Winter 2019-2020 Resource Assessment for the RF Region

The RF resource adequacy assessment for the upcoming 2019-2020 winter concludes that there should not be an issue supplying demand within the RF region. Both MISO and PJM are expected to have an adequate amount of resources to satisfy their respective planning reserve requirements. This seasonal assessment is based on data provided by PJM and MISO, and this article shares assessment highlights and statistics that support our analysis on outage risk.

PJM Capacity and Reserves

Net capacity Resources[1]	186,900 MW
Projected Peak Reserves	56,717 MW
Net Internal Demand (NID)	130,183 MW
Planning reserve margin	43.6%

The PJM forecast planning reserve margin of 43.6% is greater than the 16.0% margin requirement for the 2019 planning year. The planning reserve margin for this winter is higher than the 2018 forecast level of 40.0%. This is due to an increase in Net Capacity Resources when compared to the previous year.

MISO Capacity and Reserves

Net Capacity Resources	139,173 MW
Projected Peak Reserves	39,154 MW
Net Internal Demand (NID)	100,019 MW
Planning reserve margin	39.1%

The MISO forecast planning reserve margin of 39.1% is greater than their margin requirement of 16.8% for the 2019 planning year. The planning reserve margin for this winter is lower than the 2018 forecast level of 46.6%. This is mostly due to a decrease in Net Capacity Resources in MISO's footprint.

[1] Net capacity resources include existing certain generation and net scheduled interchange.

RF Footprint Resources

Net Capacity Resources	204,765 MW
Projected Peak reserves	61,304 MW
Net Internal Demand (NID)	143,461 MW
Total Internal Demand (TID)	146,296 MW

Since both PJM and MISO are projected to have adequate resources to satisfy their respective forecasted planning reserve margin requirements, the RF region is projected to have sufficient resources for the 2019-2020 winter period.

Random Generator Outage Risk Analysis

This analysis evaluates the risk associated with random outages that may reduce the available capacity resources below the load obligations of PJM or MISO. Reports and/or other data released by PJM, MISO or NERC for this same period may differ from the data reported in this assessment due to different assumptions that were made by RF from the onset of the report. This analysis differs from NERC's in that RF uses historical Generator Availability Data System (GADS) data from a rolling five-year period which provides a range of outages that occur during the winter period. The typical maintenance outages used in this analysis are derived from PJM and MISO for the winter months.

Exhibits 1 and 2 show forecasted winter 2019-2020 demand and capacity resource data for the PJM and MISO RTOs. The daily operating reserve requirement for PJM and MISO at the time of the peak demand is also included as a load obligation. The range of expected generator outages is included for typical maintenance and random outages. The random outages are based on actual NERC GADS outage data from December, January and February of 2014 through 2018.

The committed resources in PJM and MISO are represented by the Resources bar in shades of blue and only include the net interchange that is a capacity commitment to each RTO's market. Additional interchange transactions that may be available at the time of the peak are not included, as they are not firm commitments to satisfying each RTO's reserve margin requirement.

The firm demand and the demand that can be contractually reduced as a Demand Response (DR) are shown in shades of green. The firm demand constitutes the Net

Internal Demand (NID), with Total Internal Demand including the DR. The daily Operating Reserve requirement is shown in yellow between the NID and DR. With two different sets of demand bars, the chart shows both the 50/50 and the 90/10 demand forecasts. For instance, the 50/50 demand forecast projects a 50% likelihood that demand exceeds 130,183 MW. The 90/10 demand forecast is a more conservative model, projecting a 10% chance that demand exceeds 136,600 MW. DR is at the top of the Demand bar since in our analysis it is utilized first to reduce the load obligation when there is insufficient capacity. In the event that utilization of all DR is not sufficient to balance capacity with load obligations, system operators may first reduce operating reserves prior to interrupting firm load customers.

While scheduled outages during the winter season are generally minimal, the Outages bar reflects the amount of Typical Maintenance Outages in gray. The remainder of the Outage bar represents the entire range of random outages which occurred during the five-year reference period. Pink shows 100**%** of the random outages; rose shows less than 100**%** down to 10**%**; and red shows less than 10**%** down to 0.2**%**.

In the following discussion of the random outages, the analysis of random outages exceeding certain reserve margin targets is presented as a probability. These probabilities are not based on a true statistical analysis of the available daily random outage data. Rather than statistical probabilities, these numbers represent the percentage of the daily outages during the five prior winter periods that would have exceeded the reserve margin that is listed. They are discussed as probabilities as a matter of convenience in describing the analysis results.

The probability percentages related to the amount of random outages that equal or exceed the amount of outages shown above that line on the Outage bar are along the left side of the range of outages. Moving downward on the bar represents an increasing amount of random outages, with a decreasing probability for the amount of random outages. In the PJM chart, the random outages represented by the bar above the 100% point is 540 MW. This means that the probability of there being at least 540 MW of random generation outages is 100%. Similarly, at the 10% point, the outages represented by the bar above the 10% point is 22,570 MW (540 + 22,030 MW). There is a 10% probability that there will be at least 22,570 MW of outages. As shown by the probabilities and corresponding amounts of random outages, the distribution of random outages is not linear throughout the range of outages observed.

Exhibit 2 illustrates the same analysis for MISO. The top of the 50/50 demand obligation bar for MISO represents TID with operating reserves.

Exhibit 1 - 2019/2020 Winter PJM Resource Availability Risk Chart

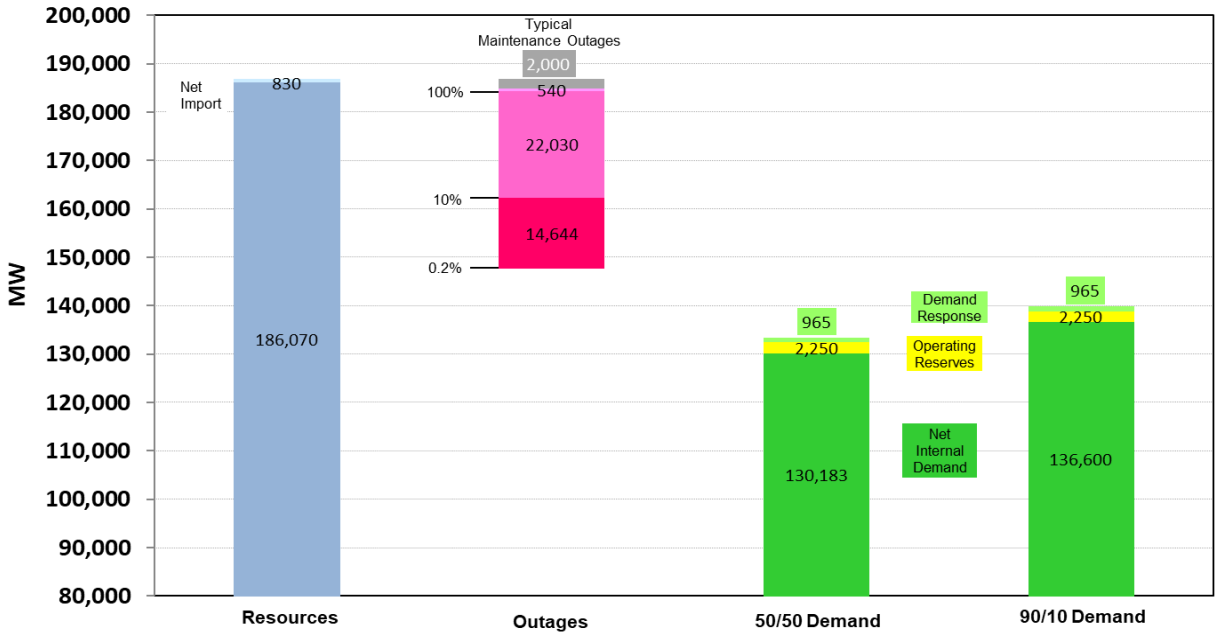

Exhibit 2 - 2019/2020 Winter MISO Resource Availability Risk Chart