Markets Report

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MC Webinar
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• PJM Wholesale Cost through May, 2016 was $48.75/MWh, down from full-year 2015 costs of $55.89/MWh. The bulk of the decrease is made up of Energy costs down $9/MWh from 2015. (Slides 5 & 6)

• Operating Reserve cost contribution to wholesale energy costs are at their lowest level in the 2011-2016 time period. (Slide 6)

• Total Uplift charges remain at their lowest level in the last two years. (Slides 8 & 9)

• Load-weighted average LMP for 2016 YTD is $26.63/MWh: (Slide 18)
  – May 2016 was $24/MWh, which is seasonally lower than May 2015 ($34) and May 2014 ($44).

• In May, both Energy and the sum of Heating and Cooling Degree Days were close to their historic averages. (Slides 16-17)
Executive Summary

- After a significant increase in July through September, the MWs registered in PJM’s Economic Demand Response leveled off in October, remained relatively level through May. (Slide 23)
- Total cleared MWh of virtual bids (INCs and DECs) have remained essentially flat from their October 2014 levels. After trending down since January, total cleared MWh of UTC transactions increased in May. (Slides 27-32 and data appendix)
- FTR revenue adequacy for the month of May is 95%. The 2015-2016 Planning Year ended fully funded. (Slides 33-36)
- Regulation and Synchronized Reserve market costs have generally tracked with energy prices over time. (Slides 48-50)
Markets Report
Operating Reserve
• Beginning in December 2008, the daily Balancing Operating Reserves (BOR) rate was replaced with six different BOR rates: RTO BOR for Reliability Rate, RTO BOR for Deviations Rate, East BOR for Reliability Rate, East BOR for Deviations Rate, West BOR for Reliability Rate, West BOR for Deviations Rate.

• Reliability rates are charged to all real-time load and exports, whereas deviation rates, as before, are charged only to real-time deviations. RTO rates are charged to the whole footprint, whereas East and West rate adders are charged based on location.
Deviations Balancing Operating Reserve Rates

$/MWh

- RTO
- East
- West

MAY14 JUL14 OCT14 JAN15 MAY15 JUL15 OCT15 JAN16 MAY16
Energy Market

LMP Summary
• The weather parameter shown in the following slide is a monthly sum of daily Heating Degree Days (HDD) and Cooling Degree Days (CDD).

• Degree days represent a deviation from a baseline temperature, in this case 60 degrees for HDD and 65 degrees for CDD. As temperatures get more extreme, colder or hotter, either HDDs or CDDs, respectively, will increase.

• Typically, winter months will only record HDDs, while summer months will only record CDDs. Shoulder months may have both HDDs and CDDs.

• Degree Days are calculated using a daily load weighting that weights values from stations in each TO zone according to the zonal contribution to the RTO peak on that day.

• Average values use data from 1998 to the most recent complete year, in this case, 2013. Averages include load data for all of TO zones in the current RTO footprint.
Historic Average Weather and Energy versus Current Month
Fuel Cost Adjusted LMP (Referenced to 1999 Fuel Prices)

$/MWh

- Fuel Cost Adjusted LMP
- Load Weighted LMP

Year:
- 1998
- 2000
- 2002
- 2004
- 2006
- 2008
- 2010
- 2012
- 2014
- 2016
In September 2014 the method for calculating LMP re-run intervals was changed to only include intervals that actually impacted LMP.
Energy Market
Demand Response Summary
Demand Side Response Estimated Revenue

Capacity revenue prior to RPM implementation on 6-01-2007 estimated based on average daily ALM capacity credits and weighted average daily PJM capacity market clearing price.
*Data for the last few months are subject to significant change due to the settlement window.
Total Registered MW in PJM's Economic Demand Response
Energy Market

Virtual Activity Summary
The following six charts depict trends in submitted and cleared virtual and up-to-congestion transactions, in terms of number and volume, into the PJM Energy Market. The first two of these charts show the submitted and cleared increment and decrement bids (virtual transactions or virtuals) and they are the same as what was previously being presented in this report. The two charts after them display the trends in submitted and cleared up-to-congestion transactions into the PJM Energy Market. The last two of these six charts combine the virtual and up-to-congestion transactions and show the sum of these two categories.

To clarify what a bid or transaction is, please consider the following example: An offer (increment, decrement or up-to-congestion) of 10 MW, valid for eight hours for a given day, is captured in the charts as eight submitted bids/transactions and 80 submitted MWh. If this offer fully clears for three of the hours it was submitted for, it shows in the charts as three cleared bids/transactions and 30 cleared MWh.
Virtual Bids (INC & DEC) - Total Number

Number of Bids (Millions)

- Submitted Bids
- Cleared Bids

MAY 14, JUN 14, JUL 14, AUG 14, SEP 14, OCT 14, NOV 14, DEC 14, JAN 15, FEB 15, MAR 15, APR 15, MAY 15, JUN 15, JUL 15, AUG 15, SEP 15, OCT 15, NOV 15, DEC 15, JAN 16, FEB 16, MAR 16, APR 16, MAY 16
Up-To-Congestion Transactions - Total Number

Number of Transactions (Millions)

- Submitted Transactions
- Cleared Transactions
Up-To-Congestion Transactions - Total Volume

MWh (Millions)

- Submitted MWh
- Cleared MWh
INCs, DECs and Up-To-Congestion Transactions - Total Number

Number of Transactions (Millions)

- Submitted Transactions
- Cleared Transactions

MAY 14: 7.5
JUN 14: 7.0
JUL 14: 6.0
AUG 14: 5.0
SEP 14: 4.0
OCT 14: 3.0
NOV 14: 2.0
DEC 14: 1.0
JAN 15: 0.5
FEB 15: 0.5
MAR 15: 1.0
APR 15: 1.5
MAY 15: 2.0
JUN 15: 2.5
JUL 15: 3.0
AUG 15: 3.5
SEP 15: 4.0
OCT 15: 4.5
NOV 15: 5.0
DEC 15: 5.5
JAN 16: 6.0
FEB 16: 6.5
MAR 16: 7.0
APR 16: 7.5
MAY 16: 8.0
Energy Market

Congestion and FTR Summary
<table>
<thead>
<tr>
<th>Period</th>
<th>Surplus / Underfunding</th>
<th>Payout Ratio</th>
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<tbody>
<tr>
<td>May, 2016</td>
<td>$-2,354,450</td>
<td>95%</td>
</tr>
<tr>
<td>2016</td>
<td>$-5,240,124</td>
<td>99%</td>
</tr>
<tr>
<td>2015/2016</td>
<td>$42,636,358</td>
<td>100%</td>
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Planning Period FTR Payout

<table>
<thead>
<tr>
<th>Year</th>
<th>Payout Ratio</th>
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<tbody>
<tr>
<td>2003</td>
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<tr>
<td>2004</td>
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<td>2014</td>
<td>30%</td>
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<tr>
<td>2015</td>
<td>20%</td>
</tr>
<tr>
<td>2016</td>
<td>10%</td>
</tr>
</tbody>
</table>
Ten Most Heavily Congested Transmission Facilities - Overall, May

- Conastone-Northwest 230 2 (BGE)
- Bagley-Graceton 230 (BGE)
- Loudound 500/230 TX1 (DOM)
- Mercer IP-Galesburg 161 (MISO)
- Braidwood-E Frankfurt 2001 345 (COMED)
- Bremo 230/115 TX9 (DOM)
- Magnetation-Reynolds 138 (MISO)
- Braidwood-E Frankfurt 2003 345 (COMED)
- Conastone-Peach Bottom 500 (EHV)
- Emilie-Falls 138 (PECO)
Energy Market

Interchange/Seams Summary
Hourly Difference Between PJM and MISO Real-Time Prices

Positive values represent hours when the PJM price was higher. Negative values represent hours when the PJM price was lower.

Average price difference for May = $-0.08
Percent of hours in which the direction of flow is consistent with price differentials = 50.94%
Hourly Difference Between PJM and MISO Day-Ahead Prices

Positive values represent hours when the PJM price was higher. Negative values represent hours when the PJM price was lower.

Average price difference for May = $-1.10
Hourly Difference Between PJM and NYISO Real-Time Prices

Positive values represent hours when the PJM price was higher. Negative values represent hours when the PJM price was lower.

Average price difference for May = $2.00
Percent of hours in which the direction of flow is consistent with price differentials = 59.27%
Hourly Difference Between PJM and NYISO Day-Ahead Prices

Positive values represent hours when the PJM price was higher. Negative values represent hours when the PJM price was lower.

Average price difference for May = $0.99
Net M2M Credit ~ MISO ($ Millions)
Net M2M Credit ~ MISO/Total FTR Targets (%)

Negative M2M Credit represents PJM payment to MISO
Negative M2M Credit represents PJM payment to NYISO
Ancillary Service Market

Summary
Average Synchronous Condenser Payments equals the 36-month rolling average plus one standard deviation.
Load-Adjusted Synchronized Reserve and Synchronous Condenser Costs

Average Synchronous Condenser Payments equals the 36-month rolling average plus one standard deviation.
DR Participation in PJM Regulation Markets

- **Total Payments ($ Millions)**
- **MWh Cleared (MWh)**

### Graph Data
- **$ Millions**
- **MWh**

#### Months:
- MAY '14
- JUN '14
- JUL '14
- AUG '14
- SEP '14
- OCT '14
- NOV '14
- DEC '14
- JAN '15
- FEB '15
- MAR '15
- APR '15
- MAY '15
- JUN '15
- JUL '15
- AUG '15
- SEP '15
- OCT '15
- NOV '15
- DEC '15
- JAN '16
- FEB '16
- MAR '16
- APR '16
- MAY '16
Regulation Market Daily Prices and Charges

- Total Daily Regulation Charges ($ Millions)
- Minimum Hourly Price ($/MWh)
- Average Hourly Price ($/MWh)
- Maximum Hourly Price ($/MWh)

$ Millions

01 MAY 16 to 31 MAY 16

$0.0 - $0.6

CH/MW/$

$0 - $300

$0 - $200

$0 - $100

$0 - $0.6

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