Presentation to Representatives of the Public Utilities Regulatory Commission of Ghana

Regional Transmission Organizations

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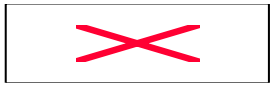
The Midwest Independent Transmission System Operator: America's First Regional Transmission Organization

What Is a Regional Transmission Organization?

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

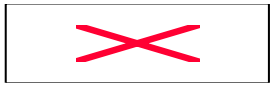
RTOs are regulated by the Federal government (Federal Energy Regulatory Commission)



RTO Activities

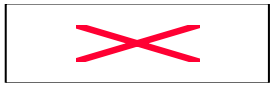
Include:

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

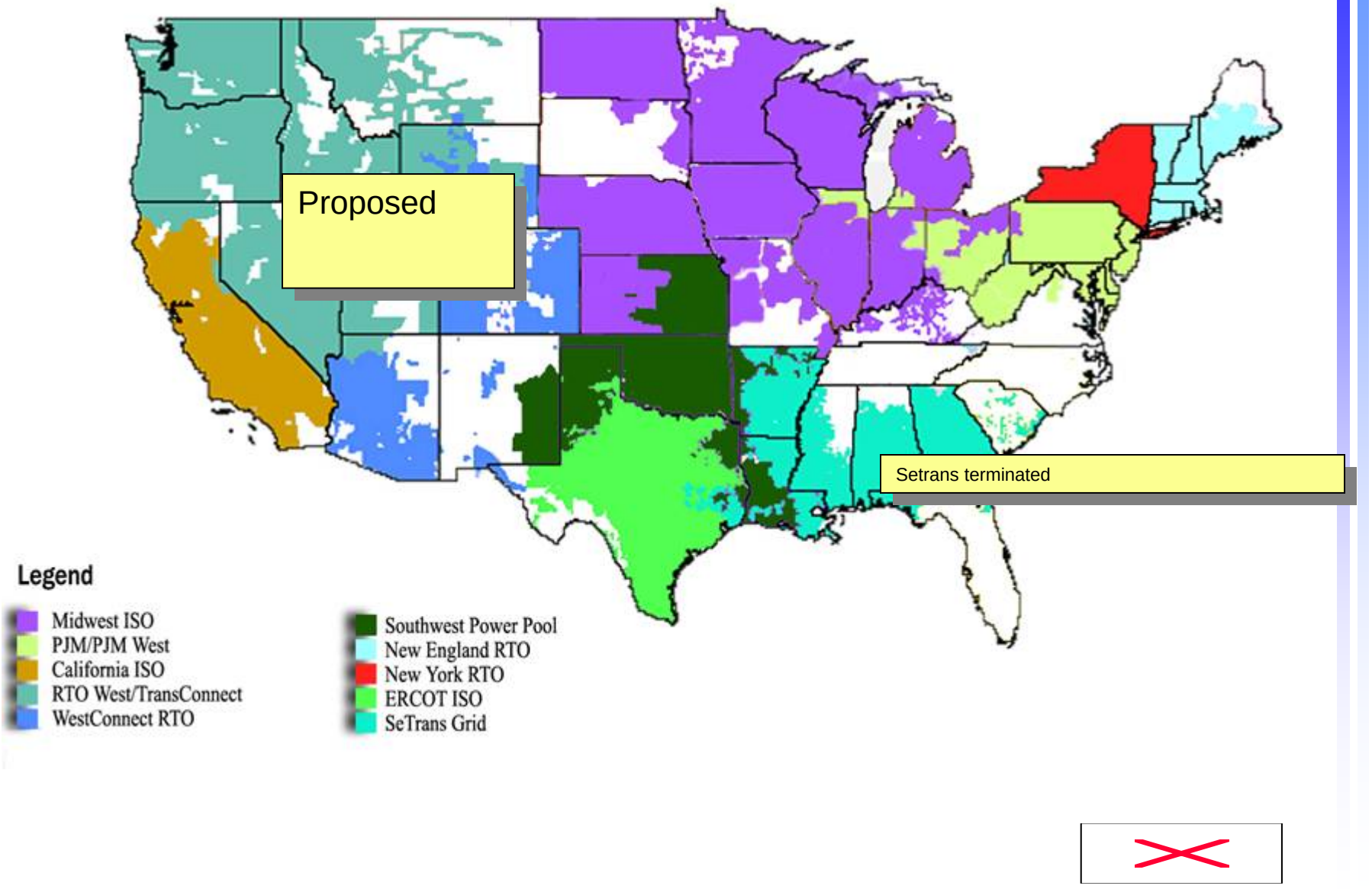


Benefits of a Regional Transmission Organization

- **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**

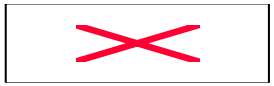


ISO/RTO Map


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

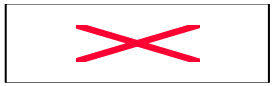
Benefits of a Regional Transmission Organization

- **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**



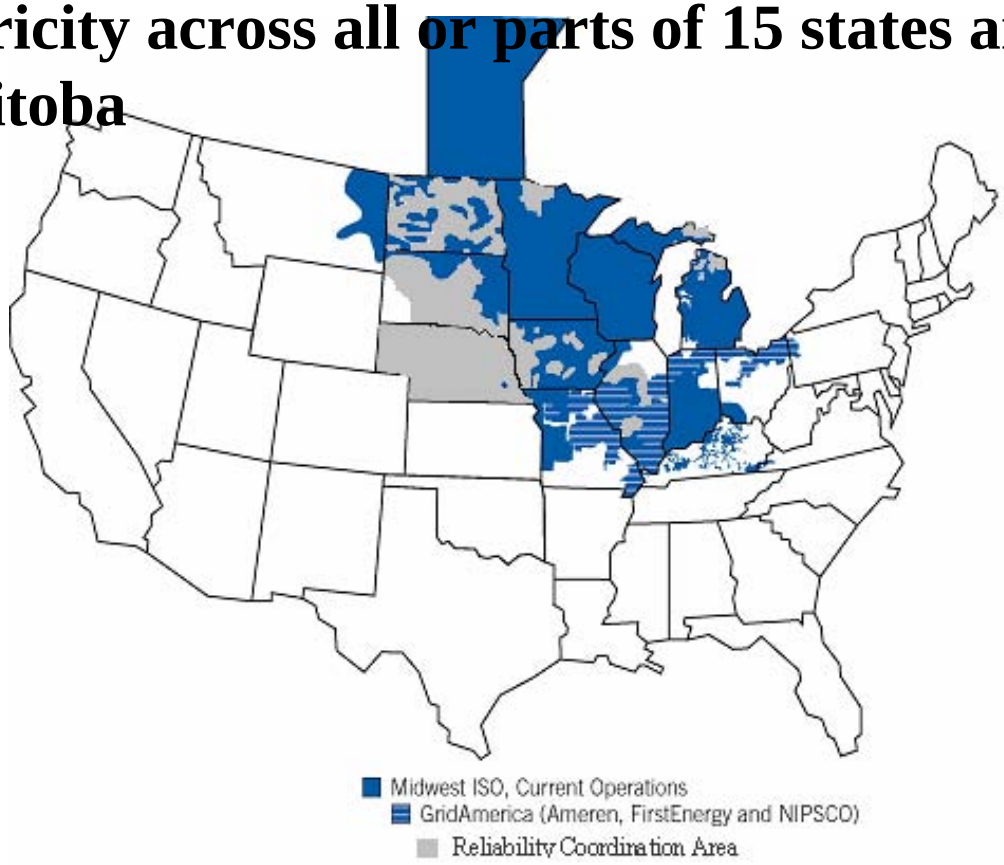
History

- 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



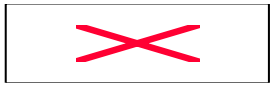
MISO

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



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

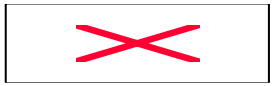
- **ATC (American Transmission Co.)** **(includes Alliant-WP&L, MG&E, WPS, UPPCO and WE transmission facilities)**
- **GridAmerica (includes ATSI** (First Energy)**, Ameren, & NIPSCO)**
- **International Transmission Co.** (formerly Detroit Edison)
- **Michigan Electric Transmission System** (formerly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

Pending Transmission Owning Members

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

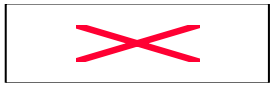
Non-Transmission Owning Members

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



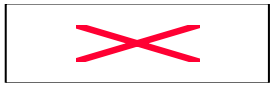
Major Transmission Owning Members

- 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



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



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: Uses 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

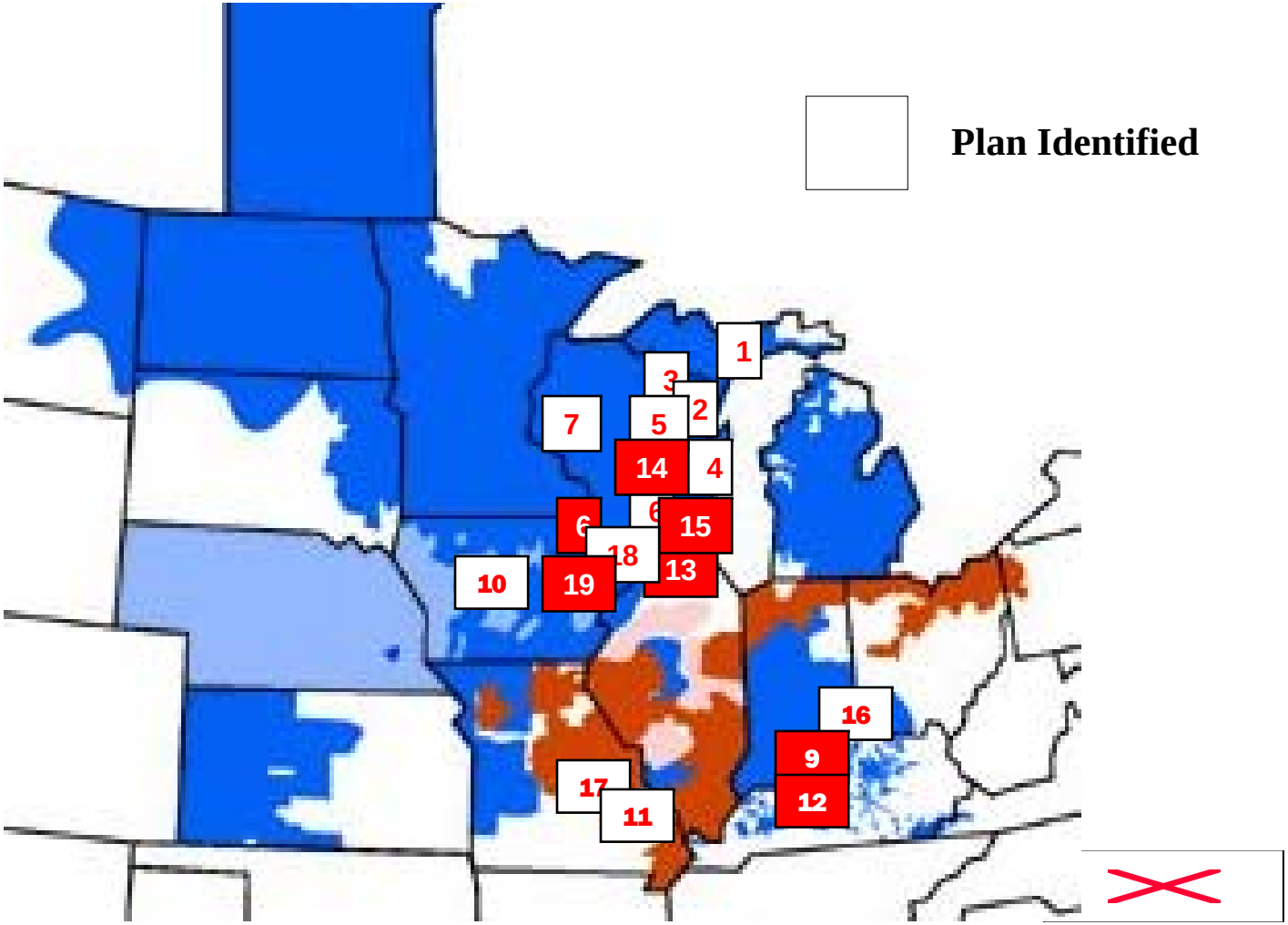
Regional Transmission Plan

5 Yr Investment

$1,832 Million

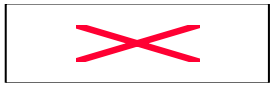
Northwest:	**$620 M**
Central:	**$984 M**
East:	**$228 M**

CONSTRAINTS ADDRESSED IN TRANSMISSION PLAN



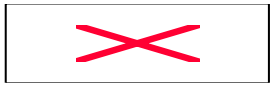
The Midwest Energy Market Yesterday

- **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**



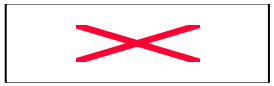
Starting April 1, 2005: The Midwest Energy Market

- 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



Market Benefits

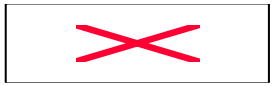
- More efficient use of existing transmission network
- Better system reliability
- $255 million in annual gross production cost savings
- $713 million in savings to consumers
- Lower spot energy prices
- Downward pressure on prices in bilateral contracts



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)**



For more information

- Visit websites: midwestiso.org and Midwestmarket.org
- Other useful websites: ferc.gov, misostates.org, miso-pjm.com, potomaceconomics.com