System Operations Report

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Markets Coordination
MC Webinar
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Average RTO load forecast error performance for December 2019 was 2.21%, within the goal of 3%.
Peak Load Forecasting Error Outlier Days

Forecast Error (Absolute %)

- 12/23/18
- 01/31/19
- 02/02/19
- 03/13/19
- 04/21/19
- 05/17/19
- 06/20/19
- 07/18/19
- 08/23/19
- 09/09/19
- 10/08/19
- 11/14/19
- 12/23/19

Month: Dec 2018 - Dec 2019
<table>
<thead>
<tr>
<th>Quarter</th>
<th>RTO</th>
<th>MIDATL</th>
<th>AP</th>
<th>CE</th>
<th>AEP</th>
<th>DAY</th>
<th>DUQ</th>
<th>DOM</th>
<th>ATSI</th>
<th>DEOK</th>
<th>EKPC</th>
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<tr>
<td>2017 Q1</td>
<td>1.0%</td>
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<td>2017 Q3</td>
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PJM’s BAAL performance has exceeded the goal of 99% for each month in 2019.
• Two spinning events in the month of December
• Three reserve sharing events with the Northeast Power Coordinating Council (NPCC)
• The following Emergency Procedures occurred in December:
  – 15 Post-Contingency Local Load Relief Warnings (PCLLRW)
  – 2 High System Voltages
  – 4 Shortage Cases Approved
The 13-month average forced outage rate is 4.07% or 8,067 MW. The 13-month average total outage rate is 15.78% or 31,128 MW.
Note: “Unplanned Outages" include tripped facilities. One tripping event may involve multiple facilities.
### Tier 1 Response

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
<th>Start Time</th>
<th>End Time</th>
<th>Duration</th>
<th>Region</th>
<th>Tier 1 Estimate (MW)</th>
<th>Tier 1 Response (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12/11/19</td>
<td>16:08</td>
<td>16:16</td>
<td>00:08</td>
<td>RTO</td>
<td>1997.8</td>
<td>1198.5</td>
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<tr>
<td>2</td>
<td>12/18/19</td>
<td>10:07</td>
<td>10:16</td>
<td>00:09</td>
<td>RTO</td>
<td>1988.2</td>
<td>1396.4</td>
</tr>
</tbody>
</table>

*Tier 2 Response is equal to Tier 2 Assigned for events less than ten minutes*
Perfect Dispatch Estimated Production Cost Savings Through December 2019

Month/Year

Monthly Production Cost Savings
Cumulative Production Cost Savings

$0 $4 $8 $12 $16 $20 $24 $28 $32

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


Cumulative Production Cost Savings ($ in Millions)

Monthly Production Cost Savings ($ in Millions)
The year-to-date Perfect Dispatch performance score through December 2019 is 90.46%.

The estimated cumulative production cost savings through December 2019 is over $1.5 billion with over $75 million in savings in 2019.
# Suggested Changes to Load Forecast Metrics

<table>
<thead>
<tr>
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<th><strong>Current Methodology</strong></th>
<th><strong>Proposed New Methodology</strong></th>
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</thead>
<tbody>
<tr>
<td><strong>Data Displayed</strong></td>
<td>Percentiles</td>
<td>Averages</td>
</tr>
<tr>
<td><strong>Forecast Evaluated</strong></td>
<td>8 hours before peak, 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>hours before valley</td>
<td>Day-Ahead, 18:00</td>
</tr>
<tr>
<td><strong>Hour Compared</strong></td>
<td>Actual Peak vs.</td>
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<tr>
<td></td>
<td>Forecasted Peak</td>
<td>Actual Peak vs. Forecasted</td>
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<tr>
<td></td>
<td></td>
<td>Peak at same hour</td>
</tr>
</tbody>
</table>

Proposal - Current charts removed and replaced with:
- Plot of RTO average error (for all hours and peak hours only), averaged by month, for the last 25-months
- Plot of peak error for each day of previous month
Appendix
Goal Measurement: Balancing Authority ACE Limit (BAAL)

- The purpose of the new BAAL standard is to maintain interconnection frequency within a predefined frequency profile under all conditions (normal and abnormal), to prevent frequency-related instability, unplanned tripping of load or generation, or uncontrolled separation or cascading outages that adversely impact the reliability of the interconnection. NERC requires each balancing authority demonstrate real-time monitoring of ACE and interconnection frequency against associated limits and shall balance its resources and demands in real time so that its Reporting ACE does not exceed the BAAL (BAAL$_{LOW}$ or BAAL$_{HIGH}$) for a continuous time period greater than 30 minutes for each event.

- PJM directly measures the total number of BAAL excursions in minutes compared to the total number of minutes within a month. PJM has set a target value for this performance goal at 99% on a daily and monthly basis. In addition, current NERC rules limit the recovery period to no more than 30 minutes for a single event.
The 13-month average forced outage rate is 4.07% or 8,067 MW.
The 13-month average total outage rate is 15.78% or 31,128 MW.
PCLLRW Count Vs. Peak Load – Daily Values For 13 Months
Perfect Dispatch refers to the hypothetical least production cost commitment and Dispatch, achievable only if all system conditions (load forecast, unit availability / performance, interchange, transmission outages, etc.) were known and controllable in advance. While being hypothetical and not achievable in reality, this is useful as a baseline for performance measurement.

The Perfect Dispatch performance goal is designed to measure how well PJM commits combustion turbines (CTs) in real time operations compared to a calculated optimal CT commitment profile.

The Perfect Dispatch performance measure is calculated as 100% x (The accumulative year-to-date optimal CT production cost in Perfect Dispatch / The accumulative year-to-date actual real-time CT production cost).

The Perfect Dispatch performance goal was removed as a goal beginning in 2015. Currently Perfect Dispatch does not have a performance goal, but the metric will continue to be tracked.

The cumulative Estimated Production Cost Savings helps to demonstrate the savings that result from PJM’s process changes since the inception of the Perfect Dispatch analysis in 2008. This estimate is determined by comparing the Perfect Dispatch performance for all resources to benchmarks set at the beginning of the Perfect Dispatch analysis. A benchmark of 98.18% is used for comparison of the 2019 metric which is 98.89% through the end of December 2019.