Markets Report

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MC Webinar
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PJM Wholesale Cost for 2015 was $55.89/MWh, down from full-year 2014 costs of $70.37/MWh. The bulk of the decrease is made up of Energy costs down nearly $18/MWh from 2014. (Slides 5 & 6)

Operating Reserve cost contribution to wholesale energy costs are at their lowest level in the 2011-2015 time period. (Slide 6)

Total Uplift charges remain at their lowest level in the last two years. (Slides 8 & 9)
- Total CT hours with offers greater than LMP remain under 30% for 2015. (Slide 10)

Load-weighted average LMP for 2015 is $36.25/MWh: (Slide 18)
- December 2015 was $25/MWh, which is seasonally lower than December 2014 ($33) or December 2013 ($38). (Slide 15)
In December, both Energy use and the sum of Heating and Cooling Degree Days were well below historic averages for the month of December. Temperatures averaged approximately 11 degrees, or 30%, above 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 and remained level into December. (Slide 23)

Total cleared MWh of virtual bids (INC-DECs and UTC-UTCs) have remained essentially flat from their October 2014 levels. (Slide 31 and data appendix)

FTR revenue adequacy for the month of December is 95%. 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
PJM Wholesale Cost

- Energy
- Reliability Capacity
- Transmission
- Other

According to the chart, the cost per MWh is as follows:

**2011**
- Energy: $45.94
- Reliability Capacity: $9.49
- Transmission: $4.34
- Other: $61.66

**2012**
- Energy: $35.23
- Reliability Capacity: $6.02
- Transmission: $4.71
- Other: $47.78

**2013**
- Energy: $38.67
- Reliability Capacity: $7.10
- Transmission: $5.00
- Other: $52.96

**2014**
- Energy: $36.25
- Reliability Capacity: $8.91
- Transmission: $5.75
- Other: $57.37

**2015**
- Energy: $36.25
- Reliability Capacity: $11.14
- Transmission: $6.93
- Other: $55.89
PJM Wholesale Cost - Other

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
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Operating Reserve
Percent of Total CT Hours with LMP < Offer

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<th>Percent of Total CT Hours</th>
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<tr>
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<td>MAR14</td>
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<tr>
<td>APR14</td>
<td>24%</td>
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<tr>
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<td>19%</td>
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<tr>
<td>JUN14</td>
<td>17%</td>
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<td>NOV15</td>
<td>24%</td>
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<tr>
<td>DEC15</td>
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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 - East and West

$0.00 $0.04 $0.08 $0.12 $0.16 $0.20

DEC13 MAR14 JUN14 AUG14 DEC14 MAR15 JUN15 AUG15 DEC15

$5 $4 $3 $2 $1 $0

$/MWh - RTO

RTO
East
West
Deviations Balancing Operating Reserve Rates

$/MWh

RTO
East
West

DEC13 MAR14 JUN14 AUG14 DEC14 MAR15 JUN15 AUG15 DEC15
Energy Market

LMP Summary
Load-Weighted Average LMP

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<tr>
<th>Month</th>
<th>$/MWh</th>
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<tr>
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<td>$76</td>
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<tr>
<td>APR14</td>
<td>$40</td>
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<tr>
<td>MAY14</td>
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<tr>
<td>JUN14</td>
<td>$38</td>
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<td>NOV15</td>
<td>$25</td>
</tr>
<tr>
<td>DEC15</td>
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• 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

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

The chart shows the comparison between historical average weather and energy consumption versus the current month. The y-axis represents TWh (Terawatt-hours) on a logarithmic scale, while the x-axis represents the months from December 2014 to December 2015. The heating degree days + cooling degree days are shown on the right y-axis.
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 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

MW

DEC13  MAR14  JUN14  AUG14  DEC14  MAR15  JUN15  AUG15  DEC15
2,000  2,200  2,400  2,600  2,800  3,000  3,200  3,400  3,600
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.
Up-To-Congestion Transactions - Total Volume

MWh (Millions)

Submitted MWh
Cleared MWh

DEC13 | JAN14 | FEB14 | MAR14 | APR14 | MAY14 | JUN14 | JUL14 | AUG14 | SEP14 | OCT14 | NOV14 | DEC14 | JAN15 | FEB15 | MAR15 | APR15 | MAY15 | JUN15 | JUL15 | AUG15 | SEP15 | OCT15 | NOV15 | DEC15
INCs, DECs and Up-To-Congestion Transactions - Total Number

Number of Transactions (Millions)

- Submitted Transactions
- Cleared Transactions

Bar chart showing the number of transactions from December 2013 to December 2015, with months represented on the x-axis and the number of transactions on the y-axis.
Energy Market

Congestion and FTR Summary
FTR Revenue vs. FTR Target Allocation

$ Millions

- Total FTR Revenues
- Total FTR Targets

DEC13, JAN14, FEB14, MAR14, APR14, MAY14, JUN14, JUL14, AUG14, SEP14, OCT14, NOV14, DEC14, JAN15, FEB15, MAR15, APR15, MAY15, JUN15, JUL15, AUG15, SEP15, OCT15, NOV15, DEC15

$0, $200, $400, $600, $800, $1,000, $1,200

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<table>
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<tr>
<th>Period</th>
<th>Surplus / Underfunding</th>
<th>Payout Ratio</th>
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<tbody>
<tr>
<td>December, 2015</td>
<td>$-3,175,524</td>
<td>95%</td>
</tr>
<tr>
<td>2015</td>
<td>$140,125,340</td>
<td>100%</td>
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<tr>
<td>2015/2016</td>
<td>$47,873,639</td>
<td>100%</td>
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</table>
Planning Period FTR Payout Ratio

- 2003
- 2004
- 2005
- 2006
- 2007
- 2008
- 2009
- 2010
- 2011
- 2012
- 2013
- 2014
- 2015
- 2016
Ten Most Heavily Congested Transmission Facilities - Overall, December

- Bagley-Graceton 230 (BGE)
- Conastone-Northwest 230 2 (BGE)
- Graceton 230 T1 (BGE)
- Cherry Valley 345 TR83 (COMED)
- Brunner Island-Middletown 230 (PPL)
- BGE/PEPCO Interface (EHV)
- Mercer IP-Galesburg 161 (MISO)
- Conastone-Peach Bottom 500 (EHV)
- Camden-Gloucester 230 (PSEG)
- Burnham-Munster 345 (COMED)

Y-Axis:Congestion Costs
X-Axis: $0, $5,000,000, $10,000,000, $15,000,000
Legend:
- Total Congestion
- Day-Ahead Congestion
- Balancing Congestion
- Market-to-Market Credit
Ten Most Heavily Congested Transmission Facilities - Overall, 2015

- Bagley-Graceton 230 (BGE)
- Conastone-Northwest 230 2 (BGE)
- 50045005 Interface (EHV)
- Joshua Falls 765/500 (AEP)
- Bedington-Black Oak Interface (EHV)
- Cherry Valley 345 TR83 (COMED)
- APSOUTH Interface (EHV)
- AEP-DOM Interface (EHV)
- Person-Halifax 230 (DOM)
- Valley 500/230 (DOM)

Legend:
- Total Congestion
- Day-Ahead Congestion
- Balancing Congestion
- Market-to-Market Credit
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 December = $1.03
Percent of hours in which the direction of flow is consistent with price differentials = 53.76%
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 December = $0.71
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 December = $-0.00
Percent of hours in which the direction of flow is consistent with price differentials = 65.99%
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 December = $2.19
Negative M2M Credit represents PJM payment to MISO.
Ancillary Service Market

Summary
Regulation Costs

$ Millions

<table>
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<th>Month</th>
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<th>FEB14</th>
<th>MAR14</th>
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Synchronized Reserve and Synchronous Condenser Costs
Load Adjusted Synchronized Reserve and Synchronous Condenser Costs

- Sync. Reserve Market Payment / MWh
- Sync. Condenser Payments / MWh
- Sync. Cond. Payments / MWh (Avg)
DR Participation in PJM Regulation Markets

Graph showing Total Payments ($ Millions) and MWh Cleared (MWh) over time from December 2013 to December 2015.

- Total Payments ($ Millions): Bar chart showing payments over time.
- MWh Cleared (MWh): Line graph showing cleared MWh over time.

Month and Year: DEC13, JAN14, FEB14, MAR14, APR14, MAY14, JUN14, JUL14, AUG14, SEP14, OCT14, NOV14, DEC14, JAN15, FEB15, MAR15, APR15, MAY15, JUN15, JUL15, AUG15, SEP15, OCT15, NOV15, DEC15.

Y-Axis: $ Millions
- $0.0
- $0.1
- $0.2
- $0.3
- $0.4
- $0.5

Y-Axis: MWh
- 0
- 1,000
- 2,000
- 3,000
- 4,000
DR Participation in PJM Synchronized Reserve Markets

Total Payments ($ Millions)
MWh Cleared (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)