UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Assessing the State of Wind Energy In Wholesale Electricity Markets — Docket No. AD04-13-000

REMARKS OF TRI-STATE GENERATION AND TRANSMISSION ASSOCIATION, INC. FOR THE FERC TECHNICAL CONFERENCE ON WIND ENERGY IN WHOLESALE ELECTRICITY MARKETS

PLANNING, GRID OPERATION, AND UTILIZATION

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SUMMARY:

Wind generation has unique and problematic characteristics such as intermittent non-dispatchable output, remote location, and off-peak production that pose particular problems to transmission planning and operation.

Without proper mitigation, wind generation can cause significant problems in system control area performance, energy imbalance, inadvertent pool interchange, and transmission system expansion.

Traditional transmission planning tools, practices, and organizations, with some modifications and changes in emphasis, can effectively study wind generation development.

Wind generation cannot contribute to operating reserve requirements but can make modest contributions toward planning reserve margins.

Investment sharing and cost allocations will continue to be the most dominant barrier to transmission system expansion.

If new transmission is to be constructed, future planning studies should be based on committed power sales agreements or generation development rather than vague possibilities for development.

COMMENTS:

Introduction:

Tri-State Generation and Transmission Association (Tri-State) is a consumer-owned electric power cooperative supplying power and transmission services to 44 member electric power distribution cooperatives and public power districts in Colorado, New Mexico, Wyoming, and Nebraska. Tri-State's member systems serve over 1 million people in a 250,000 square-mile service territory. (A Tri-State Member Service Area Map is attached.) Tri-State's 2003 member peak demand and energy sales were 2,100 MW and 11,700 GWh, respectively. Tri-State owns 2,000 MW of generation and holds contracts for an additional 1,050 MW of generation. Tri-State owns or has capacity rights in 5,083 miles of transmission line and 135 substations/switching stations. In addition, Tri-State supports a renewable power program that furnishes renewable energy to those consumers who elect to participate in the program.

Tri-State is very interested in addressing the issues surrounding the integration of wind energy resources into transmission grid and power resource operations. Tri-State owns and operates transmission facilities in many of the geographic areas containing high wind energy potential. While these transmission facilities have been constructed primarily to serve the loads of our member systems and are often of limited capability, they may be useful in providing some transmission for wind resource development. However, because of the intermittent nature of wind resources and their remote locations from load centers, we are concerned about the impacts of intermittent wind resources on transmission system planning and operations.

Unique needs of wind generators

Wind energy resources have a number of unique characteristics that pose significant problems to the transmission system planner and operator. These characteristics are:

- Intermittent, some would say erratic, power output of wind turbines
- Inability to dispatch wind resources
- High output in off-seasonal-peak months and low output in seasonal-peak months.
- Rural locations remote from load

- Short development and construction time relative to development and construction time for supporting transmission.

These characteristics generate needs that can be accommodated to some extent in current transmission system operations and planning practices, provided that the wind generation capacity is relatively low (less than 5%) compared to control area load and/or remote transmission facility capacity. However, large scale development of wind generation can overwhelm traditional approaches to operations and planning. The problems and some potential solutions are discussed in the following paragraphs.

The intermittent and non-dispatchable nature of wind generation can cause problems with <u>control area performance</u> for control areas generating, transmitting and/or receiving wind energy. Control area performance standards, as set by NERC, are extremely important to the operation of the grid. These standards assure that discipline is enforced in frequency control, scheduling, and interchange. Wide deviations from these standards can lead to severe energy imbalances within a control area and large inadvertent pool interchange accounts among control areas. Both of these outcomes can result in economic damage to parties uninvolved with the wind energy transaction. The direct <u>solution</u> to this problem is to place more conventional generation into the spinning reserve mode sensitive to both frequency and area control area (ACE) stimulus. This much larger spinning reserve would smooth out the erratic output of the wind generation by mirroring wind generation output with counterbalancing conventional generation output providing the necessary load regulation. However, there are limited candidates for spinning reserve. Pulverized-coal steam and large gas-fired combined cycle units have very slow ramp rates and usually do not cycle well. Where hydro generation is available in the western interconnection, it can be a very responsive resource for regulation. However, drought and environmental restrictions on river operations have greatly diminished the regulation capabilities of hydro generation at many locations. The only remaining generation asset for regulation is simple-cycle gas-fired turbines which can be effective if installed in sufficient quantities and with favorable operating characteristics. Resource planning for those entities purchasing large amounts of wind energy should include provisions for adequate amount of installed simple-cycle turbines. Since most simple-cycle turbines cannot operate below 50% of nameplate capacity because of NOX emission violations, there must be careful consideration given to the amount of installed turbine capacity relative to wind generation capacity and to the operating characteristics and capabilities of the turbine equipment (i.e. stop/start times, ramp rates, and efficiencies.)

The problems that wind generation encounters with energy imbalance costs are well documented and need no extensive discussion. The most direct solution to this problem is to place the burden of adequate load regulation on the entity purchasing the wind energy by dynamically scheduling the wind generation output to the control area or subarea of the purchasing entity. Also, assessing energy imbalance charges on an after-the-fact market price determination would be a fair approach provided this pricing was available on a nondiscriminatory basis to other entities in the control area. Monthly net interchange accounts result in subsidization and should not be considered.

The remote rural locations for wind generation development often require substantial transmission system expansion and improvement because of the sparse transmission facilities in those areas. Because of the transmission systems in these areas are usually adequate for area load service, transmission system expansion for wind generation development rarely brings any needed collateral transmission benefits and associated cost-sharing to the entity serving the rural loads. Also, rural areas with heavy irrigation load often have as high as an 8 to 1 ratio between loads in the summer irrigation season and loads in the off-season. This makes it impossible to use load displacement in a transmission scheme. The resulting cost burden for all of the transmission expansion investment can render the wind generation uneconomic in a competitive environment or extremely costly in a mandated RPS environment. One solution to the problem of high transmission expansion investments would be to partner with developers of conventional generation to achieve economy of scale through joint construction of high-capacity transmission. The wind resources may be able to negotiate a proportionately smaller share of the investment cost by agreeing to wind generation curtailments for transmission outages.

Wind resources can be developed in short time period relative to transmission construction. This can lead to either generation project delays or stranded generation. This may be an intractable problem. It is impossible to narrow the time lag between generation and transmission. Successful construction of the required transmission will require early and sustained commitment to the wind generation development in order to assure cost recovery for the transmission investment.

Planning process modifications

Traditional practices and tools for transmission planning and operational studies can be used for assessing the availability of existing transmission capacity or the need for new transmission facilities for wind generation. However, there is probably a need for increased use of production cost and market simulation studies run on a continuum time line as opposed to the snapshot approach of distinct powerflow and stability cases. These models must recognize and simulate the constraints imposed by existing power supply and transmission ownership and arrangements rather than blithely assume single entity operation. They must also realistically model wind generation regimes, and the implementing purchase agreements (seller, buyer, quantity, etc…) associated with the wind development.

If we are to make timely progress in the development and integration of wind resources, it is essential that we make maximum use of existing regional planning organizations, whether in RTO, ISO, or joint planning groups, that have demonstrated success in planning transmission expansion. These organizations certainly can be modified and adapted to include wider stakeholder participation and more transparent processes. It would be a mistake delay planning efforts while awaiting the implementation of regional RTOs or other similar entities since it is likely that some regions may be years away formulation of such entities.

Lastly, many regional studies have been conducted to explore the transmission requirements for possible large scale wind and/or conventional generation development. These studies have developed useful information on likely transmission construction opportunities. However, transmission will not be constructed on mere possibility or likelihood. The next round of transmission studies should be based on solid needs with identified power supply agreements (buyer, seller, quantity, generation sites, delivery points, regulation responsibilities, etc…). It is need and commitment that will construct transmission.

Cost Recovery

We must also recognize that the various studies are in some respects the easier part of the transmission expansion process. It is far more difficult to arrive at investment sharing and cost recovery agreements that are the basis for project financing and construction. Coordinated planning efforts can and have developed elegant, long-range transmission expansion plans that meet regional needs only to see such plans flounder and fail when agreement on cost allocation cannot be achieved. Regional coordinated transmission planning efforts must be founded on the expectation that participating beneficiaries are prepared to participate at high levels of investment and/or cost recovery.

Wind generation contribution to reserve requirements

Wind generation contributions to operating reserve requirements are non-existent because of their non-dispatchable nature. Therefore no capacity credit can be give to wind for operating reserves. However, despite the absence of dependable on-peak capacity, wind generation can contribute to the planning reserve component of total reserve margin requirements if those requirements are set by LOLP studies that accurately model the contribution of the wind resources. The LOLP studies should indicate that the addition of the wind generation capacity to the study reduces the amount of reserve margin required for a fixed level of LOLP probability.