Renewable Resources – Integration Challenges & Opportunities
Midwest ISO Annual Stakeholder Meeting

Appropriate Level of renewable resource integration in the region: 5, 10, & 20 years

The Midwest ISO should plan to integrate, in the near and mid-term, sufficient renewable resources to support regional state policy and market demand. Key guidelines include:

- Midwestern Governors Association Energy Security and Climate Stewardship Platform
  - Renewable electricity: 10% by 2015, 20% by 2020, 25% by 2025, 30% by 2030
- Current and developing state Renewable Energy Standards
  - Minnesota: 15% by 2012, 21% by 2016, 25% by 2020, 27.5% by 2025
  - Wisconsin: 10% by 2015 (proposal to increase to 25% by 2025)
  - Illinois: 10% by 2015, 17.5% by 2020, 25% by 2025
  - Iowa: 15% by 2015 (goal), 25% by 2025 (proposed / under development)
  - Michigan: 10% by 2015, 25% by 2025 (proposed / under development)
  - Missouri: 8% by 2015, 11% by 2020 (goal)
  - North Dakota: 10% by 2015 (goal)
  - Ohio: 12.5% by 2025 (proposed / under development)
- Generator Interconnection Queue requests

The Midwest ISO should also plan to integrate, in the mid and long-term, sufficient renewable resources to support Eastern Interconnect (state and federal) policy and market demand. Key guidelines include:

- DOE / AWEA 20% Wind Vision (by 2030)

Challenges for renewable resource integration in the region relative to: transmission, unit commitment & dispatch, public policy, and financial equity.

- Proactive, forward looking transmission planning and development for aggregated renewable generation in the near, mid, and long term; intra-regional and inter-regional transmission costs allocated broadly.
- Timely and successful processing of the Generator Interconnection Queue.
- Reduction of increased uncertainty in the unit commitment time frame.

Proper role of the Midwest ISO in the integration process.

- Regional Transmission Planning
- Generator Interconnection Queue
- Energy and Ancillary Services markets
- System Reliability
- Provide objective and factual information

Specific actions the Midwest ISO should (or should not) be taking to enable renewable resources in the region.

- Develop and implement Regionally Planned Generator Interconnection Transmission Projects
- Develop and implement Queue reform
- Incorporate wind plant output state-of-the-art forecasting to protect against unit commitment errors due to predictable changes in regional wind generation
  - Protect against under commitment (reliability issue)
  - Protect against over commitment (economic issue)

  Examine the value of stochastic unit commitment tools to develop a more robust unit commitment solution to further reduce wind integration impacts.
- Complete technically rigorous regional wind plant integration operational impacts analysis based on current and emerging best practices; examine actual integration costs independent of tariff design structure
  - Quantify net physical impacts based on multiple years of synthetic wind plant output time series data synchronized with load data from the same time period
  - Capture wind plant geographic diversity through time synchronized weather simulation
  - Utilize wind forecasting best practice and combine wind forecast errors with load forecast errors
- Based on impacts identified in rigorous regional integration analysis, increase responsive / non-spin reserves and operational flexibility
  - Consider changes in market rules to encourage more flexible and maneuverable generation; Inventory current generating capability within MISO and see if more flexibility can be gained from existing generation via incentives and/or changes in market rules to encourage such flexibility.
  - Near term, consider expanding demand response initiatives to provide flexible resources for variable renewable resource integration on the demand side; Longer term (10 years out), consider potential role of plug-in hybrids and new technologies
  - Minimize contractual obligations that limit system maneuverability (e.g. must-run QF contracts, flat block contracts, etc)
- Continue to adopt market rules and tariff provisions that are appropriate for weather driven resources
- Continue working towards consolidating balancing area functions
- Consider using curtailment for periods of high wind generation to mitigate a small, well defined number of hours of annual peak operational and transmission impacts.

Key references include:

- *Utility Wind Integration State of the Art*, Utility Wind Integration Group, in cooperation with the American Public Power Association, the Edison Electric Institute, and the National Rural Electric Cooperative Association, May 2006. http://www.uwig.org/
- IEEE Power & Energy Magazine November / December 2007 Issue on Wind Integration
- *Utility Wind Integration and Operating Impact State of the Art*, IEEE Transactions on Power Systems, Vol. 22, No. 3, August 2007. http://www.uwig.org/opimpactsdocs.html
- *Best Practices in Grid Integration of Variable Wind Power: Summary of Recent US Case Study Results and Mitigation Measures, presented at EWEC '07 Conference in Milan, Italy in May 2007.* http://www.uwig.org/opimpactsdocs.html
- *2006 Minnesota Wind Integration Study*, EnerNex and WindLogics in collaboration with the Midwest ISO, November 2006. http://www.puc.state.mn.us/news_events/index.htm#electric
- *Cost-Causation-Based Tariffs for Wind Ancillary Service Impacts*, Kirby B, Milligan M, Wan Y, June 2006. http://www.nrel.gov/wind/pdfs/40073.pdf
- Midwest ISO Transmission Expansion Plan study results
- Joint Coordinated System Plan study results and associated wind DOE/NREL Eastern Wind Integration and Transmission Study results