

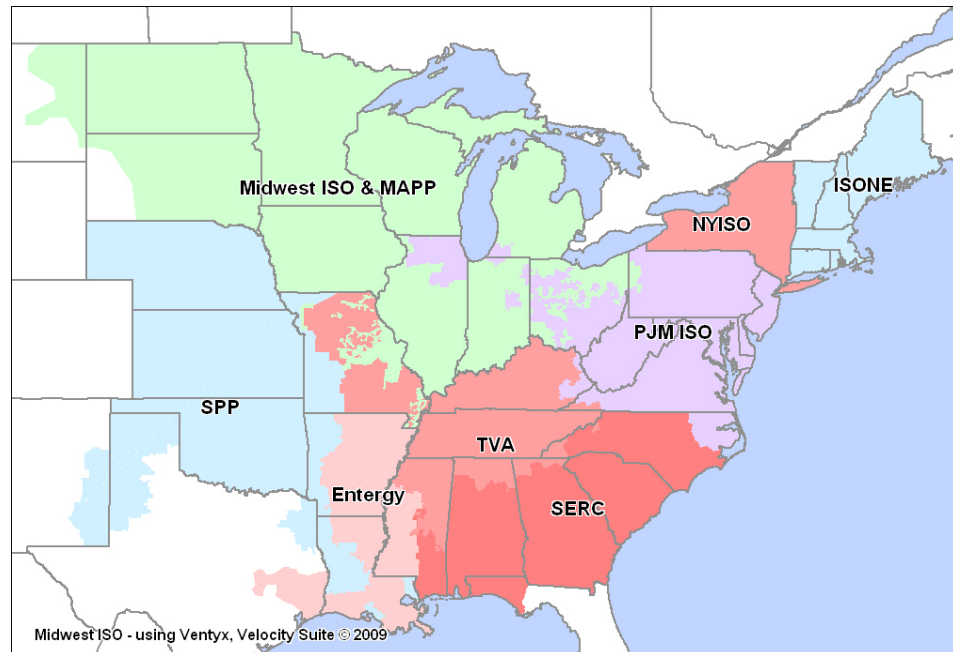
# Eastern Wind Integration and Transmission Study

Great Lakes Regional Wind Energy  
Workshop  
March 1, 2010

Dave Corbus  
National Renewable  
Energy Lab

# EWITS Analysis - What is Needed to Integrate 20% Wind in the Eastern Interconnect?

- Evaluate the power system operating impacts and transmission associated with increasing wind energy to 20% and 30%
- Build upon prior wind integration studies and related technical work;
- Coordinate with current regional power system study work;
- Produce meaningful, broadly supported results
  - Technical Review Committee



# Technical Review Committee

- Includes representation from the following organizations

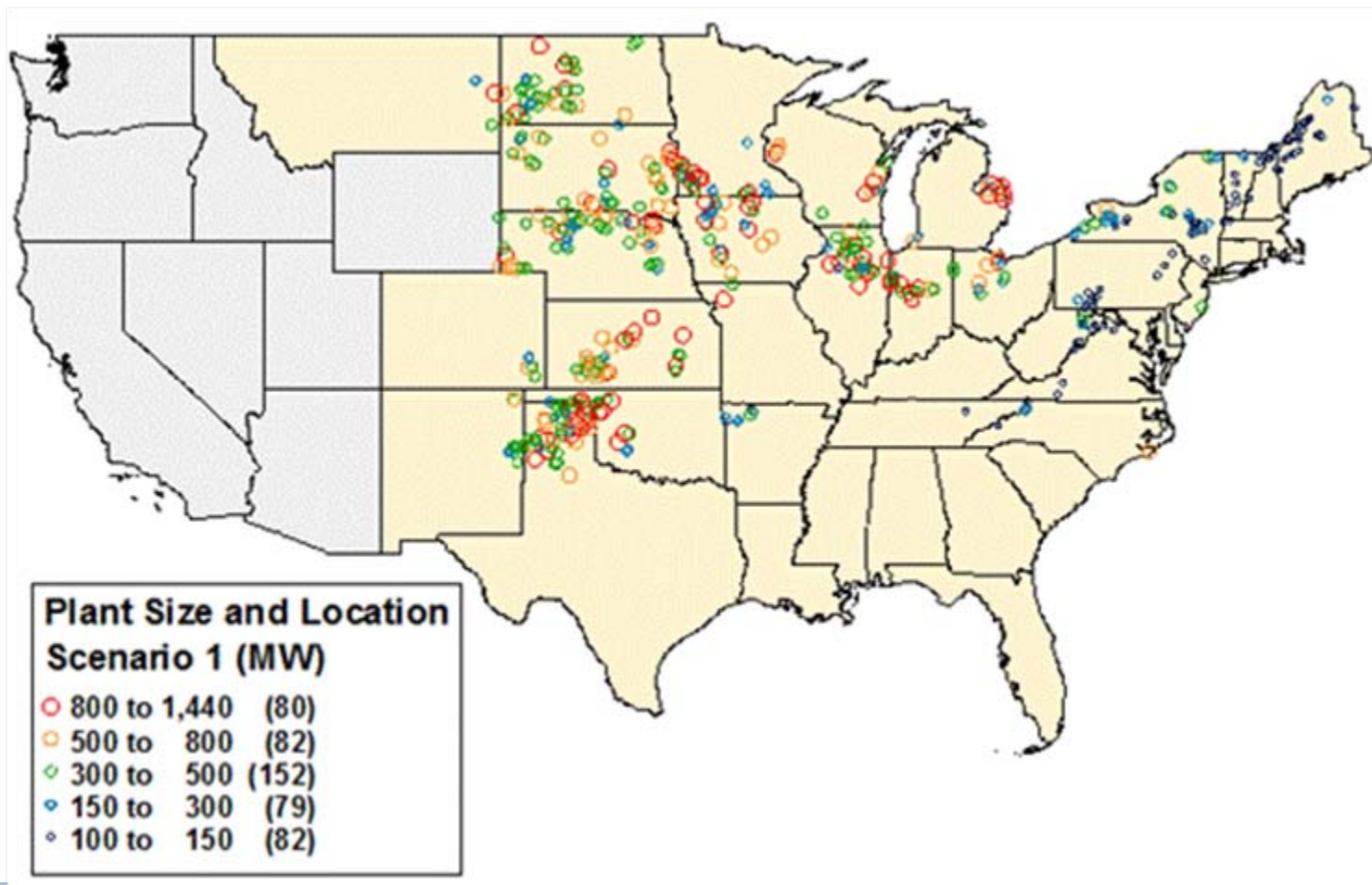
**New York Independent System Operator (NYISO)**  
**Xcel Energy**  
**Southern Company**  
**PJM Interconnection**  
**Southwest Power Pool(SPP)**  
**U.S. Department of Energy**  
**Midwest ISO (MISO)**  
**Michigan Public Service Commission**  
**Area Power Pool (MAPP)**  
**American Wind Energy Association (AWEA)**

**Federal Energy Regulatory Commission (FERC) – observer status**  
**North American Electric Reliability Corporation (NERC)**  
**CapX 2020 (Great River Energy)**  
**Windlogics**  
**National Renewable Energy Lab**  
**General Electric (GE)**  
**Regulatory Assistance Project**  
**University College Dublin**  
**Organization of MISO States (Wisconsin Public Service Commission)**

# EWITS Analysis Provides Detailed Information on

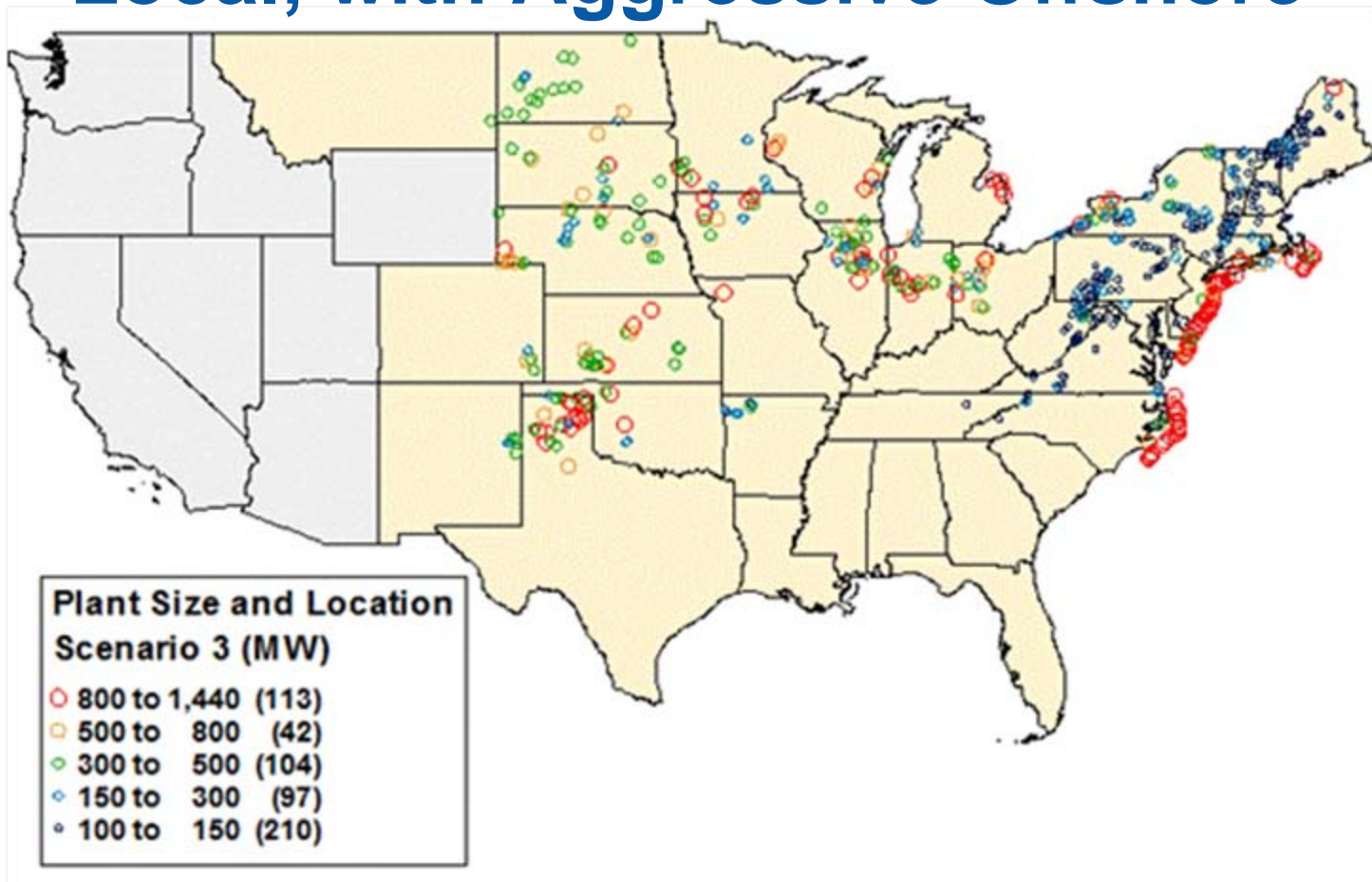
- Wind generation required to produce 20% and 30% of the projected electric energy demand over the U.S. portion of the Eastern Interconnection in 2024
- Transmission concepts for delivering energy economically for each scenario
- Economic sensitivity simulations of the hourly operation of the power system with wind generation, future market structures and transmission overlay
- The contribution made by wind generation to resource adequacy and planning capacity margin

# Scenario 1 – 20% “High Capacity Factor, On shore”



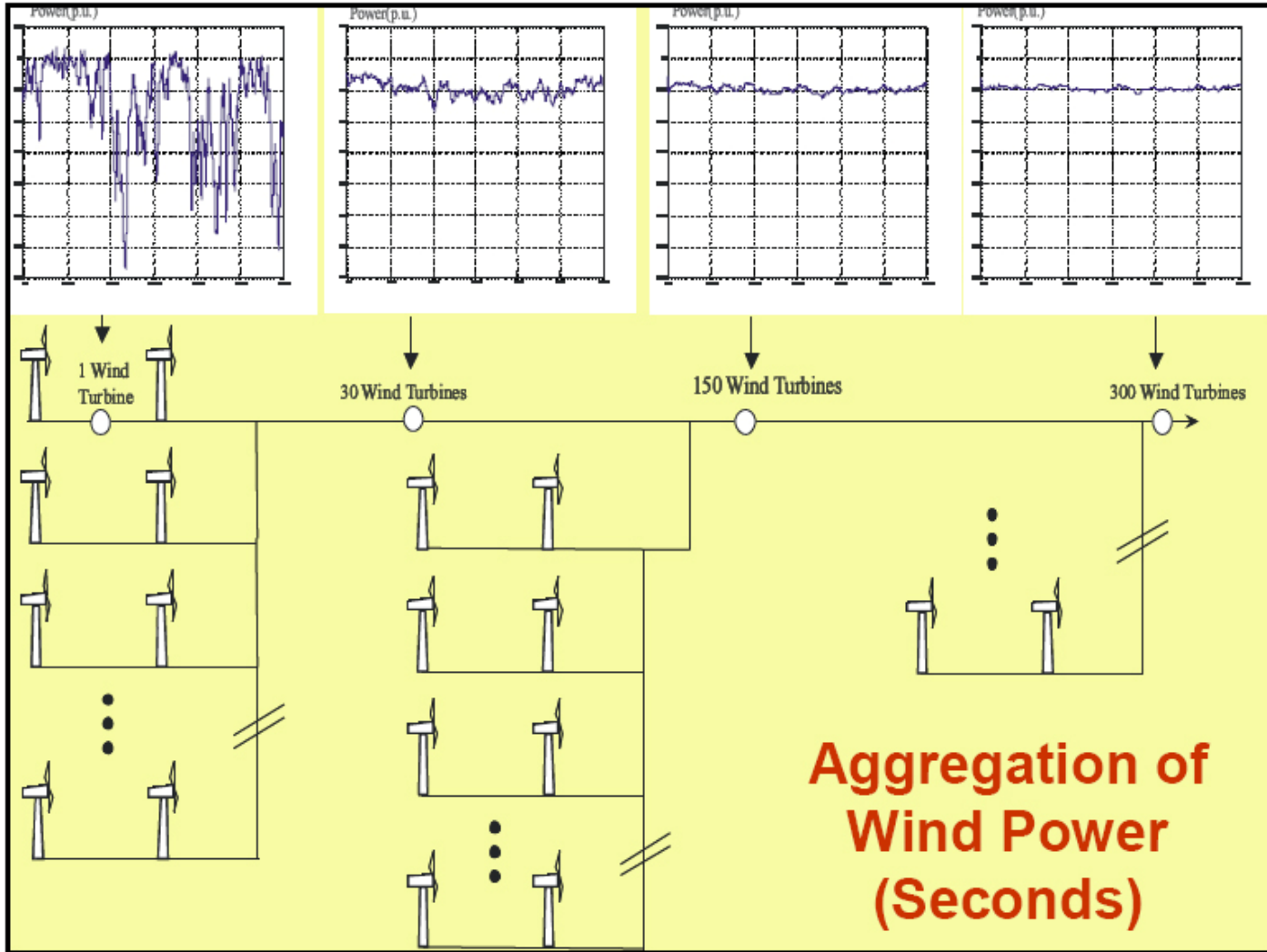
# Scenario 3 - 20%

## “Local, with Aggressive Offshore”





# The Power of Aggregation and Geographic Diversity

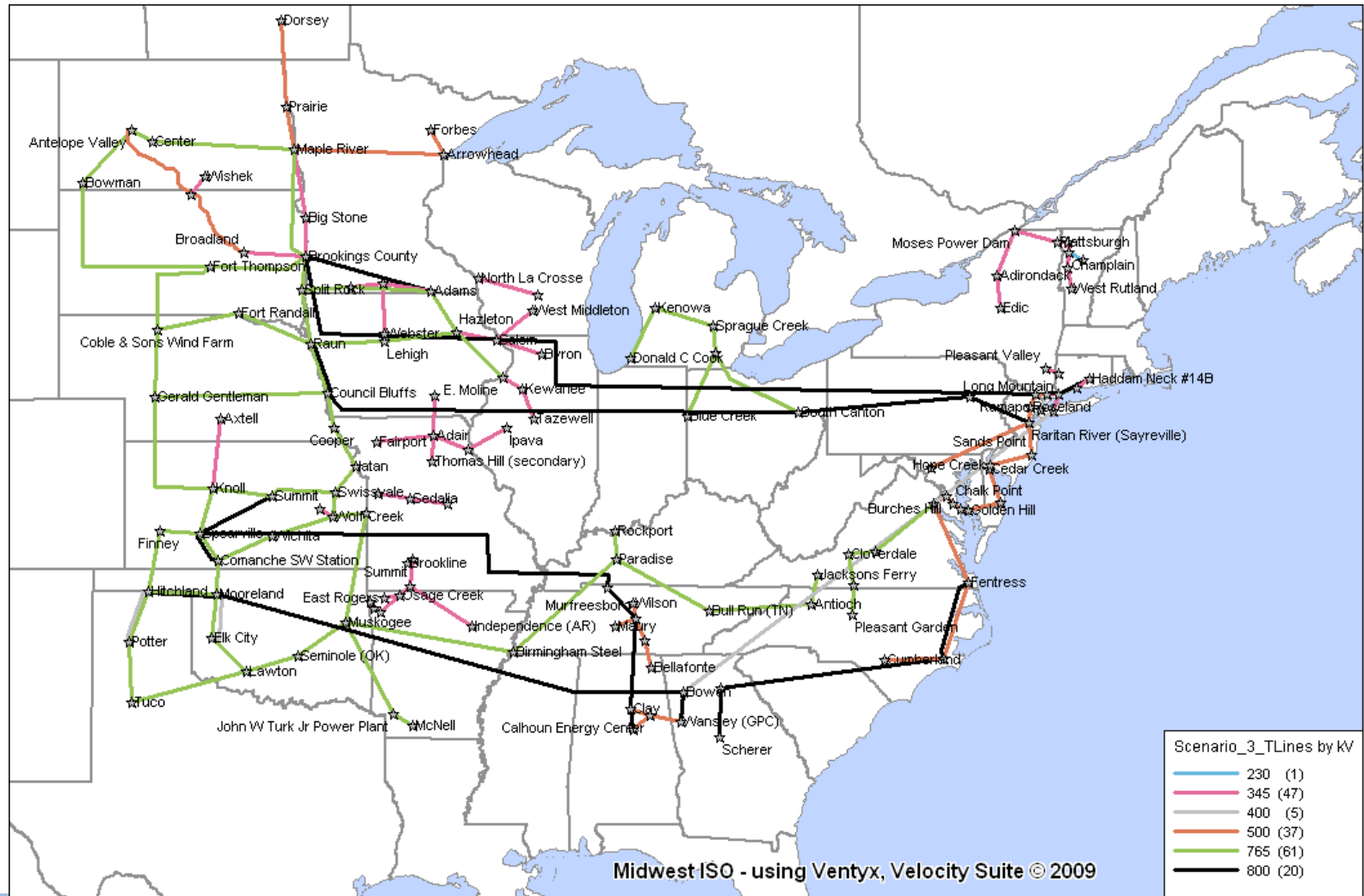


# Key Task - Transmission

- High levels of new transmission are needed across the 4 scenarios
  - **Some transmission elements are common to all overlays**
- Reference case, 20% and 30% wind scenarios all require a significant transmission build out, otherwise they are not feasible
- Transmission reduces variability and provides capacity benefits in its own right, and enhances the reliability contribution of wind generation
- The conceptual transmission overlays consist of multiple 800kV HVDC and EHV AC lines



# Transmission Overlay for Scenario 3



# EWITS Conclusions

- 20 and 30% wind penetrations are technically feasible with significant expansion of the transmission infrastructure.
  - New transmission will be required for all the future wind scenarios in the Eastern Interconnection,
- Without transmission enhancements, substantial curtailment of wind generation will occur
- Interconnection-wide costs for integrating large amounts of wind generation are manageable with large regional operating pools, where benefits of load and wind diversity can be exploited and large numbers of supply resources are efficiently committed and dispatched.

# EWITS Conclusions

- Transmission helps reduce the impacts of the variability of the wind and....
  - Reduces wind integration costs
  - Increases reliability of the electrical grid
  - Helps make more efficient use of the available generation resources
- Costs for aggressive expansions of the existing grid are significant, but they make up a relatively small piece of the total annualized costs in any of the scenarios studied
- Wind generation displaces carbon-based fuels, directly reducing carbon dioxide (CO<sub>2</sub>) emissions

## The results of this study pose some interesting policy and technology development questions

- Could the levels of transmission, including the reference case, be permitted and built and what is a realistic time frame?
- What is the best process for siting transmission for wind?
  - HVDC long distance transmission with high voltage collector systems
  - Offshore Transmission collector system
- Would a different renewable profile or transmission overlay arise from a bottom-up planning process?
- How can states and the federal government best work together on regional transmission expansion?

# EWITS Schedule & Contacts

- <http://www.nrel.gov/ewits>
- Development of Phase II of EWITS in first quarter 2010
- Roll out January 20<sup>th</sup>, Washington DC.
- Contact: Dave Corbus at [David.Corbus@nrel.gov](mailto:David.Corbus@nrel.gov)