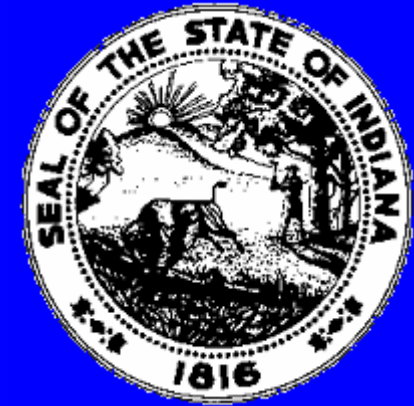


# Indiana Utility Regulatory Commission

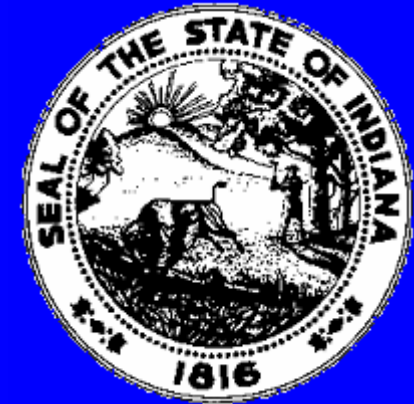


## IURC Response to the Wholesale Electricity Market

George Stevens  
Utility Analyst  
September 18, 2007

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# Wholesale Electricity Markets in the U S



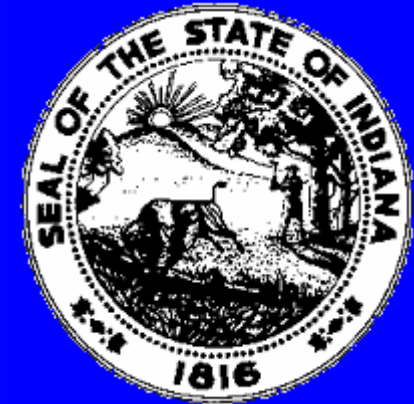
- Regulated by FERC
    - Federal Energy Regulatory Commission
  - FERC designates RTOs and ISOs
  - RTO
    - Regional Transmission Organization
  - ISO
    - Independent System Operator
  - RTOs/ISOs serve more than 60% of the load in the U. S.
-



# What is an RTO / ISO

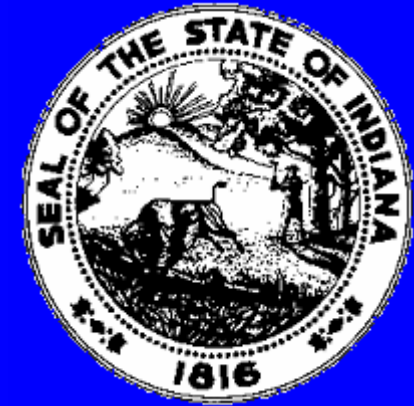
- An organization of electric utility transmission owners, users, and other entities approved by FERC to efficiently coordinate transmission planning and expansion, operation, and use on a regional basis
- Provides wholesale electric transmission service under one tariff for a large geographic area
- Offer wholesale energy markets
- 100 kV transmission and above
- Independent Organization
- Membership is voluntary

# RTO Characteristics and Functions



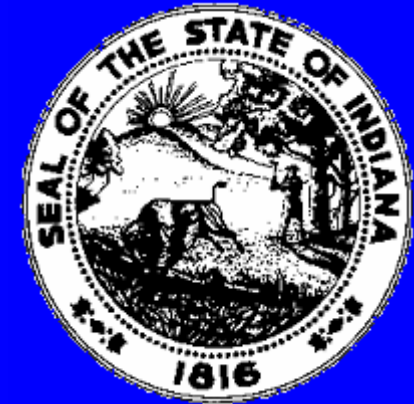
- Tariff administration
  - Congestion management
  - Control of parallel path flows
  - Ancillary services
  - OASIS, ATC
  - Market Monitoring
  - Regional Transmission Planning and Expansion
  - Inter-regional coordination
-

# RTO Benefits

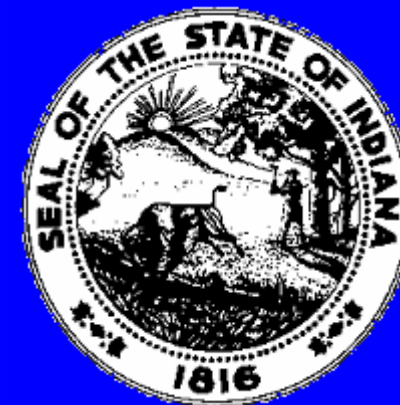


- System Reliability
- Increased Operating Efficiencies
- Congestion Management (generation redispatch)
- Five-Minute Security Constrained Economic Dispatch
- Transmission System can be operated closer to rated limits
- Regional Dispatch of Generation Lowers Energy Costs
- Real Time Energy Market
- Transparent marketplace for buyers and sellers
- Facilitates increased of renewables

# Indiana RTO Situation

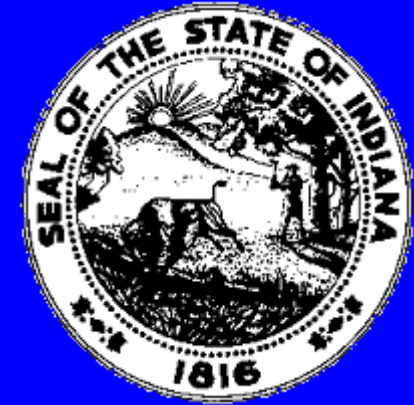


- Two different RTOs operate in Indiana
- Midwest ISO (MISO) covers approx. 80% of the state
- PJM covers the remaining 20% of the state
- All of the state is in RTO controlled transmission areas
- MISO territory encompasses 15 states and one Canadian province (Manitoba)
- PJM territory includes all or parts of the following states: Delaware, Indiana, Kentucky, Maryland, Ohio, New Jersey, North Carolina, Pennsylvania, Virginia, West Virginia



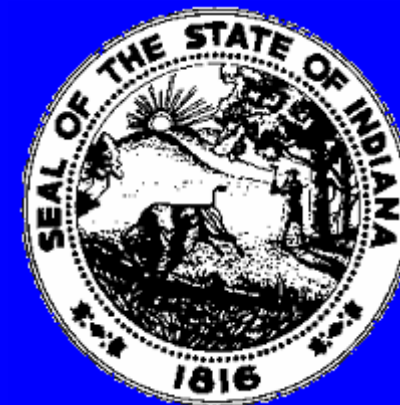
## MISO Specific Data

- MISO territory encompasses 15 states and one Canadian province (Manitoba)
- MISO peak load 136,520 MW (7/31/2006)
  - Began operation February 2002
  - Market opened April 2005
  - Provides real time and day ahead energy markets
  - 30 Transmission Owners / 36 Control Areas
  - 1,504 generating units
  - Two control centers



# Market Operations

- Real time and day-ahead markets
  - Reset every five minutes
  - Real time market fine tunes day ahead commitments
- Five-minute generation dispatch
  - Maintains flows within proper limits
  - Provides most economic solution for meeting load demand
  - More precise and faster than previous transmission loading relief procedures
    - 85% reduction in curtailed megawatt hours (mWh) as a result of the market



# Current Market Issues

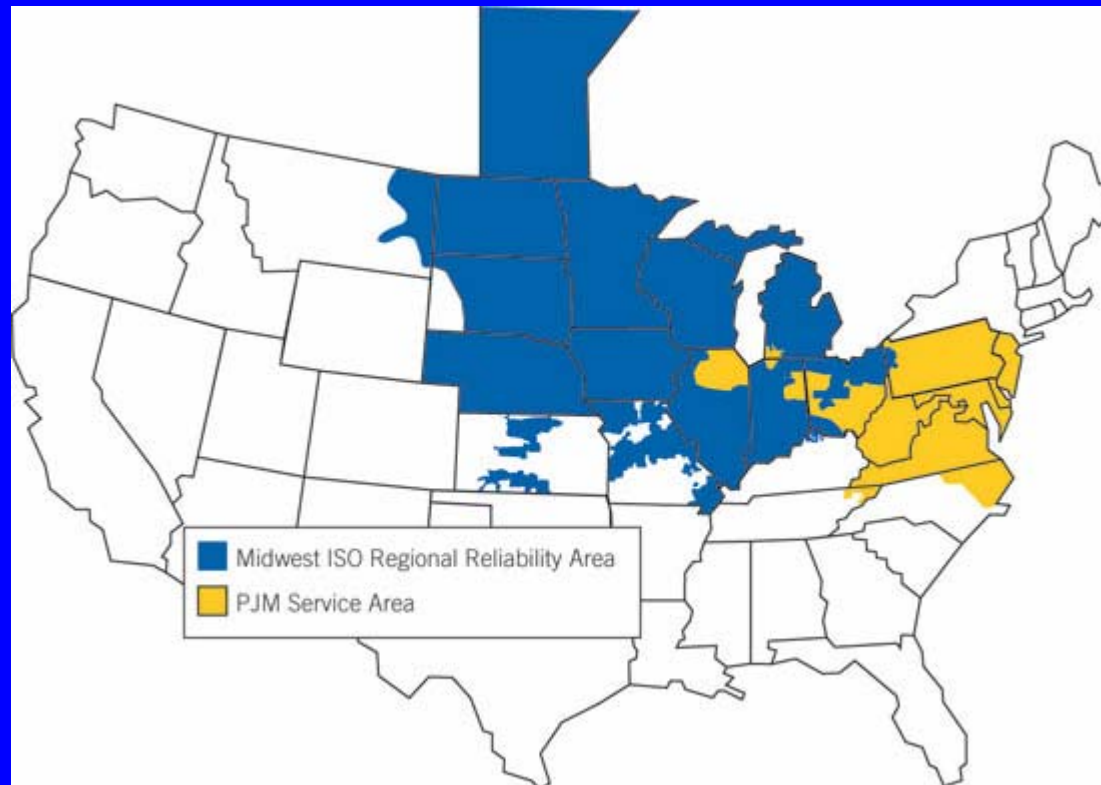
- Continuing of cost/benefit analysis of MISO operation
- Resource adequacy proposals for capacity markets
- Transmission expansion planning
- Cost sharing for economic upgrade of the transmission grid
- Start of ancillary services market
  - Reserve sharing
  - Reactive voltage control

# Statistics



	<b>MISO</b>	<b>PJM</b>
<b>Square Miles</b>	<b>175,000</b>	<b>920,000</b>
<b>Generation Sources</b>	<b>1,271</b>	<b>5,173</b>
<b>Generating Capacity (MW)</b>	<b>164,905</b>	<b>162,981</b>
<b>Peak Load (MW)</b>	<b>144,644</b>	<b>136,520</b>
<b>Annual Energy (TWh)</b>	<b>729</b>	<b>655</b>
<b>Transmission Miles</b>	<b>56,250</b>	<b>93,600</b>

# Map of Midwest ISO (MISO) and PJM

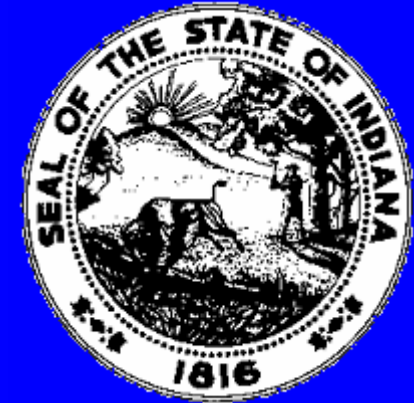


# Real Time MISO Reliability Applications



- Network Model
    - 238,890 data points
    - 5,160 generating units
  - State Estimator
    - Solves every 90 seconds or less
  - Real Time Contingency Analysis
    - 9,000+ “what if” contingencies
      - Generator trips, line failures
    - Solves < 2 minutes
-

# Real Time Control Center Displays



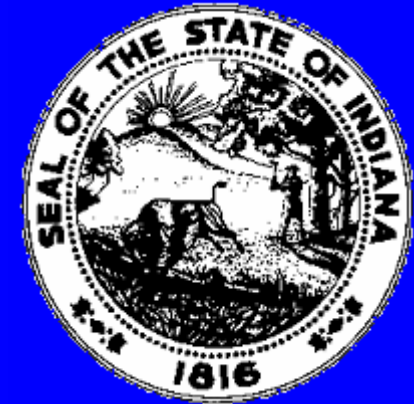
- MISO system and surrounding areas
- 230 kV and above
  - Critical facilities 100 kV and above
- Real Time megawatt and reactive values
- Real time voltage / outage indications

# Comprehensive Operator Training



- Classroom learning
- Simulator training
- System restoration drills
- System dynamics training
- Cross-training with Control Area Operators and Transmission Operators
- Voltage Stability / System Dynamics

# Comprehensive Operator Training (continued)



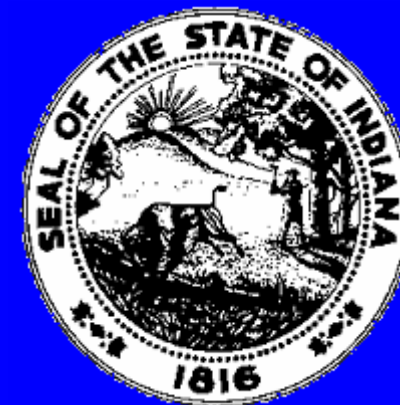
- State Estimation
- Alarming
- Interpretation of Overview/One-line displays
- Loss of key applications
- Site visits to member systems
- Emergencies

# Emergency Training



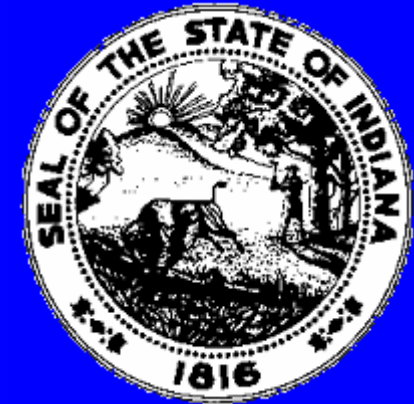
- Emergency Response and Restoration Drills
  - Alarming, covering a large geographic area
- Simulator
  - Operators undergo multiple training scenarios
- Transferring to Backup Control Center drills
- Operating from Backup Control Center drills

# List of Web Sites for More Information



- MISO – [www.midwestmarket.org](http://www.midwestmarket.org)
  - PJM – [www.pjm.com](http://www.pjm.com)
  - FERC – [www.Ferc.gov](http://www.Ferc.gov)
  - MISO States – [www.misostates.org](http://www.misostates.org)
  - Market Monitor –  
[www.potomaceconomics.com](http://www.potomaceconomics.com)
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# IURC Response to the Wholesale Electricity Market



- Discussion
- Questions