

TRANSMISSION PLANNING AND WIND ENERGY

Issue Brief

ISSUE DESCRIPTION/ PROBLEM STATEMENT

Changes over the past decade in the electric power industry are making transmission planning more challenging and complicated. In some regions, generation, transmission and system operations are becoming unbundled. Generation is becoming competitive, but transmission and system operations are still regulated. Bulk power wholesale transactions have steadily increased in volume, leading to new demands on the transmission system.

Yet investment in transmission capacity has lagged behind growth in electric load. While transmission capacity increased slightly faster than summer peak demand between 1979 and 1989, this trend sharply reversed during the 1990s, and new transmission capacity is expected to lag behind load growth for this decade as well. One report suggested that as much as \$56 billion may be needed this decade to preserve transmission adequacy at its present level.¹

These changes are leading to a re-examination of transmission planning and how best to conduct transmission planning in this new and changing market environment, not only from the perspective of adding new transmission capacity, but also from that of making the best use of existing transmission capacity and incorporating non-transmission alternatives.

¹ Hirst, Eric and Kirby, Brendan. 2001. *Transmission Planning for a Restructuring U.S. Electricity Industry*. Edison Electric Institute, Washington, D.C.

ISSUE IMPORTANCE

Generally, transmission planning has been conducted to meet local needs in accordance with planning standards of the North American Electric Reliability Council (NERC), such as frequency or reactive power standards, or to interconnect generators to the grid. In recent years, the Federal Energy Regulatory Commission (FERC) has been pushing transmission operators to expand transmission planning to enhance competitive bulk power markets, in addition to maintaining electric reliability and interconnecting generators.² In Order 2000, the proposed Standard Market Design (SMD) rule, and the April 2003 "White Paper," FERC required regional transmission organizations (RTOs) or independent system operators (ISOs) to be responsible for regional transmission planning, as well as any necessary transmission expansions, additions or upgrades for maintaining reliability and to increase access to lower cost generators.³

² See, for example, FERC's order of December 19, 2002, that approves PJM as a RTO. *Order Granting PJM RTO Status*, Dockets No. RT01-2-001 and RT01-2-002, December 19, 2002. Available at <http://www.pjm.com/documents/downloads/ferc/2002docs/december/20021219-pjm-rto-order.pdf>.

³ For Order 2000, see *Regional Transmission Organizations*, Order No. 2000, Docket No. RM99-2-000, issued December 20, 1999. Available at http://www.ferc.gov/Electric/RTO/post_rto.htm. For SMD, see *Standard Market Design*, Docket No. RM01-12-000, issued July 31, 2002. Available at <http://www.ferc.gov/Electric/RTO/Mrkt-Strct-comments/smd.htm>. The FERC White Paper, issued April 28, 2003, is available at http://www.ferc.gov/Electric/RTO/Mrkt-Strct-comments/White_paper.pdf and

Transmission planning is especially important for wind. Some of the best wind development sites are in remote areas where the transmission infrastructure is either non-existent or will need some upgrades. And although wind will need transmission, because it is an intermittent resource, it will not need it all the time. Because wind is new, it must compete for transmission with established generators. Also, wind development may occur very quickly and outstrip transmission planning processes. Wind projects may be developed in a matter of months, whereas new transmission capacity may take years to develop. For instance, in Texas, nearly 1,000 MW of wind was brought on-line in 2001, outstripping available transmission capacity. For all of these reasons, transmission is important to wind, and failure to resolve the transmission issues in a satisfactory manner could create serious impediments for future wind development.

The emergence of RTOs and ISOs could broaden transmission planning to a regional effort, rather than being performed on a utility-by-utility basis; allow other stakeholders to participate in the transmission planning process; and could potentially incorporate non-transmission alternatives into the transmission planning process. Yet this also makes transmission planning more challenging, not only because more stakeholders may be involved, but also because any proposed transmission expansion may need the approval of multiple state regulatory authorities.

Other difficulties arise from transmission planning because the transmission system comprises a network that is a common resource and affects multiple parties. Furthermore, the flow of electric power is not precisely controllable but is governed by the laws of physics; what happens in one part of the grid can affect

http://www.ferc.gov/Electric/RTO/Mrkt-Strct-comments/White_Paper_Appendix_A.pdf.

other parts of the grid. The creation of RTOs also means that transmission planning is changing, from individual utilities planning for their system to meet customer demands, to regional planning conducted by RTOs. RTOs must plan not only to ensure regional electric service reliability, but also to ensure a thriving regional bulk power market. This transition raises important questions and illustrates several issues that sometimes work in opposition to each other. Some of these issues include the following:

- *Regional Impacts*—Congestion in one part of the transmission system will affect potential power transfers in another part of the transmission system. Similarly, transmission upgrades may also affect power transfer capabilities throughout the transmission system.
- *Multiple Interests*—Transmission operations affect several entities. For example, transmission expansion may increase market opportunities for certain generators or threaten existing generators with competition from lower-cost generators.
- *Lumpy Investment and Long Operating Life*—Transmission is a long-lived and lumpy investment with low operating costs. This can result in free rider problems, in which market participants are interested in using transmission but are not interested in paying for transmission additions.
- *Regulatory Uncertainty and Complexity*—Transmission planning and investment are generally public processes. These can be quite time-consuming, and investors may be unlikely to invest in transmission projects until they are certain they will recover their investment.
- *Public Attitudes Towards Transmission*—Public opposition has emerged to new transmission because of concerns about

property values, environmental impacts, and potential health effects caused by electromagnetic fields.⁴

Complicating all this is that transmission planning is a data-intensive process, especially if transmission planning is done on a regional basis. Large amounts of detailed data are required on transmission, generation and load. Yet in a more competitive environment, this kind of data is getting more difficult to obtain.

CASE STUDIES OF WIND AND TRANSMISSION PLANNING

Because wind development can outpace the addition of new transmission capacity, a case-by-case approach to wind and transmission planning, such as through generator interconnection, may not be effective because the first wind developer may get saddled with paying for the incremental transmission upgrades needed to bring additional wind projects on-line. For these reasons, more focused regional wind development and transmission plans may be more successful. Examples of such plans are provided below.

MIDWEST:

Wind on the Wires (WOW), in conjunction with the American Wind Energy Association (AWEA) and various wind energy companies, looked at utility transmission queues and surveyed wind energy companies in the region to derive estimates of potential wind development within the Midwest ISO (MISO).⁵ The purpose was to submit the results to MISO

for input into MISO's regional transmission expansion planning process.

WOW prepared a "high wind" scenario of 10,000 MW for MISO's regional transmission expansion plan, as a means of driving the discussion of what transmission infrastructure would be necessary to deliver that amount of wind to market. Over 800 MW of wind is operational in the Midwest, with another 1,000 MW in near-term development, which is defined by WOW as identified projects with identified sites, owners and customers who have agreed on price, timing and quantity of power. According to WOW, there is currently about 5,000 MW of new wind power in the regional interconnection queues.

In June 2003, MISO's Board of Directors approved the 2003 MISO Transmission Expansion Plan (MTEP). The high wind scenario put forward by WOW and AWEA was included as one of four transmission scenarios and 11 transmission concepts. MISO determined that under the high wind scenario, lower marginal costs of wholesale energy may be realized as long as additional transmission investment is made, and that the cost-benefit ratio of that potential investment warranted additional study. The MTEP also included several exploratory transmission scenarios that will be subject to additional study to determine whether it is worthwhile to move forward with certain new transmission additions or expansion. One such scenario is the northern Iowa-southern Minnesota exploratory transmission scenario, which will be important if planned wind projects in those two states or in North Dakota and South Dakota are going to come to fruition.

Also, states in the MISO region have chartered a new Organization of MISO States (OMS) to bring state utility commissions together in their response to the regional planning underway in MISO. With its own small staff, bylaws, and a large

⁴ Hirst and Kirby, *op cit.*

⁵ American Wind Energy Association and Wind on the Wires. *Midwest Wind Development Plan*, June 1, 2002. Available at <http://www.solpath.com/luna/admin/documents/MidwestWindDevPlan.pdf>.

contingent of volunteers from state commissions, OMS is intended to coordinate the information needs and state responses to MISO regional transmission plans.

WEST:

The California electricity crisis of 2000-2001 prompted the Western Governors' Association (WGA) to conduct an ad hoc study of potential transmission enhancements that may be necessary over the next decade, as well as alternatives to transmission expansion such as emerging technologies, more efficient use of electricity that reduces demand, peak load management and distributed generation located at or near the customer load.⁶

In fall 2002, AWEA collaborated with Western Resources Advocates and wind developers in the West to devise a wind development plan.⁷ At the time of the plan, 2,254 MW of wind power were operational, with another 48 MW under construction and 1,142 MW planned. The organizations predicted another 8,000 MW of new wind projects could come on-line by 2007 and perhaps another 12,000 MW by 2013, for a total wind capacity of just over 23,000 MW by 2013.

In October 2003, the Seams Steering Group for the Western Interconnection (SSG-WI), using data provided by AWEA and Western Resource Advocates, issued a report outlining a framework for expanding transmission in the interconnection.⁸ The

⁶ Western Governors' Association. *Conceptual Plans for Electricity Transmission in the West*. August 2001. Available at http://www.westgov.org/wga/initiatives/energy/transmission_rpt.pdf.

⁷ American Wind Energy Association. *WECC Wind Development Plan*, September 5, 2002. Available at <http://www.solpath.com/luna/admin/documents/WECC Wind Development Plan.pdf>.

⁸ Seams Steering Group Western Interconnection. *Framework for Expansion of the Western Interconnection Transmission System*, October 2003.

report modeled transmission congestion in 2008 and 2013 using a variety of generation and load scenarios, and assuming that generation with the lowest operating cost would be dispatched first. The 2008 part of the study is considered the base case and only includes generation and transmission infrastructure that will likely be in operation by 2008. The 2013 part of the study considers three scenarios: gas-fired, coal-fired and renewables. The renewables scenario assumes that 72 percent of new generation added between 2008 and 2013 will be from renewables. For the renewables scenario, SSG-WI estimated that over 3,000 miles of new transmission would need to be constructed, at a cost of about \$7 billion, but annual production cost savings (as compared to the 2008 base case) would range from \$3.65 billion to \$6.1 billion, depending on natural gas prices and hydroelectric availability. These findings led to the formation of the Rocky Mountain Area Transmission Study group that is focused on Utah and the states adjacent to Wyoming. The study is intended to determine if transmission constraints can be overcome in order to access the region's coal, natural gas, and wind resources.⁹

OPTIONS FOR RESOLVING THE ISSUE

These relatively broad and conceptual studies illustrate what is necessary to bring large quantities of energy resources, such as wind, onto the grid as well as the benefits and market savings that could accrue if transmission is expanded and lower-cost resources can be accessed. The next step after these studies is to create sub-regional groups to focus on more detailed proposals, to identify potential beneficiaries of these proposals and to address and re-

Available at <http://www.ssg-wi.org/documents/316-FERC Filing 103103 FINAL Transmission Report.pdf>.

⁹ For more information, see <http://psc.state.wy.us/htdocs/subregional/home.htm>.

solve issues such as cost recovery, financing and potentially, incentive proposals.

There are other important issues that also need to be considered in transmission planning. The NWCC has undertaken an effort to identify a common set of principles that underlie a robust regional transmission planning process. These include the following considerations:

- *Transmission planning entities should be independent:* To eliminate the potential of conflict of interest, parties with a financial interest in the outcome of the planning process should not have control of the transmission planning entity.
- *Transmission planning entities should have overall responsibility for regional planning and identifying needs:* RTOs and ISOs, in particular, are well suited to consider regional needs and to devise a regional transmission plan.
- *Transmission planning should be transparent and include regional stakeholders:* Active public involvement should be encouraged to ensure that all regional values are incorporated in the transmission plan.
- *All resources should be considered when preparing a transmission plan:* In addition to traditional generation and transmission resources, demand-side resources, distributed generation and intermittent resources should be considered.

- *Congestion costs should be considered:* Transmission congestion, either measured through locational-based marginal prices or by the number of calls for requested transmission loading relief (TLRs), is illustrative of where the transmission system is undersized relative to demand.
- *Potential generator market power should be accounted for:* Transmission congestion can reduce or even stop potential market transactions from taking place. Depending on the circumstances, it could potentially increase a generator's ability to charge above-market prices. In contrast, additional transmission capability can access lower-cost generation and potentially reduce generator market power.
- *Transmission planning should comply with operating and planning standards:* Clearly, an important part of a transmission plan is to ensure that the transmission entity complies with all NERC operating and planning standards, and that non-standard technologies such as wind energy are considered.

A more complete discussion of the transmission planning principles is provided in the NWCC consensus document on the web at www.nationalwind.org. At the end of the day, it must be recognized that the transmission planning process can be very contentious, and must consider the viewpoints of a broad cross-section of society. Ultimately, the success of a transmission plan will depend not only on how well the plan is developed, but also on whether the recommendations of the plan can be implemented.

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**NWCC Members and Associate Members include
representatives from:**

Consumer Groups

Economic Development Organizations

Agricultural Interests
Rural Development

Electric Power

Co-operatives
Investor Owned Utilities
Public/Municipal Utilities

Environmental Organizations

Conservation/Wildlife Groups
Renewable Energy Advocates

Federal Government

Bureau of Land Management
Department of Energy
Fish and Wildlife Service
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