentives should be considered by the Unicameral Legislature, with particular attention to those with potential for revenue neutrality. Flexibility should be maintained to allow projects to proceed on their own outside of any incentive program that may be developed.

Joint Projects

This report has proposed wind-development approaches suitable for each of four different classes of utility jurisdiction: large public power; small municipal or group

of municipals; rural electric district; and tribal entity. In some instances, joint projects among two or more of these utility types may make good sense. For example, a small municipal utility or a rural electric district may have an attractive location for a wind plant and/or strong local support, but lack the experience to develop such a project. If the project is pursued jointly with one of the larger public power districts, then development experience and a broad spectrum of other resources would become available. And the larger utility would benefit from assistance with siting and strong local public support.

Similarly, a municipal utility may have sufficient development experience to pursue a project, but may not enjoy a nearby site with good wind resources. Such a utility could team with an interested rural electric district in a good wind resource location, and at the same time bring power plant operating experience which the rural electric district is unlikely to have. Tribes could also consider joint projects, pooling complementary resources like financing, project development experience and wind energy resources.

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Appendix: Workshop Agendas and Participants

November 12, 2002 Workshop Agenda

Workshop on Models To Encourage Wind Development in Nebraska

ENERGY SQUARE
1111 "O" Street
First Floor, Board Room, #105
Lincoln, Nebraska
Tuesday, November 12, 2002

9:00 am **Convene Workshop**
- Overview of model-development effort
- Review objectives of the overall effort and this meeting
- Schedule for the effort

9:30 **General Framework of Electric Power in Nebraska**
- What features affect wind-power development?

9:45 **Public Attitudes About Renewables in Nebraska**
- Are they clear and understood by decisionmakers?

10:00 **Does Wind Power Make Business Sense for Nebraska?**
- Examples from other states and Nebraska
- What does conventional energy cost now? What incentives exist?

11:00 **What Changes in the Electric Power Framework Would Facilitate Wind in Nebraska?**
- Definition and allocation of costs? Generation ownership? New policies? Other?

11:45 **Wrapup and Next-Steps Discussion**

12:00 **Adjourn**

December 13, 2002 Workshop Agenda

Second Workshop on Wind Energy Model Development

Friday, December 13, 2002
Energy Square
1111 "O" Street Room #105
Lincoln, Nebraska

Focus: Small Municipal Models (morning, 9 to noon) and
Rural Electric System Models (afternoon, 1:30 to 4:30)

(We anticipate working through these same topics for both the Small Municipal and the Rural Electric options. For some of the topics, the issues will be similar for both options; for others, the issues may be quite different.)

Agenda Topics:

- Review Objectives of the Model Development Effort
- Expectations for This Meeting
- Discussion of Model Features
    - Appropriate size range for local wind installations
    - Ownership and location options
    - Ownership issues -- e.g., all-requirements contracts
    - Project economics: capital and operating costs, value of displaced energy
    - Options for closing any gaps between cost and value of wind energy
    - Financing options: equity and debt
    - Local benefits and impacts: economic, environmental, other
    - Export potential and issues
    - Other potential issues or barriers
- Next Steps

Distance Access Option:

For those who want to monitor the sessions, but are unable to come to Lincoln, a call-in option is available. Because this option was added late, we were unable to obtain a toll-free number:

- From 9 to 10:05 am **Call 402.472.0060**
- From 10:05 am to 4:30 pm **Call 402.472.6295**

Workshop Participants

Ms. Kate Allen	Senator Preister's Office	Lincoln, NE	N	D
Mr. Jere Bates	Tri-State G&T, Inc.	Denver, CO	N	D
Mr. James Bauer	Administrator, City of Beatrice	Beatrice, NE	N	D
Ms. Diane Beachly		Hastings, NE	N	D
Mr. Jim Burder		Lincoln, NE		D
Mr. Michael Crisco	NE Million Solar Roofs Program	Lincoln, NE		D
Hon. Douglas Cunningham	NE Legislature	Lincoln, NE	N	
Ms. Kim Davis	Senator Cunningham's Office	Lincoln, NE	N	
Mr. Ed DeMeo	Renewable Energy Cons. Svcs.	Palo Alto, CA	N	D
Ms. Chris Dibbern	NMPP Energy	Lincoln, NE	N	D
Mr. Richard Duxbury	NMPP Energy	Lincoln, NE	N	D
Mr. Joe Francis	NE Dept. of Environm. Quality	Lincoln, NE		D
Ms. Kristen Gottschalk	NE Rural Electric Association	Lincoln, NE		D
Mr. Clint Johannes	NE Electric G&T	Columbus, NE	N	D
Ms. Marlene Johnson	Mayor, City of West Point	West Point, NE	N	D
Mr. Lew Kirk		Lincoln, NE		D
Mr. Louis LaRose	Winnebago Tribe	Winnebago, NE		D
Ms. Laurel Marsh	Senator Landis' Office	Lincoln, NE	N	
Mr. John McClure	NPPD	Columbus, NE	N	
Ms. Frances Mendenhall	NE Voters for Sustain. Energy	Omaha, NE	N	D
Mr. Al Meyer	Hastings Utilities	Hastings, NE	N	D
Mr. Monte Moss	Director, Wood River Utilities	Wood River, NE		D
Mr. Ernie Parra	OPPD	Omaha, NE	N	D
Mr. Larry Pearce	Nebraska Energy Office	Lincoln, NE	N	D
Mr. Charles Richardson		Hastings, NE	N	D
Mr. Curtis St. Cyr	Winnebago Tribal Council	Winnebago, NE		D
Ms. Jennifer States	Union of Conc. Scientists	Lincoln, NE	N	D
Mr. W. Cecil Stewart	Joslyn Castle Institute	Omaha, NE		D
Mr. Timothy Texel	NE Power Review Board	Lincoln, NE		D
Mr. Frank Thompson	NPPD	Columbus, NE	N	D
Mr. Gary Thompson	NPPD	Columbus, NE	N	
Mr. Dave Tobias		Pilger, NE		D
Ms. Stephanie Vap-Morrow	NE Dept. of Environm. Quality	Lincoln, NE		D
Mr. Rich Walters	KBR RPPD	Ainsworth, NE	N	
Mr. Albert Wood	Red Cloud Utilities	Red Cloud, NE	N	

N: participated in November 12 workshop
D: participated in December 13 workshop