2015 Winter Operations Update

April 7, 2015

TOA-AC
Chantal Hendrzak
Winter Temperature Comparison 2014 vs 2015

January

February

2014 2015
Historic RTO Winter Peak Demand

<table>
<thead>
<tr>
<th>Month</th>
<th>MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec. 14 2005</td>
<td>126,655†</td>
</tr>
<tr>
<td>Feb. 5 2007</td>
<td>136,675†</td>
</tr>
<tr>
<td>Jan. 3 2008</td>
<td>128,034†</td>
</tr>
<tr>
<td>Jan. 16 2009</td>
<td>133,844†</td>
</tr>
<tr>
<td>Jan. 4 2010</td>
<td>125,142†</td>
</tr>
<tr>
<td>Dec. 14 2010</td>
<td>132,078†</td>
</tr>
<tr>
<td>Jan. 3 2012</td>
<td>124,273†</td>
</tr>
<tr>
<td>Jan. 22 2013</td>
<td>128,593†</td>
</tr>
<tr>
<td>Jan. 7 2014</td>
<td>142,863</td>
</tr>
<tr>
<td>Feb. 20 2015</td>
<td>143,826*</td>
</tr>
</tbody>
</table>

†Coincident
*Preliminary Telemetered

2,353 Demand Response

December through February Winter Season
## Generator Performance

<table>
<thead>
<tr>
<th>Date</th>
<th>Total Forced Outages ALL fuel types (MW)</th>
<th>Forced Outage Rate</th>
<th>Total Forced Outages – Gas Availability Issues (MW)</th>
<th>% of Total Forced Outages due to Gas Availability Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/19 Evening</td>
<td>19,996</td>
<td>10.78%</td>
<td>6,945</td>
<td>34.7%</td>
</tr>
<tr>
<td>2/20 Morning</td>
<td>24,805</td>
<td>13.34%</td>
<td>7,420</td>
<td>29.9%</td>
</tr>
</tbody>
</table>

NOTE: All outage numbers are approximate and will be finalized when GADs data is submitted and reviewed.
2015 Winter Unit Outages

- MW
- 25,000
- 20,000
- 15,000
- 10,000
- 5,000
- 0
- -5,000

Unplanned Outages (MW)
Maint. Outages (MW)
Planned Outages (MW)

• January – up to 5,000 MW @ peak
• February – up to 3,000 MW @ peak
• Better generator performance:
  – 13.3% (2015) vs. 22% (2014) forced outage rate
  – More heightened awareness, winter testing and winter preparation (checklist)
  – Generators’ start-up, cycle, and some offer behavior modifications
  – Improved communication with PJM (updating unit parameters in systems, discussing flexibility, submitting outage information)

• Gas procurement issues still present but better managed:
  – 7,420 MW or 29.9% (2015) vs. 9,500 MW or 24% (2014)
  – Fewer operational challenges with dual fuel units like emission limitations, fuel deliveries, less forced outages
  – Improved fuel management strategies (oil inventory, use of unit parameters, reporting)
• Prepare (before the event)
  – Alerts/Warnings issued by Space Weather Prediction Center (SWPC)/NOAA typically 1-3 days in advance and monitored by PJM
    • Include Intensity (K-scale) and latitudes impacted
  – Notify members and neighbors as needed
  – Perform sensitivity studies ensure adequate system resiliency for future operating periods
    • Screen for loss of EHV capacitors, loss of major generating sites such as Artificial Island, loss of EHV transformers, etc.
  – Schedule additional generation if needed
  – Potentially delay/defer/restore transmission and generation outages
• Monitor (during the event)
  – Meters are in place at ~50 stations to watch for GMD impacts in real time
  – Adjust/operate more conservatively based on system conditions
  – Coordinate with members, neighbors, etc. as the situation dictates
Timeline of notices

- **Relevant SWPC GMD postings**
  - 3/17 @1334 UTC (Coordinated Universal Time) (0934hrs Eastern)
    - K-7/G-3 poleward of 50-degrees for the period of 1200-1500 UTC.
  - 3/17 @1401 UTC
    - Upgraded to K-8/G4 poleward of 45-degrees for the period of 1200-1500 UTC.
  - 3/17 @1757 UTC
    - K-8/G4 poleward of 45-degrees through 1800 UTC.
• Posted GMD notices to Emergency Procedures website
• Coordinated with Members and Neighbors to review geomagnetically induced current (GIC) meter data and system conditions
• Triggers for Conservative Operations were not met, but PJM studied the additional GMD contingencies to be prepared:
  – No overloads or low voltages were observed
• No GMD related impacts observed or reported on the system (internal or external)
9am-10am

7pm-7:30pm