Markets Report

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MC Webinar
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PJM Wholesale Cost through June 2017 was $47.63/MWh, up from full-year 2016 costs of $47.49/MWh. (Slides 5 & 6)

Operating Reserve cost contribution to wholesale energy costs remains at its lowest level in the 2011-2017 time period. (Slide 6)

Load-weighted average LMP for 2017 was $29.90/MWh: (Slide 18)
  - June 2017 was $28.3/MWh, which is slightly lower than June 2016 ($28.51) but also in line, seasonally, with June 2015 ($32.2).

In June, the sum of Heating and Cooling Degree Days was about equal to its historic average, indicating normal weather. Energy use also in line with its historic average. (Slides 16-17)
In June, the calculation of FTR surplus was changed to no longer include Balancing congestion and Market to Market payments.

FTR revenue adequacy for the month of June is 100% and thus, the 2017-2018 Planning Year starts off fully funded. Likewise, the 2016-2017 Planning Period finished at the end of May also fully funded. (Slides 33-36)

June 2017 experienced congestion levels similar to June 2016. While this level is still below the recent historic average, it is higher than the most recent seven months. (Slide 33)

Regulation and Synchronized Reserve market costs have generally tracked with energy prices over time. (Slides 49-51)
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>Synchronized Reserve</th>
<th>Black Start</th>
<th>Transmission Owner Control</th>
<th>PJM Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>$0.24</td>
<td>$1.02</td>
<td>$0.35</td>
<td>$0.32</td>
<td>$0.35</td>
<td>$0.24</td>
<td>$0.02</td>
<td>$2.19</td>
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<td>2014</td>
<td>$0.32</td>
<td>$1.23</td>
<td>$0.32</td>
<td>$0.35</td>
<td>$0.35</td>
<td>$0.32</td>
<td>$0.03</td>
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<td>2015</td>
<td>$0.23</td>
<td>$0.39</td>
<td>$0.32</td>
<td>$0.39</td>
<td>$0.35</td>
<td>$0.23</td>
<td>$0.02</td>
<td>$1.56</td>
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<tr>
<td>2016</td>
<td>$0.39</td>
<td>$0.32</td>
<td>$0.32</td>
<td>$0.32</td>
<td>$0.39</td>
<td>$0.39</td>
<td>$0.04</td>
<td>$1.20</td>
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<td>2017</td>
<td>$0.43</td>
<td>$0.32</td>
<td>$0.32</td>
<td>$0.32</td>
<td>$0.43</td>
<td>$0.43</td>
<td>$0.04</td>
<td>$1.24</td>
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Operating Reserve
Percent of Total CC, CT and Steam Hours with LMP < Offer

- **CT**
- **CC**
- **Steam**

<table>
<thead>
<tr>
<th>Month</th>
<th>JUN16</th>
<th>JUL16</th>
<th>AUG16</th>
<th>SEP16</th>
<th>OCT16</th>
<th>NOV16</th>
<th>DEC16</th>
<th>JAN17</th>
<th>FEB17</th>
<th>MAR17</th>
<th>APR17</th>
<th>MAY17</th>
<th>JUN17</th>
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<td>Value</td>
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</table>
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.
Reliability Balancing Operating Reserve Rates

$/MWh

RTO
East
West

JUN15  AUG15  NOV15  MAR16  MAY16  AUG16  NOV16  MAR17  JUN17
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, 2016. Averages include load data for all of TO zones in the current RTO footprint.
Historic Average Weather and Energy versus Current Month

- **Current Month Total Energy**
- **Current Month HDD+CDD**
- **Average Monthly Total Energy**
- **Average Monthly HDD + CDD**

The chart displays the trend of total energy consumption and heating degree days over months from June 2016 to June 2017. Each bar represents the total energy in TWh (Terawatt-hours) for each month, while the line graph shows the heating degree days and cooling degree days. The data is normalized to show variations from historical averages.
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.
*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 (INCs & DECs) - Total Number

Number of Bids (Millions)

- **Submitted Bids**
- **Cleared Bids**

Graph showing the number of submitted and cleared bids from June 2015 to June 2017.
INCs, DECs and Up-To-Congestion Transactions - Total Number
INCs, DECs and Up-To-Congestion Transactions - Total Volume

- Submitted MWh
- Cleared MWh

MWh (Millions)

- JUN15
- JUL15
- AUG15
- SEP15
- OCT15
- NOV15
- DEC15
- JAN16
- FEB16
- MAR16
- APR16
- MAY16
- JUN16
- JUL16
- AUG16
- SEP16
- OCT16
- NOV16
- DEC16
- JAN17
- FEB17
- MAR17
- APR17
- MAY17
- JUN17
Energy Market

Congestion and FTR Summary
<table>
<thead>
<tr>
<th>Period</th>
<th>Surplus / Underfunding</th>
<th>Payout Ratio</th>
</tr>
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<tbody>
<tr>
<td>June, 2017</td>
<td>$4,694,409</td>
<td>100%</td>
</tr>
<tr>
<td>2017</td>
<td>$54,136,106</td>
<td>100%</td>
</tr>
<tr>
<td>2017/2018</td>
<td>$4,694,409</td>
<td>100%</td>
</tr>
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</table>
Ten Most Heavily Congested Transmission Facilities - Overall, June

- Braid-East Frankfort 345 2003 (COMED)
- Emilie-Falls 138 (PECO)
- Bosserman-Olive 138 (AEP)
- Westwood 345/138 (MISO)
- Conastone-Peach Bottom 500 (EHV)
- Conastone-Northwest 230 2322 (BGE)
- Loudoun 230/500 TX1 (DOM)
- Aetna-Lake George 138 (MISO)
- Davis 345/138 TR83 (COMED)
- Saxton-Three Springs 115 (PENELEC)
Energy Market

Interchange/Seams Summary
Monthly Average MISO Interface Pricing

$\$/MWh

<table>
<thead>
<tr>
<th></th>
<th>PJM MISO Price (RT)</th>
<th>MISO PJM Price (RT)</th>
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<tbody>
<tr>
<td>JUN15</td>
<td></td>
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<td>AUG15</td>
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<td>JUN17</td>
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</tbody>
</table>
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 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 June = $2.94
Percent of hours in which the direction of flow is consistent with price differentials = 46.11%
Positive values represent hours when the PJM price was higher. Negative values represent hours when the PJM price was lower.
Negative M2M Credit represents PJM payment to MISO.
PJM-NYISO Market-to-Market Coordination Settlement

Net M2M Credit ~ NYISO ($ Millions)
Net M2M Credit ~ NYISO/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)

The chart shows the total payments in millions of dollars and the MWh cleared over time from June 2015 to June 2017. The payments varied significantly, with peaks in April 2016 and October 2015, and the MWh cleared showed a similar trend with fluctuations throughout the period.
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)

$ Millions

01 JUN 17 02 JUN 17 03 JUN 17 04 JUN 17 05 JUN 17 06 JUN 17 07 JUN 17 08 JUN 17 09 JUN 17 10 JUN 17 11 JUN 17 12 JUN 17 13 JUN 17 14 JUN 17 15 JUN 17 16 JUN 17 17 JUN 17 18 JUN 17 19 JUN 17 20 JUN 17 21 JUN 17 22 JUN 17 23 JUN 17 24 JUN 17 25 JUN 17 26 JUN 17 27 JUN 17 28 JUN 17 29 JUN 17 30 JUN 17

$0.40

$0.20

$0.00

$0.00

$30

$60

$0/$MWh

$0/$MWh

$0/$MWh

$0/$MWh