Markets Report

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PJM Wholesale Cost through August 2019 is $49.77/MWh, down from full-year 2018 costs of $59.96/MWh. (Slides 5 & 6)

Slides pertaining to weather conditions, in addition to slides showing average fuel prices, generation on-line fuel mixes, and System Marginal Prices have been combined into a Market Conditions section. (Slides 7-16)

In August, temperatures were at or below average for most of the month. Thus, the sum of Heating and Cooling Degree Days was about equal to its historic average. (Slides 8-10)

Because temperatures were moderate, Energy use was slightly below the historic average. (Slides 8-10)

In August, uplift did not exceed $800,000 on any days. (Slides 21 & 22)
• Load-weighted average LMP through August 2019 is $27.38/MWh: (Slides 28-29)
  – August 2019 was $24.18/MWh, which is lower than both August 2018 ($34.26/MWh) and August 2017 ($27.73/MWh).

• FTR revenue adequacy for the month of August is 100% and the 2019-2020 Planning Year is currently fully funded. (Slides 44-47)

• Congestion remains low and is more in-line with values seen earlier in 2019 than with last August. (Slide 45)

• Regulation and Synchronized Reserve market costs have generally tracked with energy prices over time. (Slides 60-62)
Markets Report
Market Conditions
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, 2018. 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

TWh vs. Heating Degree Days + Cooling Degree Days
Positive values represent days when the DA daily average price was higher than RT. Negative values represent days when the DA price was lower.
'Other' includes Hydro, Oil, Solar, Wind, and Other
‘Other’ includes Flywheels, Multiple Fuels, Storage, and Other Renewables
Daily Generation by Fuel - August

'Mother' includes Hydro, Oil, Solar, Wind, and Other
Daily Generation by Fuel, Other - August

'More' includes Flywheels, Multiple Fuels, Storage, and Other Renewables
Operating Reserve
(Uplift)
Monthly Uplift - $/MWh Load

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

The bar chart shows the uplift in $/MWh for various months, with different colors representing different types of costs.
Zonal Uplift - August

$ Millions

- Day-Ahead Operating Reserve
- Balancing Operating Reserve
- Reactive
- Blackstart
- Lost Opportunity Cost
• In August uplift did not exceed $800,000 on any days.

More information on Uplift can be found on PJM’s website at Drivers of Uplift
Percent of Total CT, CC 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.
Deviation Balancing Operating Reserve Rates

$/MWh

RTO
East
West

AUG17 OCT17 JAN18 MAY18 AUG18 OCT18 JAN19 MAY19 AUG19
Energy Market

LMP Summary
Fuel Cost Adjusted LMP (Referenced to 1999 Fuel Prices)
LMP Price Posting Suspensions and Reruns

Percentage of Intervals Price Posting Suspended
Percentage of Intervals Rerun prior to Final LMP Posting

Percentage of 5-Minute Intervals

- AUG17
- SEP17
- OCT17
- NOV17
- DEC17
- JAN18
- FEB18
- MAR18
- APR18
- MAY18
- JUN18
- JUL18
- AUG18
- SEP18
- OCT18
- NOV18
- DEC18
- JAN19
- FEB19
- MAR19
- APR19
- MAY19
- JUN19
- JUL19
- AUG19
Energy Market

Demand Response Summary
Demand Side Response Estimated Revenue

$ Millions

- Capacity
- Ancillary Services
- Emergency Energy
- Economic Energy
- Economic Energy Incentives

*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

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<th>Month</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
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<tr>
<td>AUG</td>
<td>1.5</td>
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</tr>
</tbody>
</table>
Virtual Bids (INC & DEC) - Total Volume

- Submitted MWh
- Cleared MWh

MWh (Millions)

AUG17 | SEP17 | OCT17 | Nov17 | DEC17 | JAN18 | FEB18 | MAR18 | APR18 | MAY18 | JUN18 | JUL18 | AUG18 | SEP18 | OCT18 | NOV18 | DEC18 | JAN19 | FEB19 | MAR19 | APR19 | MAY19 | JUN19 | JUL19 | AUG19
Up-To-Congestion Transactions - Total Number

Number of Transactions (Millions)

- Submitted Transactions
- Cleared Transactions

Month: AUG17, SEP17, OCT17, NOV17, DEC17, JAN18, FEB18, MAR18, APR18, MAY18, JUN18, JUL18, AUG18, SEP18, OCT18, NOV18, DEC18, JAN19, FEB19, MAR19, APR19, MAY19, JUN19, JUL19, AUG19
Up-To-Congestion Transactions - Total Volume

MWh (Millions)

Submitted MWh
Cleared MWh

AUG17 SEP17 OCT17 NOV17 DEC17 JAN18 FEB18 MAR18 APR18 MAY18 JUN18 JUL18 AUG18 SEP18 OCT18 NOV18 DEC18 JAN19 FEB19 MAR19 APR19 MAY19 JUN19 JUL19 AUG19
INCs, DECs and Up-To-Congestion Transactions - Total Number

Number of Transactions (Millions)

- Submitted Transactions
- Cleared Transactions
INCs, DECs and Up-To-Congestion Transactions - Total Volume
Energy Market

Congestion and FTR Summary
### FTR Funding

<table>
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<th>Period</th>
<th>Surplus / Underfunding</th>
<th>Payout Ratio</th>
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<tr>
<td>August, 2019</td>
<td>$14,348,614</td>
<td>100%</td>
</tr>
<tr>
<td>2019</td>
<td>$116,830,600</td>
<td>100%</td>
</tr>
<tr>
<td>2019/2020</td>
<td>$37,030,762</td>
<td>100%</td>
</tr>
</tbody>
</table>
FTR Revenue vs. FTR Target Allocation
The ten most heavily congested facilities account for 72% of total congestion for August.
The ten most heavily congested facilities account for 45% of total congestion for 2019.
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 August = $-0.50
Percent of hours in which the direction of flow is consistent with price differentials = 61.02%
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 August = -$0.51
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 = $-1.01
Percent of hours in which the direction of flow is consistent with price differentials = 55.51%
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 = $-1.87
Negative M2M Credit represents PJM payment to MISO
Negative M2M Credit represents PJM payment to NYISO
Ancillary Service Market

Summary
Regulation Costs

$ Millions

AUG17 | SEP17 | OCT17 | NOV17 | DEC17 | JAN18 | FEB18 | MAR18 | APR18 | MAY18 | JUN18 | JUL18 | AUG18 | SEP18 | OCT18 | NOV18 | DEC18 | JAN19 | FEB19 | MAR19 | APR19 | MAY19 | JUN19 | JUL19 | AUG19

$0 | $10 | $20 | $30 | $40 | $50
Load-Adjusted Synchronized Reserve and Synchronous Condenser Costs

Cents/MWh

- Synchronized Reserve Market Payments / MWh
- Synchronous Condenser Payments / MWh

Bar chart showing costs for months from August 2017 to August 2019.
DR Participation in PJM Regulation Markets

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

$ Millions

- AUG17, SEP17, OCT17, NOV17, DEC17, JAN18, FEB18, MAR18, APR18, MAY18, JUN18, JUL18, AUG18, SEP18, OCT18, NOV18, DEC18, JAN19, FEB19, MAR19, APR19, MAY19, JUN19, JUL19, AUG19

MWh

- 0, 5,000, 10,000, 15,000
DR Participation in PJM Synchronized Reserve Markets

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