Market Configuration and Coordination PJM and MISO

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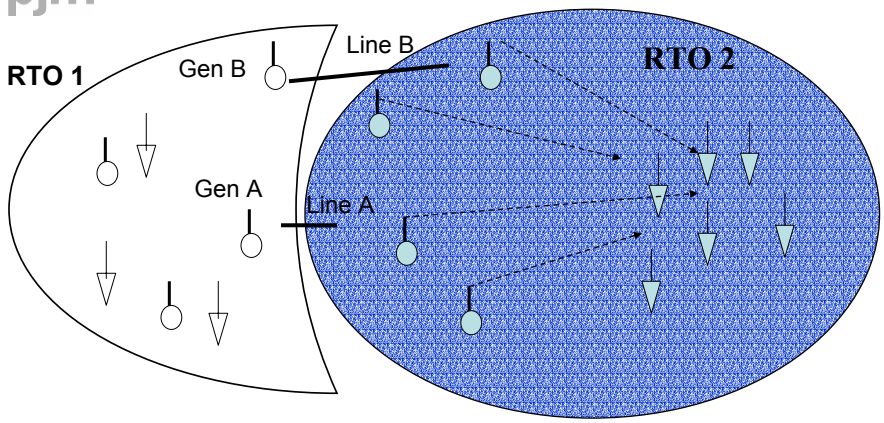
- Seams are not a new issue
- Seams will exist regardless of configuration
- Seams management issues
  - Market to market
  - Market to non-market
- PJM has significant non-market seams with MISO
- PJM has significant non-market seams with VAP and AEP
- PJM has significant market seams with NYISO

- FERC requested joint market monitors report regarding PJM-MISO interactions and related market power issues
- Report was filed July 28, 2003
- Report concludes:
  - Optimistic regarding PJM-MISO protocols
  - JOA needs to be finalized and implemented
  - Additional refinements in market to market
  - Similar coordination required with AEP
  - Monitors need to develop coordinated approach

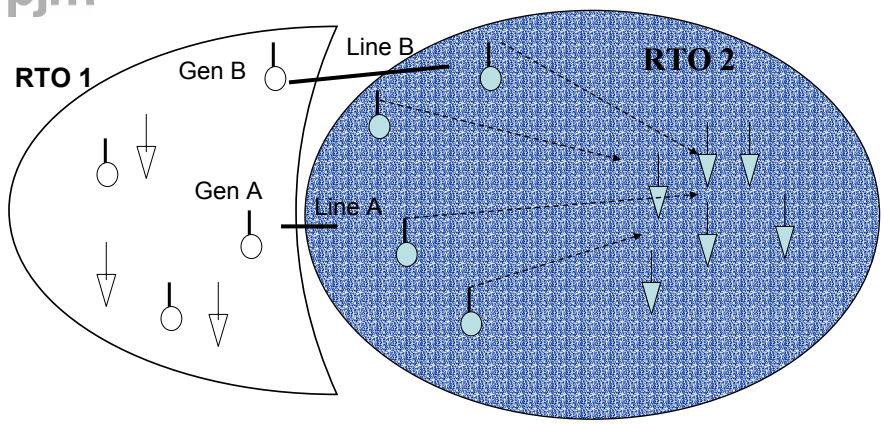
- PJM experience with market to non-market seams
  - Non-coordinated dispatch issues
  - Interface pricing issues
    - Gaming
    - Congestion costs assignment
  - NICA integration issues
    - Impacts on external flowgates
    - Market power issues

Management of Constraint Through TLR Process



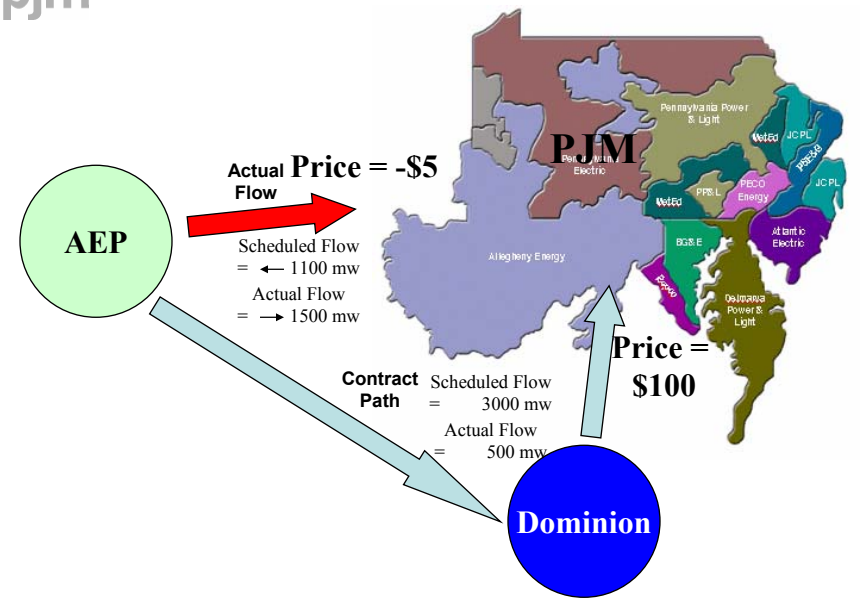
Congestion on Line A causes RTO 2 to Declare TLR
Since RTO 1 dispatch does not monitor Line A,
RTO 1 lowers Gen B in response to TLR
Result is reduced effectiveness of TLR in managing Line A flow

Management of Constraint Through Coordinated Dispatch Process



Congestion on Line A causes RTO 2 to initiate redispatch protocol
RTO 1 enters Line A into security-constrained dispatch
Result is RTO 1 lowers Gen A and congestion is reduced

Interface Pricing Issue



NICA Market Analysis

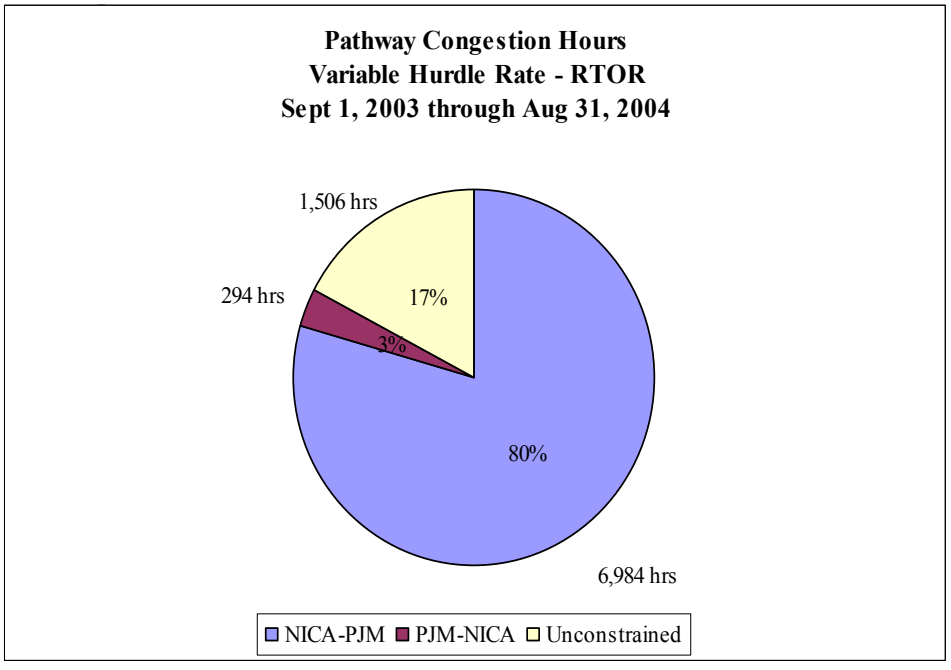
- PJM integration of NICA
  - Interface pricing issues
  - Redispatch issues
  - Potential impacts on external flowgates

- PJM integration of NICA
  - MMU Report on competitiveness of markets after NICA integration
    - http://www.pjm.com/markets/market-monitor/market-monitor.html
  - Analysis of expected market conditions post integration
  - Expected competitiveness of NICA markets post integration

NICA Market Analysis

- Analysis
  - Energy Market
  - Capacity Market
  - Regulation Market
  - Spinning Reserves Market
  - Blackstart Market
  - Reactive Market

- Energy Market: Market Conditions
  - Relevant market
  - NICA market
  - PJM market
  - Surrounding control areas
  - Role of through and out transmission rates



- NICA Energy Market
  - Highly concentrated ownership in base load and mid-merit portion of the supply curve
  - Market power concern in absence of external competitive pressures
    - PJM area via pathway
    - External control areas via imports
- PJM Energy Market
  - Competitive results

- PJM – MISO Market to Non-Market Coordination
  - JOA
  - Status of JOA

- JOA (Joint Operating Agreement Between MISO and PJM)
- JOA covers market to non-market issues (Phase 1)
- JOA is on hold as a result of the blackout
- Parties considering whether JOA should be implemented prior to final blackout resolution
- Relationship between timing of Com Ed integration and JOA implementation

- Key elements of JOA
  - Extensive data sharing
    - Real time operating data
    - Projected operating data
    - Transmission system data
    - Load data
    - Generation dispatch order
  - Model sharing (EMS)
  - Joint operation of emergency procedures
  - Joint reliability coordination (per NERC)
  - Coordinated scheduling checkouts

- Key elements of JOA
  - Calculation of ATC/AFC
    - Available transmission capacity for transactions
  - Coordination of outages
    - Generation
    - Transmission
  - Coordinated regional transmission planning
    - Joint modeling/analysis
    - Facilitate interstate transmission facilities
    - Develop coordinated system plan
  - Reciprocal coordination of flowgates

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  - Identify flowgates in PJM impacted by MISO loads
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  - Rights of firm load to use of flowgates
  - When facility limits exceeded, flows controlled by
    - Redispatch (PJM)
    - TLRs (MISO/PJM)

- Reciprocal coordination of flowgates
  - Market areas (PJM) improvements
    - Real time, detailed management impact of market impacts on external flowgates (MISO and others)
    - Redispatch
    - Transaction curtailments
    - TLRs
  - Non-market areas (MISO) improvements
    - IDC/TLR granularity improved

- PJM – MISO market to market coordination

Market to Market Coordination: Overview

- Purpose - provide a process to allow coordinated management of transmission constraints that are significantly impact by generation dispatch in both markets
- Benefits
  - Most efficient and least costly management of transmission constraints near market boundaries
  - Coordinated pricing at market boundaries

Identification of Jointly Managed Transmission Constraints

- The list of transmission constraints that are jointly coordinated will be pre-identified
- Limited to those constraints for which at least one generator in the adjacent (non-monitoring) RTO has a significant power distribution factor (i.e. 5 percent)
- Flow entitlements will be quantified for all transmission constraints that are designated to be coordinated.

Interregional Coordination in Various Market Timeframes

- Real-time Market
  - Least-cost management of transmission constraints through joint, iterative security-constrained economic dispatch
- Day-ahead Market
  - Day-ahead market will recognize flow entitlements of adjacent RTO
  - provides Day-ahead congestion relief upon request
- Reliability Scheduling
  - Transmission security analysis will recognize flow entitlements of adjacent RTO
- FTR Allocations and Auctions
  - Will recognize flow entitlements of adjacent RTO

Real-time Market

- When any of the pre-identified transmission constraints becomes binding in the monitoring RTO security-constrained dispatch, it is also entered in the non-monitoring RTO security-constrained dispatch.
- Monitoring RTO will manage constraint based on actual limit
- Non-monitoring RTO will manage constraint based on flow entitlement and based on the requested MW relief amount.
- RTOs will share constraint shadow price information to determine least-costly dispatch alternatives

- Compare powerflow contribution from non-monitoring RTO dispatch to flow entitlement
- If flow > flow entitlement
  - Non-monitoring RTO payment to monitoring RTO is calculated as follows:
  - Payment = (flow-flow entitlement) * Transmission Constraint shadow price in monitoring RTO
- If flow < flow entitlement
  - Monitoring RTO payment to non-monitoring RTO is calculated as follows:
  - Payment = (flow entitlement-flow) * Transmission Constraint shadow price in non-monitoring RTO

- If either RTO identifies need to coordinate flow on a Day-ahead basis then it will notify the other RTO and a joint Day-ahead scheduling protocol will be implemented.
- Provides capability for RTOs to adjust the flow entitlements that are used in the Day-ahead Markets as necessary to coordinate pre-identified transmission congestion.
- If Day-ahead coordination is performed, then the corresponding flow entitlement adjustments are made in the applicable hours in the Real-time market.
- Settlements protocols are similar to Real-time but will used Day-ahead quantities and prices.

- The FTR simultaneous feasibility analysis in both RTOs will recognize the flow entitlements that exist flow the adjacent RTO.
- Technical models for FTR analysis, Day-ahead market and Real-time market will contain similar levels of detail to ensure consistency and revenue adequacy.