Resource Availability and Need (RAN)

MISO is improving the conversion of capacity into energy during all hours of the year

PJM Fuel Security Senior Task Force
April 26, 2019
Purpose & Key Takeaways

Purpose: Provide an overview of MISO’s Resource Availability & Need (RAN) initiative

Key Takeaways:

• MISO has had 21 days with Maximum Generation emergencies since June 1, 2016

• RAN grew out of stakeholder discussions focused on the conversion of capacity into energy all year

• FERC approved three recent tariff filings which provide relief and allow time for further efforts

• Fuel availability issues are being evaluated along with other relevant risks in the MISO markets such as those seen on January 30, 2019
MaxGen emergencies have occurred in all seasons but haven’t yet surpassed step 2 of our EOP

- Two more occurred in late January 2019
- Includes MaxGen alerts, warnings and events
The RAN Issues Statement whitepaper published March 2018 analyzed sources of uncertainty which challenge the conversion of capacity to energy

Key industry trends

- Aging and retirement of the portfolio’s generating units
- Outage correlation
- Growth in demand side and other emergency-only capacity as a percent of the overall portfolio
- Growing reliance on intermittent or unscheduled resources
- Growth of variable energy resources as a major element of the fleet

Areas for improvement in MISO processes

- Increase transparency of resource availability & need
- Refine resource availability requirements
- Improve price signals
The RAN data illustrated how lower margins and the increasing volatility of supply and load were challenging reliability.

MISO increasingly reliant on interchange (NSI) and wind to meet load.
Outage data shows the correlation of planned outages in the shoulder seasons

- 2018 average 25-30GW on outage and another 10GW derated
- 2018/19 Planning Resource Auction (PRA): 142 GW offered, 135GW cleared
- 37GW average outages/derates is 27% of the 135GW cleared in the PRA
- Average of 33% on outage/derate in shoulder seasons
Increasing amounts of emergency-only Load Modifying Resources clear our PRA

BTMG, DR, EE & ER Cleared In Auctions (MW)

<table>
<thead>
<tr>
<th>CLR 17-18</th>
<th>CLR 18-19</th>
<th>CLR 19-20</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTMG=Behind the Meter Generation, DR=Demand Response, EE=Energy Efficiency, ER=External Resources</td>
<td>3,377.6</td>
<td>7,371.5</td>
</tr>
<tr>
<td>6,013.9</td>
<td>3,089.4</td>
<td>3,182.7</td>
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<tr>
<td>97.9</td>
<td>172.8</td>
<td>312.3</td>
</tr>
</tbody>
</table>

04/12/2019: MISO Planning Resource Auction (PRA) for Planning Year 2019-2020 Results Posting
Themes in stakeholder advice on solution options led to recently approved FERC filings related to LMRs and outage coordination.
Phase 1 was targeted to deliver an additional 5-10 GWs of availability to mitigate the risk of tight operating margins.

Near Term Objective:
Improved availability to 5 – 10 GWs will reduce risks

Associated MaxGens
- June 2016 Alert South
- July 2016 Event Step 1 for footprint
- August 2016 Alert Central and North
- April 2017 Warning and Alerts in South
- September 2017 Multiple Events up to Step 1b/c
- May 2018 Alert footprint
The filings focused on making better use of existing capabilities by enhancing transparency.

Increase LMR transparency, align requirements, and improve processes:

- **Align capability and requirements:**
  Required notification time and seasonal availability will be set to physical and retail tariff capability.

- **Testing:**
  Adjust testing requirements for Demand Response to align with other resources.

- **Operating Procedures:**
  LMRs called in anticipation of Emergency declaration.

Improve planned outage transparency through forward signals and incentives:

- **Incent forward scheduling and flexibility:**
  Consider short lead time outages scheduled over low margin, high risk times as forced, impacting accreditation.

- **Transparency and Tool Improvement:**
  Increased information can inform Generator Owner’s scheduling process; improving capability, use, and awareness of tools complements transparency.
Work continues on short and long-term efforts needed to deliver reliable and efficient operations

**PHASE 1:** Improve Resource Transparency and Performance for Spring 2019 and subsequent Planning Year

- **LMRs**
  - Create transparency and better align LMR obligations to other resources
- **Outage Coordination**
  - Improve forward-looking transparency for stakeholders and MISO
  - Increase early outage notification and flexibility during emergencies

**PHASE 2:** Continued refinements for 2020 PRA, movement toward holistic solution(s)

- Expected focus on Improved Planning Resource Auction (PRA) inputs, include resource accreditation

**PHASE 3:** Holistic solution(s)

- Expected focus on Improved market incentives for resource availability and flexibility to meet daily and variable energy needs
- Seasonal resource adequacy

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**Filed Dec 2018 / Jan 2019**
**Accepted Feb 2019 / Mar 2019**
**IMPLEMENT 2019**

**File Q2-3 2019**
**IMPLEMENT 2020**

**File as early as Q2 2020**
**IMPLEMENT TBD**
Our most recent MaxGen occurred January 30-31\textsuperscript{st} due to high load and generation outages driven by extreme cold.

- North Region low temperatures for the 2019 time periods were more than 6\degree F colder than 2014
- 2019 North/Central Region load was dampened by lingering voluntary load curtailments

\*Average is for the two days listed
MISO observed unplanned gas outages ranging from 6 – 12 GW during the Cold Weather Event

MISO North/Central Daily Average Unplanned* Generation Outages

- January 29: 20.1 GW
- January 30: 29.6 GW
- January 31: 28.9 GW

*Unplanned: Forced plus derates

The outage chart reflects the data as it resided in the CROW Outage system on February 11, 2019. Wind often reported as derate over the time period.
MISO is continuing its investigation into the risk to reliability from natural gas fuel delivery issues.

Over the past four years MISO has not found significant reliability impacts in its assessment of gas-related contingencies.

However, fuel availability related outages have contributed to the severity of maximum generation emergencies, most notably in January 2014 and 2019.
Cold-related mechanical issues and fuel supply limitations affected all generation types

### MISO North/Central Region Unplanned* Outages (GW)

<table>
<thead>
<tr>
<th>Installed Capacity (PRA cleared plus uncleared internal MISO generation that qualified for the 18-19 PY)</th>
<th>Coal</th>
<th>Gas</th>
<th>Wind</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>48.4</td>
<td>31.9</td>
<td>14.2**</td>
<td>18.2</td>
<td>112.7</td>
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</tr>
</tbody>
</table>

| January 29 | 10.3 (21%) | 6.3 (20%) | 1.3 (9%) | 2.2 (12%) | 20.1 (18%) |
| January 30 | 10.3 (21%) | 10.8 (34%) | 4.0 (28%) | 4.5 (25%) | 29.6 (26%) |
| January 31 | 9.3 (19%) | 11.9 (37%) | 2.7 (19%) | 5.0 (28%) | 28.9 (26%) |

*Unplanned: Forced plus derates

The outage data is based on records reflected in the CROW Outage system on Feb 11, 2019

**Wind installed capacity does not include wind online after 03/01/2018
RT imports from PJM tripled after the morning peak on January 30th
Going forward, MISO will work with stakeholders to ensure our markets and processes effectively manage uncertainty across various timeframes.
For example, we are evaluating the impact of renewables growth which can shift risk by the minute, hour, day and season.

Average Daily Load minus Renewables (GW)

Note 1: Renewable percentages are based on gross load
Note 2: Renewable scenarios assume 75/25 wind/solar penetration, and 50/50 penetration between utility scale and distributed solar.
Questions?

- Issue tracking home for RAN

- Summary document posted to MISO’s Market Subcommittee
  https://cdn.misoenergy.org/20190117%20MSC%20Item%2008%20RAN%20Executive%20Summary%20310728.pdf

- Issues Statement Whitepaper

- Solution Evaluation Whitepaper

- Renewables Integration Impact Assessment (RIIA) update

Dustin Grethen
Market Design Advisor
dgrethen@misoenergy.org