Market Monitoring in PJM
PJM/NICA Markets in June

Illinois Commerce Commission
Post 2006 Initiative
July 20, 2004

Joseph E. Bowring
Market Monitoring Unit
PJM’s Operational Markets and Services

- **Energy Markets**
  - Day Ahead
  - Real Time
- **Capacity Credits Markets**
  - Daily
  - Long-Term
- **Financial Transmission Entitlements Market**
  - Auction Options
- **Ancillary Services**
  - Regulation Market
  - Spinning Reserve Market
  - Blackstart Service
  - Reactive Services
PJM Market Monitoring Unit Goals

- Develop/modify market rules to **facilitate competition**
- **Limit returns to market power**
- **Provide incentives to competitive behavior**
- **Make exercise of market power more difficult**
• Monitor **compliance with rules**, standards, procedures and practices of PJM.

• Monitor **actual or potential design flaws** in rules, standards, procedures and practices of PJM.

• Monitor **structural problems** in the PJM market that may inhibit a robust and competitive market.

• Monitor the potential of Market Participants to **exercise undue market power**.
• **Discussion of issues** with relevant Market Participants; informal resolution of issues.

• **Issue demand letters** requesting a change in behavior by relevant Market Participants.
  – Provide demand letters to relevant Authorized Government Agencies.

• **Recommend modifications to rules**, standards, procedures and practices of PJM.
  – **Make recommendations** to PJM Committees or to PJM Board.
  – **Make regulatory filings** to address market issues and seek remedial measures.

• **Evaluate additional enforcement mechanisms**.
Market Monitoring Function

- Include diverse staff expertise
  - Economics/Engineering
  - Generation
  - Transmission
  - Power markets
  - Database/IT
- Build understanding of detailed market structure: macro/micro
- Build understanding of physical infrastructure
- Build understanding of operations
- Build in MMU data access/storage to RTO data designs
- Confidentiality protocols
- Complaint protocols
• Independent Internal Market Monitoring
  – Independent System Operator
  – ISO/RTO has no financial stake in market outcomes
  – ISO/RTO has independent Board
  – ISO and MMU are independent from all market participants
    • Market Monitoring Plan is not subject to modification by PJM members.
    • Amendment to PJM’s Open Access Transmission Tariff subject to FERC approval
  – MMU is independent from ISO

• MMU Accountability
  – To FERC (per FERC MMU Orders and MM Plan).
  – To PJM Board.
  – To PJM President.
Lessons Learned

• Interaction with market participants is critical to understanding real markets

• Interaction with state Commissions is critical to understanding retail/wholesale interaction issues

• Interaction with RTO staff is critical to understanding real markets

• Coordination with FERC is essential to efficient monitoring and mitigation
• Market design  
  – Market design critical for effective monitoring  
  – Good market design does not obviate need for monitoring

• Market structure  
  – Aggregate, supply-side market structure conditions not adequate to ensure competition  
  – Transmission constraints limit competition in unpredictable ways  
  – Full demand side participation a prerequisite - complex regulatory interactions to create required infrastructure

• Need to define market power as clearly as possible  
  – Communicate definition to participants  
  – Explain specific examples as they arise

• Need to define consequences of exercising market power  
  – Explain specific examples as they arise
Market Power

- Subtle and complex ways to exercise market power
- Generally not aggregate market issue
- Operating reserves
- Bid parameters
- Retirements/mothballing
- Ramp violations
- Loop flows
- FTR/Inc/Dec
- Creation of congestion
NICA market results – May/June 2004

• Overall, the integrated NICA markets functioned well and effectively.
• The NICA energy market results were reasonably competitive.
• Pathway flows have increased competition in NICA and in PJM CA.
• Interface pricing has been reasonably effective.
• FTRs in NICA have provided an effective congestion hedge.
• Congestion has been limited.
• Financial offer and bid levels reflect an active use of PJM hedging instruments.
Energy market prices – June 2004

- NICA real-time zonal LMP was less than $30 per MWh for 69 percent of the hours.

- NICA day-ahead zonal LMP was less than $30 per MWh for 60 percent of the hours.

- PJM CA real-time LMP was greater than NICA real-time LMP by an average of $13.19 per MWh.

- PJM CA day-ahead LMP was greater than NICA day-ahead LMP by an average of $12.40 per MWh.
NICA Zonal LMP - June 2004

The diagram shows the distribution of LMP (Locational Marginal Prices) for NICA Zone in June 2004. The x-axis represents different LMP ranges, while the y-axis shows the number of hours in the month within each range. The chart uses orange bars for Real-Time LMP and blue bars for Day-Ahead LMP.
Average Hourly Real-Time LMP - June 2004

Average LMP Difference for June: $13.19
Average Hourly Day-Ahead LMP - June 2004

Average LMP Difference for June: $12.40
Energy market price differentials – May and June 2004

- NICA day-ahead zonal LMP was less than NICA real-time zonal LMP in May. The average hourly difference was $2.47 per MWh.

- PJM CA day-ahead zonal LMP was less than PJM CA real-time zonal LMP in May. The average hourly difference was $1.58 per MWh.

- NICA day-ahead zonal LMP was greater than NICA real-time zonal LMP in June. The average hourly difference was $0.91 per MWh.

- PJM CA day-ahead zonal LMP was greater than PJM CA real-time zonal LMP in June. The average hourly difference was $0.12 per MWh.
Average Hourly Difference of Day-Ahead and Real-Time LMPs
May 2004

Average Difference in NICA: -$2.47
Average Difference in PJM: -$1.58
Average Hourly Difference of Day-Ahead and Real-Time LMPs

June 2004

Average Difference in NICA: $0.91
Average Difference in PJM: $0.12
NICA Peak Demand Day

NICA Peak Demand for 2004 through June 30th
June 8, 2004

NICA Real-Time Load
NICA Day-Ahead LMP
NICA Real-Time LMP

Hour Ending (Eastern Prevailing Time)

NICA Load (MW)

LMP ($/MWh)

0 2,500 5,000 7,500 10,000 12,500 15,000 17,500 20,000

$0 $25 $50 $75 $100 $125 $150 $175 $200

$0 $25 $50 $75 $100 $125 $150 $175 $200

6/8/04 - 1800 EPT NICA 19,586 MW
Fuel Type of NICA Marginal Units

Fuel of NICA Marginal Units

Coal

Natural Gas

May

June

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NICA Congestion for June 2004

- Congestion was very limited in NICA in June.
- Day-Ahead Market congestion:
  - 8 event hours
- Real-Time Market congestion:
  - 1 event hour
- No NICA units were offer-capped in the Real-Time Markets in June 2004.
- No NICA units were offer-capped in the Day-Ahead Markets in June 2004.
NICA Congestion Event Hours by Facility

JUNE 2004

- Goodings Grove - Elwood
- Jefferson - Taylor
- LaSalle - State
- LaSalle - Streator
- Powerton - Goodings Grove
- State Line - Washington Park

Market | DA | RT
Real-time pathway statistics for June 2004

- Pathway limited from NICA to PJM 354 hours, or 49 percent.
- Pathway limited from PJM to NICA 65 hours, or 9 percent.
- Pathway not limited for 301 hours, or 41 percent.
- Pathway flowed from NICA to PJM for 485 hours, or 67 percent.
- Pathway flowed from PJM to NICA for 235 hours, or 33 percent.
Day-ahead pathway statistics for June 2004

- Pathway limited from NICA to PJM 478 hours, or 66 percent.
- Pathway limited from PJM to NICA 82 hours, or 11 percent.
- Pathway not limited for 160 hours, or 22 percent.
- Pathway flowed from NICA to PJM for 585 hours, or 81 percent.
- Pathway flowed from PJM to NICA for 135 hours, or 19 percent.
- The direction of flow on the pathway is primarily a function of interface price differentials.
Actual vs. Scheduled Tie Flows

NICA Actual Minus Scheduled Tie Flows

June 2004

[Graph showing actual vs. scheduled tie flows for different interfaces with dates from June 1 to June 30.]

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NICA Imports, Exports and Net
June 2004
• Daily forward prices for NIHub and CINergy tracked closely in June.
  
  – The maximum daily NIHub – CINergy spread was $9.05 per MWh during June.
  
  – The average daily NIHub – CINergy spread was $0.75 per MWh during June.
  
  – The NIHub – CINergy spread was $0.00 per MWh on the final trading day of June.
Forward Prices
• Forward prices for the **July-August** contract showed varying spreads during June.
  – Spreads reflect traders’ expectations about future prices.
  – The maximum NIHub – CINergy spread was $7.40 per MWh during June.
  – The average NIHub – CINergy spread was $5.12 per MWh during June
  – The NIHub – CINergy spread was $2.00 per MWh on the final trading day for the July-August contract.
Forward prices for the August contract showed varying spreads during June.

- Spreads reflect traders’ expectations about future prices.
- The maximum NIHub – CINergy spread was $7.65 per MWh during June.
- The average NIHub – CINergy spread was $4.81 per MWh during June.
- The NIHub – CINergy spread for the August contract was $0.10 per MWh on the final day of June.
Cinergy, NiHub and PJM West Forward Prices

Platts Data
Aug 2004 Contract

Forward Prices
NICA Daily Regulation Cost per MW
2004

$/MW

NICA Regulation Rate
• NICA Capacity Market structural tests indicate significant potential market power.

• Results of NICA Capacity Market auctions were generally less than the proposed offer cap.
• Average capacity price per MW for the summer 2004 period was $30.39.

• Average capacity price per MW for the fall 2004 period was $25.88.

• Average capacity price per MW for the winter 2004/2005 period was $25.66.

• Average capacity price per MW for the full planning period was $27.86.
• The NICA energy market had high HHIs during June.
  – High HHIs reflect highly concentrated ownership of the units
    supplying energy on an hourly basis.

• The NICA energy market had low RSIs during June.
  – RSIs less than 1.0 indicate that a single supplier is pivotal during
    the hour.

• The pathway flows served to provide competitive
  pressures in the NICA energy market, offsetting the
  stand-alone structural market power concerns.
Market Herfindahl-Hirschman Index (HHI)

NIGCA Hourly Energy Market HHI
JUNE 2004

HHI

01JUN04 16JUN04 01JUL04
## NICA Residual Supply Index – May 2004 (Revised)

<table>
<thead>
<tr>
<th>Number of Hours</th>
<th>Number of Hours</th>
<th>Percent of Hours</th>
<th>Percent of Hours</th>
<th>Overall Average RSI</th>
<th>Overall Minimum RSI</th>
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<tr>
<td>426</td>
<td>337</td>
<td>57%</td>
<td>45%</td>
<td>0.93</td>
<td>0.69</td>
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<tr>
<td>570</td>
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<td>77%</td>
<td>63%</td>
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