



# Independent Market Monitoring for the Midwest ISO

Presented by:

Organization of MISO States

David B. Patton, Ph.D.  
Independent Market Monitor

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POTOMAC  
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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.



## Primary Indices and Screens

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.