The Midwest Independent Transmission System Operator: America's First Regional Transmission Organization

July 28, 2004

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What Is an Regional Transmission Organization?

A Regional Transmission Organization (RTO) provides wholesale electric transmission service under one tariff for a large geographic area

RTOs are regulated by the Federal government (Federal Energy Regulatory Commission)

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RTO Activities

Include:

- ✓ **Tariff administration**
- ✓ **Congestion management**
- ✓ **Parallel path flow**
- ✓ **Calculate available transmission capacity**
- ✓ **Market monitoring**
- ✓ **Planning and expansion**
- ✓ **Inter-regional coordination**

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Benefits of a Regional Transmission Organization

- **Independence**
  - **Non-discriminatory open access to a large consolidated transmission system**
  - **Independent calculation of Available Transfer Capability/Available Flowgate Capability**
  - **Independent market monitoring and mitigation**

- **Enhanced Reliability**
  - **Better planning process over a larger region**
  - **Better congestion management**
  - **Improved maintenance and outage coordination**

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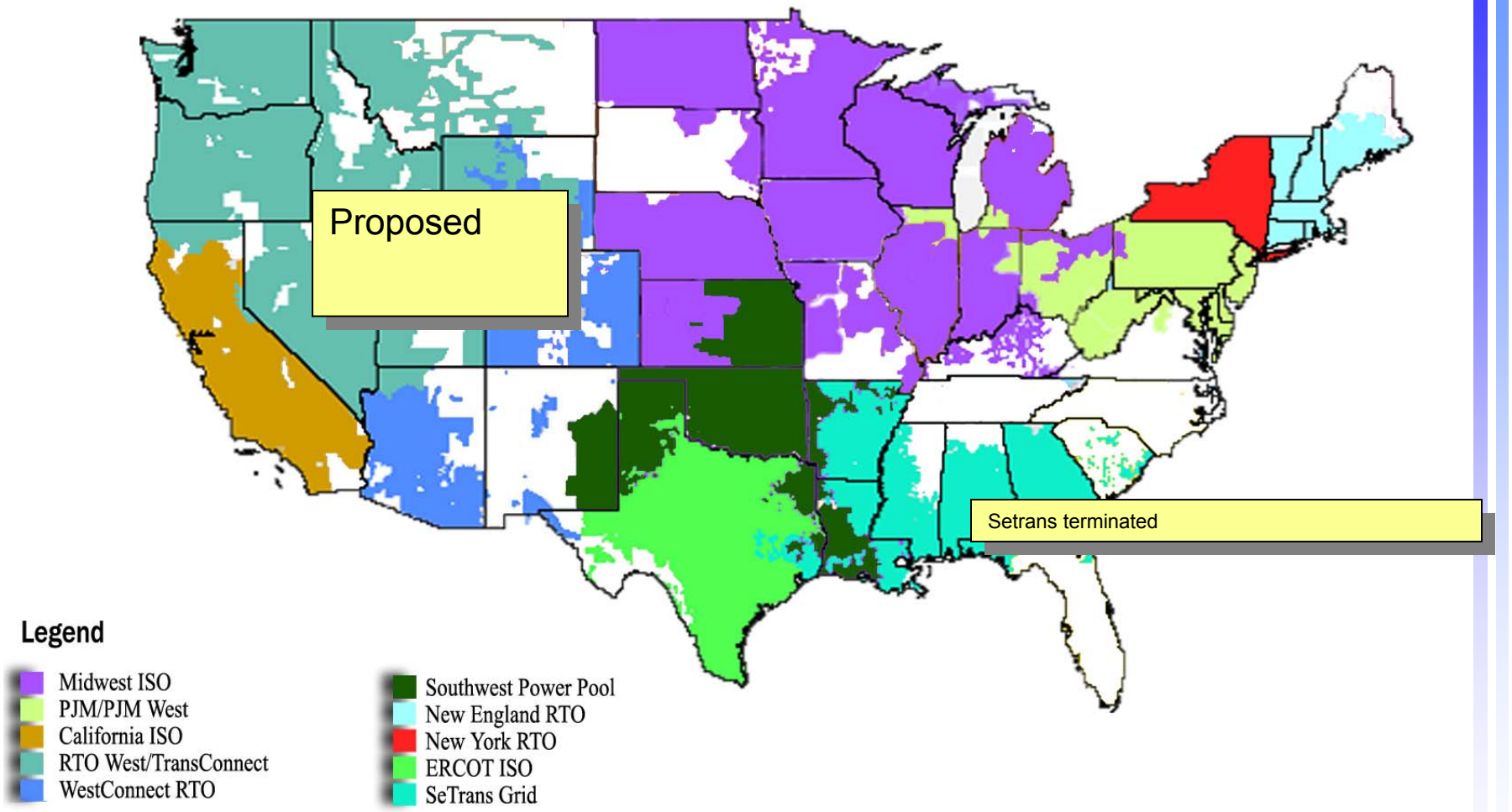
ISO/RTO Map


Proposed
Setrans terminated
Legend
Midwest ISO
PJM/PJM West
California ISO
RTO West/TransConnect
WestConnect RTO
Southwest Power Pool
New England RTO
New York RTO
ERCOT ISO
SeTrans Grid

Benefits of a Regional Transmission Organization

- One-stop Shopping
  - Single OASIS (Open Access Same Time Information System)
  - Single scheduling system
  - Consolidation of reliability coordinators into one regional entity
  - One standardized generator interconnection process
- Savings
  - Elimination of pancaked rates
  - Eliminates seams within the RTO and addresses seams with other RTOs
  - Lower reserve requirements on a regional basis

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History

- **1996: FERC requires open access, first meetings held to form MISO**
- **1999: FERC order on RTOs**
- **2001: MISO moves into control center**
- **2002: Full operations begin**
- **2004: Energy market tariff filed**

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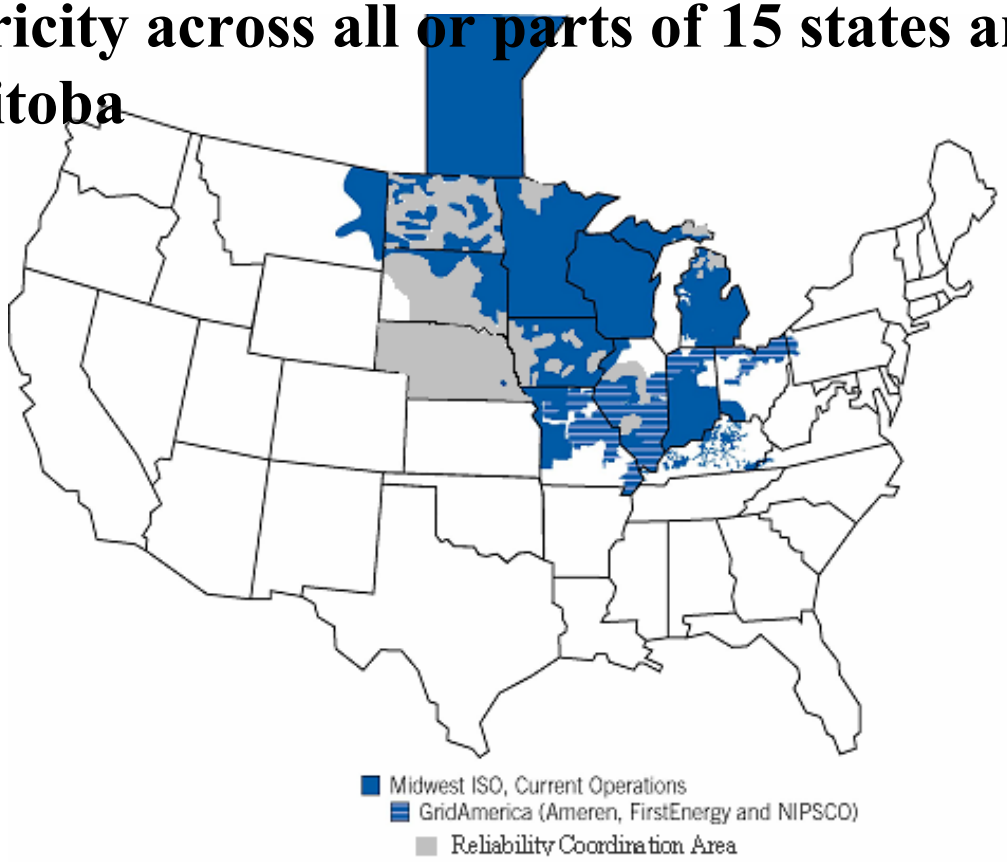
Midwest ISO is an independent, non-profit grid monitor for the transmission of high voltage electricity across all or parts of 15 states and Manitoba



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MISO Fast Facts

- **Control centers both in Indiana and Minnesota**
- **24 transmission-owning utility members**
- **Administrative cost adder capped at 15 cents per megawatt-hour funds current operations. (Market costs will be recovered once market starts)**
- **Voluntary membership**
- **Independent**
- **Non-profit**

Members

Coordination Agreement Members

- **Manitoba Hydro**

Stand-Alone Transmission Companies

- **ATC (American Transmission Co.)** (includes Alliant-WP&L, MG&E, WPS, UPPCO and WE transmission facilities)
- **GridAmerica (includes ATSI** (First Energy)**, Ameren, & NIPSCO)**
- **International Transmission Co.** (formerly Detroit Edison)
- **Michigan Electric Transmission System** (formerly Consumers Energy)

Pending Transmission Owning Members

- **Great River Energy (MN), Illinois Power, and Columbia (MO)**

Non-Transmission Owning Members

- **Marketers**
- **Industrial Customers**
- **IPPs**
- **Munis/Coops/TDUs/Other**

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Major Transmission Owning Members

- Alliant Energy
- Aquila, Inc.
- Ameren
- CILCO
- Cinergy
- Hoosier Energy
- IMPA
- IP&L
- LG&E
- Michigan Public Power Agency
- Minnesota Power
- Montana-Dakota Utilities
- Otter Tail Power Company
- Southern Illinois Power Coop.
- City of Springfield, Illinois
- Vectren
- Wabash Valley Power
- Xcel

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MISO Services Today

- Schedule transmission service over multiple control areas at non-pancaked rates via one OASIS site
- Analyze system conditions and provide reliability coordination services
- Standardized generation interconnection agreement process for all new generation plants
- Long-term transmission planning

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MISO Reliability Actions

- **Enhanced visualization**
- **Improved monitoring tools**
- **Increased staff**
- **Operator training**
- **Grid monitoring computer applications**
- **New telephone system**

Control Center

- ✓**Since August 2003, MISO has developed and implemented a large number of tools, applications, procedures, and processes that have dramatically increased the level of service to our customers**

- ✓**MISO has worked closely with its member companies, as well as with neighboring regional grid operators in this effort**

- ✓**Many of these processes and tools have moved MISO beyond the current requirements as set forth in NERC and other industry standards**

MISO Visualization Tools

Real-time overview displays show:

- ✓**MISO transmission system and surrounding areas**
- ✓**All 230kV and above – and critical underlying facilities 100kV and above**
- ✓**Real-time megawatt & reactive values**
- ✓**Voltage/Outage indications**
- ✓**Provides “Big Picture” of transmission system**

MISO System Monitoring Tools and Applications

State Estimator

- ✓State Estimator is a computer model of the Eastern U.S. grid
- ✓Model contains 100,000 real-time data points
- ✓Model contains 30,500 busses

MISO System Monitoring Tools and Applications

Contingency Analysis: U**ses the State Estimator model which performs 5,500 contingencies ("what ifs") every 5 minutes and identifies potential problems on the system**

- ✓**Personnel on duty at the control center 24 hours a day for support of the State Estimator and Contingency Analysis applications**

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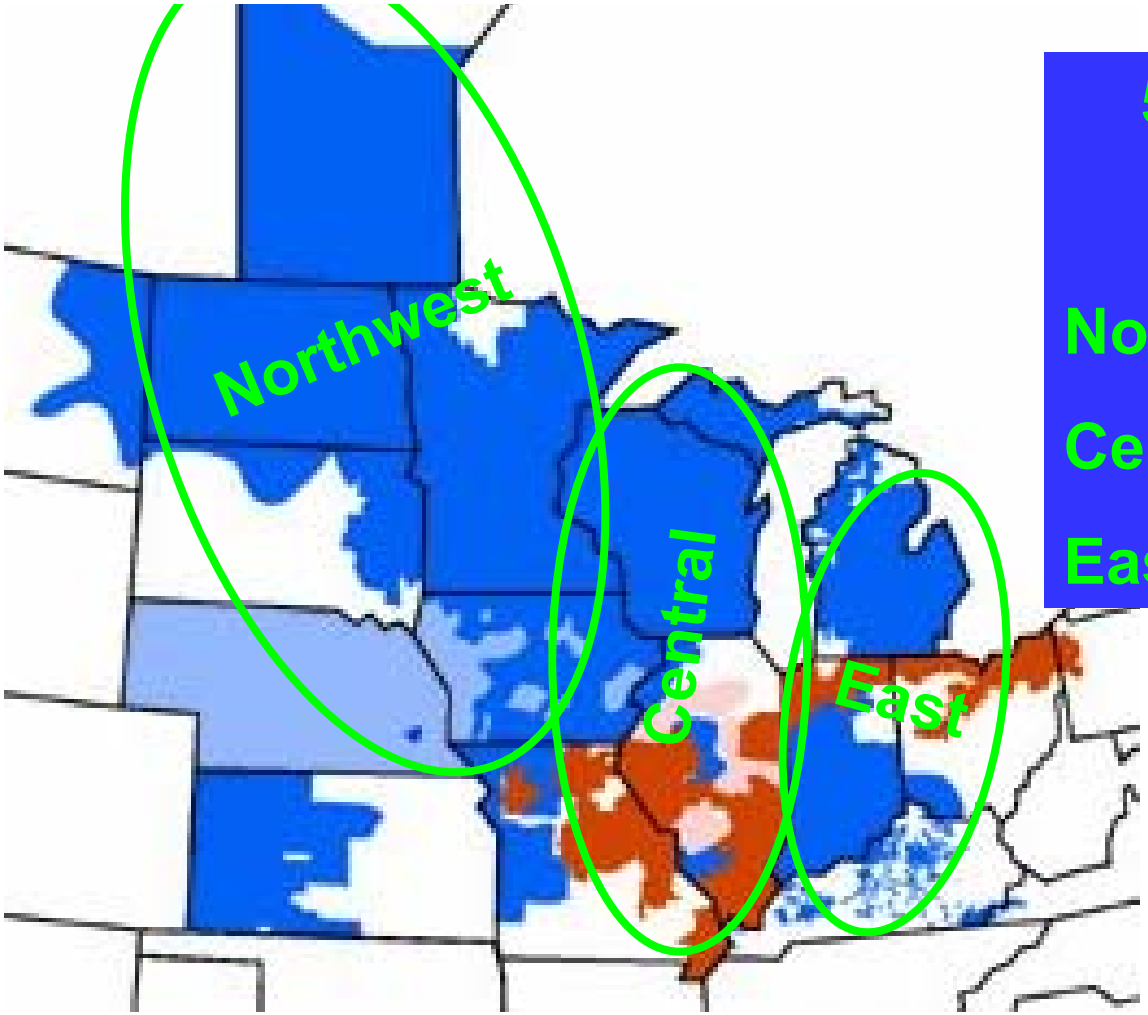
Regional Transmission Plan



5-Yr Investment

$1,832 Million

Northwest:	**$620 M**
Central:	**$984 M**
East:	**$228 M**

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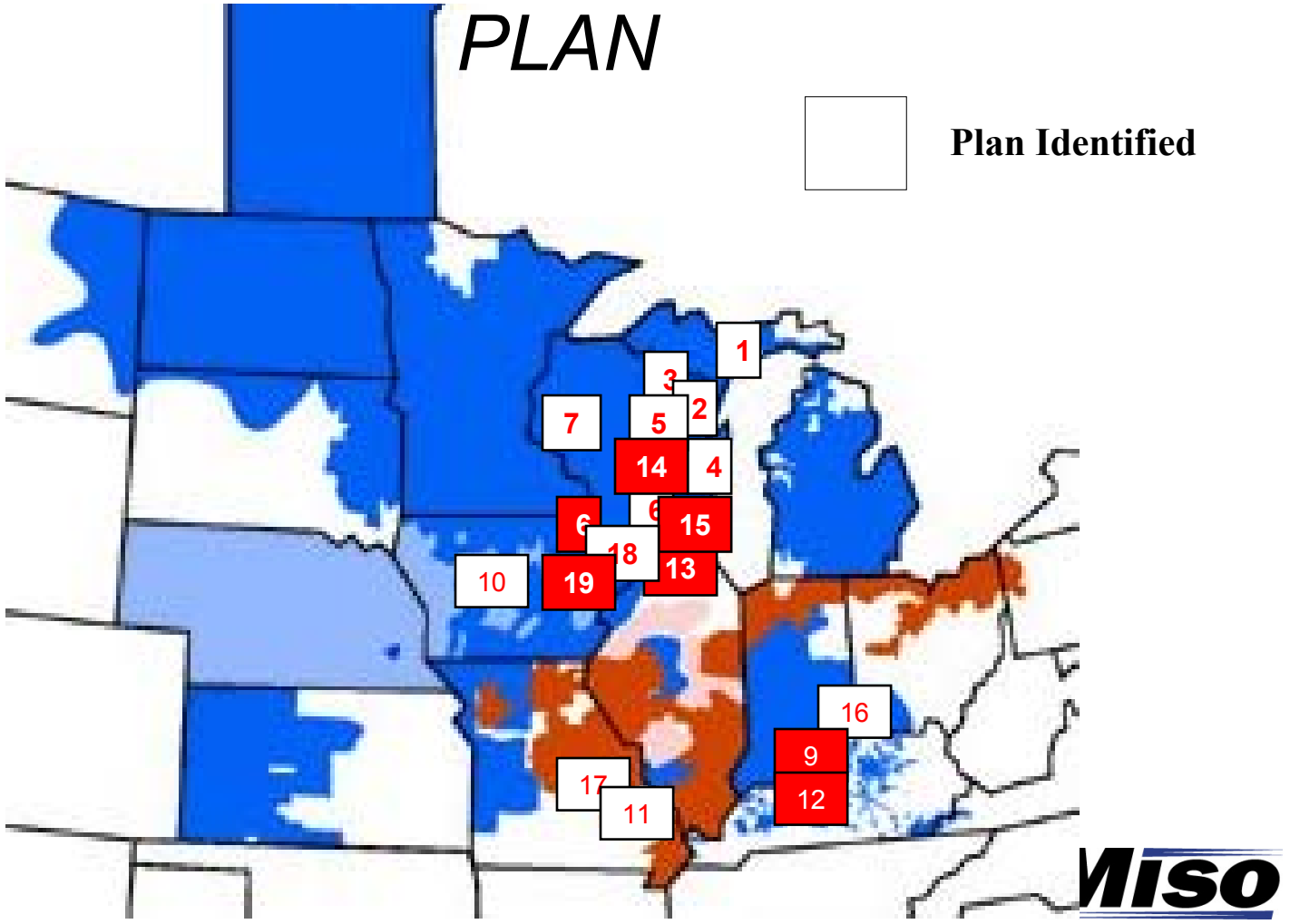
CONSTRAINTS ADDRESSED IN TRANSMISSION PLAN

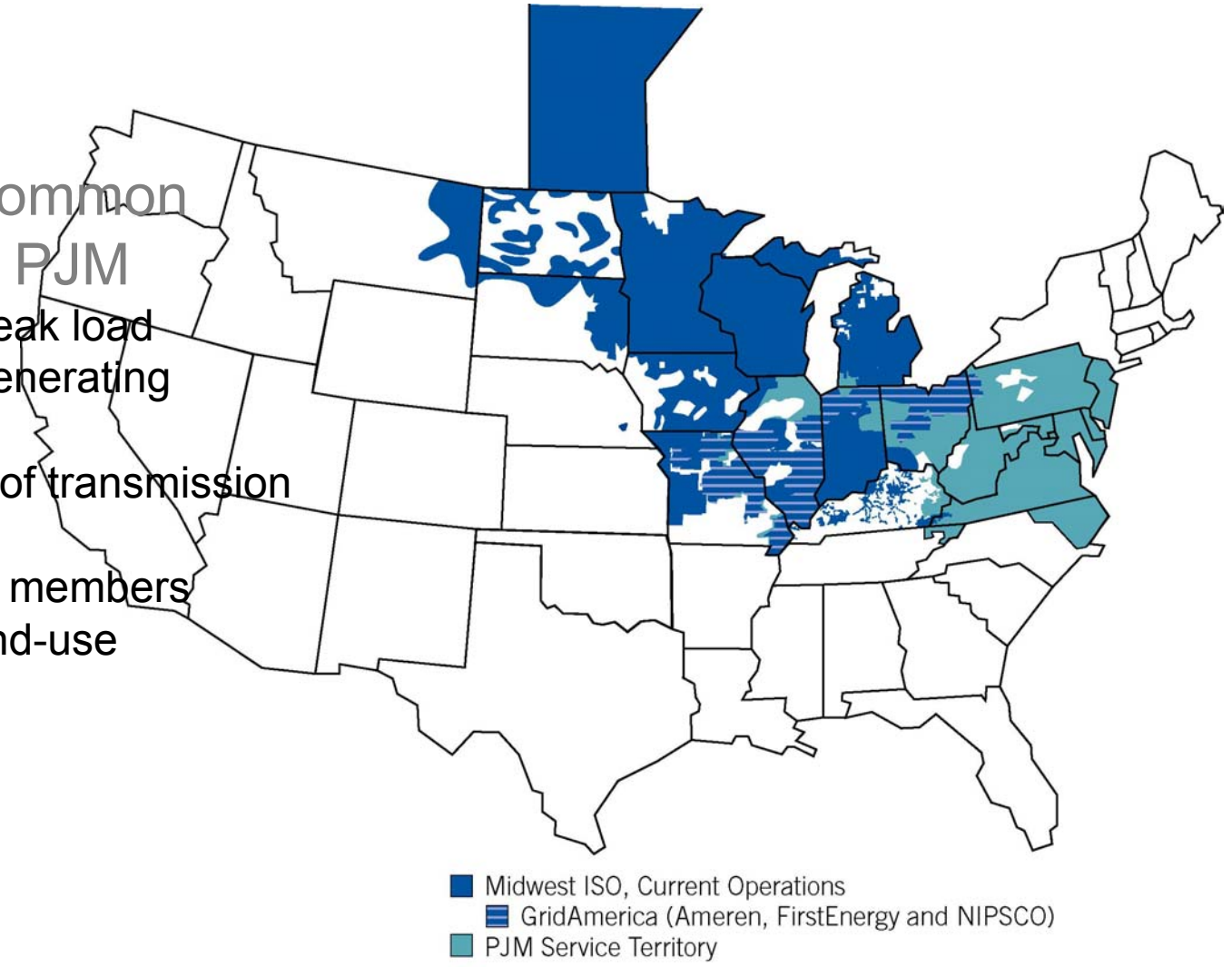


The Organization of MISO States

- **A group of 15 states**
- **First regional state committee**
- **Provides state regulator input to FERC and MISO management**
- **Based in Des Moines, Iowa**
- **Executive committee of five Commissioners**
- **Advisory only**
- **Visit their website: misostates.org**

Joint and Common Market with PJM

- 233,000 mw peak load
- 290,544 mw generating capacity
- 166,000 miles of transmission lines
- more than 325 members
- 79.5 million end-use consumers



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Recent Developments

- Seams agreements neighbors including with PJM, SPP, IMO, TVA, and MAPP
- Elimination of thru and out rate between MISO and PJM via rate re-design (re-vamping of the license plate rate design)
- Market implementation preparation
- New members

The Midwest Energy Market Today

- **Each utility dispatches their own generation in their own control area**
- **No transparent wholesale market**
- **Trading opportunities not fully exploited**
- **Transmission loading relief (TLRs) -- curtailments – are used to manage congestion instead of re-dispatch**
- **Under-utilization of network**

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Coming March 1, 2005: The Midwest Energy Market

- **Centralized security constrained economic dispatch**
- **MISO collects bids at each node and computes the cheapest way to meet demand at every node (locational marginal cost pricing or LMPs)**
- **Bilateral contracts complimented by energy purchases on spot markets**
- **Financial transmission rights (FTRs) used to hedge against congestion risk**

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Market details

- **LMPs are the cheapest way to deliver an additional unit of power to a specific node.**
- **FTRs are the right to collect money based on the price difference between two nodes, are a hedge against congestion risk**
- **Congested paths will be used by those who value them the most**

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Market Implementation

- **LMP replaces TLRs to manage congestion**
- **Real-time and day-ahead energy markets**
- **Used in other parts of the U.S. including PJM, New England ISO, New York ISO and other energy markets**
- **Comprehensive training and testing program underway**
- **Market monitor prevents market manipulation**

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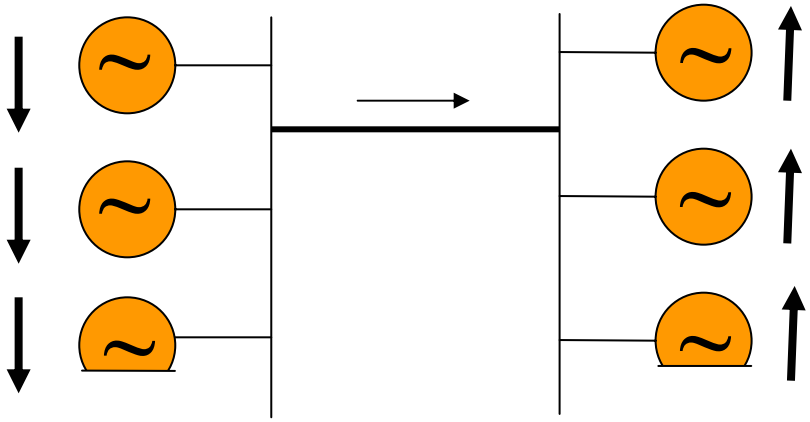
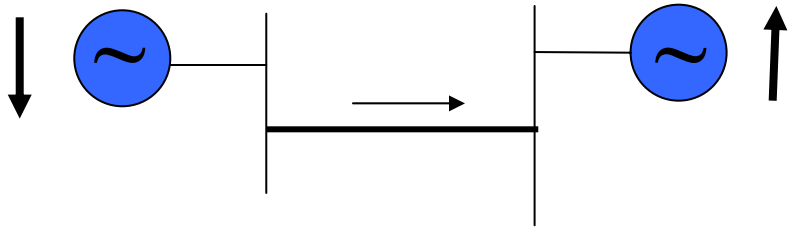
LMP-Based Congestion Management:
***Less** redispatch than with TLR*

TLR
Curtailment



260 MW
Redispatch

LMP
Redispatch



100 MW
Redispatch

Market Benefits

- More efficient use of existing transmission network
- Better system reliability
- $255 million in annual gross production cost savings
- $713 million in savings to consumers
- Lower spot energy prices
- Downward pressure on prices in bilateral contracts

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Market Monitor Sees Improvements from LMP

Centralized redispatch…will select the most effective generators to redispatch.

1. **The current bilateral energy markets do not accurately reflect congestion occurring on the system….**
2. **Improved accuracy and transparency of the price signals …will provide significant benefits**
3. **Increase the utilization of the transmission network and promote reliability.**
4. **The real-time redispatch (every 5 minutes) will allow interfaces to be operated closer to the rated limits…. The relief available from redispatch is much more predictable and timely than through current processes… -- should contribute to improved reliability. (Source:Potomac Economics State of Mkt Report, 5/03)**

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For more information

- Visit our websites: midwestiso.org and Midwestmarket.org
- Send your follow up questions to Bill Malcolm at bmalcolm@midwestiso.org
- Other useful websites: ferc.gov, misostates.org, miso-pjm.com, potomaceconomics.com