System Operations Report

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MC Webinar
July 25th, 2022
Average Load Forecast Error

June 2022
Hourly Error: **2.04%**  Peak Error: **2.26%**

<table>
<thead>
<tr>
<th>Month</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jun</td>
<td>2.75</td>
<td>2.75</td>
<td>2.85</td>
</tr>
<tr>
<td>Jul</td>
<td>2.60</td>
<td>2.60</td>
<td>2.60</td>
</tr>
<tr>
<td>Aug</td>
<td>2.50</td>
<td>2.50</td>
<td>2.50</td>
</tr>
<tr>
<td>Sep</td>
<td>2.40</td>
<td>2.40</td>
<td>2.40</td>
</tr>
<tr>
<td>Oct</td>
<td>2.30</td>
<td>2.30</td>
<td>2.30</td>
</tr>
<tr>
<td>Nov</td>
<td>2.20</td>
<td>2.20</td>
<td>2.20</td>
</tr>
<tr>
<td>Dec</td>
<td>2.10</td>
<td>2.10</td>
<td>2.10</td>
</tr>
</tbody>
</table>

**Legend:**
- **All Hours**
- **Winter**
- **Summer**
- **25-month Average**

**Months:**
- Jun (June)
- Jul (July)
- Aug (August)
- Sep (September)
- Oct (October)
- Nov (November)
- Dec (December)
- Jan (January)
- Feb (February)
- Mar (March)
- Apr (April)
- May (May)

**Years:**
- 2020
- 2021
- 2022
Daily Peak Forecast Error (June)

-7% -6% -5% -4% -3% -2% -1% 0% 1% 2% 3% 4% 5% 6% 7%

Error at Peak Hour
Weekend / Holiday

Over-forecasting
Under-forecasting
Load Forecast Error – Monday, June 13, 2022

- Significant, widespread under-forecasting of temperatures throughout entire RTO
- First occurrence of extremely high heat indices this year
- Drastic increase in temperature and load from previous day (Sunday)
- Storms, which would have lowered load, did not materialize until after the load peak

### Day-Ahead Load Forecasts for 6/13

<table>
<thead>
<tr>
<th>Temp-Based Forecast</th>
<th>Temp-Based Backcast</th>
<th>THI-Based Forecast</th>
<th>THI-Based Backcast</th>
</tr>
</thead>
</table>
| THI-Based Backcast solved closest to actual load, indicating load forecast error was caused mainly by temperature error and humidity impacts
Load Forecast Error – Tuesday, June 14, 2022

- High load forecast initially
  - Heat expected to intensify in the west
  - Storms expected, but location uncertain
  - Under-forecasting previous day

- Over-forecasting of temperatures, significant in some zones due to storm activity

- Ongoing customer outages from severe weather the night before

![Day-Ahead Load Forecasts for 6/14](image)

Increasing temperatures and under-forecasting from previous day contributed to decision to make PJM Forecast high.
PJM’s BAAL performance has exceeded the goal of 99% for each month in 2022.
• Two spinning events
• One reserve sharing event with the Northeast Power Coordinating Council (NPCC)
• The following Emergency Procedures occurred:
  – 59 Post-Contingency Local Load Relief Warnings (PCLLRW)
  – 11 Hot Weather Alerts
  – 1 Maximum Generation Emergency Alert
  – 3 Emergency Load Management Reduction Actions
  – 6 Load Shed Directives
  – 1 NERC EEA Level 1
  – 3 NERC EEA Level 2
• 35 Shortage Cases Approved

• The approved Shortage Cases occurred on:
  – 06/27/22:
    – 2 Shortage Cases for 17:10 and 17:15 intervals
    – Unit trip
  – 06/29/22:
    – 1 Shortage Case for 16:35 interval
    – Load coming in higher than forecasted
    – Unit ramping down
Shortage Intervals – Monday, June 13th

- 35 Shortage Intervals approved by Dispatch
  - Between 14:55 and 18:05
- All intervals reviewed and validated during LMP Verification on June 14

<table>
<thead>
<tr>
<th>Number of Intervals</th>
<th>Reserve Penalty Factors</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>MAD &amp; RTO – Primary</td>
<td>• Under-forecasting during peak hours</td>
</tr>
<tr>
<td>8</td>
<td>MAD &amp; RTO – Primary and Sync</td>
<td>• Unit trip during peak hours</td>
</tr>
<tr>
<td>3</td>
<td>MAD – Primary / RTO Primary &amp; Sync</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>RTO Primary</td>
<td></td>
</tr>
</tbody>
</table>
The 13-month average forced outage rate is 4.50% or 9,043 MW. The 13-month average total outage rate is 16.20% or 32,581 MW.
2021-2022 Planned Emergency, Unplanned, and Total Outages by Ticket

Note: “Unplanned Outages” include tripped facilities. One tripping event may involve multiple facilities.
### Spin Response

**Tier 2 Response is equal to Tier 2 Assigned for events with duration less than ten minutes**

<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>06/22/22</td>
<td>15:06:33</td>
<td>15:13:45</td>
<td>00:07:12</td>
<td>RTO</td>
<td>658.8</td>
<td>305.5</td>
</tr>
<tr>
<td>2</td>
<td>06/27/22</td>
<td>17:01:40</td>
<td>17:10:43</td>
<td>00:09:03</td>
<td>RTO</td>
<td>516.7</td>
<td>595.5</td>
</tr>
</tbody>
</table>

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<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>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>06/22/22</td>
<td>15:06:33</td>
<td>15:13:45</td>
<td>00:07:12</td>
<td>RTO</td>
<td>1121.2</td>
<td>1121.2</td>
<td>0.0</td>
</tr>
<tr>
<td>2</td>
<td>06/27/22</td>
<td>17:01:40</td>
<td>17:10:43</td>
<td>00:09:03</td>
<td>RTO</td>
<td>1267.7</td>
<td>1267.7</td>
<td>0.0</td>
</tr>
</tbody>
</table>
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\textsubscript{LOW} or BAAL\textsubscript{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 4.50% or 9,043 MW. The 13-month average total outage rate is 16.20% or 32,581 MW.
PCLLRW Count Vs. Peak Load – Daily Values For 13 Months
PROTECT THE POWER GRID
THINK BEFORE YOU CLICK!

Be alert to malicious phishing emails.

Report suspicious email activity to PJM.
(610) 666-2244 / it_ops_ctr_shift@pjm.com