

Wind Power and Transmission 101 Workshop

July 30, 2008

Dearborn, MI

Transmission & Integration



Mike Bull
Regional Policy Manager
Wind on the Wires

Background on Wind on the Wires

- **Organized** in 2001 to overcome the barriers to bringing wind power to market in the Midwest. WOW is the Midwest regional partner of the American Wind Energy Association (AWEA)
- **Work in 3 areas**: technical, regulatory/legislative, education/outreach
 - **Technical** – work with electric utilities and Midwest Independent System Operator (MISO – regional “grid” operator) on transmission planning for wind
 - **Regulatory/legislative** – actively promoting state and regional policies and decisions to advance wind power
 - **Education/outreach** – speak to many people and groups about our work and issues
- **Support** – Foundations and membership dues.
- **Members** – Wind developers, environmental and community energy advocates, goods & services providers.

Wind on the Wires Members

green – non-profit

blue – developers

pink – goods/services providers

American Wind Energy Association

BP Alternative Energy

Clipper Windpower

D.H. Blattner & Sons

Environmental Law & Policy Center

enXco

E.on Climate & Renewables

FPL Energy

Fredrikson & Byron

Fresh Energy

GE Energy

Tradewind Energy

Horizon Wind Energy

Intertribal Council on Utility Policy

Izaak Walton League of America

John Deere

M.A. Mortenson

National Wind

Navitas/Gamesa Energy

PPM Energy/Iberdrola

Rahn Group

RENEW Wisconsin

RES-Americas, Inc

Stoel Rives

Suzlon Wind Energy

Vestas

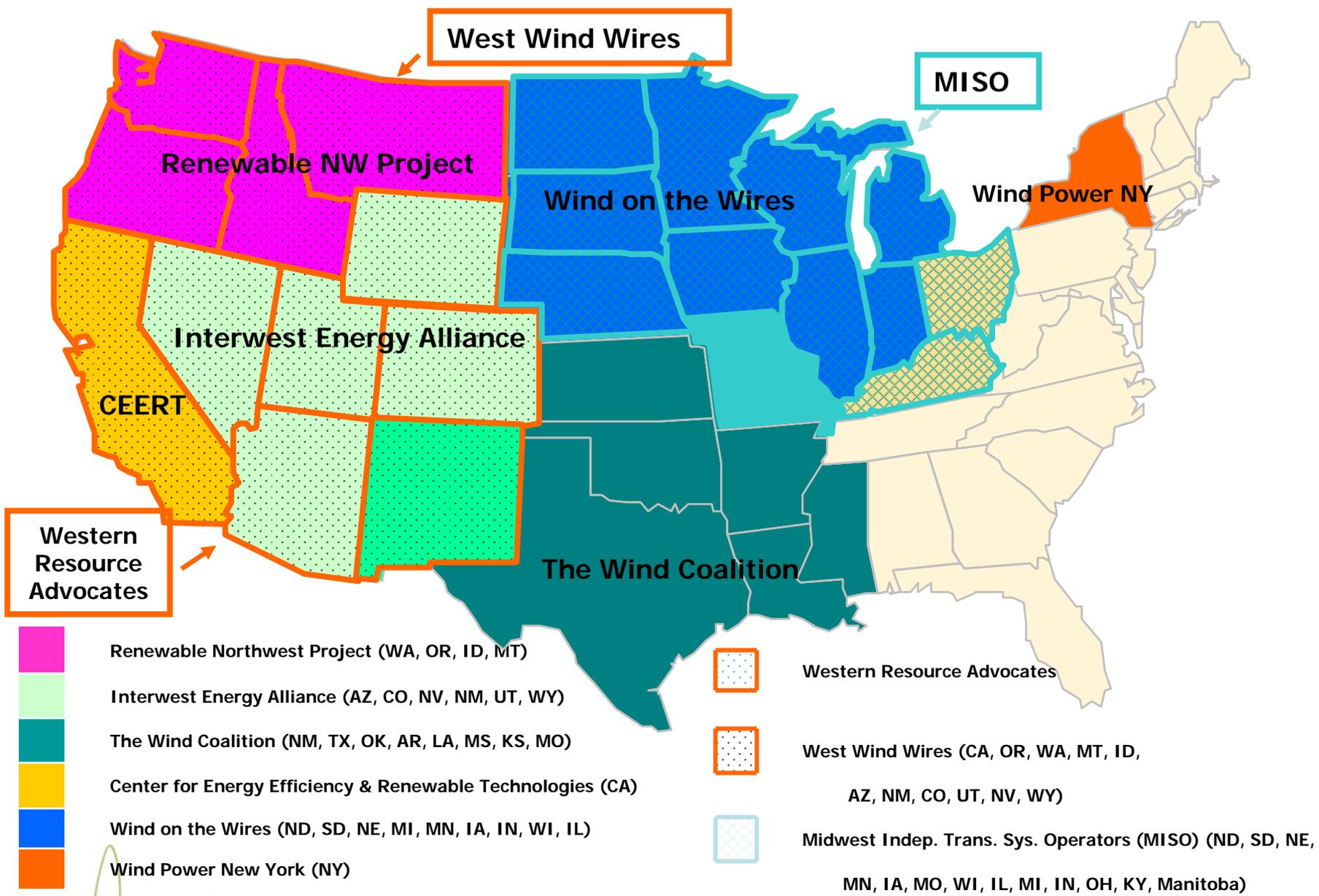
Windlogics

Windustry

The logo features a stylized green wind turbine icon on the left, with a green line looping around the text. The text "wind on the wires" is in a blue, lowercase, sans-serif font, with a trademark symbol (TM) to the right. Below the text is the tagline "Bringing Wind Power to Market" in a smaller, blue, sans-serif font.

wind on the wires™

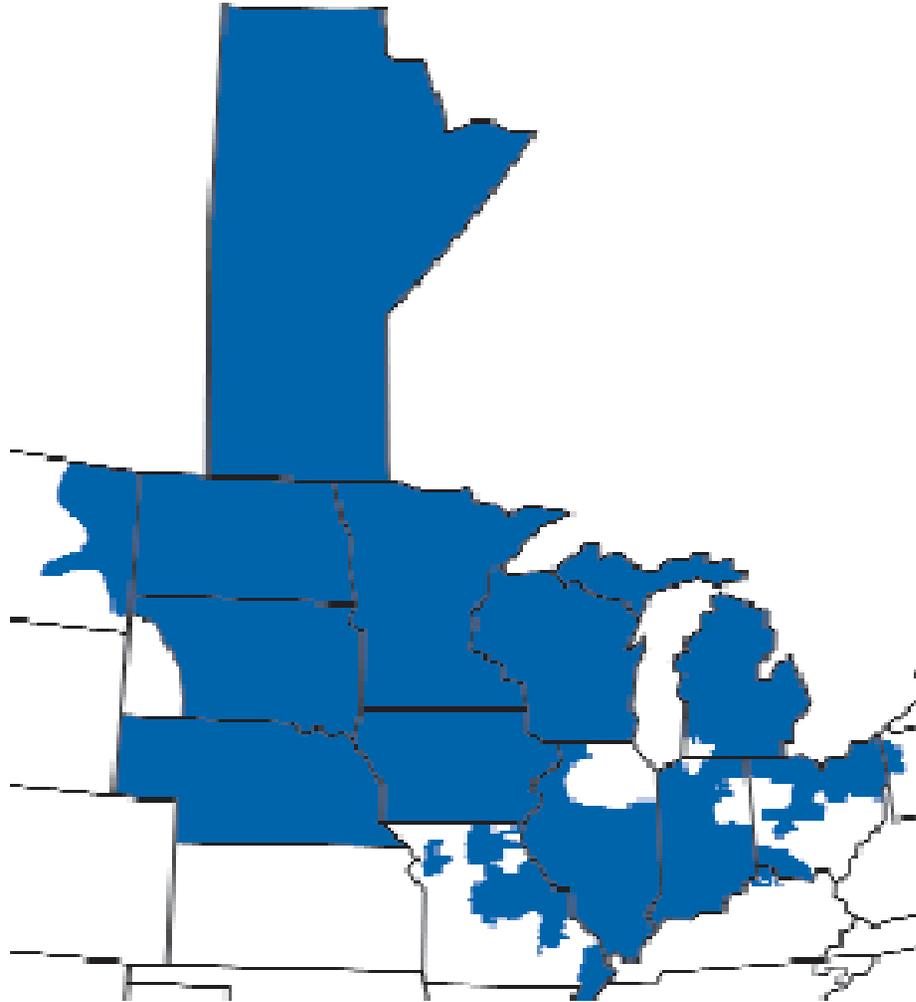
Bringing Wind Power to Market



wind on the wires™

Bringing Wind Power to Market

WoW has a similar footprint as the Midwest Independent System Operator...



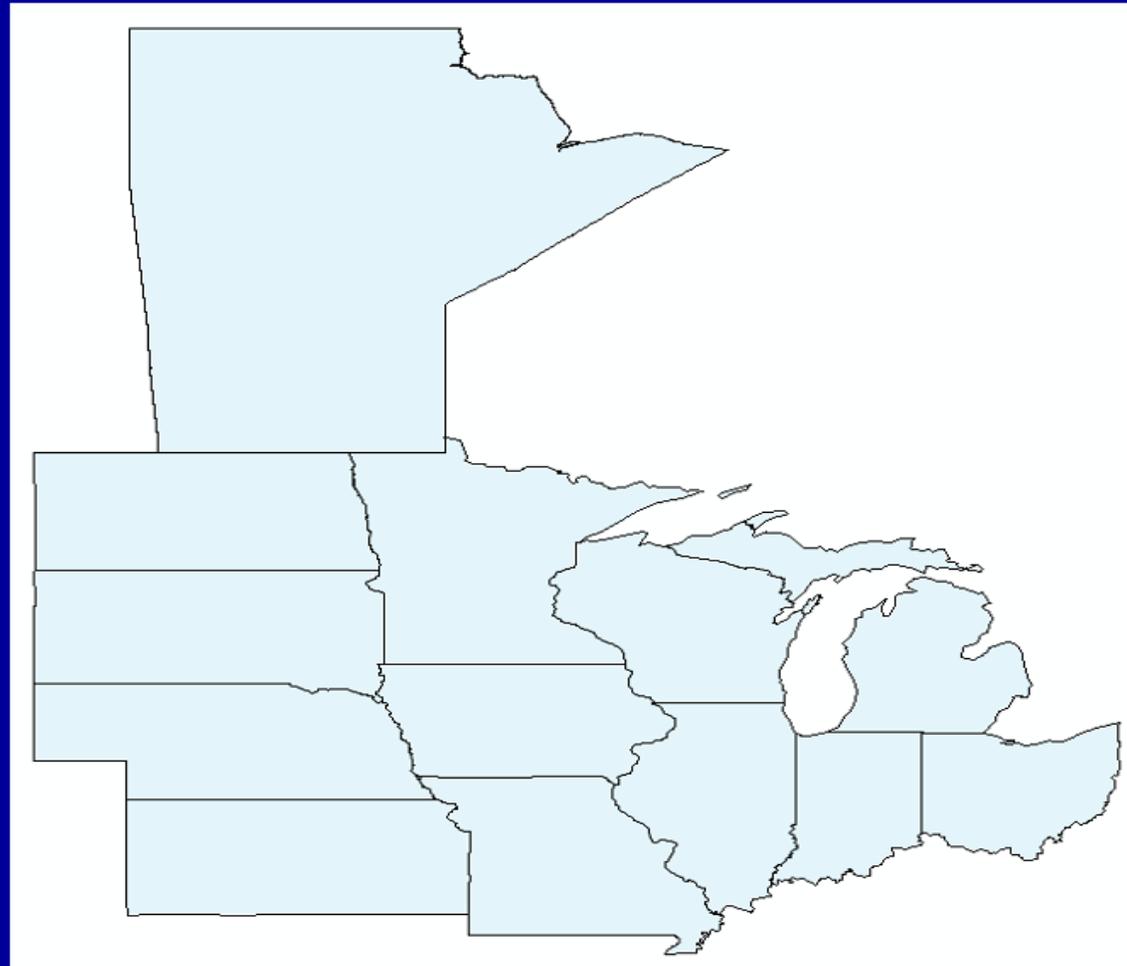
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Bringing Wind Power to Market

Midwestern Governors Association

12 States

- Illinois
- Indiana
- Iowa
- Kansas
- Michigan
- Minnesota
- Missouri
- Nebraska
- North Dakota
- Ohio
- South Dakota
- Wisconsin



12-State MGA Footprint plus Manitoba

... and the MGA.

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Bringing Wind Power to Market

What's driving the case for wind in the Midwest?

- Need to reduce environmental & climate impacts from energy production
 - Wind is our most reliable cost-competitive carbon-free generation resource
 - Energy efficiency and wind energy have to be the foundation of any cost-effective climate strategy
- Economic development
 - Benefits to rural economies
 - Green jobs, green economy

Resulting Policy Commitments

- Midwest state renewable electricity standards
 - Current state commitments < 20,000 MW by 2025
 - Ill, MN, IA, WI, OH
- Midwest Governors Association - 2007
 - Regional commitment to 30% renewable electricity by 2030
 - Over 100,000 MW installed in the next 22 years
 - Consistent with DOE/AWEA/NREL 20% National Vision

Transmission – the major barrier

- To accomplish those goals, we need a regional transmission network adequate to support that MGA vision.
- *If you love wind energy, you have to at least like transmission!*

Transmission for Wind

The problem

- Best wind resources far away from load
- Transmission system not designed to:
 - Carry wind power long distances or
 - Optimize management of system variability (load & supply)
- Where will the new wind farms be located?
- Who pays for new transmission?
- Who gets to use the capacity on the new lines?
- Build new transmission “one generator at a time”

Transmission for Wind

The solution

- **Integrated** – planning for wind power along with other generating resources
- **Aggregated** – large amount of wind power rather than one wind farm at a time
- **Coordinated** – Utilities working together, joint ownership, cost allocation, committed to construction
- **Forward looking** – plan infrastructure today for large amounts of wind power

Transmission for Wind

The solution

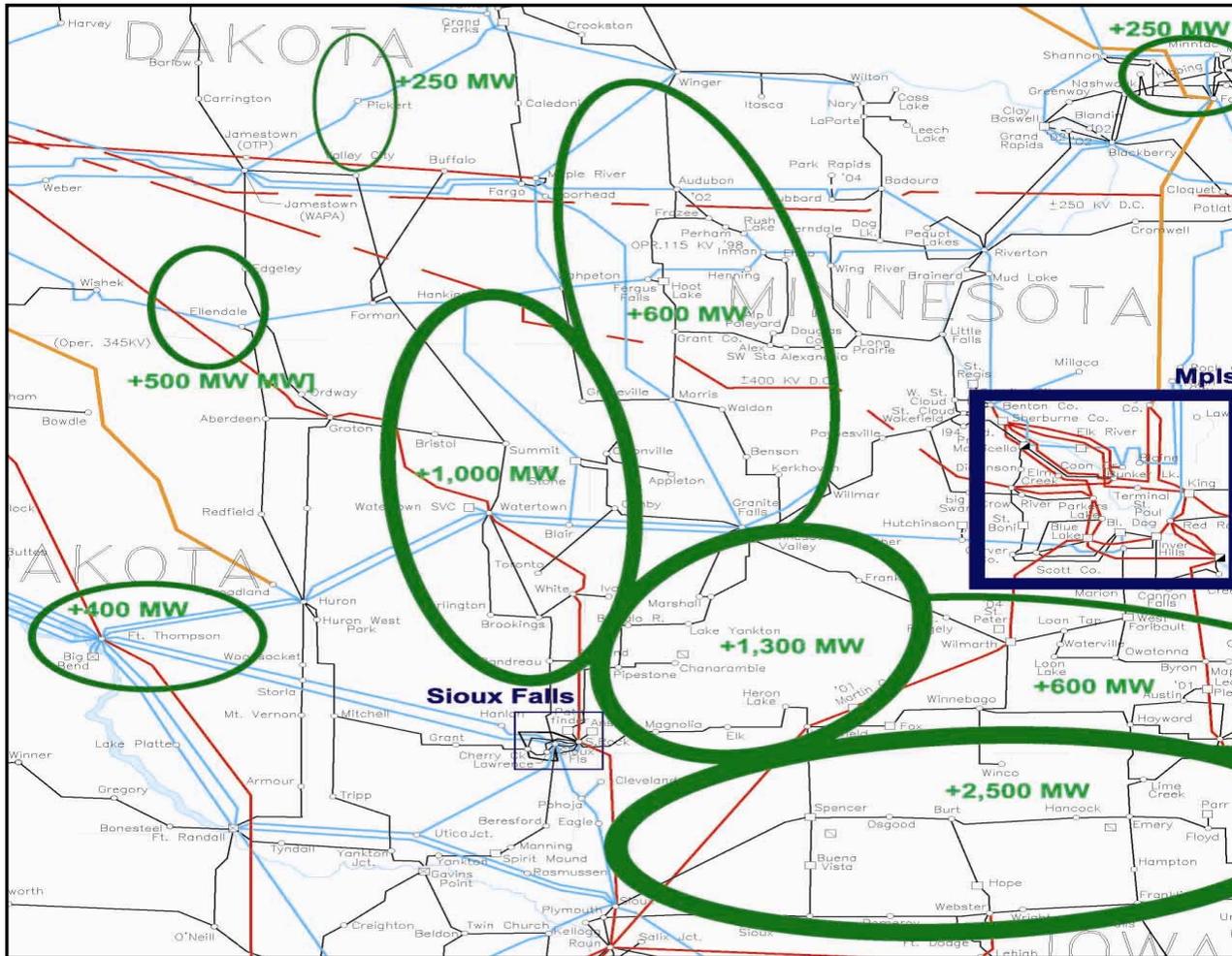
Renewable Energy Zones

- Identify best renewable energy resource areas
- Plan for most efficient transmission additions to serve those areas
- Figure out cost allocation & ownership issues
- Get the wires in the air!
- Examples:
 - Texas, California, Colorado, Minnesota

CapX 2020 – a good example

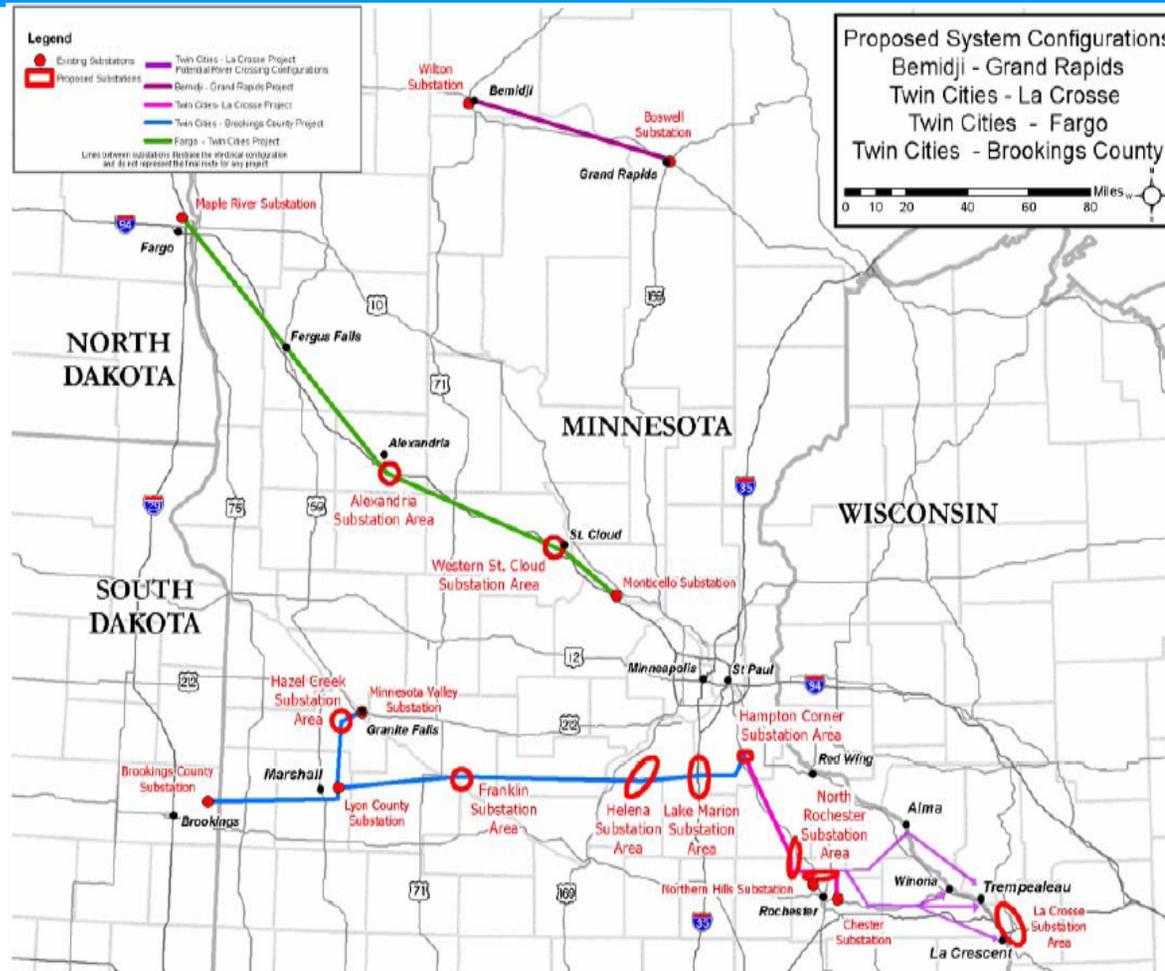
- Since 2005, Minnesota's electric utilities have been working together to:
 - Assess collective transmission needs
 - Work out cost allocation & ownership issues
 - Obtain regulatory approvals and
 - Build transmission capacity

CapX 2020 Group 1 Lines



Identify the wind resources...

CapX 2020 - Group 1 Lines



And build high-voltage lines to those resources

We need to “regionalize” CapX

A Promising Regional Example – Midwest ISO Regional Generation Outlet Study (RGOS)

- Midwest ISO, working with utilities, developers and other technical stakeholders
- Jointly analyze various scenarios of the transmission needed to support the Renewable Electricity Standards of Minnesota, Illinois, Iowa, and Wisconsin
 - Report by end of 2008
- Later, add Ohio, Michigan, Missouri, as those states pass and implement standards

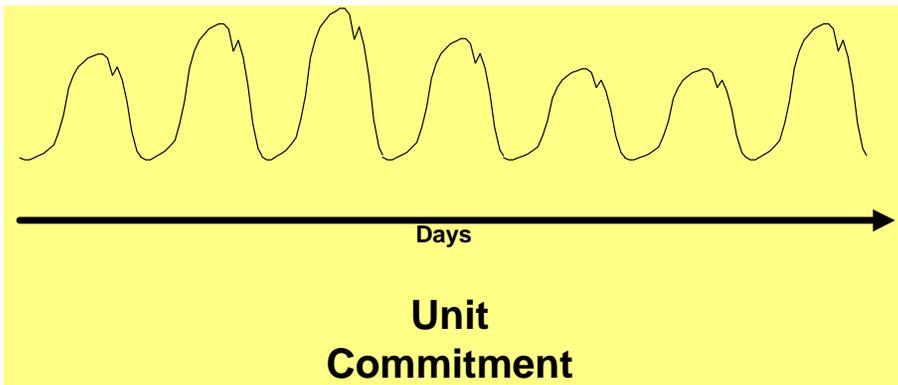
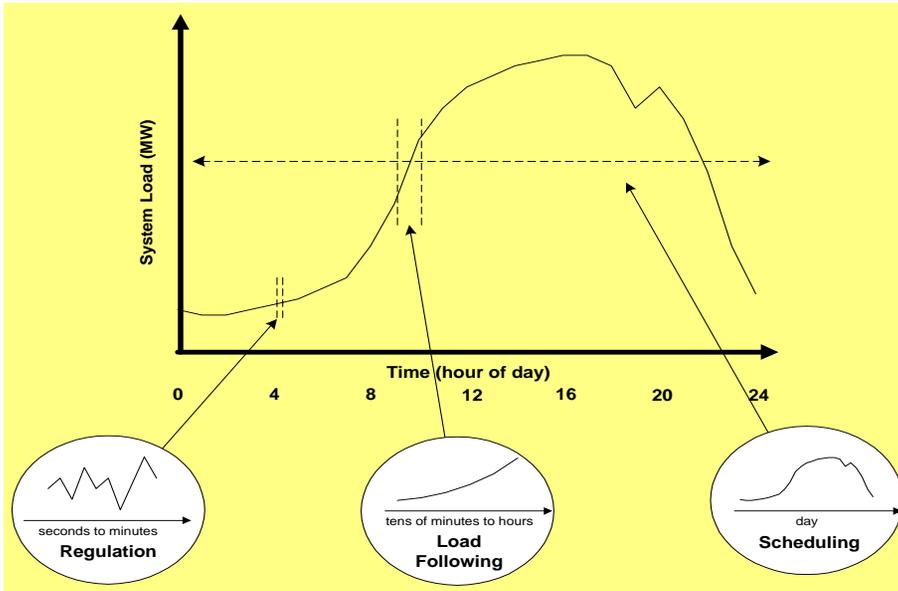
MGA Transmission Adequacy Workgroup

- Support Midwest ISO queue reform
- Develop state by state evaluation of new MW of wind power development needed for 30% by 2030 MGA commitment
- Develop regional transmission plan to support that wind development
- Address cost allocation issues for transmission investments
- Ensure consideration of regional benefits in state regulatory proceedings on transmission infrastructure

Wind Integration Challenges

- Reliable power system operation requires balance between load and generation *within acceptable statistical limits*
- Output of wind plants cannot be controlled and scheduled with high degree of accuracy
- Wind plants becoming large enough to have measurable impact on system operating cost
- System operators concerned that **additional** variability introduced by wind plants will increase system operating cost

Time Frames of Wind Impact



- Terminology

- Regulation -- seconds to a few minutes -- similar to variations in customer demand
- Load-following -- tens of minutes to a few hours -- demand follows predictable patterns, wind less so
- Scheduling and commitment of generating units -- hours to several days -- wind forecasting capability?
- Capacity value (planning): based on reliability metric (ELCC=effective load carrying capability)

Wind Integration Issues

- Size of interconnected electricity markets
 - The larger the area within which resources must be balanced, the better
 - Robust interconnections:
 - decrease congestion and
 - allow greater access to system resources for efficient dispatch of balancing resources

Wind Integration Issues

- The mix of generation in the balancing area matters
 - Availability of easily dispatchable resources
- Increased geographic diversity of the wind generators reduces impacts
- At 20% wind penetration, system operating cost increases estimated to be less than 10% of wholesale cost of wind energy
 - Still cost competitive with other resources
 - Need to look at higher penetration rates

Contact Information

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