Markets Report

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MC Webinar
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• PJM Wholesale Cost for February, 2016 was $48.21/MWh, down from full-year 2015 costs of $56.57/MWh. The bulk of the decrease is made up of Energy costs down nearly $8/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 $28.32/MWh: (Slide 18)
  – February 2016 was $26/MWh, which is significantly lower than February 2015 ($72.16) or February 2014 ($70.82).
• In February, Energy use was at its historic average, however, the sum of Heating and Cooling Degree Days was below its historic average. (Slides 16-17)
• After a significant increase in July through September, the MWs registered in PJM’s Economic Demand Response leveled off in October, remained level through January, and ticked up slightly in February. (Slide 23)

• Total cleared MWh of virtual bids (INCs and DECs) have remained essentially flat from their October 2014 levels. Total cleared MWh of UTC transactions increased 46% in January from December 2015 and remained higher in February. (Slide 27, 29, 31 and data appendix)

• FTR revenue adequacy for the month of February is 100%. The 2015-2016 Planning Year to-date revenue adequacy remains fully funded. (Slides 33-36)

• Regulation and Synchronized Reserve market costs have generally tracked with energy prices over time. (Slides 49-51)
Markets Report
Operating Reserve
Monthly Uplift - $/MWh Load

- Day-Ahead Operating Reserve
- Balancing Operating Reserve
- Reactive
- Blackstart
- Lost Opportunity Cost

$/MWh

- FEB14
- MAR14
- APR14
- MAY14
- JUN14
- JUL14
- AUG14
- SEP14
- OCT14
- NOV14
- DEC14
- JAN15
- FEB15
- MAR15
- APR15
- MAY15
- JUN15
- JUL15
- AUG15
- SEP15
- OCT15
- NOV15
- DEC15
- JAN16
- FEB16
Percent of Total CC, CT and Steam Hours with LMP < Offer
• 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

FEB14  MAY14  AUG14  NOV14  FEB15  MAY15  AUG15  NOV15  FEB16

RTO
East
West
Energy Market

LMP Summary
Load-Weighted Average LMP

<table>
<thead>
<tr>
<th>Month</th>
<th>Price ($/MWh)</th>
</tr>
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<tbody>
<tr>
<td>FEB14</td>
<td>$71</td>
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<tr>
<td>MAR14</td>
<td>$76</td>
</tr>
<tr>
<td>APR14</td>
<td>$40</td>
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<tr>
<td>MAY14</td>
<td>$44</td>
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<tr>
<td>JUN14</td>
<td>$38</td>
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<td>JUL14</td>
<td>$38</td>
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<td>AUG14</td>
<td>$34</td>
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<td>OCT14</td>
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<td>NOV14</td>
<td>$38</td>
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<tr>
<td>DEC14</td>
<td>$33</td>
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<tr>
<td>JAN15</td>
<td>$38</td>
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<tr>
<td>FEB15</td>
<td>$72</td>
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<tr>
<td>MAR15</td>
<td>$42</td>
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<td>AUG15</td>
<td>$30</td>
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<tr>
<td>SEP15</td>
<td>$33</td>
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<tr>
<td>OCT15</td>
<td>$28</td>
</tr>
<tr>
<td>NOV15</td>
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<td>JAN16</td>
<td>$30</td>
</tr>
<tr>
<td>FEB16</td>
<td>$26</td>
</tr>
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</table>
• 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.
Fuel Cost Adjusted LMP (Referenced to 1999 Fuel Prices)
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.
Economic Demand Response Activity

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
Virtual Bids (INCs & DECs) - Total Volume

MWh (Millions)

Submitted MWh
Cleared MWh

FEB14  MAR14  APR14  MAY14  JUN14  JUL14  AUG14  SEP14  OCT14  NOV14  DEC14  JAN15  FEB15  MAR15  APR15  MAY15  JUN15  JUL15  AUG15  SEP15  OCT15  NOV15  DEC15  JAN16  FEB16
Up-To-Congestion Transactions - Total Volume

- **Submitted MWh**
- **Cleared MWh**

<table>
<thead>
<tr>
<th>Month</th>
<th>MWh (Millions)</th>
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<tbody>
<tr>
<td>FEB14</td>
<td>150</td>
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<tr>
<td>MAR14</td>
<td>160</td>
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<tr>
<td>APR14</td>
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<tr>
<td>MAY14</td>
<td>180</td>
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<td>JUN14</td>
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<td>JUL14</td>
<td>200</td>
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<td>AUG14</td>
<td>190</td>
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<td>SEP14</td>
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<td>OCT14</td>
<td>170</td>
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<td>DEC14</td>
<td>150</td>
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<td>JAN15</td>
<td>140</td>
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<td>FEB15</td>
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<td>MAR15</td>
<td>120</td>
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<td>APR15</td>
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<td>OCT15</td>
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<tr>
<td>JAN16</td>
<td>20</td>
</tr>
<tr>
<td>FEB16</td>
<td>10</td>
</tr>
</tbody>
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INCs, DECs and Up-To-Congestion Transactions - Total Number

Number of Transactions (Millions)

- Submitted Transactions
- Cleared Transactions

FEB14: 6.5
MAR14: 9.0
APR14: 7.0
MAY14: 6.0
JUN14: 6.0
JUL14: 6.0
AUG14: 7.0
SEP14: 5.0
OCT14: 4.0
NOV14: 3.0
DEC14: 2.0
JAN15: 1.0
FEB15: 2.0
MAR15: 3.0
APR15: 3.0
MAY15: 3.0
JUN15: 3.0
JUL15: 3.0
AUG15: 3.0
SEP15: 3.0
OCT15: 3.0
NOV15: 3.0
DEC15: 3.0
JAN16: 3.0
FEB16: 3.0
INCs, DECs and Up-To-Congestion Transactions - Total Volume

- Submitted MWh
- Cleared MWh
Energy Market

Congestion and FTR Summary
FTR Revenue vs. FTR Target Allocation

$ Millions

- Total FTR Revenues
- Total FTR Targets

Data for months from Feb 2014 to Feb 2016.
<table>
<thead>
<tr>
<th>Period</th>
<th>Surplus / Underfunding</th>
<th>Payout Ratio</th>
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<tr>
<td>February, 2016</td>
<td>$7,239,260</td>
<td>100%</td>
</tr>
<tr>
<td>2016</td>
<td>$11,974,546</td>
<td>100%</td>
</tr>
<tr>
<td>2015/2016</td>
<td>$59,851,029</td>
<td>100%</td>
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Planning Period FTR Payout

Planning Period FTR Payout Ratio

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<td>%</td>
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Ten Most Heavily Congested Transmission Facilities - Overall, February

- Conastone-Northwest 230 2 (BGE)
- Loudoun 500/230 TX2 (DOM)
- Kanawha River-Matt Funk 345 (AEP)
- Graceton 230/115 T1 (BGE)
- Milford-Steele 230 (DPL)
- Cherry Valley 345/138 TR82 (COMED)
- Braidwood-E. Frankfurt 2001 345 (COMED)
- Person-Halifax 230 296B (DOM)
- Cherry Valley-Silver Lake 345 15616 (COMED)
- Bedington-Black Oak Interface (EHV)

(Graph showing congestion levels for each facility, with categories for Total, Day-ahead, Balancing, and Market-to-market.)
Energy Market

Interchange/Seams Summary
Monthly Average MISO Interface Pricing

$/MWh

PJM MISO Price (RT)
MISO PJM Price (RT)
PJM MISO Price (DA)
MISO PJM Price (DA)

FEB14 MAY14 AUG14 NOV14 FEB15 MAY15 AUG15 NOV15 FEB16
Monthly Average NYISO Interface Pricing

$/MWh

PJM NYISO Price (RT)
NYISO PJM Price (RT)
PJM NYISO Price (DA)
NYISO PJM Price (DA)

FEB14  MAY14  AUG14  NOV14  FEB15  MAY15  AUG15  NOV15  FEB16
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.

- Hourly difference between PJM and MISO - RT - $
- Average + 1 Standard Deviation
- Average - 1 Standard Deviation

Average price difference for February = $0.71
Percent of hours in which the direction of flow is consistent with price differentials = 56.32%
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 February = $0.54
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 February = $0.10
Percent of hours in which the direction of flow is consistent with price differentials = 60.06%
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 February = $1.54
PJM-MISO Market-to-Market Coordination Settlement

- Net M2M Credit ~ MISO ($ Millions)
- Net M2M Credit ~ MISO/Total FTR Targets (%)
PJM-NYISO Market-to-Market Coordination Settlement

Negative M2M Credit represents PJM payment to NYISO

Net M2M Credit ~ NYISO ($ Millions)
Net M2M Credit ~ NYISO/Total FTR Targets (%)
Ancillary Service Market

Summary
Synchronized Reserve and Synchronous Condenser Costs

Average Synchronous Condenser Payments equals the 36-month rolling average plus 1 standard deviation.
Load-Adjusted Synchronized Reserve and Synchronous Condenser Costs

Average Synchronous Condenser Payments equals the 36-month rolling average plus 1 standard deviation.
DR Participation in PJM Synchronized Reserve Markets

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

The chart shows the total payments and MWh cleared for different months from February 2014 to February 2016.
Regulation Market Daily Prices and Charges

- Total Daily Regulation Charges ($ Millions)
- Minimum Hourly Price ($/MWh)
- Average Hourly Price ($/MWh)
- Maximum Hourly Price ($/MWh)
Synchronized Reserve Market Daily Prices and Charges

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