Operations Report

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Manager, Markets Coordination
Members Committee Webinar
July 23, 2018
Load Forecasting Error (Achieved 80% of the Time)

- **On-Peak**
  - June 2017: 2.25%
  - July 2017: 4.58%
  - August 2017: 1.68%
  - September 2017: 2.60%
  - October 2017: 1.50%
  - November 2017: 1.89%
  - December 2017: 1.35%
  - January 2018: 2.18%
  - February 2018: 2.38%
  - March 2018: 2.79%
  - April 2018: 1.64%
  - May 2018: 1.58%
  - June 2018: 3.40%

- **Off-Peak**
  - June 2017: 1.68%
  - July 2017: 2.98%
  - August 2017: 1.68%
  - September 2017: 1.80%
  - October 2017: 1.35%
  - November 2017: 2.54%
  - December 2017: 2.18%
  - January 2018: 2.38%
  - February 2018: 2.79%
  - March 2018: 1.64%
  - April 2018: 1.58%
  - May 2018: 1.40%
  - June 2018: 3.08%

- **Average**
  - June 2017: 2.25%
  - July 2017: 4.58%
  - August 2017: 2.98%
  - September 2017: 2.60%
  - October 2017: 2.43%
  - November 2017: 1.89%
  - December 2017: 1.80%
  - January 2018: 2.54%
  - February 2018: 2.38%
  - March 2018: 2.43%
  - April 2018: 1.58%
  - May 2018: 1.40%
  - June 2018: 3.08%

- **3% Line**
  - June 2017: 2.25%
  - July 2017: 4.58%
  - August 2017: 2.98%
  - September 2017: 2.60%
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  - November 2017: 1.89%
  - December 2017: 1.80%
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  - February 2018: 2.38%
  - March 2018: 2.43%
  - April 2018: 1.58%
  - May 2018: 1.40%
  - June 2018: 3.08%
Average RTO load forecast error performance for June was 2.55%, within the goal of 3%. 

Peak Load Forecasting Error Outlier Days

Forecast Error (Absolute %)

Jun  07/30/17  09/01/17  11/24/17  01/15/18  06/07/18
Jul  06/13/17  08/02/17  10/09/17  12/22/17  02/17/18  03/06/18  05/07/18
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
2017
2018

PJM®2018
Peak Load Average Forecast Error by Zone
### Peak Load Average Forecast Error by Zone

<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>
</tr>
</thead>
<tbody>
<tr>
<td>2016 Q1</td>
<td>2.1%</td>
<td>1.8%</td>
<td>2.3%</td>
<td>1.5%</td>
<td>2.7%</td>
<td>2.4%</td>
<td>2.2%</td>
<td>2.6%</td>
<td>2.1%</td>
<td>2.4%</td>
<td>4.7%</td>
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<tr>
<td>2016 Q2</td>
<td>1.4%</td>
<td>2.3%</td>
<td>2.4%</td>
<td>2.6%</td>
<td>2.3%</td>
<td>3.1%</td>
<td>2.8%</td>
<td>2.7%</td>
<td>2.6%</td>
<td>3.2%</td>
<td>3.6%</td>
</tr>
<tr>
<td>2016 Q3</td>
<td>2.0%</td>
<td>2.7%</td>
<td>2.5%</td>
<td>3.9%</td>
<td>2.3%</td>
<td>3.9%</td>
<td>3.5%</td>
<td>2.9%</td>
<td>3.1%</td>
<td>3.4%</td>
<td>4.0%</td>
</tr>
<tr>
<td>2016 Q4</td>
<td>1.1%</td>
<td>1.7%</td>
<td>2.3%</td>
<td>1.5%</td>
<td>1.8%</td>
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<td>2.3%</td>
<td>1.8%</td>
<td>1.9%</td>
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<tr>
<td>2017 Q1</td>
<td>1.0%</td>
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<td>2.1%</td>
<td>1.6%</td>
<td>1.8%</td>
<td>2.1%</td>
<td>1.6%</td>
<td>2.2%</td>
<td>1.4%</td>
<td>2.0%</td>
<td>3.7%</td>
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<td>1.8%</td>
<td>2.2%</td>
<td>2.2%</td>
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<td>4.4%</td>
<td>2.7%</td>
<td>2.5%</td>
<td>2.0%</td>
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<td>3.6%</td>
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<td>3.0%</td>
<td>2.2%</td>
<td>3.0%</td>
<td>3.0%</td>
<td>2.4%</td>
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<td>3.6%</td>
<td>3.5%</td>
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<td>1.6%</td>
<td>2.4%</td>
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<td>3.5%</td>
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<tr>
<td>2018 Q1</td>
<td>1.3%</td>
<td>2.1%</td>
<td>2.0%</td>
<td>1.5%</td>
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<td>2.8%</td>
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<td>3.5%</td>
</tr>
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<td>2.4%</td>
<td>2.3%</td>
<td>2.9%</td>
<td>2.5%</td>
<td>3.0%</td>
<td>2.9%</td>
<td>2.5%</td>
<td>2.3%</td>
<td>3.4%</td>
<td>3.7%</td>
</tr>
</tbody>
</table>
PJM's BAAL performance has exceeded the goal of 99% for each month in 2018.
Three spinning events in the month of June
Two reserve sharing events with NPCC
The following Emergency Procedures occurred in June:
  – 23 Post-Contingency Local Load Relief Warnings (PCLLRW)
  – 1 Minimum Generation Alert
  – 5 Hot Weather Alerts
The 13-month average forced outage rate is 4.55% or 9,194 MW. The 13-month average total outage rate is 14.64% or 29,752 MW.
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Note: “Unplanned Outages” include tripped facilities. One tripping event may involve multiple facilities.
PCLLRW Count Vs. Average Load – 24 Months

Average Peak Load (MW) Total PCLLRW
### Spin Response

#### Tier 1 Estimate (MW) and Response (MW)

<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>06/04/2018</td>
<td>10:22</td>
<td>10:28</td>
<td>00:06</td>
<td>RTO</td>
<td>1584.5</td>
<td>533.6</td>
</tr>
<tr>
<td>2</td>
<td>06/29/2018</td>
<td>15:21</td>
<td>15:30</td>
<td>00:09</td>
<td>RTO</td>
<td>1425.8</td>
<td>1135.6</td>
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<tr>
<td>3</td>
<td>06/30/2018</td>
<td>09:46</td>
<td>09:57</td>
<td>00:11</td>
<td>RTO</td>
<td>2710.1</td>
<td>2086.2</td>
</tr>
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</table>

#### Tier 2 Assigned (MW), Response (MW), and Penalty (MW)

<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 2 Assigned (MW)</th>
<th>Tier 2 Response (MW)</th>
<th>Tier 2 Penalty (MW)</th>
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<tbody>
<tr>
<td>1</td>
<td>06/04/2018</td>
<td>10:22</td>
<td>10:28</td>
<td>00:06</td>
<td>RTO</td>
<td>58.0</td>
<td>58.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2</td>
<td>06/29/2018</td>
<td>15:21</td>
<td>15:30</td>
<td>00:09</td>
<td>RTO</td>
<td>167.4</td>
<td>167.4</td>
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<tr>
<td>3</td>
<td>06/30/2018</td>
<td>09:46</td>
<td>09:57</td>
<td>00:11</td>
<td>RTO</td>
<td>71.6</td>
<td>56.8</td>
<td>14.8</td>
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</tbody>
</table>
Perfect Dispatch Estimated Production Cost Savings Through June 2018

Monthly Production Cost Savings ($ in Millions)
Cumulative Production Cost Savings ($ in Millions)

Month/Year

Perfect Dispatch – Performance
The year-to-date Perfect Dispatch performance score through June 2018 is 88.45%.

The estimated cumulative production cost savings through June 2018 is over $1.4 billion with over $17 million in savings in 2018.
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 ACE does not exceed the BAAL (BAALLOW or BAALHIGH) 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.
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 $100\% \times \frac{\text{The accumulative year-to-date optimal CT production cost in Perfect Dispatch}}{\text{The accumulative year-to-date actual real-time CT production cost}}$.

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 2018 metric which is 98.44% through the end of June.