Markets Report

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MC Webinar
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• PJM Wholesale Cost through August, 2016 was $47.93/MWh, down from full-year 2015 costs of $55.89/MWh. The bulk of the decrease is made up of Energy costs down over $7/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)

• Balancing Operating Reserves were higher than usual this month due to very hot weather. (Slides 8 & 9)

• Load-weighted average LMP for 2016 YTD is $29.10/MWh: (Slide 18)
  – August 2016 was $35.6/MWh, which is seasonally in line with, but higher than, August 2015 ($30.1) and August 2014 ($34.4).

• In August, both Energy and the sum of Heating and Cooling Degree Days were well above their historic averages. (Slides 16-17)
After a significant increase in July through September 2015, the MWs registered in PJM’s Economic Demand Response leveled off in October, and remained relatively level through May 2016. The large decrease seen starting in June and continuing through August is mainly administrative and due to registrations expiring at the end of the planning period. (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 have been increasing since April. (Slides 27-32 and data appendix)

FTR revenue adequacy for the month of August is 100%. The 2016-2017 Planning Year is fully funded. (Slides 33-36)

Regulation and Synchronized Reserve market costs have generally tracked with energy prices over time. (Slides 48-50)
Markets Report
PJM Wholesale Cost - Other

<table>
<thead>
<tr>
<th>Year</th>
<th>Regulation</th>
<th>Operating Reserve</th>
<th>PJM Cost</th>
<th>Reactive</th>
<th>Transmission Owner Control</th>
<th>Synchronized Reserve</th>
<th>Black Start</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>$0.23</td>
<td>$0.75</td>
<td>$0.32</td>
<td>$0.82</td>
<td>$0.33</td>
<td>$0.00</td>
<td>$1.82</td>
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<tr>
<td>2013</td>
<td>$0.22</td>
<td>$0.82</td>
<td>$0.32</td>
<td>$0.85</td>
<td>$0.32</td>
<td>$0.00</td>
<td>$2.19</td>
</tr>
<tr>
<td>2014</td>
<td>$0.22</td>
<td>$0.85</td>
<td>$0.32</td>
<td>$0.82</td>
<td>$0.32</td>
<td>$0.00</td>
<td>$2.58</td>
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<tr>
<td>2015</td>
<td>$0.22</td>
<td>$0.90</td>
<td>$0.32</td>
<td>$0.85</td>
<td>$0.32</td>
<td>$0.00</td>
<td>$1.56</td>
</tr>
<tr>
<td>2016</td>
<td>$0.22</td>
<td>$0.90</td>
<td>$0.32</td>
<td>$0.82</td>
<td>$0.32</td>
<td>$0.00</td>
<td>$1.19</td>
</tr>
</tbody>
</table>
Operating Reserve
Monthly Uplift

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

$ Millions

Month:
- AUG14
- SEP14
- OCT14
- NOV14
- DEC14
- JAN15
- FEB15
- MAR15
- APR15
- MAY15
- JUN15
- JUL15
- AUG15
- SEP15
- OCT15
- NOV15
- DEC15
- JAN16
- FEB16
- MAR16
- APR16
- MAY16
- JUN16
- JUL16
- AUG16
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

AUG14  OCT14  JAN15  MAY15  AUG15  OCT15  JAN16  MAY16  AUG16

RTO  East  West
Energy Market

LMP Summary
<table>
<thead>
<tr>
<th>Month</th>
<th>LMP ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUG14</td>
<td>$34</td>
</tr>
<tr>
<td>SEP14</td>
<td>$36</td>
</tr>
<tr>
<td>OCT14</td>
<td>$37</td>
</tr>
<tr>
<td>NOV14</td>
<td>$38</td>
</tr>
<tr>
<td>DEC14</td>
<td>$38</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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<td>MAR15</td>
<td>$42</td>
</tr>
<tr>
<td>APR15</td>
<td>$30</td>
</tr>
<tr>
<td>MAY15</td>
<td>$34</td>
</tr>
<tr>
<td>JUN15</td>
<td>$32</td>
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<tr>
<td>JUL15</td>
<td>$35</td>
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<tr>
<td>AUG15</td>
<td>$33</td>
</tr>
<tr>
<td>SEP15</td>
<td>$33</td>
</tr>
<tr>
<td>OCT15</td>
<td>$28</td>
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<tr>
<td>NOV15</td>
<td>$27</td>
</tr>
<tr>
<td>DEC15</td>
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<td>JAN16</td>
<td>$30</td>
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<td>FEB16</td>
<td>$26</td>
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<td>MAR16</td>
<td>$23</td>
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<td>APR16</td>
<td>$24</td>
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<tr>
<td>MAY16</td>
<td>$29</td>
</tr>
<tr>
<td>JUN16</td>
<td>$33</td>
</tr>
<tr>
<td>JUL16</td>
<td>$36</td>
</tr>
<tr>
<td>AUG16</td>
<td>$36</td>
</tr>
</tbody>
</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

MW

AUG14  OCT14  JAN15  MAY15  AUG15  OCT15  JAN16  MAY16  AUG16
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 (INCs & DECs) - Total Volume

- Submitted MWh
- Cleared MWh

MWh (Millions)

- AUG14
- SEP14
- OCT14
- NOV14
- DEC14
- JAN15
- FEB15
- MAR15
- APR15
- MAY15
- JUN15
- JUL15
- AUG15
- SEP15
- OCT15
- NOV15
- DEC15
- JAN16
- FEB16
- MAR16
- APR16
- MAY16
- JUN16
- JUL16
- AUG16
Up-To-Congestion Transactions - Total Volume

- Submitted MWh
- Cleared MWh

MWh ( Millions )

AUG14  SEP14  OCT14  NOV14  DEC14  JAN15  FEB15  MAR15  APR15  MAY15  JUN15  JUL15  AUG15  SEP15  OCT15  NOV15  DEC15  JAN16  FEB16  MAR16  APR16  MAY16  JUN16  JUL16  AUG16
INCs, DECs and Up-To-Congestion Transactions - Total Number
INCs, DECs and Up-To-Congestion Transactions - Total Volume

MWh (Millions)

- Submitted MWh
- Cleared MWh

- AUG14
- SEP14
- OCT14
- NOV14
- DEC14
- JAN15
- FEB15
- MAR15
- APR15
- MAY15
- JUN15
- JUL15
- AUG15
- SEP15
- OCT15
- NOV15
- DEC15
- JAN16
- FEB16
- MAR16
- APR16
- MAY16
- JUN16
- JUL16
- AUG16
Energy Market

Congestion and FTR Summary
<table>
<thead>
<tr>
<th>Period</th>
<th>Surplus / Underfunding</th>
<th>Payout Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>August, 2016</td>
<td>$28,222,775</td>
<td>100%</td>
</tr>
<tr>
<td>2016</td>
<td>$52,449,818</td>
<td>100%</td>
</tr>
<tr>
<td>2016/2017</td>
<td>$57,690,257</td>
<td>100%</td>
</tr>
</tbody>
</table>
Ten Most Heavily Congested Transmission Facilities - Overall, August

- Graceton 230/115 T1 (BGE)
- Cool Springs-Milford 230 (DPL)
- Dixon-McGirr Road 10714 138 (COMED)
- Bagley-Graceton 230 (BGE)
- Conastone-Northwest 230 2 (BGE)
- Brambleton-Loudoun 230 2045A (DOM)
- Center-Westport 115 2 (BGE)
- South Millers-Buckhorn 138 (AEP-APS)
- Brandon Shores-Riverside 5 230 (BGE)
- Dumont-Twin Branch 2 345 (AEP)
Energy Market

Interchange/Seams Summary
Monthly Average MISO Interface Pricing

$/MWh

AUG14 OCT14 JAN15 MAY15 AUG15 OCT15 JAN16 MAY16 AUG16

- PJM MISO Price (RT)
- MISO PJM Price (RT)
- PJM MISO Price (DA)
- MISO PJM Price (DA)
Monthly Average NYISO Interface Pricing

$/MWh

AUG14  OCT14  JAN15  MAY15  AUG15  OCT15  JAN16  MAY16  AUG16

PJM NYISO Price (RT)
NYISO PJM Price (RT)
PJM NYISO Price (DA)
NYISO PJM Price (DA)
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 August = $-1.04
Percent of hours in which the direction of flow is consistent with price differentials = 63.44%
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.
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 August = $-1.73
Percent of hours in which the direction of flow is consistent with price differentials = 59.01%
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 August = $-2.12
PJM-MISO Market-to-Market Coordination Settlement

**Summary:**
Negative M2M Credit represents PJM payment to MISO.

**Graph Details:**
- X-axis: Months from AUG14 to AUG16
- Y-axis: $ Millions
- Two lines:
  - Net M2M Credit ~ MISO ($ Millions)
  - Net M2M Credit ~ MISO/Total FTR Targets (%)
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 Synchronized Reserve Markets

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

Chart showing the trend of total payments and MWh cleared over time from August 2014 to August 2016.
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)