Markets Report

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Executive Summary

- PJM Wholesale Cost for February 2020 is $41.21/MWh, down from full-year 2019 costs of $48.98/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 7-18)

- In February, temperatures were above average for most of the month. Thus, the sum of Heating and Cooling Degree Days was also below its historic average. (Slides 8-10)

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

- In February, uplift did not exceed $800,000 on any days. (Slides 23 & 24)
• Load-weighted average LMP through February 2020 is $20.76/MWh: (Slides 30-31)
  – February 2020 was $19.40/MWh, which is significantly lower than both February 2019 ($28/MWh) and February 2018 ($27/MWh).
• FTR revenue adequacy for the month of February is 100% and the 2019-2020 Planning Year is currently fully funded. (Slides 46-49)
• Congestion remains low and lower than the values observed last February. (Slide 47)
• Regulation and Synchronized Reserve market costs have generally tracked with energy prices over time. (Slides 62-64)
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, 2019. 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

Heating Degree Days + Cooling Degree Days

Feb19  Mar19  Apr19  May19  Jun19  Jul19  Aug19  Sep19  Oct19  Nov19  Dec19  Jan20  Feb20
Historic Average Weather and Energy versus Current Month - Daily

Percent of Daily Average

- Blue: Daily Energy as a Percent of the Historic Average for February
- Green: Daily HDD + CDD as a Percent of the Historic Average for February
- Black: Daily Temperature as a Percent of the Historic Average for February

Dates: 01Feb2020 to 28Feb2020
Average Fuel Prices - Daily

- Average Gas - $1.74
- Average Coal - $1.71
- Average Oil - $11.02
- Average LMP - $19.26

Fuel Price Source: S&P Global Platts
Daily Difference Between Day-Ahead and Real-Time System Marginal Prices

Positive values represent days when the DA daily average price was higher than RT. Negative values represent days when the DA price was lower.

Average price difference for February = $0.45
Load Forecast Error – 10:00 Forecast

-5%
-4%
-3%
-2%
-1%
0%
1%
2%
3%
4%
5%

Error at Peak Hour
Weekend / Holiday
PJM prepares a day-ahead load forecast at 10:00 am for use by our members.

This forecast is not used to clear the day-ahead market and is not utilized for the reliability tools that run subsequent to the day-ahead market.

The following days had load forecast error exceeding 3%:

- 2/6/20 – Much cooler than forecasted (widespread rainstorm)
- 2/16/20 – Warmer than forecasted (ComEd) and a bit sunnier, leading to quick afternoon drop in load. Also potentially impacted by President’s Day.
- 2/17/20 – Temps were a bit warmer than forecasted in MidAtl+Dom, but this error appears to be largely due to President’s Day.
- 2/19/20 – A bit warmer than forecasted in several zones. Loads didn’t respond as expected to much colder temps (as compared to day prior) in ComEd.
### Monthly Generation by Fuel

`'Other' includes Hydro, Oil, Solar, Wind, and Other`
'Other' includes Flywheels, Multiple Fuels, Storage, and Other Renewables
Daily Generation by Fuel - February

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

'Other' includes Flywheels, Multiple Fuels, Storage, and Other Renewables
Operating Reserve
(Uplift)
Monthly Uplift

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

$ Millions

- FEB18
- MAR18
- APR18
- MAY18
- JUN18
- JUL18
- AUG18
- SEP18
- OCT18
- NOV18
- DEC18
- JAN19
- FEB19
- MAR19
- APR19
- MAY19
- JUN19
- JUL19
- AUG19
- SEP19
- OCT19
- NOV19
- DEC19
- JAN20
- FEB20
Monthly Uplift - $/MWh Load

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

$/MWh

- FEB18
- MAR18
- APR18
- MAY18
- JUN18
- JUL18
- AUG18
- SEP18
- OCT18
- NOV18
- DEC18
- JAN19
- FEB19
- MAR19
- APR19
- MAY19
- JUN19
- JUL19
- AUG19
- SEP19
- OCT19
- NOV19
- DEC19
- JAN20
- FEB20
Zonal Uplift - February

$ Millions

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

AECO, AEP, APS, ATSI, BGE, COMED, DAY, DEOK, DOM, DPL, EKPC, JCPL, METED, PECO, PENELC, PEPCO, PPL, PSEG
In February, 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

FEB18 MAY18 AUG18 NOV18 FEB19 MAY19 AUG19 NOV19 FEB20
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
Energy Market

Demand Response Summary
Demand Side Response Estimated Revenue

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

$ Millions

Years: 2008 to 2020
*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

FEB18  MAY18  AUG18  NOV18  FEB19  MAY19  AUG19  NOV19  FEB20

1,500  1,600  1,700  1,800  1,900  2,000  2,100  2,200  2,300  2,400  2,500  2,600  2,700  2,800  2,900  3,000
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
Virtual Bids (INC & DEC) - Total Volume

- Submitted MWh
- Cleared MWh
Up-To-Congestion Transactions - Total Number

Number of Transactions (Millions)

- Submitted Transactions
- Cleared Transactions
INCs, DECs and Up-To-Congestion Transactions - Total Number

Number of Transactions (Millions)

- Submitted Transactions
- Cleared Transactions

FEB18 | MAR18 | APR18 | MAY18 | JUN18 | JUL18 | AUG18 | SEP18 | OCT18 | NOV18 | DEC18 | JAN19 | FEB19 | MAR19 | APR19 | MAY19 | JUN19 | JUL19 | AUG19 | SEP19 | OCT19 | NOV19 | DEC19 | JAN20 | FEB20
INCs, DECs and Up-To-Congestion Transactions - Total Volume
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>February, 2020</td>
<td>$21,661,944</td>
<td>100%</td>
</tr>
<tr>
<td>2020</td>
<td>$39,857,573</td>
<td>100%</td>
</tr>
<tr>
<td>2019/2020</td>
<td>$105,709,286</td>
<td>100%</td>
</tr>
</tbody>
</table>
FTR Revenue vs. FTR Target Allocation

$ Millions

- Total FTR Revenues
- Total FTR Targets

Data for months from FEB18 to FEB20 is shown in the chart.
Monthly FTR Payout
Ten Most Heavily Congested Transmission Facilities - Overall, February

The ten most heavily congested facilities account for 74% of total congestion for February.
The ten most heavily congested facilities account for 66% of total congestion for 2020.
Energy Market

Interchange/Seams Summary
Monthly Average MISO Interface Pricing

$/MWh

FEB18  MAY18  AUG18  NOV18  FEB19  MAY19  AUG19  NOV19  FEB20

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

$/MWh

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

FEB18 | MAY18 | AUG18 | NOV18 | FEB19 | MAY19 | AUG19 | NOV19 | FEB20
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 February = $-1.42
Percent of hours in which the direction of flow is consistent with price differentials = 70.69%
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 = $-1.72
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: $1.59
Percent of hours in which the direction of flow is consistent with price differentials: 52.01%
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 = $0.77
PJM-MISO Market-to-Market Coordination Settlement

**Net M2M Credit ~ MISO ($ Millions)**

**Net M2M Credit ~ MISO/Total FTR Targets (%)**

Negative M2M Credit represents PJM payment to MISO.
Negative M2M Credit represents PJM payment to NYISO
Ancillary Service Market

Summary
Synchronized Reserve and Synchronous Condenser Costs

$ Millions

- Synchronized Reserve Market Payments
- Synchronous Condenser Payments

FEB18 | MAR18 | APR18 | MAY18 | JUN18 | JUL18 | AUG18 | SEP18 | OCT18 | NOV18 | DEC18 | JAN19 | FEB19 | MAR19 | APR19 | MAY19 | JUN19 | JUL19 | AUG19 | SEP19 | OCT19 | NOV19 | DEC19 | JAN20 | FEB20
Load-Adjusted Synchronized Reserve and Synchronous Condenser Costs

Cents/MWh

Synchronized Reserve Market Payments / MWh
Synchronous Condenser Payments / MWh
DR Participation in PJM Regulation Markets

- Total Payments ($ Millions)
- MWh Cleared (MWh)
DR Participation in PJM Synchronized Reserve Markets
Regulation Market Daily Prices and Charges

- Total Daily Regulation Charges ($ Millions)
- Minimum Interval Price ($/MWh)
- Average Interval Price ($/MWh)
- Maximum Interval Price ($/MWh)

$ Millions vs. $/MWh