A Review of Market Monitoring Activities at U.S. Independent System Operators

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Committee on Regional Electric Power Cooperation
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**Approach**

- Focused on four operating ISOs
  - CAISO, ISO-NE, NYISO, and PJM

- Conducted Interviews
  - ISO market monitoring staff
  - External Market monitors (e.g., CAISO MSC)
  - State PUC and FERC OMOI staff

- Review documents on Market Monitoring
  - ISO Market Monitoring plans; Annual Reports
  - Regulatory proceedings
Approach (cont)

• Synthesize information on market monitoring experience in wholesale electricity markets
  - Purpose of market monitoring
  - Structure of the MMU within ISO
  - Data they are authorized to collect
  - Metrics used and their purpose
  - Process of monitoring
  - Scope of authority
  - Reporting responsibilities
  - Impact of market monitoring: Case Studies
Power System Technical Requirements

- Sufficient **Capacity** to meet load
- A reliable network to deliver energy
- **Reserve** energy supply for contingencies
- Consideration for future needs

These needs can be handled by geographically distinct, regulated franchises, or by competitive market-based mechanisms. The former requires a central controller, the latter, an independent operator.
## Comparison of Market Design Elements

**Table 1. Markets Operated by the ISOs – as of October 2003**

<table>
<thead>
<tr>
<th>Element</th>
<th>PJM</th>
<th>NYISO</th>
<th>ISO-NE</th>
<th>CAISO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Day-Ahead Energy Market</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Real-Time Energy Market</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Capacity</strong></td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td><strong>Regulation</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td><strong>Reserves</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Financial Transmission Rights</strong></td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td>Yes</td>
</tr>
</tbody>
</table>

ISOs have similar markets, but differ in implementation.

Capacity is required to be available in CA.

FTRs serve a function that is not in traditional vertically integrated utilities.
Purpose of Market Monitoring

- Evaluate and report on market performance
- Propose changes to rules to improve market operation and performance
- Monitor compliance with the rules and apply mitigating measures and sanctions when applicable and authorized

<table>
<thead>
<tr>
<th>Market Monitoring Staff</th>
<th>PJM</th>
<th>NYISO</th>
<th>ISO-NE</th>
<th>CAISO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Time Employees</td>
<td>12</td>
<td>31.5</td>
<td>11</td>
<td>14</td>
</tr>
</tbody>
</table>
Organization of Market Monitoring: ISO-New England

- Day-to-day mitigation
- Data review
- Short-term analysis
- Longer-term issues
- Involvement with market design
- Feedback to other groups
## Daily Monitoring: Data and Metrics

### Grid Statistics
- Load
- Available capacity
- Congestion and binding constraints
- Deviations from scheduled dispatch
- Resource outages
- Must-Run unit operation

### Market Statistics
- Prices
- Market Volume
- Congestion Costs
- Supply Curves
- Marginal Units

### Competition
- Concentration Measures
- Price-Cost Markup
- Congestion Costs
- Residual Supplier Index

### Market Power
- The frequency a participant sets the clearing price
- Correlations between prices and offers in different markets
- Correlations between prices and bidding to operating conditions (outages, congestion, load)
Impact of Market Monitoring: 
Case Studies

- **PJM Interface pricing**: Demonstrates technical knowledge, and regulatory savvy to quickly eliminate the problem
- **PJM Capacity Market**: Shows process of implementing a rule change through ISO and FERC
- **CAISO RMR Unit Outages**: Investigation that led to FERC action
- **CAISO MSC DCBC opinions**: Demonstrates effectiveness & independence of external monitor
Market Monitoring Impact: PJM Interface Pricing (1)

- During summer of 2002, scheduled and actual deliveries diverged.
- Prior to July 19, 2002 payments based on scheduled flows.
- Deliveries scheduled at the Southern Interface were delivered at the Western Interface.
- The Southern Interface had higher prices than Western Interface.
Market Monitoring Impact: PJM Interface Pricing (2)

PJM Solution: change payment policy so that deliveries originating to the west are paid the western interface price regardless of schedule.

- Policy announced 2pm July 19, 2002; effective at 3pm same day
- No rule change was required; PJM simply chose a more appropriate flow analysis

Energy Analysis Department
Longer Term Analysis and Metrics

• Averaged of frequency quantities
  - Monthly/Yearly Average Energy Price
  - Percent of time RSI <1.1

• Special Long term Metrics
  - 12-month competitive index
  - Revenue Adequacy for New Generation
## Revenue Adequacy for New Generation

<table>
<thead>
<tr>
<th></th>
<th>Revenue Adequacy $(/kW-yr)</th>
<th>Comparison $(/kW-yr)</th>
<th>Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAISO</td>
<td>72 - 77</td>
<td>70 - 100</td>
<td>Typical 500 MW Combined Cycle</td>
</tr>
<tr>
<td>PJM</td>
<td>72</td>
<td>63 - 74</td>
<td>$30/MWh marginal cost</td>
</tr>
<tr>
<td>NYISO</td>
<td>32 - 40</td>
<td>80</td>
<td>10,000 btu/kWh heat rate gas turbine, (outside NYC)</td>
</tr>
<tr>
<td>NYISO</td>
<td>130 - 150</td>
<td>180</td>
<td>10,000 btu/kWh heat rate gas turbine (NYC)</td>
</tr>
</tbody>
</table>
Corrective Actions to Encourage Compliance and Mitigate Market Power

- ISO authority is derived from FERC
- Market monitor’s “toolbox”
  - Informal discussions with market participant(s)
  - Formal request for participants(s) to change behavior
  - Internal ISO dispute resolution procedures when appropriate
  - Modification of rules and procedures
  - Request FERC action
- Greatest Impact: Deterrence value
Market Power Mitigation Measures: Automatic Mitigation Procedures (AMP)

- **Rationale:** Quickly-applied mitigation procedures can stem noncompetitive behavior and limit impacts of exercise of market power.

- ISO looks at bids and applies AMP in multiple steps:
  1. **Conduct Test** – offers are below some reference price threshold.
  2. **Impact Test** – impact of bid that fails the conduct test on market prices.
  3. ISO may replace bid(s) with the reference (default) offer.
Getting AMPed: What matters?

• Scope – which market(s) (day-ahead and/or real-time)?

• Determining Reference Price Level
  - 90 day average (lower of mean or median) during “competitive periods” adjusted for fuel prices (NYISO, ISO-NE)
  - What if not enough info available? Mean of lower 25% of LMP for past 90 days

• Conduct Level Trigger
  - $25 increase or 50% (ISO-NE) vs. Lower of $100 or 300% (NYISO) above Ref. Price
Key Issues: “Independence of MMU”

• What are major actions to ensure “independence” of Market Monitoring?
  - From Mkt Participants
  - From ISO market & operations

• How should resource/funding needs be established for market monitors?
  - Benchmark approaches (e.g. staffing at other ISOs)
  - Bottoms-up budget (reviewed by RTO Board and/or FERC)
  - Account for distinctive features of proposed approach to Market Monitoring in West
Key Issue: Potential roles and value of External Market Advisors/Monitors

• Focus on longer-term issues related to market design & suggested market rules;
• Can conduct independent studies/investigations
• Three models observed:
  - Consultant (NYISO, ISO-NE)
  - Committee of experts (CAISO)
  - Internal MMU unit that hires consultants (PJM)
• West-wide MME:
  - Will it focus *primarily* on longer term market performance and design issues?
Key Issues: Access to ISO confidential market data by state agencies

- MMU at center of debate over access to market data
- NYISO:
  - Mkt Monitoring Plan prohibits MMU from disclosing Protected Information to any entity without consent
  - NYPSC staff have access based on NYPSC Order
- PJM: Prohibited from providing confidential Member data without Member permission BUT policy under review after FERC Technical Conference
- ISO-NE: Non-public meeting and quarterly report available to appropriate state agencies (subject to confidentiality protections of NEPOOL info policy)
Key Issues: Access to ISO confidential market data by state agencies?

- Defining “appropriate State agencies”
- Purpose and Specific Data requested
  - NYPSC: Look at Bids; Look at Bills
  - Avoid “fishing expeditions” but difficult to pre-specify data requirements for specific market problems/flaws
- Assess State PUC technical capabilities and staff resources
- Useful Information vs. massive amounts of undigested raw market data
- Philosophy:
  - Competitive wholesale markets will benefit from more or less transparency and increased availability of timely market data
## AMP: Determining Appropriate Reference Price is Key

<table>
<thead>
<tr>
<th>Reference Price Level</th>
<th>CAISO</th>
<th>ISO-NE</th>
<th>NYISO</th>
<th>PJM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presently determined by independent entity.</td>
<td>90 day average (lower of mean and median), during competitive periods, adjusted for fuel prices.</td>
<td>90 day average (lower of mean and median), during competitive periods, adjusted for fuel prices.</td>
<td>Weighted average LMP for a specified period for which the resource was dispatched in merit order.</td>
<td>Or, incremental costs plus ten percent.</td>
</tr>
<tr>
<td>In new market design it will be the mean of the lower 25% of LMPs over the past 90 days – adjusted for fuel cost. (separate values for off- and on-peak supply)</td>
<td>If not enough information, mean of the lower 25% of LMPs for past 90 days, adjusted for fuel cost.</td>
<td>If not enough information, mean of the lower 25% of LBMPs for past 90 days, adjusted for fuel cost.</td>
<td></td>
<td></td>
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