

WIND INTEGRATION HOT TOPIC QUESTIONS - OMS ANSWERS

- 1) What are the key barriers¹ to participation of wind resources in the Midwest ISO markets?
 - a) Limited, inadequate or constrained transmission capacity.
 - b) Uncertainty in timing of Midwest ISO queue/interconnection process.
 - c) Time to complete new interconnection upgrades and upgrade costs. Problematic even if developers get 100% of the costs refunded after commercial operation begins, as is the case for some Midwest ISO states..
 - d) Lack of economical energy storage. Because wind generation is higher during times when load is lower, with high levels of wind generation there can be significant operational issues that will limit the amount of wind generation that can be integrated into the Midwest ISO region. Energy storage would help to expand this limitation.
 - e) Learning curve for existing market and operational processes to incorporate wind resources.
 - f) Many wind stakeholders are not used to working within Midwest ISO stakeholder process.
 - g) Some of what is happening regarding wind is outside of Midwest ISO's and/or state regulators' sphere of influence. For example, it is not clear whether federal legislation will require a "federal transmission highway" to deliver wind from the best resource locations throughout the entire Eastern Interconnection. Thus, the amount of wind that can be integrated into the MISO footprint may be significantly restricted by MISO's ability to integrate only limited amounts of wind power because of operational issues.
 - h) Longer-term wind generation forecasts have a high level of inaccuracy making participation in Midwest ISO day-ahead market problematic.
 - i) Under tariff provisions during low load periods, the scope and use of must-run, must-offer coal facilities with the potential curtailment of wind may act as a barrier to entry to wind resources.
- 2) What recommendations would you have to address these barriers?
 - a) The Midwest ISO Reliability Subcommittee should work on operational issues associated with wind generation and report to the Midwest ISO Advisory Committee and OMS Board of Directors.
 - b) Continue work in Minimum Generation Task Force. Created last year, the objective of the Minimum Generation Task Force is to provide input, policy guidance, and recommendations to the Market Subcommittee (MSC) and the Reliability Subcommittee (RSC) on how the Midwest ISO might mitigate and better deal with issues that arise during Supply Surplus situations, as defined under the Midwest ISO Emergency Operating Procedure RTO-EOP-003, "Supply Surplus Procedures".
 - c) Resolve cost allocation issues.
 - d) Keep interconnection queue reform a priority.

¹ The OMS recognizes that many of these barriers apply to wind and to other forms of generation as well.

- e) The Midwest ISO should sponsor seminars or other forums on wind integration issues for exchange of ideas and educational purposes. Invited attendees could include industry, academia, system operators, regulatory and legislative representatives.
- f) The Midwest ISO's Independent Market Monitor (IMM) should opine whether any tariff provisions or bidding and offer provisions or other opportunities exist for the exercise of market power by must-run base load fossil fuel units that are not committed by economics.
- g) Possible solutions to forecasting difficulties could include showing wind in real time or in shorter and more reliable four-to-six-hour time increments.

3) Given the characteristics of wind resources, how can the Midwest ISO products and services be enhanced to enable participation of significant amount of wind resources in the markets?

- a) Explore possible changes to the Reliability Assessment Commitment (RAC) process to better integrate intermittent resources such as wind. For example, consider whether adding a four-to-six-hour RAC would allow for more accurate wind forecasts.
- b) Explore how well the current Renewable Energy Credit (REC) exchange processes are working and report whether further actions are needed to facilitate exchanging of credits among participants.
- c) To reduce problems with trapping wind generation in supply zones, the Midwest ISO should proactively plan transmission that will more fully integrate wind power into Midwest ISO energy markets.

4) What specific changes would you recommend to the Midwest ISO with respect to integration of variable generation resources - based on what the other RTOs, RROs, or other reliability/market organizations are doing?

- a) The Midwest ISO is already involved in issues related to wind integration. Along with the Southwest Power Pool and ERCOT, these three RTOs encompass some of the most significant wind resources in the United States. It is important that these RTOs coordinate and share information on wind integration. The Midwest ISO is reviewing wind interconnections with the experience of day-ahead, real-time and nodal markets across multiple RTOs.
- b) The Southwest Power Pool is running Generation Interconnection Cluster studies to determine transmission upgrades necessary to integrate large amounts of wind, and is using the results of these studies along with other potential transmission upgrade needs to evaluate the cost-effectiveness of various near-term upgrades to its transmission system. While MISO has several good longer-term planning processes for possible futures, it needs to move forward with near-term plans that will help to systematically integrate wind into its footprint.
- c) ERCOT currently has the greatest wind penetration to load and is therefore already dealing with operational issues that the Midwest ISO is likely to face in the near future. While it is clear the Midwest ISO is aware of many of the operational issues associated with wind integration, meeting with and seeking input from ERCOT on operational issues and solutions could prove helpful. ERCOT does have experience with Competitive Renewable Energy Zones and the performance of transmitting wind power out of those zones to load zones.
- d) Coordinate information from the Western Interconnection on wind integration. Research and present any wind integration work done internationally.

5) In the presentation provided, it is stated that Midwest ISO strives to provide a level playing field for all Market Participants. What areas of market design related to Wind Integration should Midwest ISO consider in creating this level playing field?

a) As a nascent industry, wind generation is currently being incubated by different tax, regulatory, and operational policies. Midwest ISO operational policies that favor certain generation types should be phased out as the wind industry matures. Any temporary skewing of competitive markets due to these incubation policies needs to be addressed. For example, wind generation has still run at -\$40 LMP due to renewable portfolio standard (RPS) requirements, dollars coming in from RECs, and tax credits. Typical generation would stop generating at such a high negative LMP if it could.

In this regard, MISO may want to consider revisiting methods used to set LMPs. For example in the day-ahead market for energy, MISO may want to look further into the future with respect to unit commitments to determine the cost impact that shutting down base-load, non-wind generation at night will have in terms of that generation not being available to meet load the next day when wind generation has significantly decreased. If there are significant cost increases, then perhaps they should be reflected in the LMPs that are paid both day-ahead and real-time for generation at night.

b) Wind generation should be subject to the same Revenue Sufficiency Guarantee (RSG) rules as other generation while also being allowed to provide services that use shorter term forecasts. (See # 3 above.)

6) To the extent you believe there are operational (from presentation slide 6) and planning (from presentation slide 7) process challenges associated with integrating significant amounts of wind generation, how would you propose addressing them?

a) Capacity credits under Module E – resource adequacy. The Midwest ISO should continue stakeholder work toward qualifying wind resources in a manner that recognizes geographical and other operational differences.

For example, the Midwest ISO may want to assign a capacity credit based on average capacity credit information in the zone and then revise the number based on historical information once site-specific historic information is available.

Another example would be to consider the use of statistical analysis when determining capacity credits. An appropriate statistical metric may include use of the coefficient of variation (defined as standard deviation divided by mean) in determining how much of a capacity credit to give a particular generating unit. Technologies or resources in locations with a low coefficient of variation should be given significantly more credit than resources with a high coefficient of variation. At a high enough level, no credit for Module E purposes would be appropriate. The coefficient of variation is a useful statistical technique in assessing risk, and is used extensively in the insurance industry where risk assessment is paramount, a situation not unlike system electric reliability and resource adequacy assessment under Module E.

Another statistical example would be to consider using the standard deviation of the percentage change as a measure of the volatility of capacity available from a particular generating unit during monthly peak periods. This is the metric used in measuring the level of price volatility in both bilateral and RTO energy markets.

b) RSG – revenue sufficiency guarantee. Currently wind generation does not pay RSG charges for deviations in real time. The Midwest ISO should consider changes in the RAC process such that wind can better avoid deviations and be subject to the same rules as other generators within the Midwest ISO.

c) Min Gen alerts. Issue resolution should continue to be handled in the Midwest ISO Min Gen Task Force with changes to Midwest ISO procedures and tariffs recommended to the MSC and RSC.

d) Load following. Wind can start up and cease very quickly resulting in significant ramping problems for other generation. The Midwest ISO should consider a pricing method that has the cost causer pay the cost. Currently it is assumed that load is the cost causer for ramping problems, but with significant amounts of wind coming on line, this will no longer be true.

e) Market power. Some states require that RPS be met from in-state renewable generation or must be met by a certain amount of hours of renewable generation without regard to market prices. States must be vigilant to spot possible market power abuse from a critical supplier. Beyond a state however, there may be a potential for market power issues such as the exercise of market power due to renewable generation sellers' involvement in a sellers market. The Midwest ISO IMM should provide information as to how/if it monitors such market power abuse potential.

7) To the extent there are additional market costs associated with addressing operational issues, how should they be allocated?

a) Where possible Midwest ISO should determine the cause of additional operational costs and develop policies (cost allocations or pricing) that result in the additional operation costs being paid by those causing the costs.

8) Should a stakeholder Task Force be established to coordinate Wind Integration issues or should the issues be vetted at existing stakeholder groups? Does your sector have any comments or recommendations on the time line provided?

a) The wind integration issues cover almost every aspect of market and reliability operations. Therefore, Midwest ISO needs some way to coordinate these issues among the existing stakeholder groups. A possible approach is to have each of existing stakeholder groups appoint a small number of representatives to a Wind Integration Team. The Wind Integration Team would group the various issues that the representatives bring to the table. Then as the stakeholder groups propose solutions for these issues, the Wind Integration Team would review the solutions for consistency across the various area involved.

b) Though ambitious, time line for high-level milestones and deadlines meshes with the OMS Cost Allocation Regional Planning (CARP) and the Midwest ISO Regional Expansion Criteria & Benefits Task Force timelines. Facing a possible national renewable energy standard, wind integration should be a top priority for Midwest ISO. Wind integration issues and solutions for these issues need to be fully developed and ready for implementation by the end of 2010.