

National Wind Coordinating Committee Transmission Case Studies

CASE THREE: TRANSMISSION SYSTEM IMPROVEMENTS

DRAFT March 1, 2000 Under review by the National Wind Coordinating Committee¹. Do not circulate or cite. Revised by Terry Allison, June 15, 2000. Revised by Steve Wiese June 23, 2000 and June 26, 2000. Final draft submitted 7/19/2000.

Transmission System Improvements for Wind Energy Development in the Upper Midwest and Great Plains: Opportunities and Obstacles

The Upper Midwest and Great Plains by many accounts are the regions with the greatest potential for wind development in the US. There are many potential developable sites and areas with particularly strong wind resources. Southwestern and western Minnesota, the Dakotas and other parts of the Great Plains, and Wyoming are among the most commonly mentioned. Optimists are calling these areas the "Saudi Arabia of wind." With wind generation possible in the Upper Midwest and Great Plains at \$0.03 - \$0.04 per kWh and electricity prices as high as \$0.14 per kWh in Chicago and other load centers, some advocates envision wind energy as a "new crop" of the Midwest, one they hope can lessen the economic plight of the region's farmers and rural communities. For example, in Lake Benton, Minnesota, home to over 200 MW of wind power capacity, banners now line the streets proclaiming the town as the original "Wind Power Capital of the Midwest."

Another driver of wind development in the Upper Midwest is a Minnesota legislative mandate that requires Northern States Power (NSP) to build 425 MW of renewable generation by 2003 and an additional 400 MW by 2012. To date, NSP has fulfilled 345 MW of the mandate, mostly with wind energy projects, and is initiating procurement processes to complete its 425 MW obligation by 2003. In the near future, other possible regulatory drivers of wind power development would include a federal renewable portfolio standard, additional state renewable portfolio standards or system benefits policies adopted in the Midwest, as well as adoption of new rules facilitating development of distributed generation resources.

However, serious transmission obstacles hamper the expansion of wind power in the Upper Midwest and Great Plains. For the past 10 to 15 years, traditional utilities have built very few large generating plants. Instead, independent power producers (IPPs) have built most of the new generation by simply interconnecting to existing transmission facilities. As one consequence, the rate of investment in new or upgraded transmission facilities has lagged behind historical averages.² As a result, the existing transmission system in many locations is becoming heavily loaded and transmission planners are growing concerned about the integrity and stability of the transmission system in general.

This transmission situation makes wind power deployment in the Midwest and Great Plains more difficult than it might otherwise be. In many cases, the best wind resources are located far from major electrical load centers. Often, electrical transmission facilities connecting the windy

¹ The NWCC is a consensus-based collaborative endeavor formed in 1994 that includes representatives from electric utilities and their support organizations, state legislatures, state utility commissions, consumer advocacy offices, wind equipment suppliers and developers, green power marketers, environmental organizations, and local, state, tribal, regional, and federal agencies. The NWCC identifies issues that affect the use of wind power, establishes dialogue among key stakeholders, and catalyzes activities to support the development of an environmentally, economically, and politically sustainable commercial market for wind power. More than 2,500 individuals from diverse sectors and wind resource areas across the country have participated in the NWCC's collaborative efforts.

² Hirst, Eric, *Electric Reliability: Potential Problems and Possible Solutions*, April 2000.

areas and the load centers are non-existent or at best minimal. Even in cases where a good wind resource has nearby transmission, that transmission often has limited available capacity to transport additional energy. In fact, transmission facilities throughout much of the Upper Midwest/Great Plains are strained, and this problem is acute at specific points of congestion. Representatives of NSP acknowledge that the Mid-Continent Area Power Pool (MAPP) does not have a robust transmission grid and that it will have to increase transmission capacity to accommodate additional wind or other types of generation. According to Charles Grunewald, senior engineer in NSP's transmission planning group, most of MAPP's transmission was built to support the goals of reliability and reserve-sharing, not to support spot generation, such as wind.³

The problem of transmission capacity is not confined to wind. Instead it is a general problem of concern to many in the electric power sector. Transmission upgrades system improvements have been proposed, are being considered, or have been carried out in several parts of the Midwest (See Box 3A). The experience of these transmission upgrades system improvement proposals contains lessons that should prove instrumental in dealing with transmission needs associated with regional wind power expansion.

Box 3A. Proposed Transmission System Improvements in the Upper Midwest and Great Plains	
Respondents in this case study cite two transmission system improvement proposals currently under consideration. These proposals are:	
Chisago Electric Transmission Project *	
Route: From Chisago Substation northeast of Minneapolis to Taylor's Falls, MN, crossing St. Croix National Scenic River in St. Croix, WI, and ending in Baron County, WI.	
Cost:	Information not available.
Proponents:	Northern States Power, Dairyland Power, and Wisconsin Electric.
Opponents:	Concerned River Valley Citizens, Renew Wisconsin, various municipalities.
Note:	On June 21, 2000, a settlement was reached to enable the Chisago project to move forward. This settlement was worked on by Northern States Power, Dairyland Power Cooperative, Concerned River Valley Citizens, Citizens Advisory Task Force, and the cities of Taylor's Falls, MN and St. Croix Falls, WI. The settlement will result in significant changes to the original Chisago proposal (pending approval), including a smaller project scope, with more of the line following existing rights-of-way, and many existing lines being removed.
Arrowhead-Weston Transmission Line Project	
Route:	Duluth, MN to Weston, WI
Cost:	\$200-\$250 million.
Proponents:	Minnesota Public Power and Wisconsin Public Service
Opponents:	Unspecified environmental organizations.

A critical issue brought to light in this study is whether wind and other forms of power generation see common interests in pursuing transmission system improvements. North Dakota is an illustrative example. North Dakota has the nation's highest or second-highest wind resource potential, yet current wind generation online in the state is less than 1 MW. The state has a very

³ Windpower Monthly, October 1999.

low population and exports three times as much electricity as it consumes. The lignite coal industry is an important economic actor in the state, and according to one public utility commissioner interviewed, the industry recently blocked two legislative resolutions calling for studies on green pricing and the economic effects of wind development. Until transmission issues are resolved, wind energy and other generation sources may be caught in a zero-sum situation where wind development is perceived as competition for the base load, which is primarily derived from coal.

Another critical issue is actual and potential opposition to transmission system improvements from those along transmission rights-of-way. Local opposition tends to believe the benefits of these improvements accrue to interests outside of the abutting communities while the impacts are felt locally. Area utilities stress that such improvements benefit all customers. Environmental advocates generally are strong allies of the wind community, but their support of wind generation sometimes takes a back seat to their opposition to facilities that benefit coal and hydroelectric power stations. In addition, environmental advocates often object to the environmental and aesthetic impacts of new transmission lines.

The cost of making transmission system improvements also is a barrier to resolving these issues. These costs often make reaching customers far from the wind resources prohibitive. A related issue is the challenge of allocating financial costs of transmission facilities among regions that share in the benefits and costs of the infrastructure as well as among utility shareholders, taxpayers, and electric utility customer classes within each region. Also, there is suspicion among environmental and community stakeholder groups that utilities advocate for transmission system improvements in order to better position themselves in a more competitive electric market, perhaps at the expense of other parties.

Resolution of each of these issues is made more difficult by the lack of a coherent regional stakeholder or regulatory forum in which the needs and concerns of disparate governmental, industry, and interest group representatives can be heard and balanced. In addition to federal regulation by the Federal Energy Regulatory Commission (FERC), electric power transmission is regulated at the state level by Public Utility Commissions (PUCs). These state commissions determine the need for transmission projects and may be involved in transmission siting decisions. The two electric reliability organizations in the Upper Midwest and Great Plains, MAPP and the Mid-America Interconnected Network (MAIN), have some authority to study and recommend transmission system improvements, but the fragmented nature of transmission system governance is a concern.

Some people see a need for a larger entity governing transmission with broader regional representation and greater decision-making authority. A recent proponent of regional transmission system governance has been the FERC, which in late 1999 mandated the formation of regional transmission organizations (RTOs) to move transmission system governance in this direction. As RTO development progresses in the Upper Midwest and Great Plains, any effort to build a coalition in favor of transmission system improvements faces the challenge of convincing stakeholders that the upgrades are of universal benefit.

Case Study Approach

This NWCC case study focuses on transmission issues in the Upper Midwest and Great Plains as they relate to wind development and seeks to understand some of the issues, viewpoints, benefits, concerns, and potential alliances among stakeholders as perceived by diverse constituent groups within the region. NWCC staff conducted interviews with a variety of affected stakeholders in the utility, regulatory, wind industry, environmental, and community advocate sectors from Wisconsin, Minnesota, Illinois, and North Dakota. Their views on transmission

system improvement issues were solicited through a questionnaire that aimed to test three assumptions:

- Assumption 1. Transmission system improvements would provide significant benefits to the electricity network and its customers;
- Assumption 2. The benefits from transmission system improvements would be helpful, but not confined, to wind power; and
- Assumption 3. Transmission alliances among stakeholders within and external to the wind community can provide benefits in the public interest.

Although the pool of interviewees was not comprehensively representative of the relevant sectors in every state mentioned, the interviews are useful for identifying issues of importance to different stakeholder groups and for identifying some of the concerns and preferences they hold for transmission system improvements. The findings should be seen as preliminary conclusions about diverse interests' views of a technically and politically complex situation. The findings do suggest further lines of inquiry that can be pursued through more in-depth research or through stakeholder involvement activities.

Stakeholder Responses

The following sections detail the responses of stakeholder group representatives to each of the assumptions listed above.

Assumption 1. Transmission system improvements would provide significant benefits to the electricity network and its customers.

None of the interviewees disagrees with the assumption that all power generation, including wind, would benefit from a more robust transmission system. Possible benefits acknowledged include reducing line losses, improving stability of the grid, and reinforcing the grid for improved reliability. The ability to schedule firm transmission also would improve, giving utilities greater ability to move blocks of power around the grid and facilitating more economically efficient power transactions.

Respondents also are aware of transmission constraints, congestion, and reliability issues in the MAPP/MAIN region. Of particular note are the congestion difficulties in Minnesota, reliability problems in Wisconsin, and the constrained interface between the MAPP/MAIN systems. A wind industry member states, "The [Midwest transmission] infrastructure is lacking in many areas and needs to be upgraded." One MAPP transmission planning subcommittee member states,

"We're seeing a real problem getting more wind out of Minnesota and the Dakotas. You could possibly squeeze some out of Western Area Power Administration transmission lines, but you can only put so much new generation in without new transmission. For example, the additional 197 MW of new wind generation in Iowa is already stressing the system."

Opinions vary on the extent to which transmission system improvements would result in performance and reliability improvements in the transmission system and cost savings to utility customers. One utility representative posits that an increase in transmission system capacity by 10 percent would increase the typical customer's retail bill by about 1 percent, greatly increase system stability, and ease the problem of wind integration considerably. Another respondent states some cost savings could result from reduced transmission congestion. A wind industry member predicts transmission system improvements would be more expensive in the short run, but would pay for themselves in the long run. A member of the MAPP transmission planning

committee suggests that reduced line losses could decrease the amount of energy needed to be produced by area power plants and offset at least part of the cost of improvements.

While respondents agree that transmission system improvements would provide benefits, many also point out that significant financial, environmental and social costs are associated with these projects. A financial cost concern involves the issue of who pays for transmission improvements that benefit wind power projects under deregulation. Owners of traditional generation may argue in RTO forums that wind generators should pay for a larger portion of the transmission improvements since wind may be a primary beneficiary of these improvements. Indeed, an emerging trend in RTOs is to place the burden of new transmission capacity onto individual generators or marketers who want to resolve a congestion problem.

Discussions revealed the following issues as environmental cost concerns over transmission system improvements:

1. Forest and habitat fragmentation impacts.
2. Aesthetic/visual impacts, particularly viewshed impacts to protected areas; e.g., the St. Croix National Scenic River in Wisconsin and Minnesota and Theodore Roosevelt National Park in North Dakota.
3. Avian impacts; e.g., birds can collide with conductors.
4. Land use impacts; e.g., contribution to changes in larger land use patterns.
5. Vegetation impacts; e.g., herbicides sprayed under lines to suppress vegetation.
6. Construction/demolition impacts; e.g., upgrades of existing lines may require demolition of old towers and construction of new towers.

These specific land abutter concerns also were identified:

1. Lines cross farmers' fields and disrupt their machinery;
2. Electromagnetic fields (EMF) are a perceived health risk;
3. Property values decline proximate to transmission lines; and
4. TV/radio reception is affected.

On the question of social costs, the issues of equity and fairness are paramount, i.e., who benefits from a transmission system improvement and who pays for it. While utility representatives argue that such improvements provide their ultimate benefit to all electricity customers, many environmentalists and community advocates are concerned that the distribution of both internal and external costs associated with a transmission improvement does not mirror the distribution of benefits. One community advocate suggests that NSP's ratepayers will pay the majority of the costs to build the Chisago transmission line and receive relatively few of the benefits, while Wisconsin Electric's ratepayers and others will receive the majority of the benefits and pay little or none of the costs. Says one environmental activist, "The locals are the ones making the environmental sacrifices and not getting the benefits."

Environmentalists and community advocates distinguish between upgrades of existing transmission lines within existing rights-of-way and construction of new transmission lines. These interests generally oppose any new transmission lines involving new rights-of-way. A community advocate whose organization is currently opposing both the Chisago and Arrowhead-Weston projects states: "Strictly upgrading existing transmission lines [within existing rights-of-way] is environmentally friendly. However, there is no environmental benefit to

building new transmission lines." Other environmental and community advocate respondents have concerns about the physical impacts of transmission system improvements, but are not automatically opposed to construction of new lines. Their primary concern is that new lines do not benefit sources of generation that they normally oppose.

Utility perspectives on transmission proposals are quite different. Transmission system improvements are viewed as necessary steps to maintain the reliability of the transmission system and to continue to provide customers with low cost power. These respondents believe there is a lack of understanding by the public and advocate groups on the function and operation of the transmission system.

Assumption 2. The benefits from transmission system upgrades would be helpful, but not confined, to wind power.

In the Upper Midwest and Great Plains, respondents agree that transmission system improvements will benefit wind. The greatest demand for electricity is in the population centers of Minneapolis, Chicago and other cities far from the best wind resources. As one respondent put it, "The Great Plains are sitting on a huge source of cheap power," but without additional transmission capacity, wind energy can't get to the markets.

If transmission system improvements are adopted and capacity constraints dealt with, the region could significantly increase its export of wind energy in ways that are either benign or beneficial to other major generation interests. The laws of physics dictate that the electric power transmission system cannot distinguish between energy produced from different sources. The consequence is that transmission system improvements that are beneficial to wind may also be beneficial to any other generation sources. Transmission constraints limit the ability of utilities to supply cost-effective power, whether from renewable or non-renewable resources, to demand centers efficiently. Increased transmission capacity could enable utilities such as Basin Electric and Otter Tail Power to export more fossil fuel-derived power from the Dakotas.

This attribute of transmission system improvements is problematic for wind, whose advocates typically oppose fossil fuel development. These advocates tend to hold the view that environmental benefits of new wind generation will not be realized unless the new wind generation displaces new or planned generation from non-renewable sources. This line of reasoning is extended beyond generation to transmission system improvements; unless the improvements facilitate additional wind generation without facilitating fossil generation, the environmental benefits of the transmission improvement are questionable.

Environmental and community advocates are very concerned about which interests benefit from transmission system improvements. When they perceive coal and hydroelectric power interests as benefiting from proposed transmission projects they tend to take a negative view toward the projects. One environmental respondent acknowledged that a proposed transmission project could result in some benefits for wind in terms of increased transmission capacity, but says, "It would not be worth the cost in terms of environmental impact. It would be better to displace less environmentally desirable generation first." Another environmental respondent states,

"The proposed [Arrowhead-Weston] transmission line could not benefit wind. The line would serve underused coal plants in Minnesota and hydro power in Canada. We are generally opposed to any transmission capacity that serves coal."

The same environmental respondent states that for his organization to support a transmission project, a considerable portion of the capacity must be dedicated to renewables. He adds that benefits to renewable energy "from transmission projects that also accommodate non-renewables are conceivable, but renewable energy advocates will likely view any project through the lens of what the net carbon emissions are." He asks further,

"Are we doing transmission projects to help wind power or are we doing this to help large utilities improve their bottom line? How do we know the transmission improvements will be used for wind power and not be just an increase in capacity so that utilities focusing on transmission (under deregulation) can have more capacity to move huge blocks of hydro from Canada and coal from the Dakotas to Milwaukee and Chicago?"

Further, while environmentalists and community advocates tend to be strong supporters of wind energy they often consider conservation and efficiency as higher priorities than renewable energy. This statement of an environmental respondent captures this perspective: "Most increases in load can be addressed through efficiency improvements. We could cut electricity demand 50 percent and not suffer any deficiencies. Additional energy consumption should bear the cost of new transmission." A utility respondent counters that a 50 percent reduction in load through conservation and efficiency efforts is not realistic to expect and that new transmission is vital for remote renewable resources like wind.

Assumption 3. Transmission alliances among stakeholders within and external to the wind community can provide benefits in the public interest.

Respondents in nearly every stakeholder group note that the fractured, multi-jurisdictional governance of the transmission system makes accomplishing transmission goals a difficult process. A wind industry member states that, "transmission in the Midwest is a patchwork of different interests and different lines." One MAPP transmission planning committee member noted that,

"In the MAPP region, which includes portions of 7 U.S. States and 2 Canadian Provinces, it is difficult to get wind projects going that require transmission system improvements crossing several jurisdictional boundaries. We need some kind of regional entity that can identify the need for new transmission and follow through with a plan that can be implemented on a regional basis. This way the wind farm developer doesn't have to pay the capital cost of transmission."

He goes on to say, "No regional plan has yet been proposed for exporting more wind power from the Buffalo Ridge area. This is an important issue, because it tests the ability of a regional transmission planning group to see a regional need and then propose a solution." A consequence of this system is that it may be necessary to develop regional alliances that bring together diverse stakeholder perspectives to ensure that proposed transmission system improvements serve the public interest.

Further, distrust and diversity of perspectives among affected stakeholders may frustrate attempts to form and sustain alliances necessary to accomplishing transmission goals. Environmental respondents tend to perceive a need for a cultural shift among utility personnel regarding their willingness to work positively to accommodate wind and other renewable energy resources on the transmission system. In contrast, utility respondents tend to perceive a need for deeper understanding of the functions and operation of the transmission system by environmental and community advocates, as well as by the general public. An appropriate stakeholder alliance could provide a forum in which these misunderstandings, differences of opinion, and cultural barriers could begin to be broken down.

Summary and Conclusions

This case study set out to ascertain the validity of three assumptions from the perspectives of stakeholders involved in wind energy and transmission issues in the Upper Midwest and Great Plains. The assumptions, and the stakeholders' reactions to each, are summarized below:

Assumption 1. Transmission system improvements would provide significant benefits to the electricity network and its customers.

Respondents acknowledge the potential for overall system benefits in the form of reduced line losses, improved grid stability and reliability, and enhanced ability to conduct spot market transactions. They also agree that these benefits relate to specific regional needs. However, there is disagreement over the extent of other benefits such as efficiency gains and cost savings from reduced line losses. Further, environmental and community interest groups point out that none of these benefits are realized without significant financial, environmental and social costs.

Assumption 2. The benefits of transmission improvements would be helpful, but not confined, to wind power.

All respondents agree that wind energy could benefit from transmission system improvements. But they also acknowledge, reluctantly, in the case of environmental stakeholders, that the benefits of an improved transmission system cannot be limited to environmentally preferable forms of generation. Some environmental and community advocate respondents also feel that transmission system improvement projects can be avoided altogether through energy conservation and efficiency measures, and by substituting wind energy for fossil generation.

Assumption 3. Transmission alliances among stakeholders within and external to the wind community can provide benefits in the public interest.

The fractured, multi-jurisdictional governance of the regional transmission system, and the distrust and diversity of perspectives among affected stakeholders, may make the formation of multi-stakeholder alliances necessary to accomplishing transmission goals. If the wind industry and utilities want to partner with environmental and community advocate groups in supporting a transmission project, they may have to convince these groups that the project would result in a net environmental benefit. The project proponents would have to make the case that the benefits of the additional wind energy will at least offset the emissions of any additional fossil generation made possible by the transmission project, as well as offset the environmental impact of the transmission project itself.

The interviewees' responses suggest several conclusions and actionable next steps that address the transmission issues covered. They are:

1. Stakeholder groups have different perspectives that lead to conflicting conclusions on the need for new transmission. Additional education and dialogue on transmission issues would be beneficial to fostering common understanding among diverse interests about both the impacts of the transmission infrastructure to society and its benefits. Utility respondents feel strongly that there needs to be greater public understanding of how the transmission system works and its changing use after open access policies were mandated by FERC.
2. Current transmission planning processes are insufficient for bringing new transmission projects to fruition. A broader consensus is needed on energy policy objectives, environmental impacts, and economic benefits to help resolve the standoff on the need for improvements to the transmission system. An improved regional approach to resolving transmission planning disputes ultimately must be found. It is possible that the evolving Midwest ISO could emerge as the forum needed to develop such an approach

in the Upper Midwest and Great Plains. Wind advocates and other interested parties should monitor the formation of the Midwest ISO and act to influence emerging transmission policies and procedures. RTO development proceedings in other regions also present promising opportunities to develop regional consensus-building alliances in support of transmission upgrades.

3. Transmission system improvements that are needed in the Upper Midwest and Great Plains to serve the needs of wind development and other generation interests seem unlikely to occur without facing continued opposition from environmental and community advocate interests. A new approach that provides assurances that proposed transmission system improvements will produce renewable energy and environmental benefits, and will provide compensation for those along the transmission rights-of-way, may be required.

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