Markets Report

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MC Webinar
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• PJM Wholesale Cost for 2021 is $53.45/MWh, up from full-year 2020 costs of $43.41/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 8-19)

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

• Energy use was also above its historic average for February. (Slides 8-10)
In February, uplift exceeded $800,000 on six days – February 13th and 15th-19th. (Slides 24 & 25)

Load-weighted average LMP for 2021 is $33.07/MWh: (Slides 31 & 32)
- February 2021 was $41.60/MWh, which is higher than February 2020 ($19.40/MWh) and February 2019 ($28.10/MWh).

FTR revenue adequacy for the month of February is 100% and the 2020-2021 Planning Year is currently funded at 99%. (Slides 47-50)

Congestion remains low, however, higher than values observed last February. (Slide 48)

Regulation and Synchronized Reserve market costs have generally tracked with energy prices over time. (Slides 63-65)
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, 2020. 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

Graph showing TWh vs Heating Degree Days + Cooling Degree Days from February 2020 to February 2021.
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 = $2.43
Load Forecast Error – Monthly Absolute Error, 10:00 Forecast

The chart above illustrates the monthly absolute error in load forecasts for different periods and hours. It compares the actual load with the forecasted load for each month from February 2019 to February 2021. The error is measured as a percentage and is color-coded to show different periods:

- Blue: All Hours
- Gray: Peak Hours Only
- Light Blue: Winter
- Pink: Summer
- Dashed line: 25-month Average

The chart shows a fluctuation in error percentages across different months and years, with some months experiencing higher errors than others. The 25-month average line provides a benchmark to compare the actual error against.
Load Forecast Error – February Daily Peaks, 10:00 Forecast

Error at Peak Hour
Weekend / Holiday

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
-7% -6% -5% -4% -3% -2% -1% 0% 1% 2% 3% 4% 5% 6% 7%
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 load forecast continued to perform well in February, as models remained adapted to colder weather conditions.
- Weather forecast error and load forecast model error both contributed to the under-forecasting of the peaks on 2/21 and 2/22.
- Weather forecast error primarily drove the over-forecasting of the peaks on 2/25 and 2/26.
'Other' includes Hydro, Oil, Solar, Wind, and Other
Monthly Generation by Fuel, Other

'Other' includes Flywheels, Multiple Fuels, Storage, and Other Renewables
Daily Generation by Fuel, Other - February

'Mother' includes Flywheels, Multiple Fuels, Storage, and Other Renewables
Operating Reserve

(Uplift)
Zonal Uplift - February

$ Millions

- AECO
- AEP
- APS
- ATSI
- BGE
- COMED
- DAY
- DEOK
- DOM
- DPL
- DUQ
- EKPC
- JCPL
- METED
- PECO
- PENELEC
- PEPCO
- PPL
- PSEG

Colors:
- Black: Day-Ahead Operating Reserve
- Green: Balancing Operating Reserve
- Blue: Reactive
- Orange: Blackstart
- Pink: Lost Opportunity Cost

Values:
- AECO: $0.0
- AEP: $2.0
- APS: $0.0
- ATSI: $0.0
- BGE: $0.0
- COMED: $1.0
- DAY: $3.0
- DEOK: $0.0
- DOM: $4.0
- DPL: $0.0
- DUQ: $0.0
- EKPC: $1.0
- JCPL: $0.0
- METED: $0.0
- PECO: $0.0
- PENELEC: $0.0
- PEPCO: $0.0
- PPL: $0.0
- PSEG: $0.0

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In January, uplift exceeded $800,000 on six days – February 13th and February 15th – 19th.

Contributing factors to uplift were:

• Load forecast error (particularly on the 17th where load came in below what we anticipated)
• Interchange exporting out
• Constraint control
• Increased offer costs

More information on Uplift can be found on PJM’s website at [Drivers of Uplift](#)
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

- RTO
- East
- West

FEB19  MAY19  AUG19  NOV19  FEB20  MAY20  AUG20  NOV20  FEB21
Energy Market

LMP Summary
Load-Weighted Average LMP

$/MWh

<table>
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<th>Month</th>
<th>Value</th>
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<td>FEB19</td>
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<td>JAN21</td>
<td>$25</td>
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<td>FEB21</td>
<td>$42</td>
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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

FEB19 | MAR19 | APR19 | MAY19 | JUN19 | JUL19 | AUG19 | SEP19 | OCT19 | NOV19 | DEC19 | JAN20 | FEB20 | MAR20 | APR20 | MAY20 | JUN20 | JUL20 | NOV20 | DEC20 | JAN21 | FEB21
Energy Market

Demand Response Summary
Demand Side Response Estimated Revenue

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

$ Millions

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity</th>
<th>Ancillary Services</th>
<th>Emergency Energy</th>
<th>Economic Energy</th>
<th>Economic Energy Incentives</th>
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<td>2021</td>
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</table>
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

FEB19  MAY19  AUG19  NOV19  FEB20  MAY20  AUG20  NOV20  FEB21

1,000  1,500  2,000  2,500  3,000
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

FEB19 | MAR19 | APR19 | MAY19 | JUN19 | JUL19 | AUG19 | SEP19 | OCT19 | NOV19 | DEC19 | JAN20 | FEB20 | MAR20 | APR20 | MAY20 | JUN20 | JUL20 | AUG20 | SEP20 | OCT20 | NOV20 | DEC20 | JAN21 | FEB21

0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0
Virtual Bids (INCs & DECs) - Total Volume

- **Submitted MWh**
- **Cleared MWh**

MWh (Millions)

- FEB19
- MAR19
- APR19
- MAY19
- JUN19
- JUL19
- AUG19
- SEP19
- OCT19
- NOV19
- DEC19
- JAN20
- FEB20
- MAR20
- APR20
- MAY20
- JUN20
- JUL20
- AUG20
- SEP20
- OCT20
- NOV20
- DEC20
- JAN21
- FEB21
Up-To-Congestion Transactions - Total Number

Number of Transactions (Millions)

- Submitted Transactions
- Cleared Transactions
Up-To-Congestion Transactions - Total Volume

MWh (Millions)
INCs, DECs and Up-To-Congestion Transactions - Total Number
INCs, DEC\text{s} and Up-To-Congestion Transactions - Total Volume
Energy Market

Congestion and FTR Summary
## FTR Funding

<table>
<thead>
<tr>
<th>Period</th>
<th>Surplus / Underfunding</th>
<th>Payout Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>February, 2021</td>
<td>$6,845,773</td>
<td>100%</td>
</tr>
<tr>
<td>2021</td>
<td>$7,908,826</td>
<td>100%</td>
</tr>
<tr>
<td>2020/2021</td>
<td>$-4,263,332</td>
<td>99%</td>
</tr>
</tbody>
</table>
FTR Revenue vs. FTR Target Allocation

$ Millions

- Total FTR Revenues
- Total FTR Targets
The ten most heavily congested facilities account for 81% of total congestion for February.
The ten most heavily congested facilities account for 63% of total congestion for 2021.
Energy Market

Interchange/Seams Summary
Monthly Average MISO Interface Pricing

$/MWh

- PJM MISO Price (RT)
- MISO PJM Price (RT)
- PJM MISO Price (DA)
- MISO PJM Price (DA)

FEB19  MAY19  AUG19  NOV19  FEB20  MAY20  AUG20  NOV20  FEB21
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 = $-3.52
Percent of hours in which the direction of flow is consistent with price differentials = 50.74%
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 = $-10.05
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 = $6.72
Percent of hours in which the direction of flow is consistent with price differentials = 49.40%
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
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

Bar chart showing costs from FEB19 to FEB21.
Load-Adjusted Synchronized Reserve and Synchronous Condenser Costs

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

Cents/MWh

FEB19 | MAR19 | APR19 | MAY19 | JUN19 | JUL19 | AUG19 | SEP19 | OCT19 | NOV19 | DEC19 | JAN20 | FEB20 | MAR20 | APR20 | MAY20 | JUN20 | JUL20 | AUG20 | SEP20 | OCT20 | NOV20 | DEC20 | JAN21 | FEB21

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