

Historic Congestion in the Eastern Interconnection

Midwest ISO Overview and Comments



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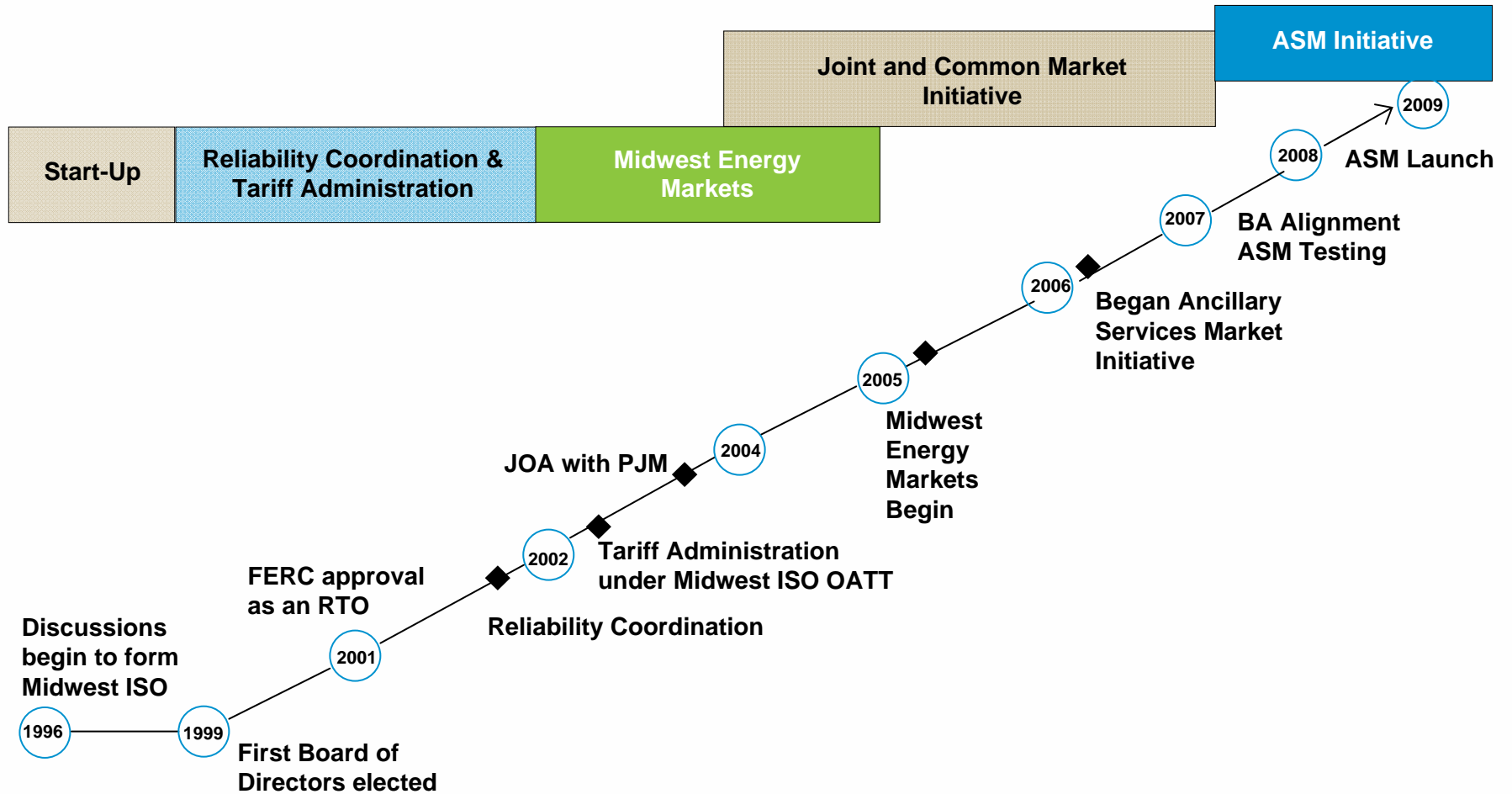
Spring 2009 Technical Workshop in Support of the DOE 2009 Congestion Study

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Who We Are

- Independent, non-profit organization responsible for maintaining reliable transmission of power in 14 states and one Canadian province
- First Regional Transmission Organization (RTO) approved by the Federal Energy Regulatory Commission (FERC)

Midwest ISO Evolution



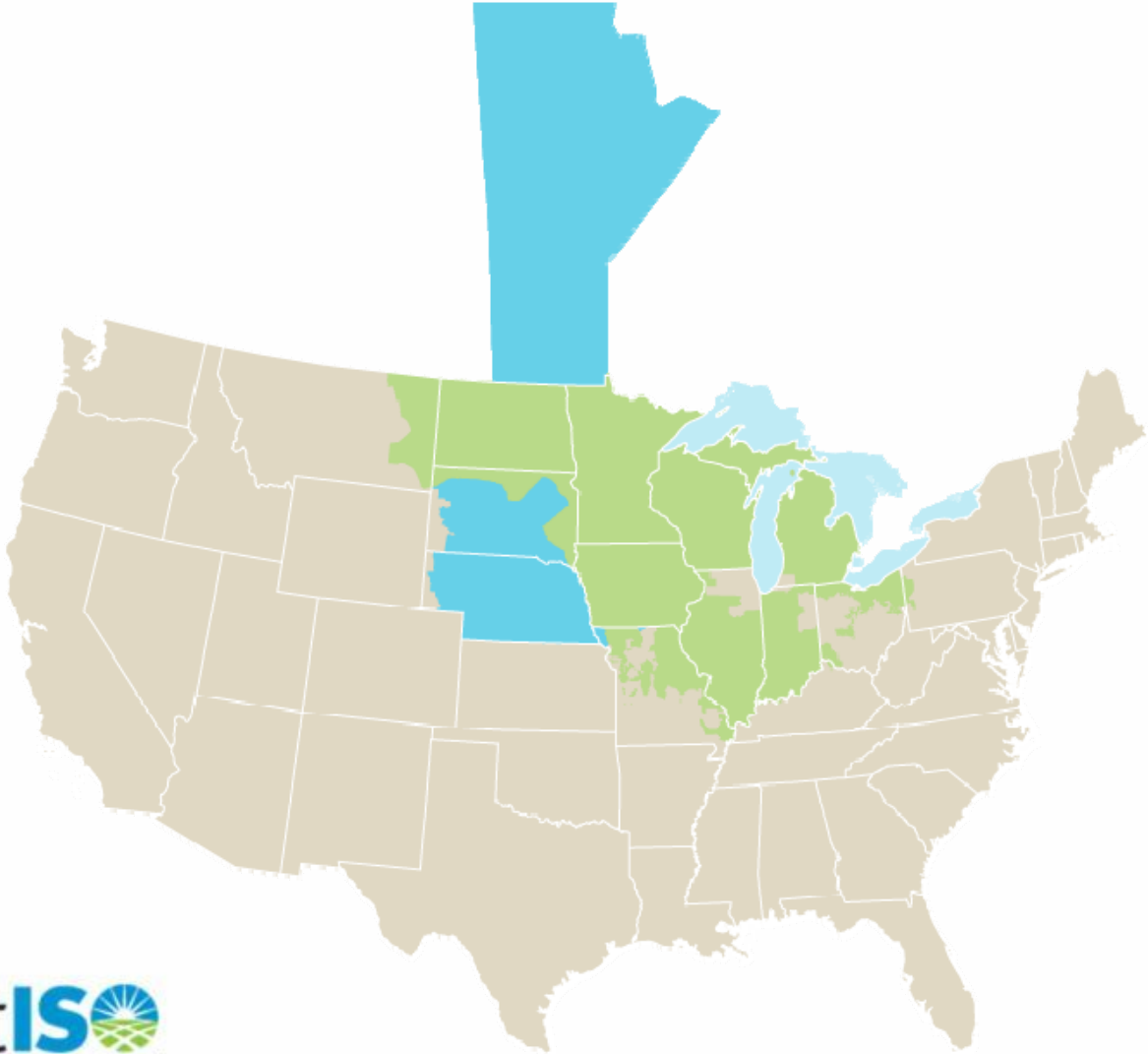
What We Do

- Monitor energy transfers on the high voltage transmission system
- Schedule transmission service
- Manage power congestion through security-constrained economic dispatch
- Operate day-ahead and real-time energy markets
- Regional transmission planning

Scope of Operations

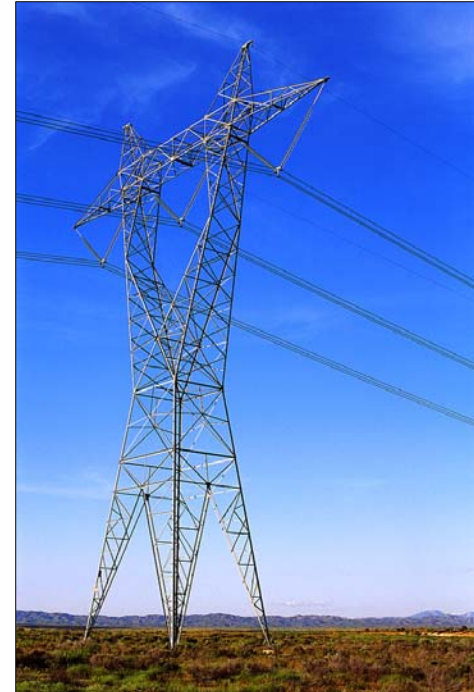
- Generation Capacity
 - 130,000 MW (market)
 - 159,000 MW (reliability)
- Peak Load (set July 31st, 2006)
 - 109,157 MW (market)
 - 129,647 MW (reliability)
- 93,600 miles of transmission
- 14 states, 1 Canadian province
- 920,000 square miles
- 5-minute dispatch
- 1,896 pricing nodes
- 5,389 generating units in the network model
- ~ \$3.5 billion per month settled in energy markets
- 280 market participants serving 40 million people

Midwest ISO Footprint



Congestion Management

- Ensure transmission system does not overload
- Managed in real time
- 5-minute Security
Constrained Economic
Dispatch
- Market to Market
- TLR



“Drivers” of 2007 Congestion

- Summer and winter peak loads (several Central Region Balancing Authority areas set all-time summer peak loads in 2007)
- Higher than normal loads in October 2007 due to higher than normal temperatures (during fall maintenance season)
- Transfers west to east and north to south
- Planned transmission and generation outages (internal and external)
- Unplanned transmission and generation outages (internal and external)
 - Forced transmission outages in the West Region due to a significant winter storm at the end of December 2006
 - Forced transmission outages in the Central and East Regions due to a significant winter storm in February 2007

OASIS and IDC Metrics

AFC Results

– MN-WI tie

- One planning horizon flowgate (common tower contingency)
- Request to add to AFC process
- Became limiting flowgate in AFC process
- Subsequent transmission upgrades have addressed this – no longer in AFC process
- Common tower contingencies are not normally simulated in real-time

OASIS and IDC Metrics

Reservation Results

- Recommended zone changes are pending
- Reservation analysis based on reservations sinking into MISO
- Recommend analyzing schedules (tags) instead of reservation information
 - Better reflection of “actual” usage vs “planned” usage

OASIS and IDC Metrics

IDC Results

- Need to update (includes non-MISO flowgates that are not under the purview of the MISO RC)
- Flowgate list includes non-MISO flowgates that are under the purview of the MISO RC (MAPP flowgates – MISO West Region)
- Need to exercise caution when comparing AFC results and TLR results
 - AFC (forecasts) and TLR (real-time) results can vary for several reasons.
- Suggest analysis of Market, TLR, and Tag data would be a better means to identify historical congestion than analysis of AFC information (based on forecasts) and TSR information (does not include market activity)...at least for the MISO footprint

OASIS and IDC Metrics

IDC Results

- 2463_08KOKHP230 KO IN41.0 05JEFRSO GRNTWN 765
 - Central Indiana constraint
 - Local congestion
 - TLR4 (transmission reconfiguration)
 - January - March 2007
 - No non-firm transaction impacts - not an AFC flowgate
 - **Subsequent transmission upgrades have addressed this congestion**
- EAU CLAIRE – ARPIN 345 KV
 - Central Wisconsin constraint
 - West to East flow
 - TLR3 and constraint binding
 - Lengthy forced generator outage in latter half of 2007 - reduced voltage stability limits
 - AFC and TLR trends are comparable
 - **Subsequent transmission upgrades have addressed this congestion**

Market Metrics

Frequency/Shadow Price Results

- MISO - Top 50 Most Frequently Congested Constraints
 - 38 MISO constraints
 - 8 PJM constraints (M2M)
 - 4 MAPP constraints (MISO market impacts)
- Some of the 2007 constraints were temporary constraints (e.g., driven by planned and unplanned transmission and generation outages)
- **Significant transmission upgrades have been completed (or are planned) for many of the MISO constraints**
 - See Midwest ISO Transmission Expansion Plan 2008

Market Metrics

Frequency/Shadow Price Results

- BLACKO_BEDNGT500_PRNTY_MTSTM500
 - PJM constraint
 - M2M
- State_Line_Wolf_Lake_138_flo_Burnham_Sheffield 345
 - MISO constraint
 - Northern Indiana
 - West to East flows
 - Congestion primarily during off-peak hours
 - MISO Redispatch and M2M
 - No upgrades planned at this time
- S1226_Tekamah_161kV_flo_S3451_Raun_345kV
 - MAPP constraint
 - Eastern Nebraska
 - South to North flows
 - TLR and MISO Redispatch
 - High shadow prices due to significant redispatch of MISO market generation to meet market flow obligations (based on a 0% threshold in 2007)

Market Metrics

LMPCC Results

- Need to complete review of LMPCC results
- LMPCCs can be driven by multiple and/or competing constraints
- Aggregate Nodes with LMPCCs that substantially changed sign were located in East Central Iowa and associated with planned/forced outages and competing constraints.
- Need to work with OATI to determine best method to cluster aggregates and tie to specific constraints

Next Steps

- Work with OATI to update results based on recent comments and changes
- Complete review of draft report and provide comments
- (Preliminary review has been completed and comments provided)