

# The Transmission Lay of the Land

*Overview*

*Energy Markets*

*Transmission Planning*

Beth Soholt

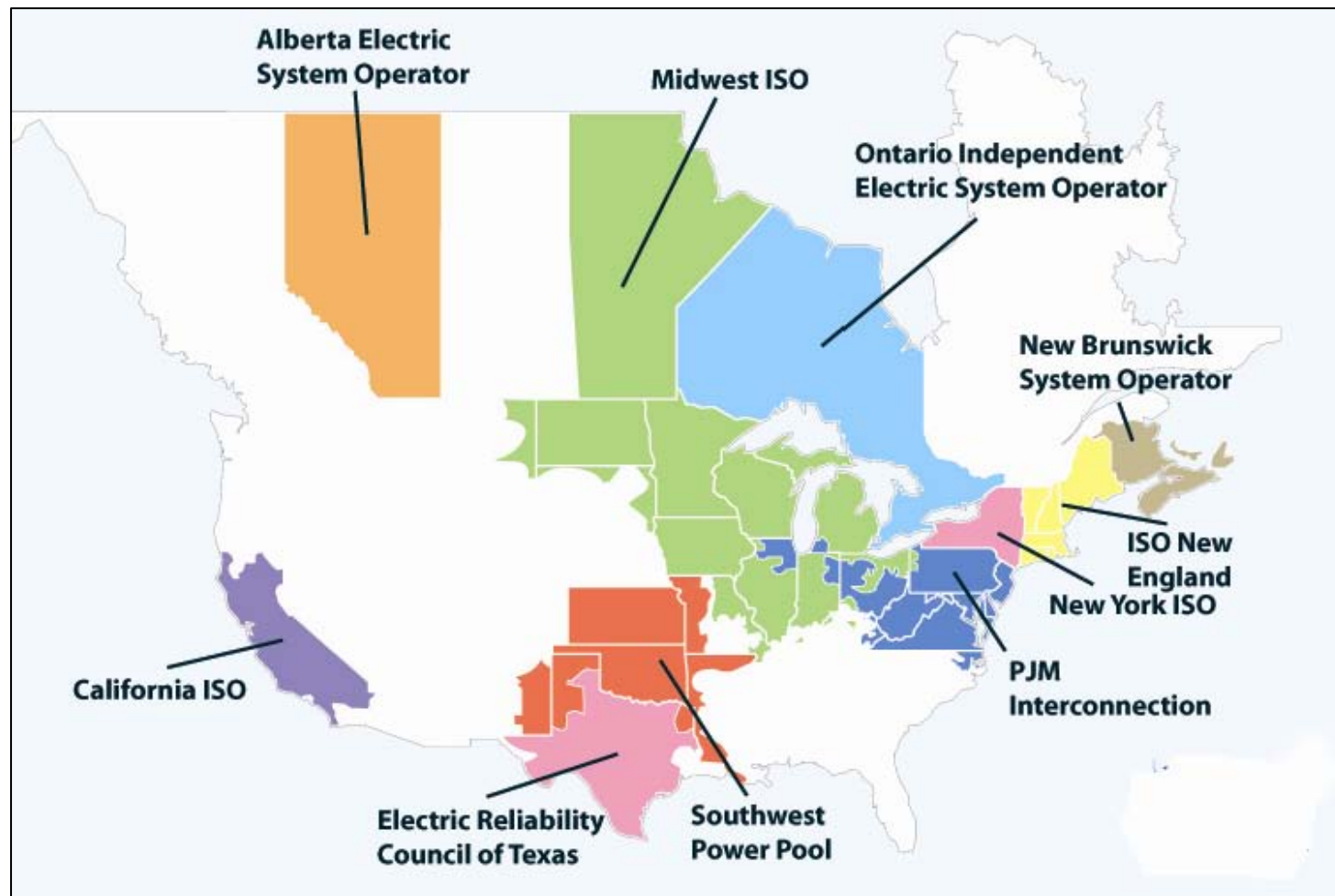
John Moore

April 21, 2010

# Overview

# Regional Transmission Organizations

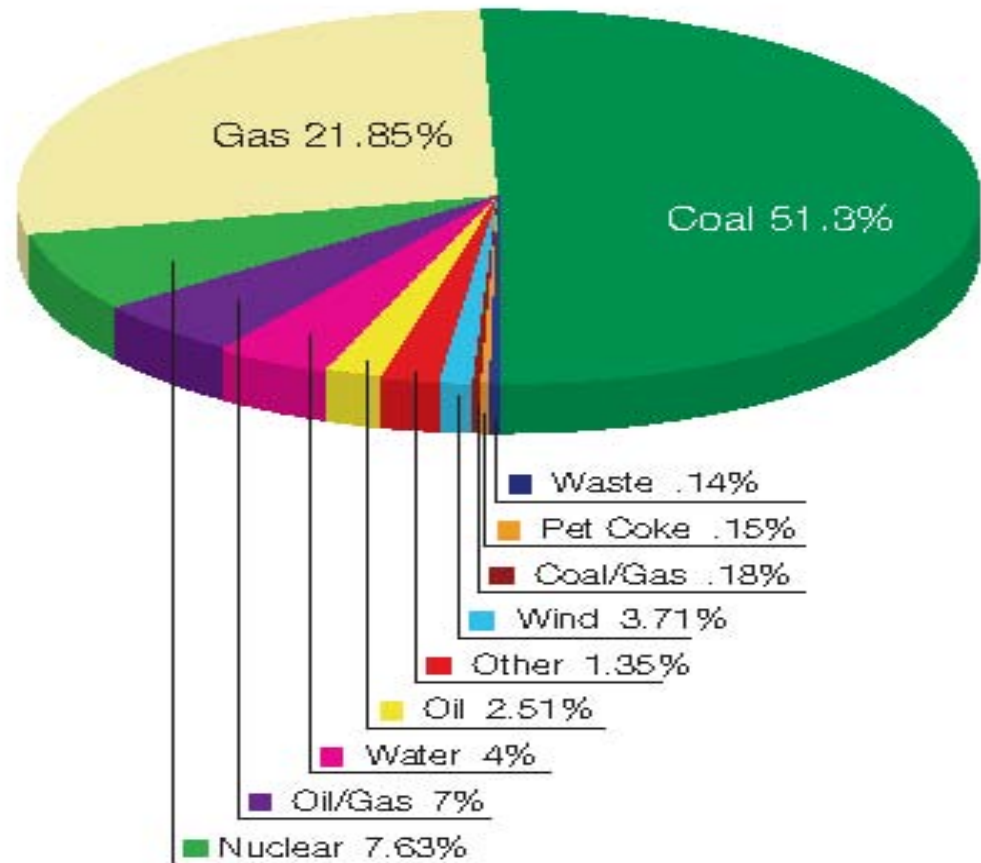
- ❖ Organizations of transmission owners, users, and other entities
- ❖ Manage regional energy markets, grid reliability and transmission planning/expansion



# Focus on Midwest ISO

## ❖ About 138 GW of generation

- Coal-fired generation is majority of MISO's installed capacity (52%) and an even larger proportion of the total energy produced (77%) .
- Natural gas generation is second in installed capacity (almost 22%) but produces less than 5% of the energy in the region.



# Focus on Midwest ISO

- ❖ Provides independent and open access transmission system access
- ❖ Better reliability coordination – and exclusive authority to maintain short-term reliability
- ❖ Administer its own tariff and transmission pricing system
- ❖ Coordinate regional transmission planning (supposed to include DR and other demand-side actions)
- ❖ Responsible for calculating Total Transmission Capacity (TTC) and Available Transmission Capacity (ATC)

# Other MISO Facts

## ❖ **MISO relies heavily on imports from adjacent areas**

- Although power can flow in either direction depending on prevailing prices, the Midwest ISO generally imports power from PJM and Manitoba and exports power to IESO.

## ❖ **Development of demand participation is lagging behind PJM**

- Although MISO has more than 8,000 MW of total demand response (2008), much of this is interruptible load which was developed under regulated utility programs and is only curtailable for reliability purposes.

# Energy Markets

# Midwest ISO – Energy Markets

## ❖ Markets

- **Day-Ahead and Real-Time Energy Markets**
- **Financial Transmission Rights Market (hedging against congestion)**
- **Ancillary Services Market**
- **No binding capacity market (unlike PJM)**

# Midwest ISO – Energy Markets

## ❖ Energy Market Description:

*Real-time, centralized, bid-based, security-constrained economic dispatch using Locational Marginal Pricing (LMP) to manage transmission congestion.*

# Energy Market Basics

## ❖ Economic Dispatch

- *“The operation of generation facilities to produce energy at the lowest cost to reliably serve consumers, recognizing any operational limits of generation and transmission facilities.”*
- Markets use demand bids and supply offers, rather than generating unit costs, as economic measure of dispatch. (Goal is to use competitive market forces to drive down cost to the marginal cost)
- Dispatch occurs every 5 minutes.

# Energy Market Basics

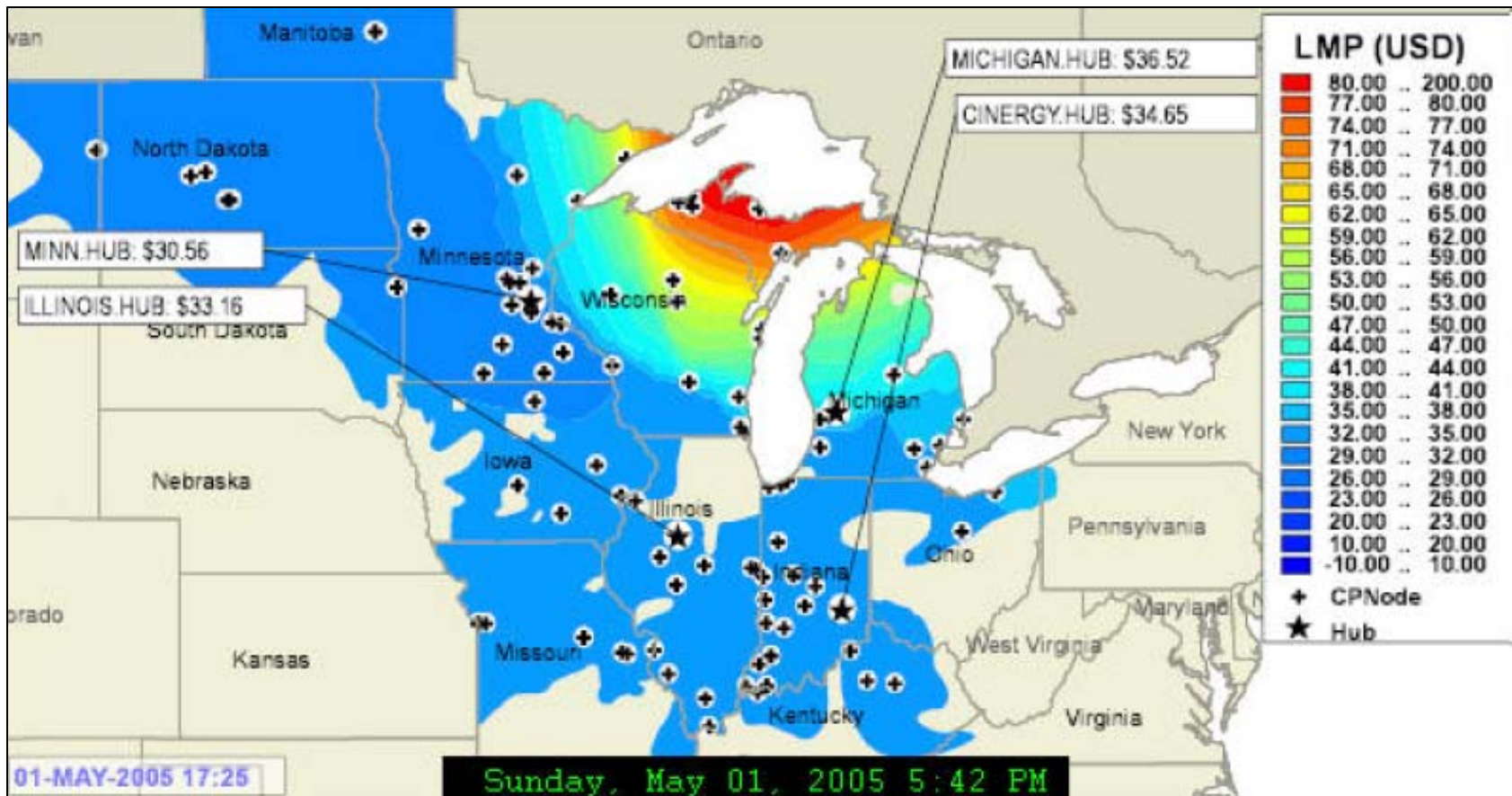
## ❖ LMPs – reflects energy value at specific time and location

- Defines the marginal cost of serving the next increment of load at each location/area, taking into account the electricity demand, generation costs, and the limits of the transmission system.
- Generally, the highest variable cost unit (unit on the margin) that must be dispatched to meet load within a transmission-constrained boundary will set the LMP for that area.
  - *If no transmission constraints, LMPs will not vary across the region.*

## ❖ Goals of LMPs

- Price signals intended to encourage new generation where they will receive higher prices – or DR and EE, in a properly designed market.
- Supposed to encourage new transmission construction in congested areas to reduce the financial impact of congestion on electricity prices.

# LMP Contour Map Identifies Prices, Congestion



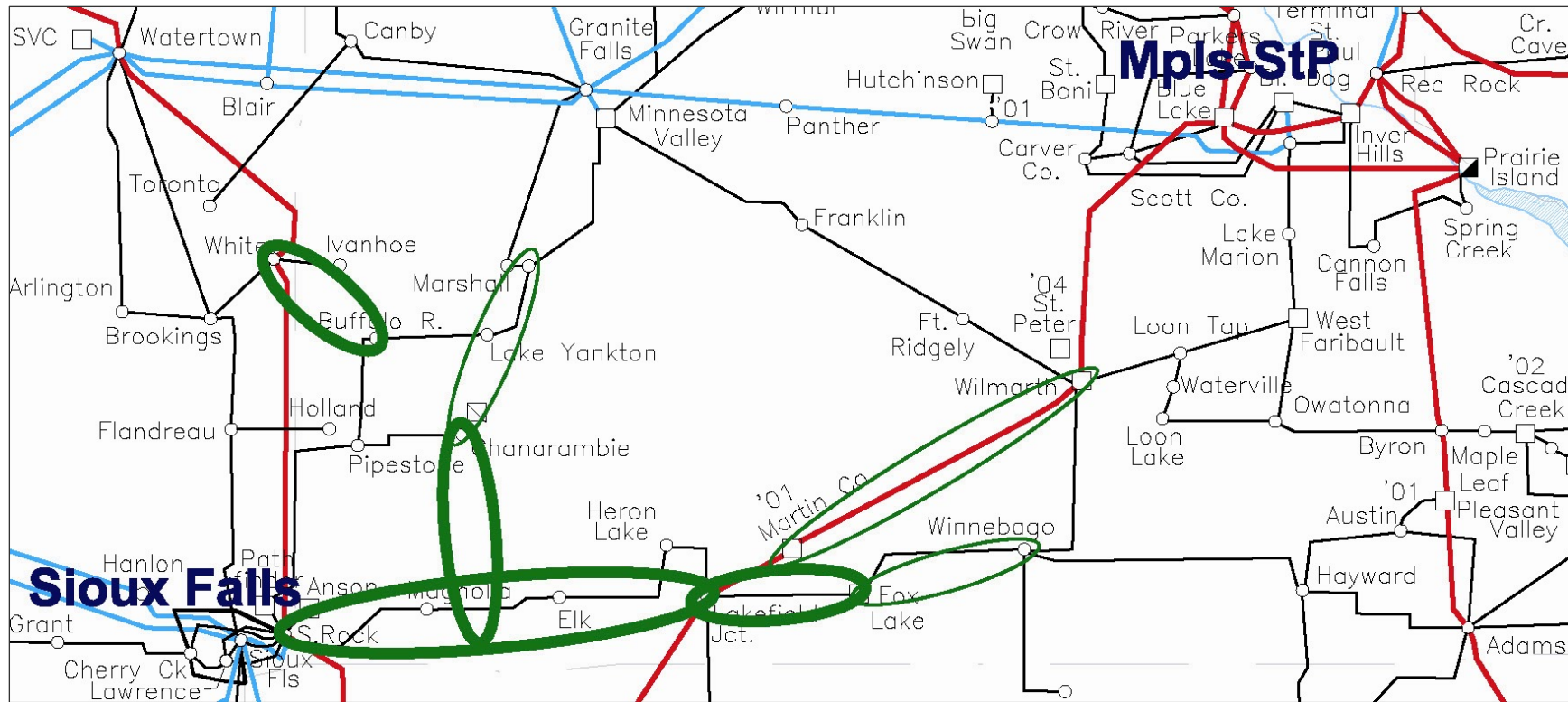
# Transmission Planning

# Policy Issues for Implementing Transmission for Clean Energy Vision

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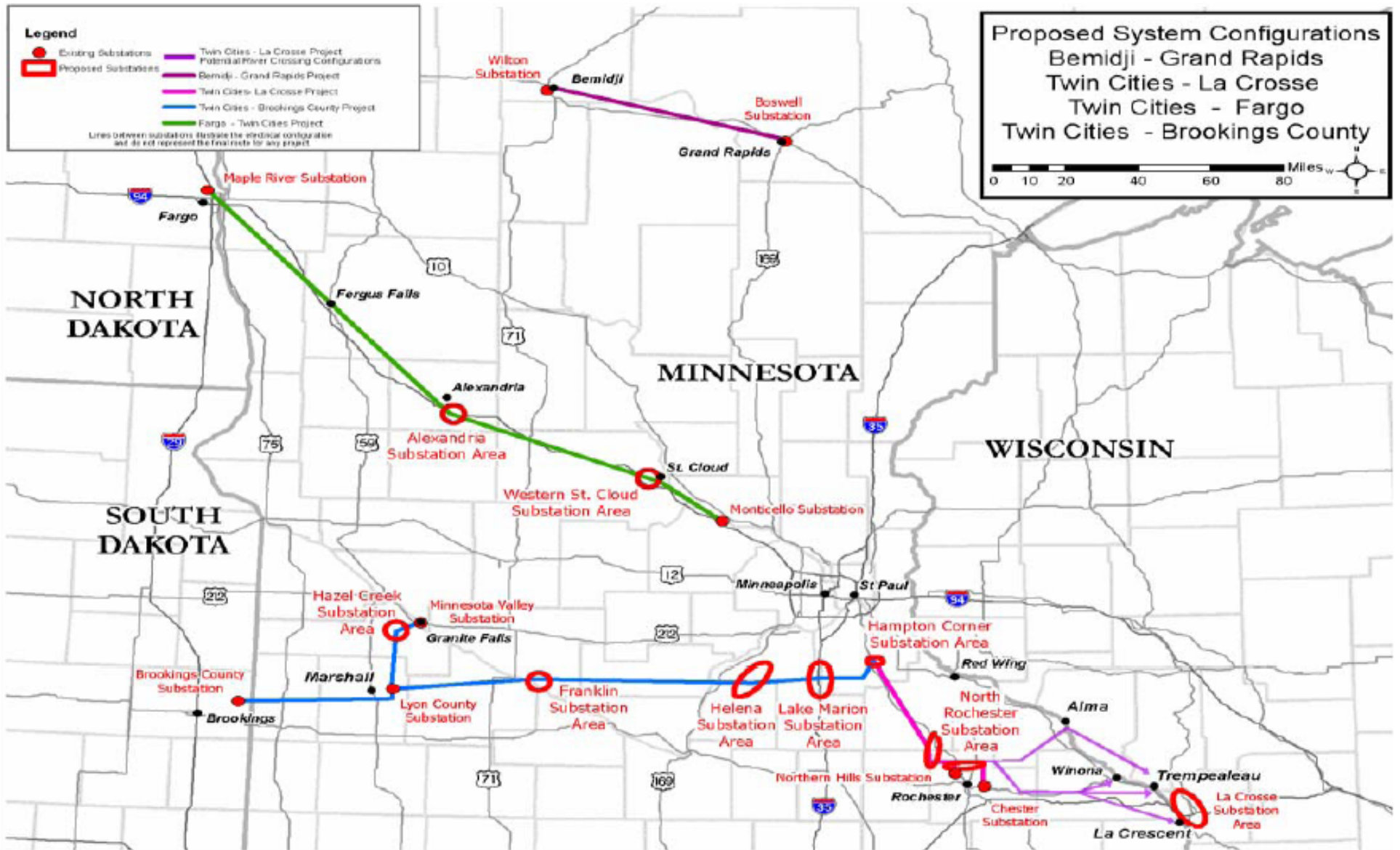
- ❖ Planning – what to build?
  - Individual utility, MISO/PJM expansion plans, multi-state (UMTDI), interconnection-wide (EIPC, EISPC)
- ❖ Cost Allocation – who pays?
  - MISO CARP (state regulators)
  - MISO RECB (filing July 15, 2010)
- ❖ Siting/Routing - permitting

# New and Upgraded Transmission in SW MN for Wind Power



<u>New lines:</u>	Split Rock – Lakefield Junction*	345 kV
	Lakefield Junction – Fox Lake*	161 kV
	Nobles – Fenton – Chanarambie*	115 kV
	Buffalo Ridge – White*	115 kV
	Chanarambie – Lake Yankton – Lyon	115 kV
<u>Upgraded lines:</u>	Fox Lake – Winnebago	161 kV
	Martin Co – Wilmarth	345 kV

\*Xcel Energy Certificate of Need, Minnesota Public Utilities Commission Decision 1/30/03



### CapX Group I Lines

Twin Cities – LaCrosse, WI: ~150 miles, 345 kV

Fargo, ND - Twin Cities: ~250 miles, 345 kV

Brookings, SD – Hampton Corners : ~200 miles, 345 kV

# Regional Transmission Planning

## ❖ **Midwest ISO**

- Transmission Expansion Planning (MTEP 2010)
  - Regional Generation Outlet Study (RGOS)
  - Top Congested Flowgate, Cross Border Congested Flowgate Studies

## ❖ **PJM**

- Regional Transmission Expansion Planning (2010 RTEP)

## ❖ **DOE**

- Eastern Interconnection Planning Collaborative  
Eastern Interconnection States Planning Council

## **Other Initiatives – input to regional planning**

### ❖ **“Strategic Area Midwest Transmission Study”**

- ATC, AEP, MidAmerican, Exelon, Xcel, Northwestern
- Study of transmission needed to deliver 55 GW of total wind

### ❖ **“Green Power Express”, ITC, Proposal to deliver 12 GW of wind**

# Regional Planning Initiatives - MISO

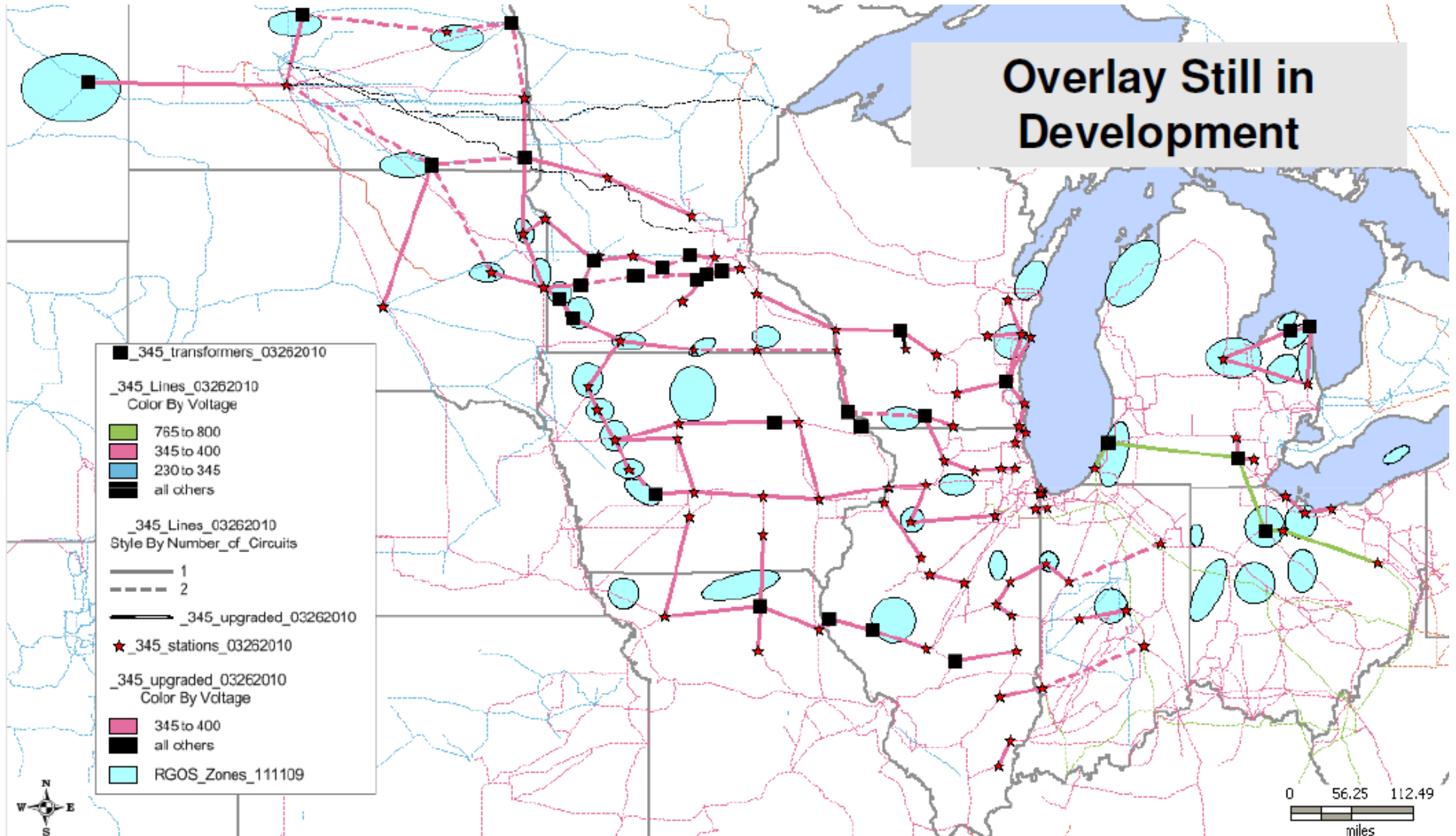
## ❖ Upper Midwest Transmission Development Initiative (UMTDI)

- Led by Governors of Minnesota, North Dakota, South Dakota, Iowa and Wisconsin to coordinate sub-regional transmission planning and related cost allocation issues
- Provides input to MISO Regional Generation Outlet Study (RGOS)
  - Renewable Energy Zone Selection
  - Transmission Scenarios
    - 345 kV, 765 kV and DC lines and combinations

# Regional Generation Outlet Study - MISO

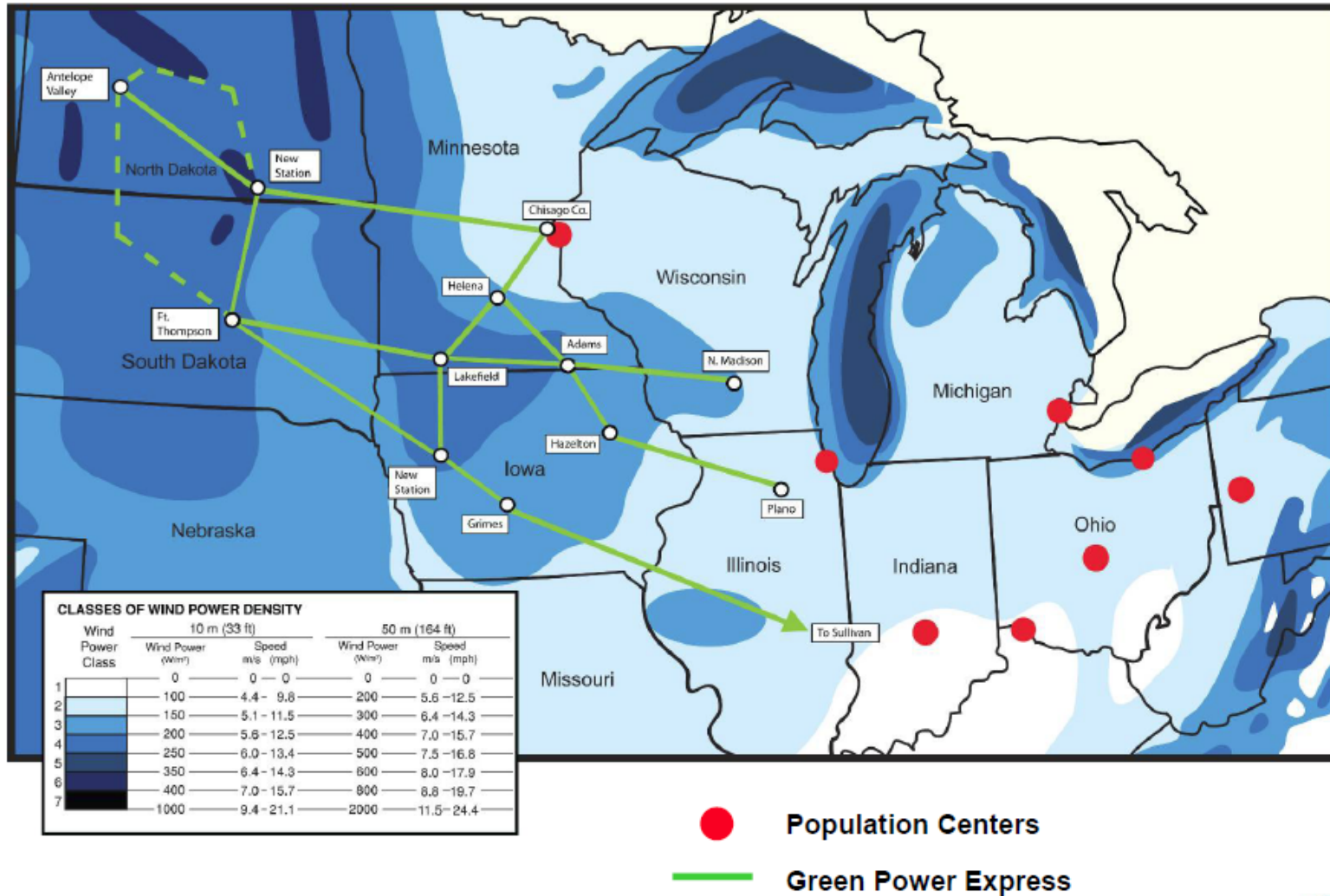
- ❖ Developing transmission projects that will facilitate the state renewable energy mandates in the Midwest ISO footprint
- ❖ Phase I (North Dakota, South Dakota, Minnesota, Wisconsin, Iowa, Illinois)
  - Started May 2008; Final report posted March 5, 2010
  - 15 GW & 25 GW; UMTDI Scenarios plus IL zones & existing wind
- ❖ Phase II (added Missouri, Illinois, Indiana, Michigan, Ohio; incorporates results for RGOS I)
  - Referred to as ‘RGOS’ going forward (from December 2009)
  - The development of zones is complete; ~ 40 GW of total wind
  - Iterative development of transmission plans under way; options will include 345 kV, 765 kV, and HVDC
  - Analysis will include power flow, production cost models (PROMOD), and business case / value metrics
  - Goal is to deliver one plan to Appendix B of the MTEP 2010 Report

# Regional Generation Outlet Study - MISO



# “Green Power Express”

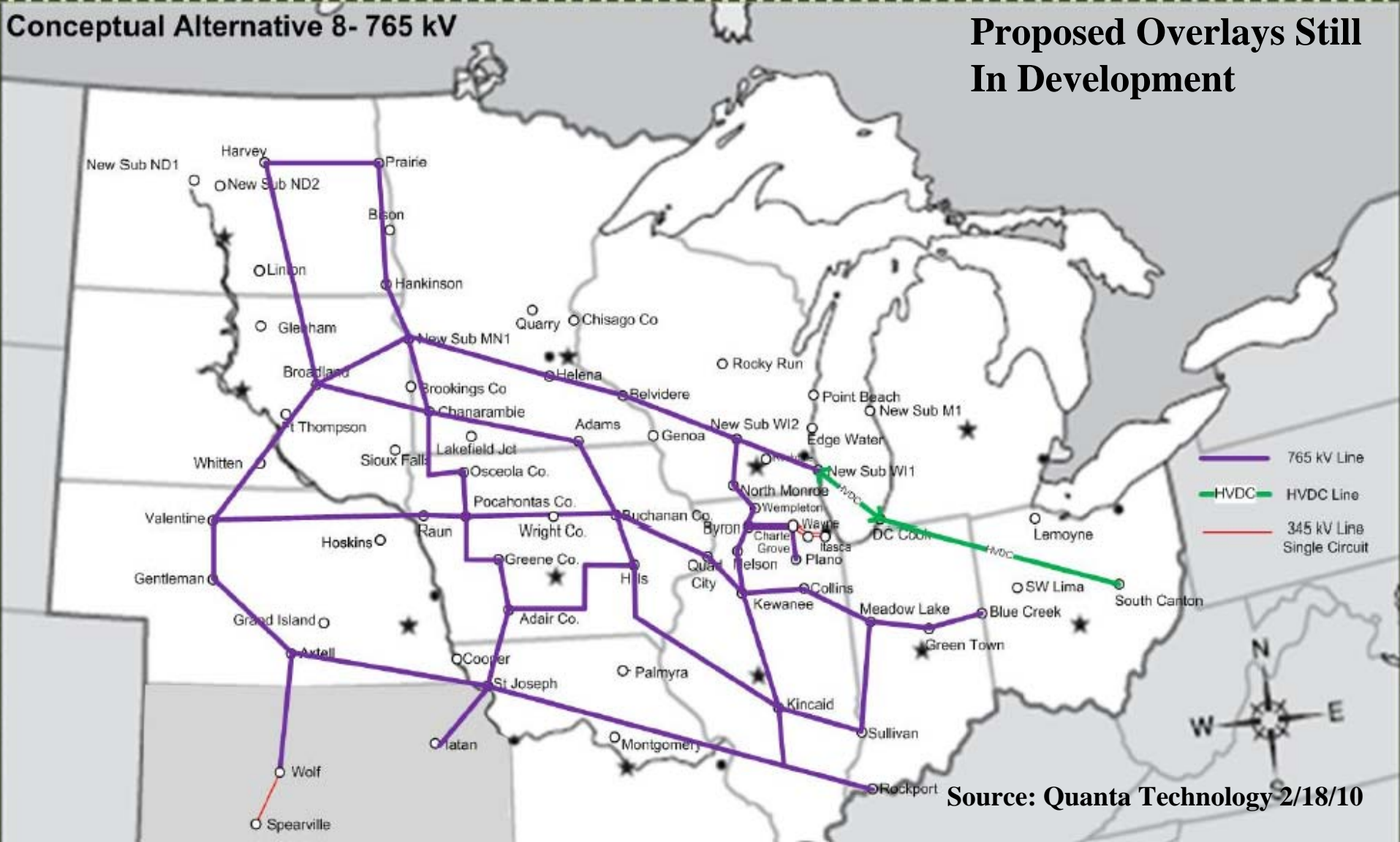
Proposed Overlay Still In Development



# “Strategic Midwest Area Transmission Study”

Conceptual Alternative 8- 765 kV

Proposed Overlays Still In Development



Source: Quanta Technology 2/18/10

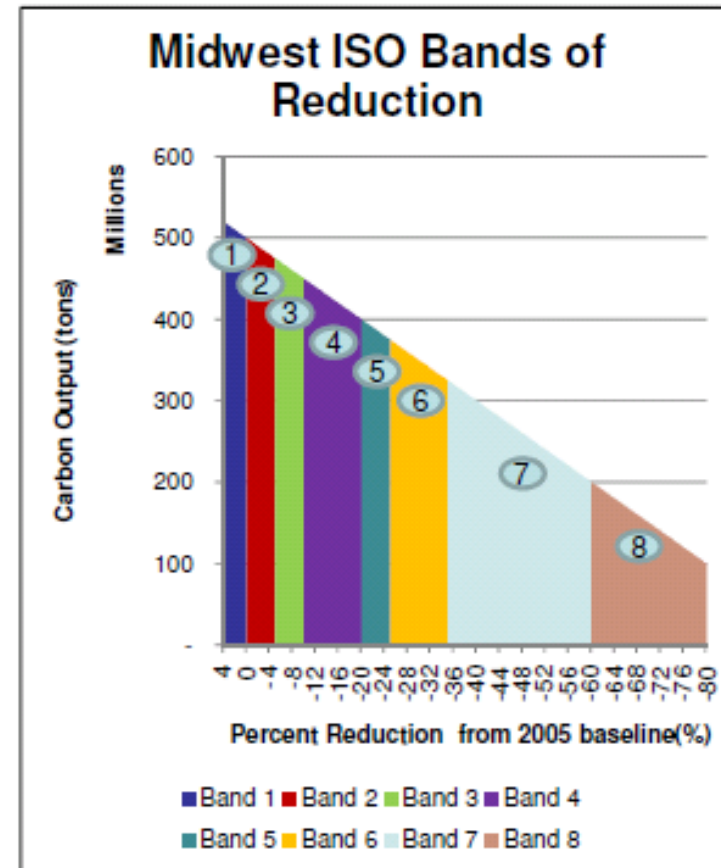
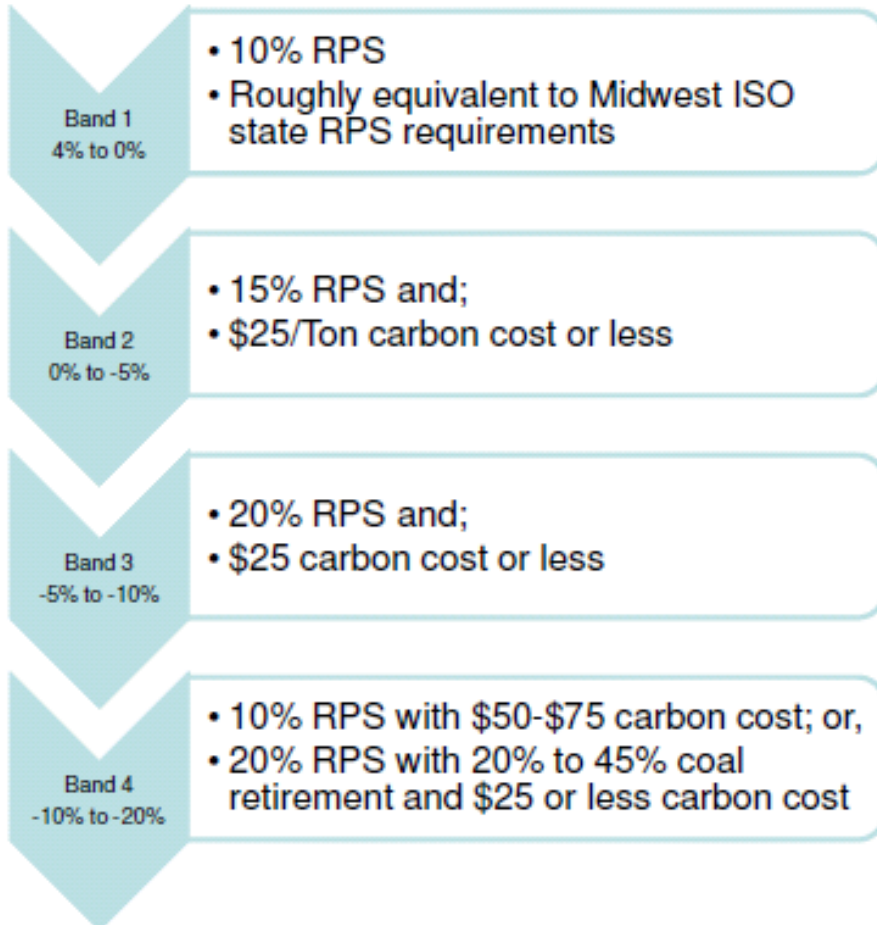
**Extra Slides**

Carbon

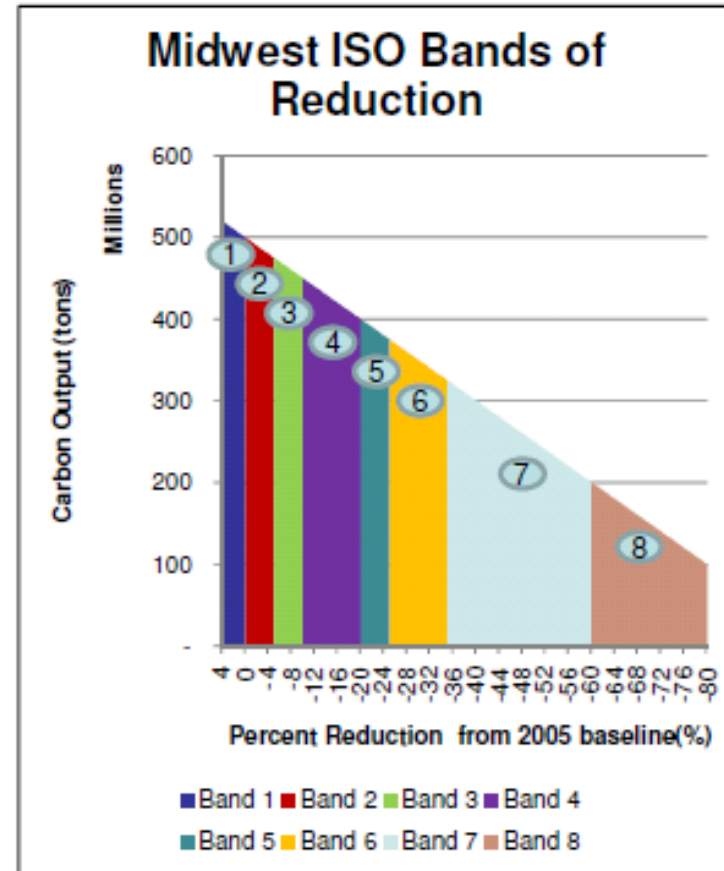
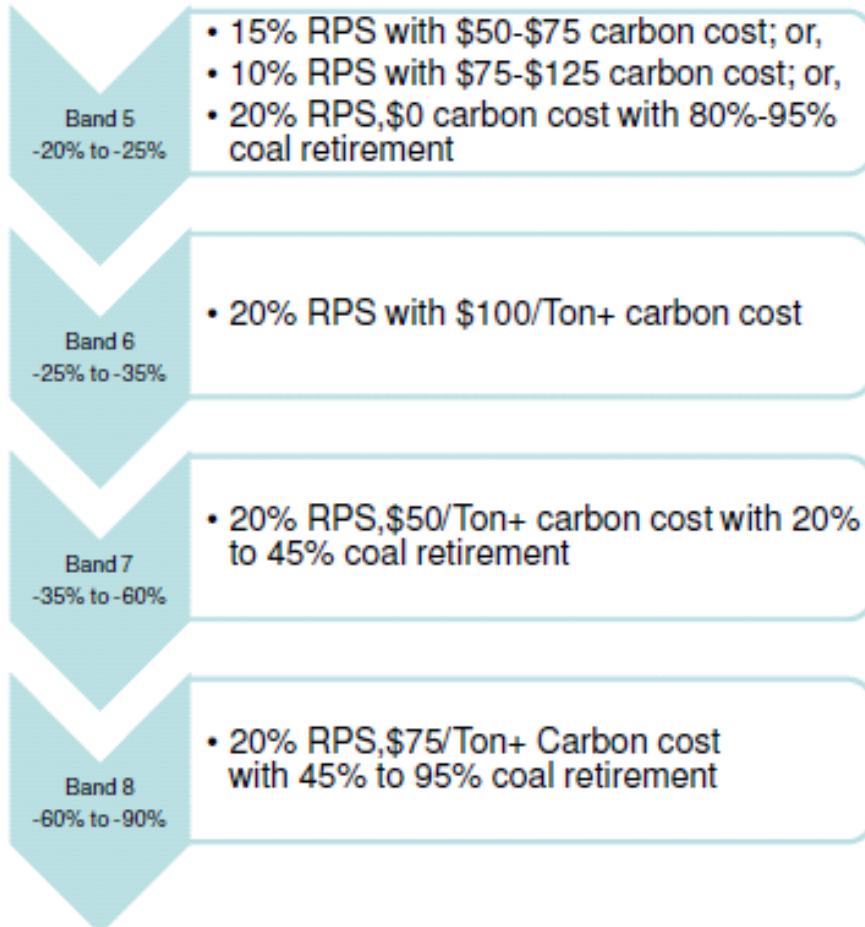
# Carbon – Midwest ISO

- ❖ MGA and Re-Amp carbon goals
- ❖ Waxman-Markey proposes an 83% carbon reduction (against a 2005 baseline) by 2050
  - The 2005 Carbon Baseline for the Midwest ISO is approximately 500 million tons
  - Would require a reduction of approximately 400 million tons by 2050
- ❖ Achieving a reduction in emissions to that level will require a combination of regulatory and policy options to be employed
  - Demand Response and Energy Efficiency programs to manage future load and slow need for new generation, and its associated emissions
  - Implementation of existing & strengthened Renewable Portfolio Standards and regional goal to implement large amounts of wind resources
  - Carbon pricing to support fuel switching and drive retirement

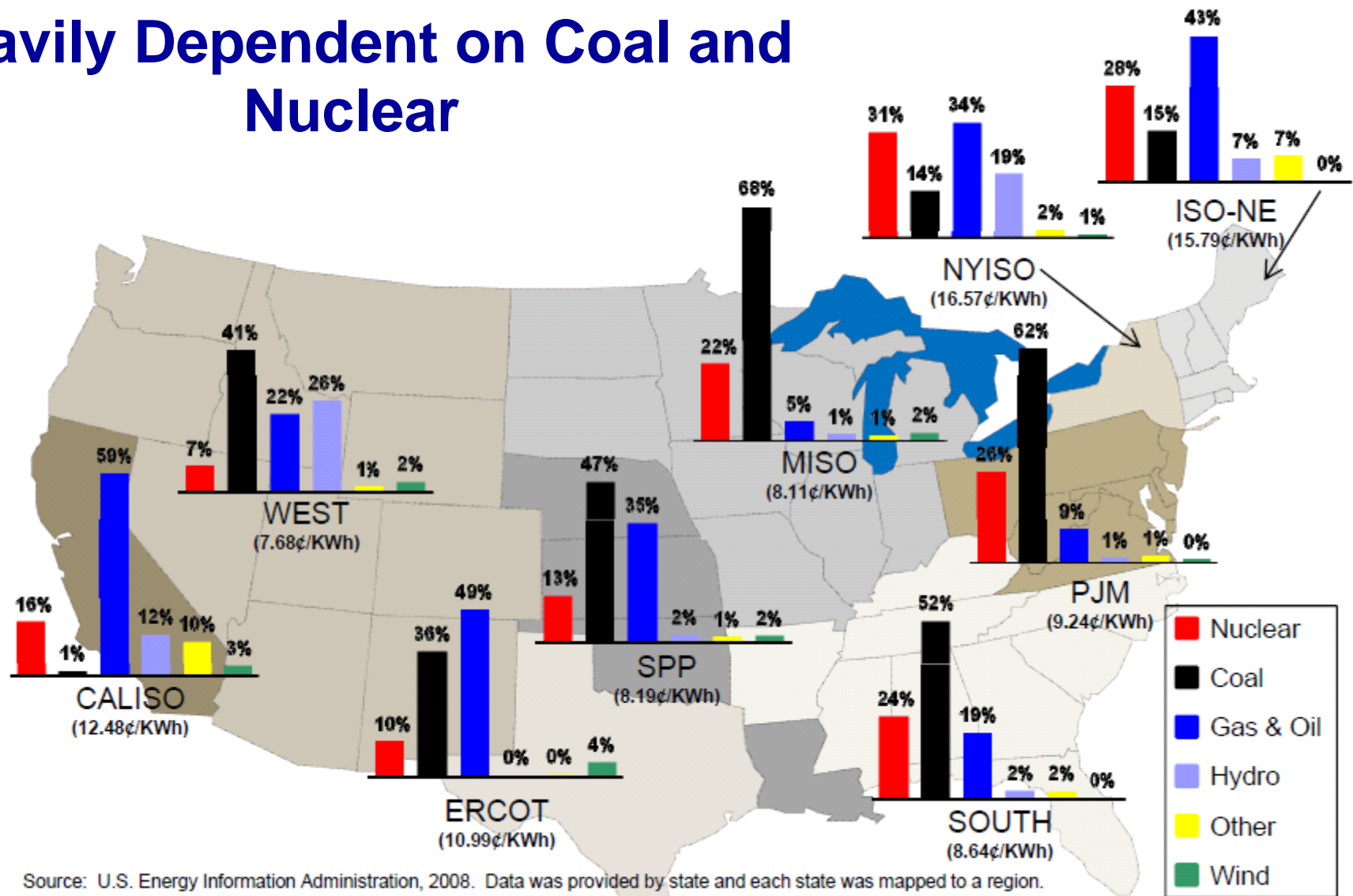
# Carbon Bands of Reduction



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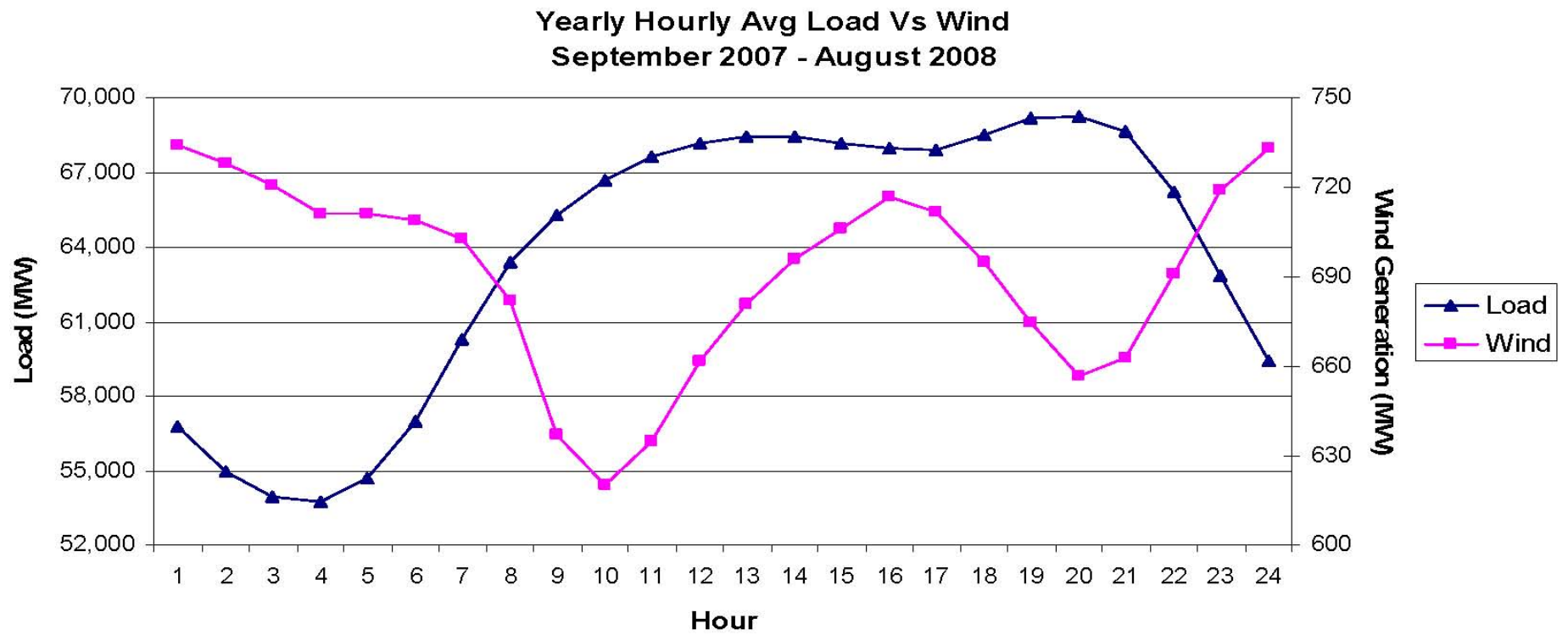


# Midwest Electric Generation is Heavily Dependent on Coal and Nuclear

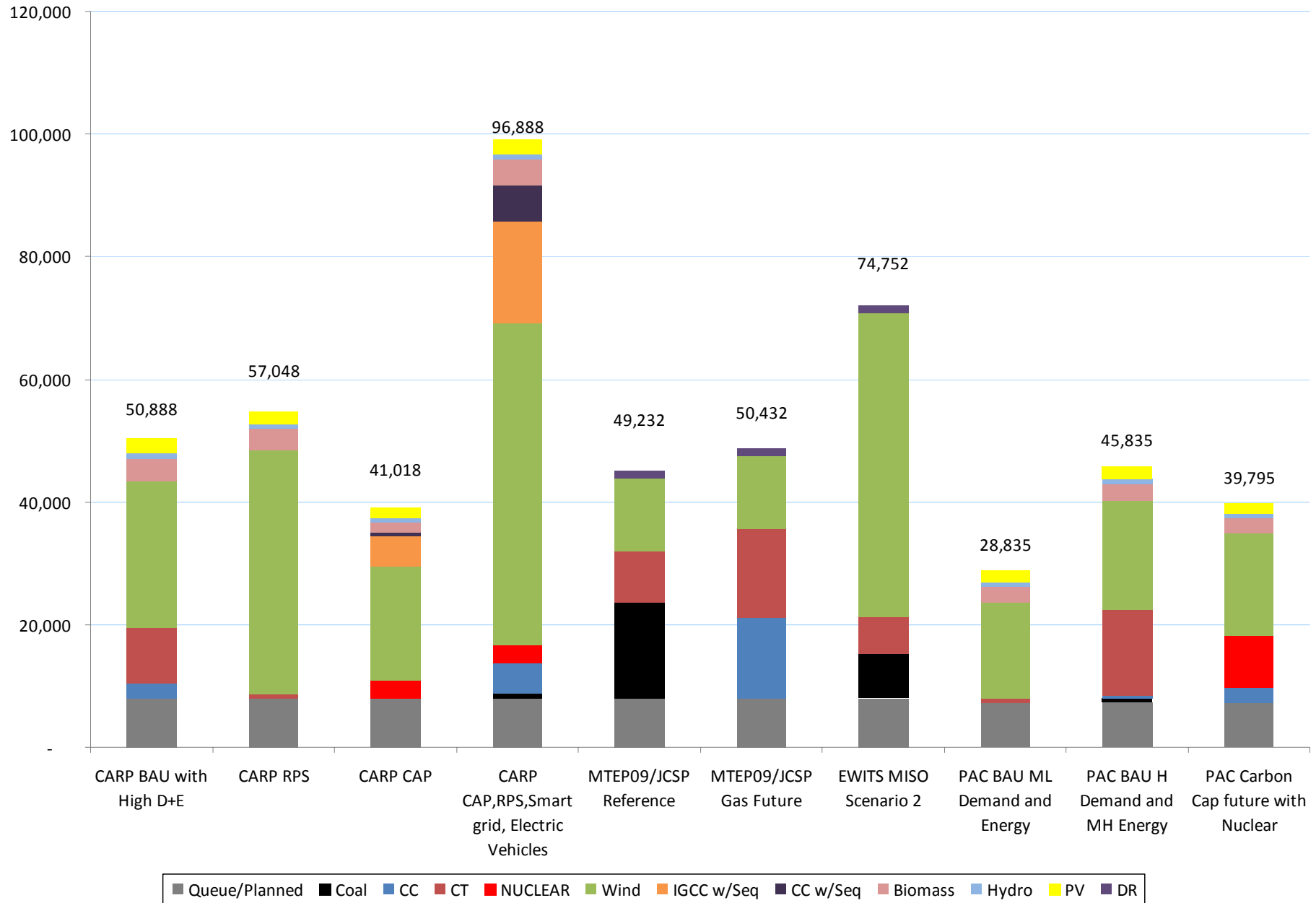


Source: U.S. Energy Information Administration, 2008. Data was provided by state and each state was mapped to a region. Therefore, each region characterized as a RTO is a compilation of entire state(s) and is only a proxy for actual RTO production totals. The weighted average retail price is shown under each region.

# MISO Wind and Load

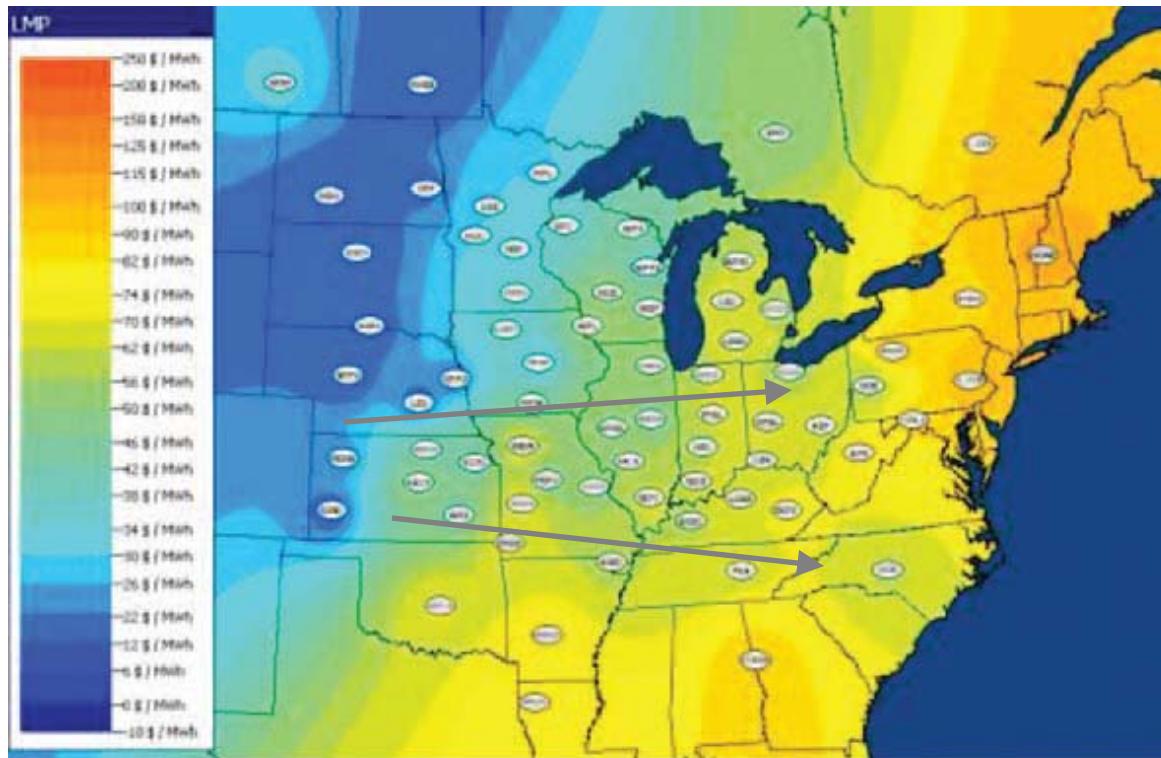




# MISO Capacity Additions through 2025



# Power Moves from Low-Cost to High-Cost Areas

- NREL's EWITS report found that major new transmission paths will continue to “drive energy from low-cost source areas in the Midwest to high cost sink areas:



-  = lower power prices
-  = higher power prices