Independent Market Monitoring for the Midwest ISO

Presented by:

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The Role of Market Monitoring

• Market monitoring is intended to ensure that the markets operate competitively and efficiently to achieve the benefits of competition.

  ✓ Market monitoring should provide improved transparency to the markets and increased confidence in the market overall.

• Market monitoring is designed to identify:

  ✓ Flaws in market rules that create inefficiencies or gaming opportunities;
  ✓ Efficiency improvements;
  ✓ Market power abuses and manipulation;

• As the Independent Market Monitor (“IMM”) for the Midwest ISO, we monitor the conduct and actions of both market participants and the Midwest ISO.
Independence of Market Monitoring

• In the Midwest, States and participants designed the market monitoring function to be independent of the ISO – performed by an independent entity (i.e., the independent market monitor or IMM).

• Independence of the Market Monitor from the RTO is important due to its role in monitoring the RTO’s rules, procedures, and operations.
  ✓ The actions of a market operator generally have a larger impact on the market outcomes than any single participant.
  ✓ Manual actions taken to maintain reliability can distort the market outcomes -- the rules and operating procedures can often be modified to improve the consistency of the market and reliability requirements.

• The IMM is also required to be independent of any Market Participant by adhering to conflict of interest restrictions that prevent the IMM from having any relationships with an MP.
IMM Market Monitoring Processes

The IMM’s processes to accomplish this role include:

1. Downloading and processing of market data (initiated every 30 seconds).

2. Real-time screening and analysis to identify circumstances that require further investigation (monitoring reports produced continually and email alerts/text messages automatically sent to IMM staff 24/7).

3. Investigations of market operations or conduct identified through the daily screening or the receipt of a complaint.

4. Periodic analysis and reporting, including production of:
   - Monthly and quarterly market reports to the Markets Committee and FERC;
   - Investigations on market conduct provided to the Midwest ISO or provided to FERC as a referral;
   - Assessments of an existing or proposed market rule or market design.
   - Annual State of the Market Report;
IMM Market Monitoring Processes

The IMM’s processes (cont.)

5. Provide advice the RTO regarding market issues or recommendations to modify market rules and procedures;

6. Making presentations and otherwise conveying information and conclusions regarding the performance of the market to:
   - Market participants (periodic through participant committees);
   - Midwest States (quarterly);
   - Midwest ISO Board of Directors (monthly)
   - FERC (weekly or more as needed).

7. Development and maintenance of production software to implement the market power mitigation that runs in the Midwest ISO;
Market Monitoring Resources

- The market monitoring function requires an interdisciplinary team of experts, including:
  - Economists,
  - Power system engineers;
  - Generation engineers;
  - Software developers; and
  - Other professionals with math and statistics.
- Potomac Economics currently has 23 staff to perform market monitoring.
- The market monitoring function also requires an extensive market monitoring software system and data interfaces with the ISO.
Market Monitoring Scope

- Market monitoring addresses a broad array of competitive and efficiency issues. This scope includes:
  - The existence of market power: evaluating competitive issues and the effectiveness of market power mitigation measures.
  - Abuses of market power: identifying conduct by participant to exercise market power.
  - Market manipulation: detecting attempts to influence market outcomes or settlements through fraud or manipulation.
  - Market performance: determining whether market rules and procedures provide efficient incentives and lead to efficient market outcomes.
  - Operator performance: evaluating whether the Midwest ISO is operating the system in a manner that is consistent with their reliability requirements and not undermining market performance.
- A discussion of indices and screens that address these areas are provided in the next few slides.
We produce hundreds of screens and indices. Some are descriptive and others are more useful for evaluation. The following are key screens and indices by area:

**Market Power:** The key to differentiating between market power and scarcity is to determine whether resources are being withheld from the market.

- **Economic withholding** – raising an offer price or other offer parameter so as not to run or raise the clearing price.
  - Output gap: The output gap is the quantity of power not produced when suppliers’ competitive costs are significantly lower than the price.
  - “Conduct” test failures: changes in offer parameters that could cause a resource to warrant mitigation.
- **Physical withholding** – withdrawing or derating an economic unit.
  - Deratings and outages: absolute levels and the correlation of their changes with other market conditions.
- **Uneconomic production** – producing substantially more than is economic in order to overload a constraint.
  - Uneconomic production amounts by units with positive generation shift factors (“GSF”) on a constraint.
Primary Indices and Screens

Prospective Market Power Indicators: indices to identify potential competitive concerns.
- Market concentration indices: HHI indices that identify high supply concentration.
- Residual demand index: portion of the demand that can be served without the largest supplier (>1 means that no supplier is pivotal).
- Area-specific pivotal supplier indicator: demand in an area cannot be serviced without the resources of a supplier.
- Constraint-specific pivotal supplier indicator: a constraint cannot be managed without the resources of a supplier.

Market Manipulation: engaging in conduct that is only rational because its effect on market outcome benefits an unrelated position or asset of the participant.
- Virtual Trading: material losses associated with price-insensitive virtual bids & offers.
- External Transactions:
  - Transactions that generate intentional losses
  - Multi-control area transactions designed to create inflated congestion relief payments
- Providing misleading information or withholding information from the RTO
  - Self-scheduling economic generation after the RTO’s reliability commitment process
  - Scheduling or terminating transmission outages in a manner that causes the RTO’s transmission topology to be incorrect in the FTR market
**Primary Indices and Screens**

**Market Performance:** screens and indices to evaluate market rules and design

- Long-run economic signals: In long-run equilibrium, the market should create efficient incentives for investment and retirement.
  - Net Revenue: the net revenue is the revenue the unit would have received in hours it would have run, less its variable production costs in those hours.
  - Net revenues should be sufficient to cover a new resource’s fixed O&M costs and provide a return on the investment when the investment is needed.

- Liquidity and arbitrage
  - Day-ahead to real-time price convergence: average price difference and average absolute price difference metrics are used to evaluate price convergence, which is an important indicator that the day-ahead market is functioning well.
  - Geographic price convergence: average price difference and average absolute price difference metrics are used to determine whether flows between markets are efficient.

- Congestion Management: the frequency with which the real-time market cannot manage the flow on a constraint
- FTR market profits – measures the convergence of FTR prices and FTR values.
- Dispatch flexibility – maximum output level minus minimum output level. Can be compared to physical limits to determine the loss in dispatch flexibility.
Primary Indices and Screens

Market Operation: screens and indices to evaluate the ISO’s operation of the market

- Real-time commitments
  - Effective headroom and reserve levels
  - Relative economics of the committed units vs. uncommitted units
  - Level of RSG paid to committed units

- Load forecasting
  - Day-ahead forecast accuracy: average error and average absolute error
  - Short-term load forecast accuracy: average error and average absolute error

- Transmission operations
  - Real-time congestion shortfalls or surpluses: occur when the real-time transmission capability is lower (shortfall) or higher (surplus) than assumed in the day-ahead
  - FTR funding shortfalls or surpluses: occur when the day-ahead transmission capability is lower (shortfall) or higher (surplus) than assumed in the FTR market
  - Marginal value limit changes

- Ramp management
  - Frequency of ramp and operating reserve shortages
  - Load offset level used vs. optimal offset level
Market Monitoring Software System

• The software needed to perform the monitoring and mitigation functions are embodied in the Market Monitoring System.

• The Market Monitoring System includes:
  ✓ Data interfaces to automatically receive, read, and manage MISO data from a number of sources;
  ✓ The calculation of a wide array of indices and screens;
  ✓ The production of monitoring reports that contain the results of many of the indices and screens;
  ✓ A framework for automatically producing real-time alerts;
  ✓ A “scenario analysis” version of the MISO market software.
  ✓ Mitigation software that is integrated with MISO’s production system to detect and mitigate offers in real-time and day-ahead (future) markets.
Market Monitoring System: Data Interfaces

- Potomac Economics is the developer of the Market Monitoring System and its interfaces with the Midwest ISO databases, including:
  - Day-Ahead and Real Time Market databases (DART);
  - Billings and Settlements database;
  - Financial schedule database (Finsched);
  - Physical scheduling system (PSS);
  - FTR database;
  - SPD Market Cases;
  - EMS/Market Operations databases;
  - Operator logs; and
  - Control Area data.

- Data is received continuously – e.g., the five-minute real-time market results are typically downloaded within one minute after they are posted.
Market Monitoring Tools and Reports

• The market monitoring tools provide key information on:
  ✓ General market conditions such as load levels, price levels, spark spreads, and transmission congestion.
  ✓ Resource commitment levels, scheduling patterns, and manual operator actions.

• The tools also employ specific screens and indices to quickly identify issues that warrant investigation:
  ✓ Potential market power abuses and gaming;
  ✓ Anomalous market outcomes; and
  ✓ Operating actions by MISO and the control areas that may raise efficiency concerns.
Market Monitoring Tools and Reports

The market monitoring tools and reports provide indices and screens in the following areas:

- Energy Price Statistics
- Generating Capability
- Economic Withholding
- Deratings and Outages
- Energy Output
- Physical External Schedules
- Internal Financial Schedules
- Virtual Purchases and Sales
- Reserves and AGC Performance

- Pivotal Supplier Analysis
- Excess Capability Index
- Control area actions
- Load Statistics
- Out-of-Merit Commitments
- Out-of-Merit Dispatch Instructions
- Binding Transmission Constraints
Automated Alerts

• To ensure that the market monitoring is effective on a 24/7 basis, we have also developed a framework to produce automated alerts.
• The alerts are sent via email and beeper to IMM staff in response to wide array of market conditions and conduct.
• Alerts currently identify:
  ✓ Unusually high nodal prices;
  ✓ Potential market power abuses;
  ✓ Active market power mitigation;
  ✓ MISO operating problems;
  ✓ Monitoring and mitigation software failures; and
  ✓ Forecasted shortages and other significant market conditions.
Study SPD Software

• We use MISO’s day-ahead and real-time market software (i.e., the Scheduling, Pricing, and Dispatch (“SPD”) software).
  ✓ The study SPD is a simulation version of MISO’s market software.
  ✓ It is automatically run in MISO’s production environment to perform the “impact” test as part of the market power mitigation framework.
  ✓ This software is also be run offline by the IMM staff as part of its market monitoring analysis and investigations.

• This capability is extremely useful for evaluating the specific effects of outages, market participant conduct, and network changes.
Real-Time Mitigation Software

• We have developed mitigation software that runs as part of the MISO’s real-time production system.
  ✓ The mitigation software automatically performs the conduct and impact tests that determine when mitigation will be imposed.
  ✓ This system ensures that mitigation to limit economic withholding is imposed within 10 minutes of the conduct and impact tests being satisfied.

• On a daily basis, we compute the competitive reference levels against which suppliers’ offers are compared.

• The impact test utilizes the real-time energy market software, run in parallel to determine the price effects of conduct that fails the economic withholding tests.