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NERC/ReliabilityFirst 2022-23 Winter and Long-Term Reliability Resource Risk Assessment

Jan. 23, 2023

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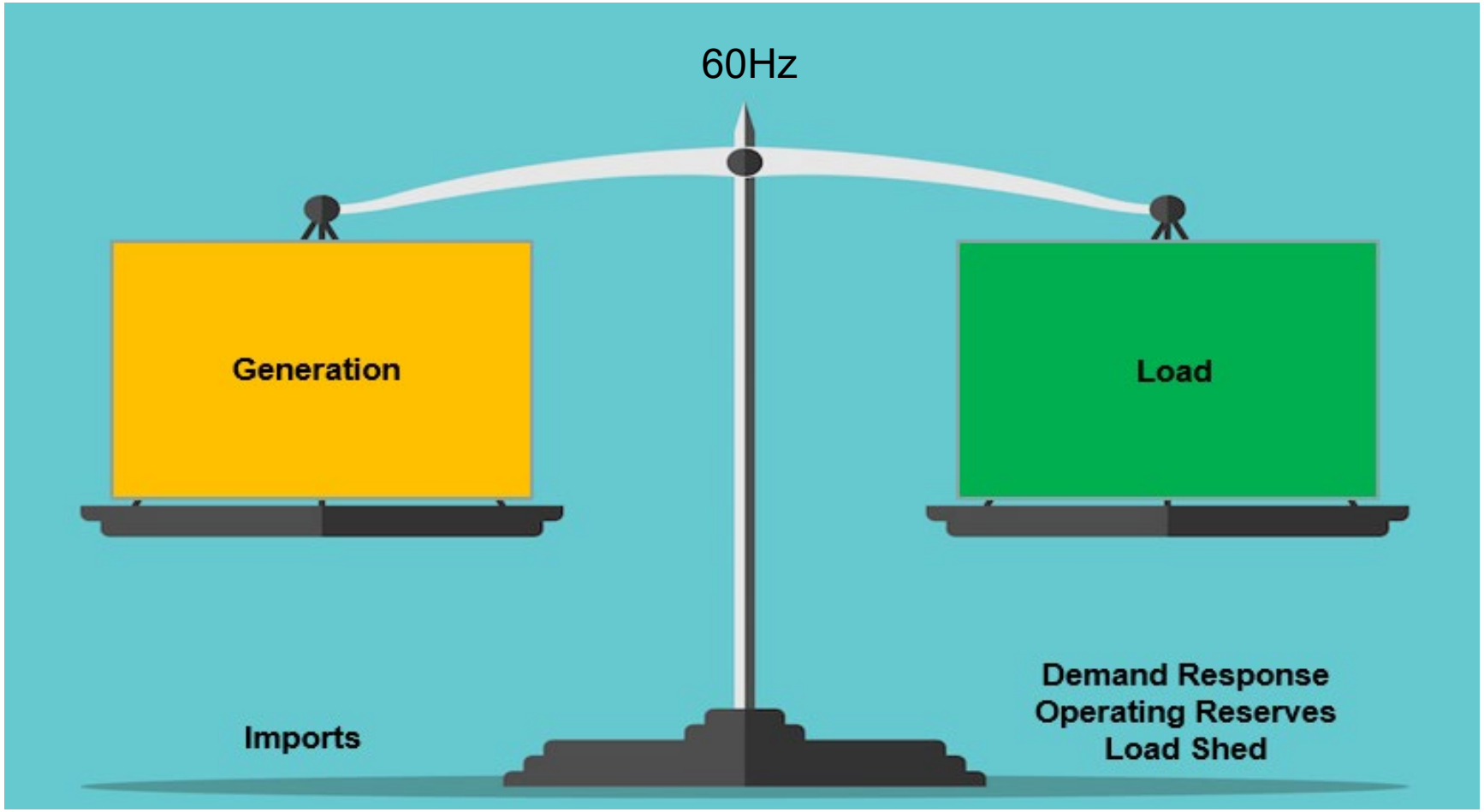
Resource Adequacy - Purpose



Identify seasonal risks associated with having enough generation resources and import capability to reliably serve anticipated load demand.

What is Resource Adequacy trying to identify and assess?

1. **Increased need for conservative operations**
   - Request end-use customers reduce demand
   - Dispatch resources to maximum output
   - Bring on additional off-cost resources
2. **Stressing of transmission grid with increased energy import**
3. **Pre-emptive manual load shed**
   - Texas February 2021 Cold Weather Event
4. **Potential to result in uncontrolled load loss**

Additional Risks for Consideration

Rapidly changing generation fleet

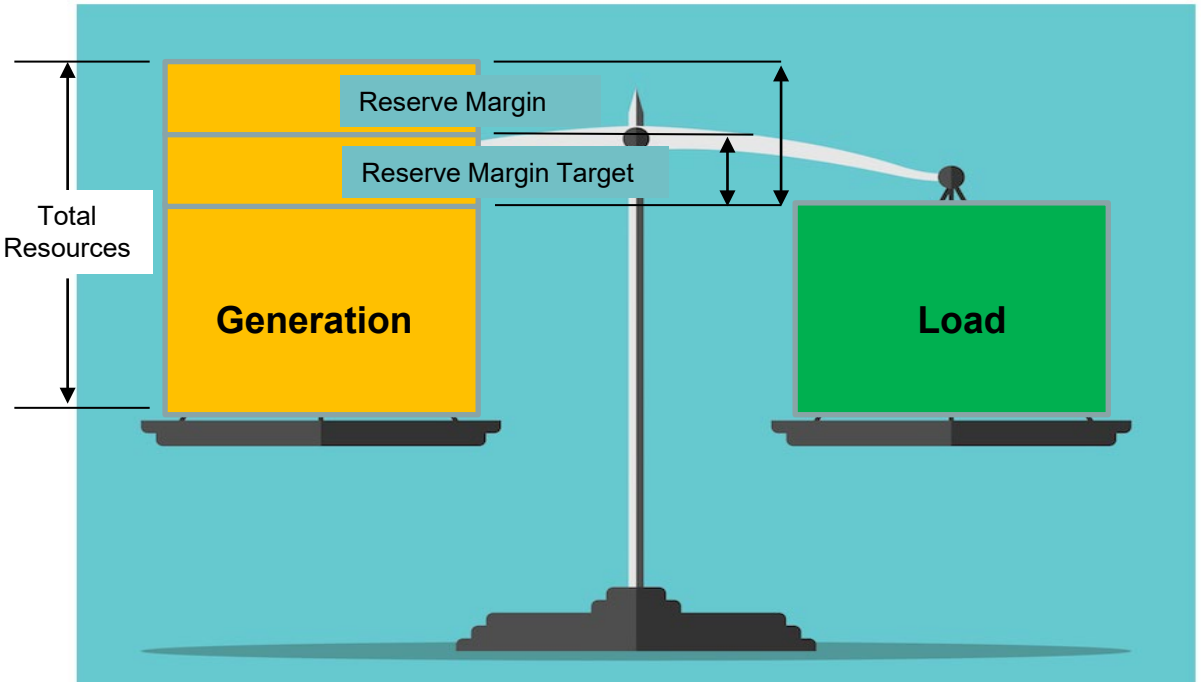
Increasing electrification

Widespread, long-duration, extreme weather events

Fuel availability, regardless of fuel type

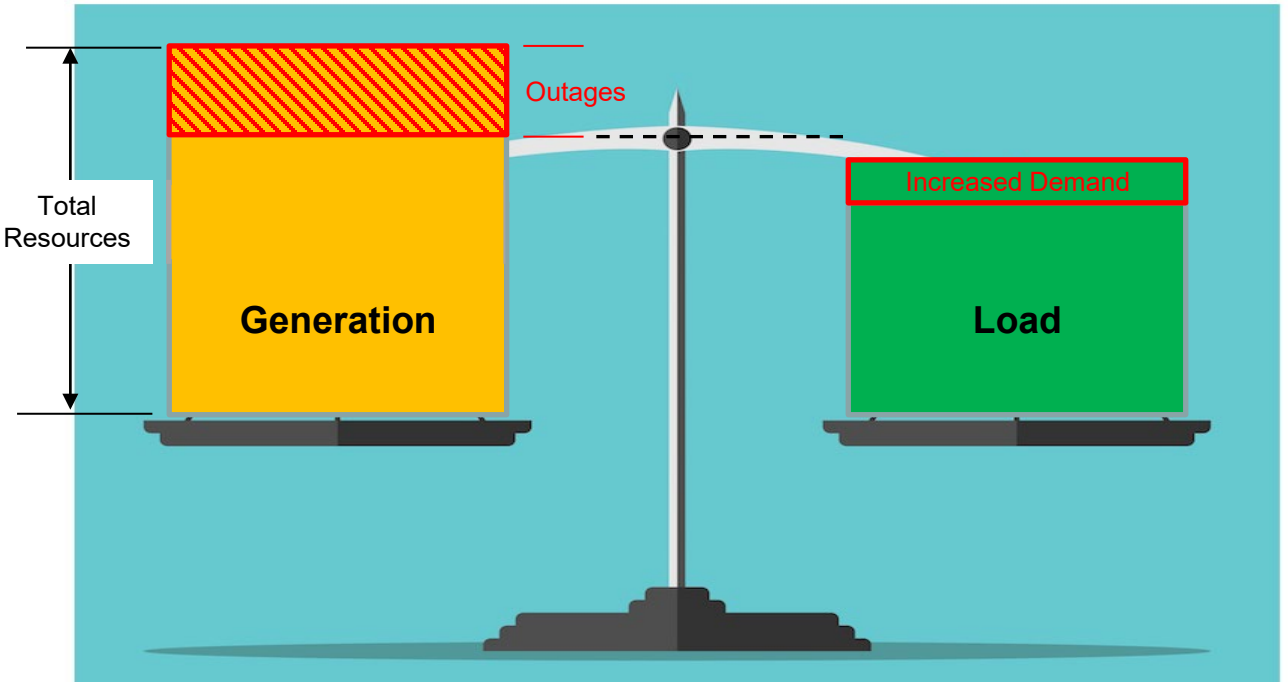
How to Measure Risk?

Reserve Margin



Goal: Reserve Margin greater than Reference Margin

Risk Scenario



Goal: Total Resources minus Outages above Load

Resource Adequacy - Roles

ERO Enterprise

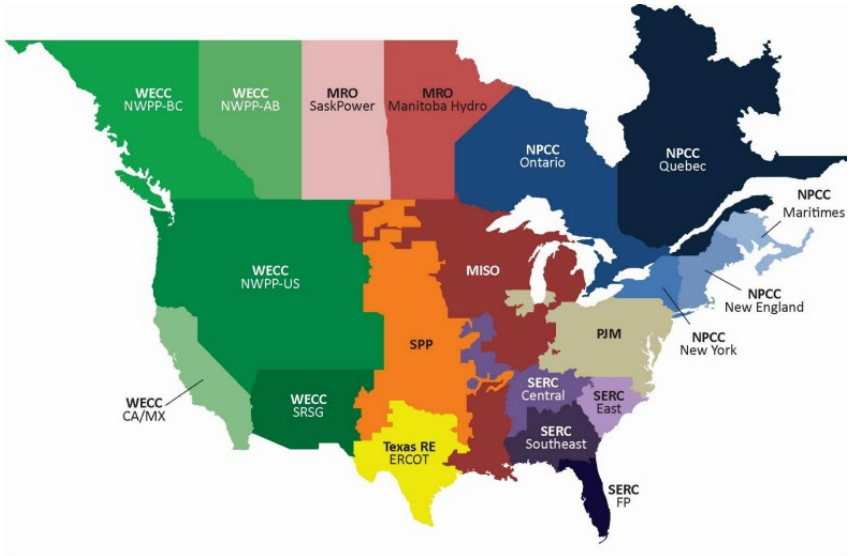
- Perform risk assessments, identify, create an awareness, and educate owners, users and operators

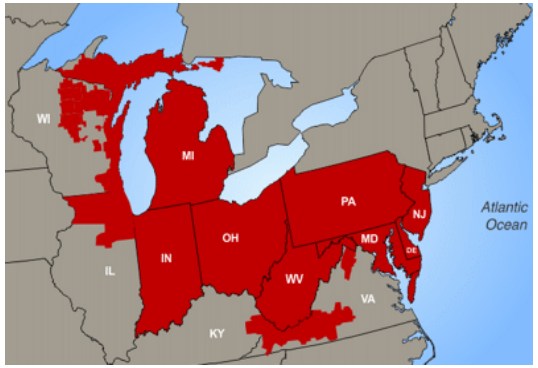
RTO/ISO

- Perform risk assessments, identify areas, create an awareness, and further educate
- Develop sufficient transmission (i.e., delivery)
- Implement fair and equal access to markets for all resources
- Reliably operate the grid and implement emergency procedures to safeguard

States

- Institute resource adequacy requirements
- Develop policies and procure resources to meet anticipated demand





Outline

Winter Reliability Assessments

- NERC 2022/2023 WRA
- RF 2022/2023 WRA

Long Term Reliability Assessments

- NERC 2022 LTRA for the next ten years
- RF 2022 LTRA for the next ten years

Winter Energy and Capacity Risk Summary

Texas

- High generator outages, fuel disruption and volatile demand in extreme cold

MISO

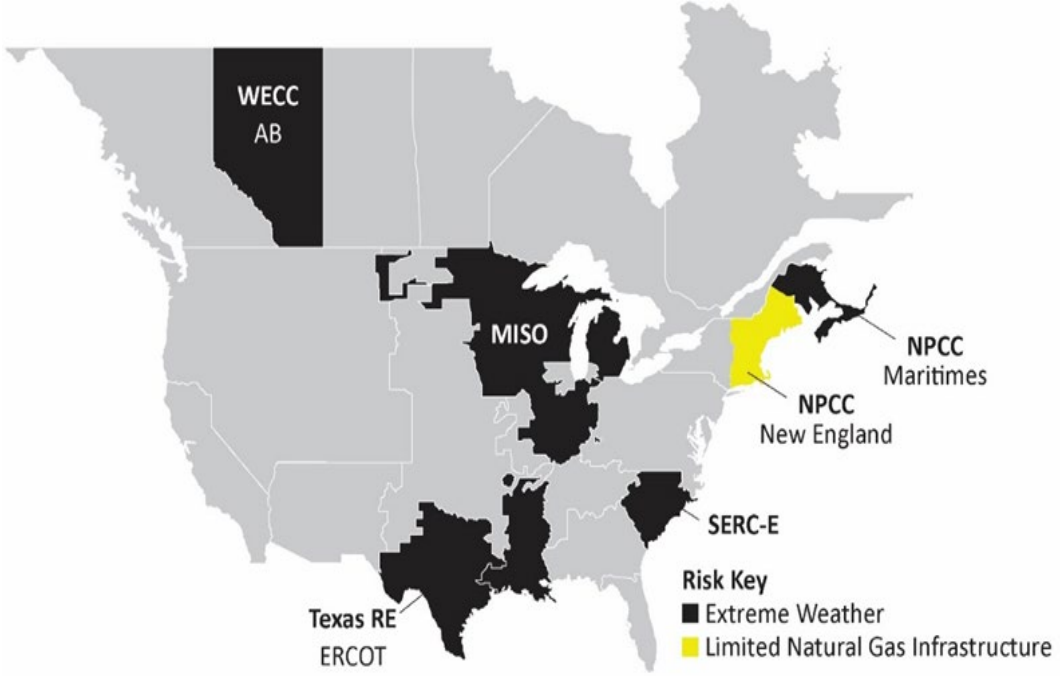
- 4.2 GW of nuclear and coal plant retirements since last winter
- Extreme cold impact to generation and fuel

Alberta and Maritimes Provinces

- Peak electricity demand growth strains tight winter reserve margins

SERC East

- Lower capacity and growth in demand cause risk of shortfall in extreme cold



Winter Reliability Risk Map

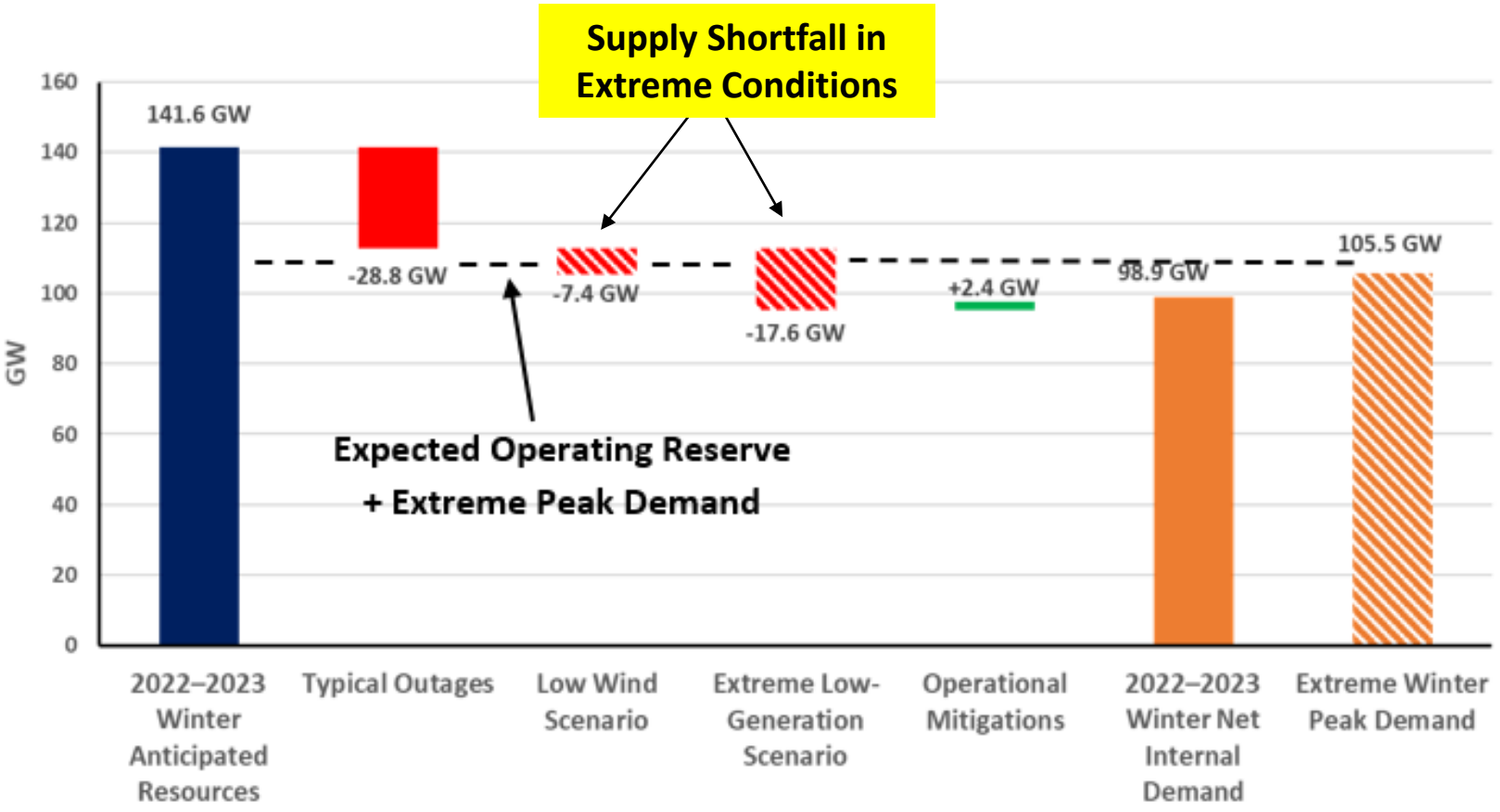
New England

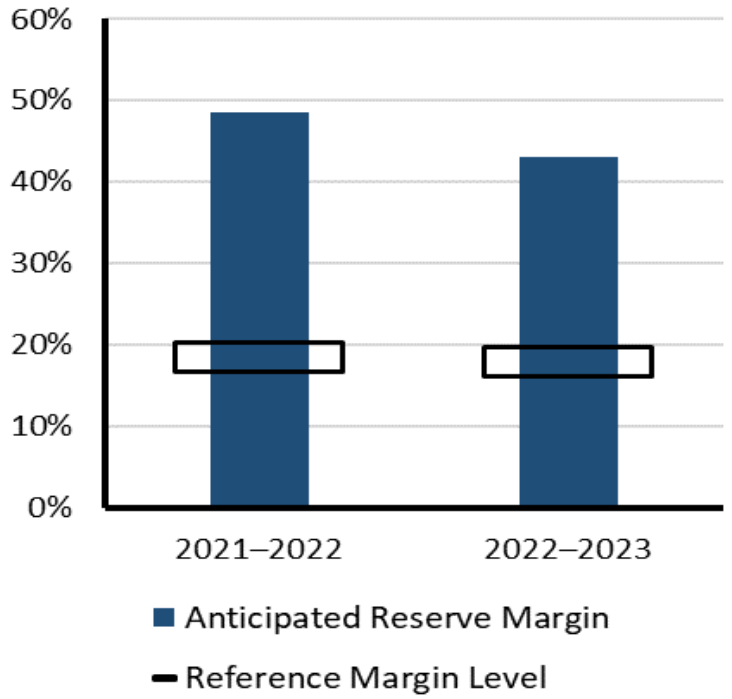
- Natural gas supply infrastructure limitations

MISO Risk Assessment

Reserve margin has fallen by over 5% since 2021-2022 winter as retired generation exceeds replacement capacity

Generators in the south are exposed to weather-related outages in extreme cold



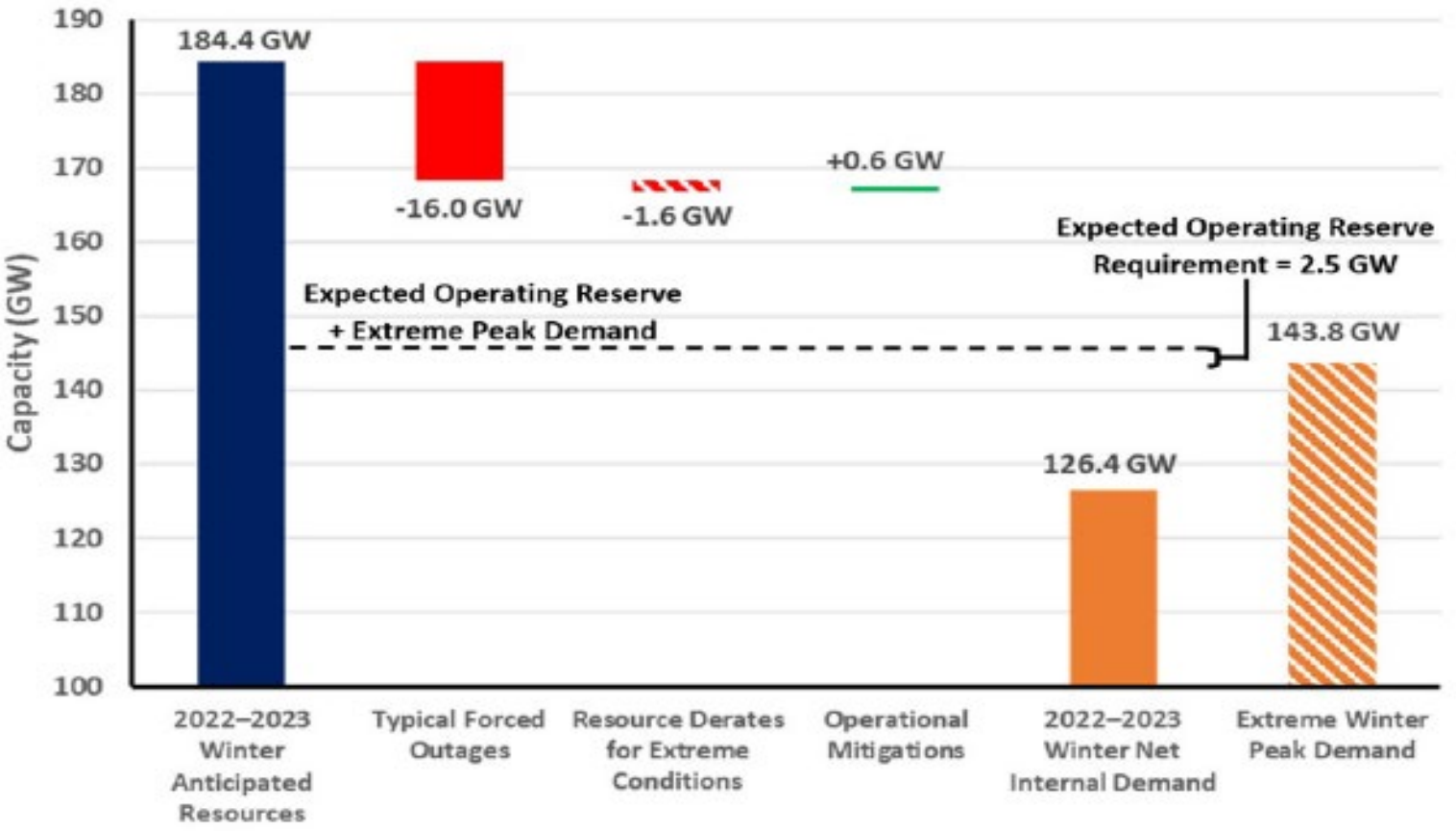


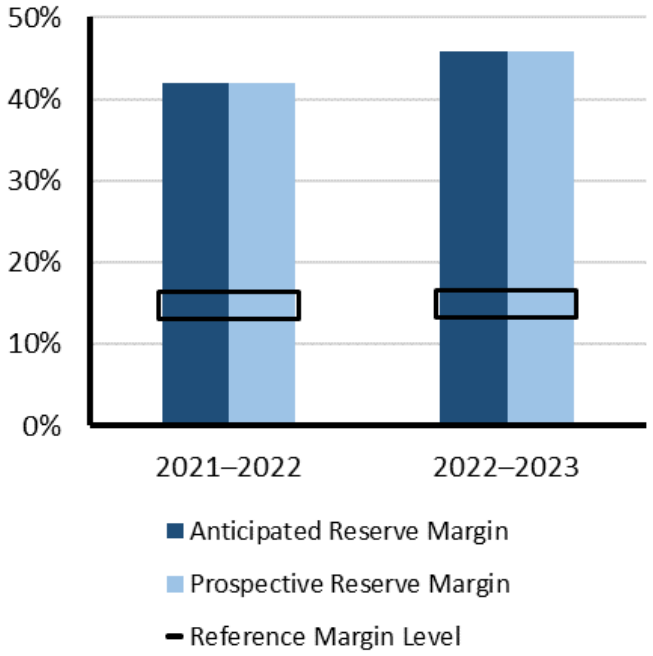
Energy emergencies are likely in extreme conditions

Wind generator performance is a key factor

PJM Assessment – Low Risk

PJM expects no resource problems over the entire 2022–2023 winter peak season because installed capacity is almost three times the reserve requirement.





Comparison of Assessments

- RF analysis uses the same load and resources data gathered during the NERC Assessment.
- RF publishes the results of the assessment in the RF quarterly newsletter and posts it on our public website.

- **Differences in analysis:**
  - RF uses actual historical Generator Availability Data System (GADS) data from a rolling five-year period between November through February.
  - NERC polls the assessment area (i.e., PJM and MISO) and requests the average forced outages for December through February weekdays, over the past three years.

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Resource Adequacy Analysis

PJM Capacity and Reserves	
Net Capacity Resources	184,376 MW
Projected Peak Reserves	57,979 MW
Net Internal Demand (NID)	126,397 MW
Planning reserves margin	**45.9%**
Planning reserve requirement	**14.9%**

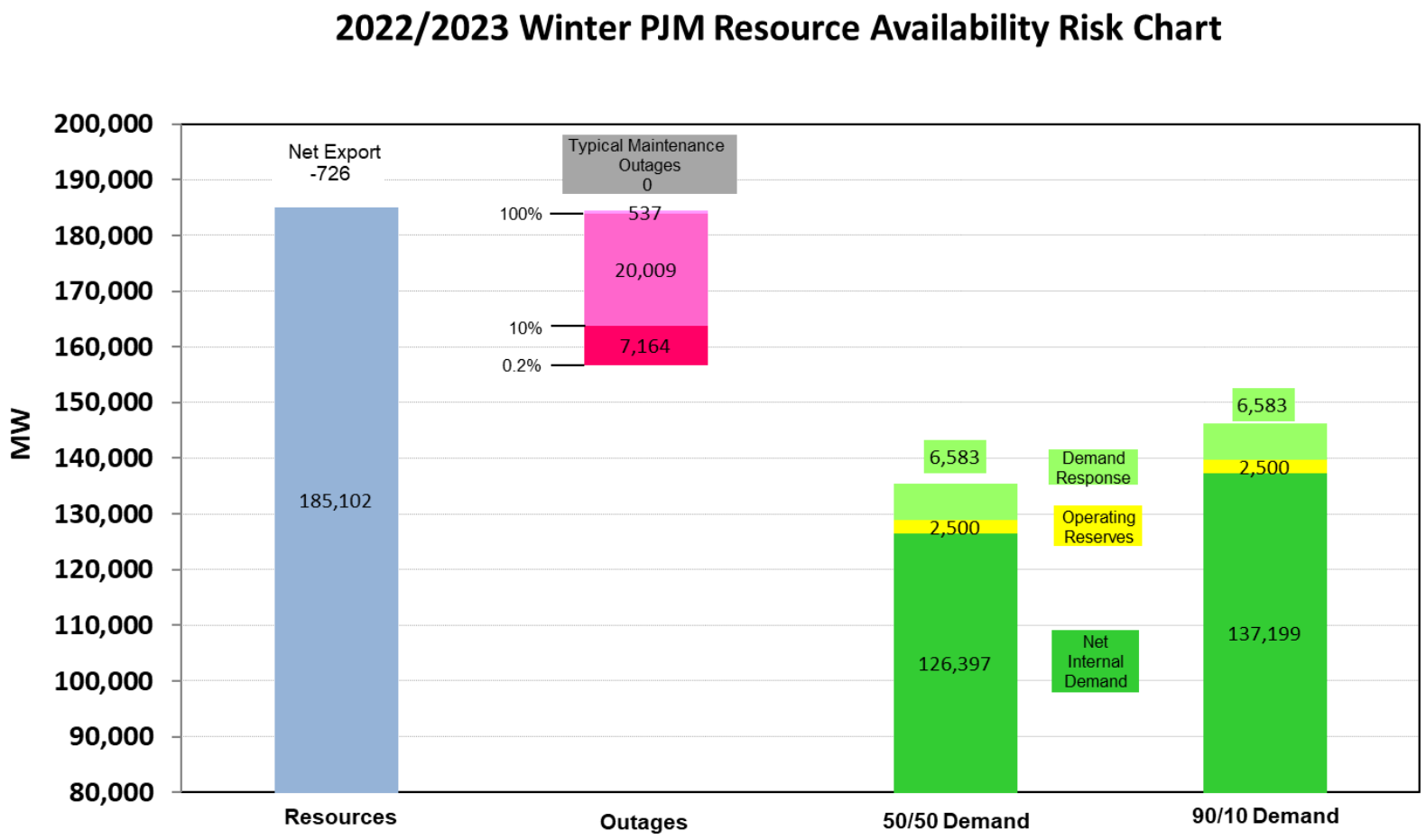
MISO Capacity and Reserves	
Net Capacity Resources	141,565 MW
Projected Peak Reserves	42,626 MW
Net Internal Demand (NID)	98,939 MW
Planning reserves margin	**43.1%**
Planning reserve requirement	**17.9%**

RF Footprint Resources	
Net Capacity Resources	194,470 MW
Projected Peak Reserves	58,388 MW
Net Internal Demand (NID)	136,082 MW
Total Internal Demand (TID)	143,809 MW

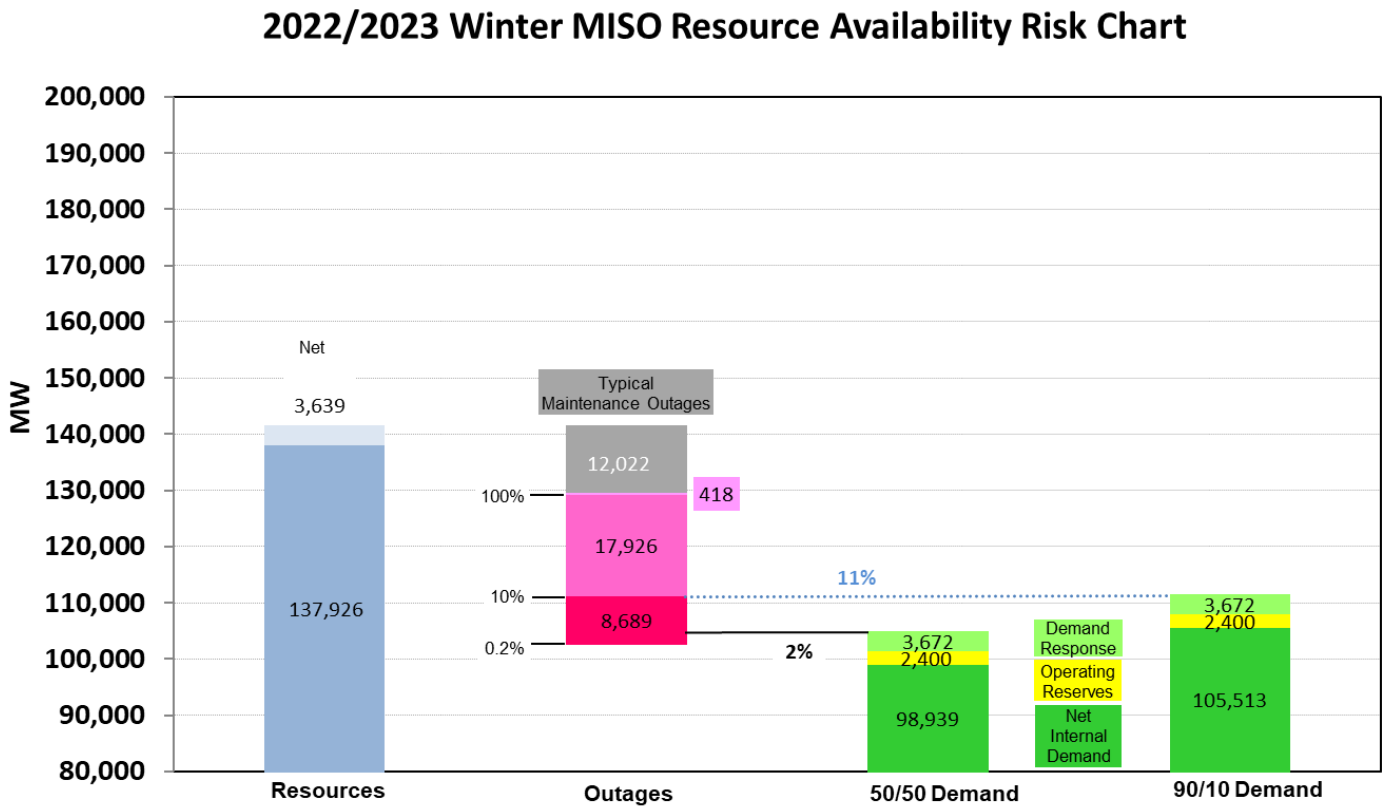
Since PJM and MISO are projected to have adequate resources to satisfy their respective forecasted reserve margin requirements, the RF region is projected to have sufficient resources for the 2022-23 winter period.

PJM Random Generator Outage Risk Analysis

PJM is projected to have adequate capacity to meet expected and 90/10 demand scenarios based on historical GADS outages.



MISO Random Generator Outage Risk Analysis



During normal operating conditions there will be minimal probability that there will be an amount of outages that will require Demand Response resources to be utilized.

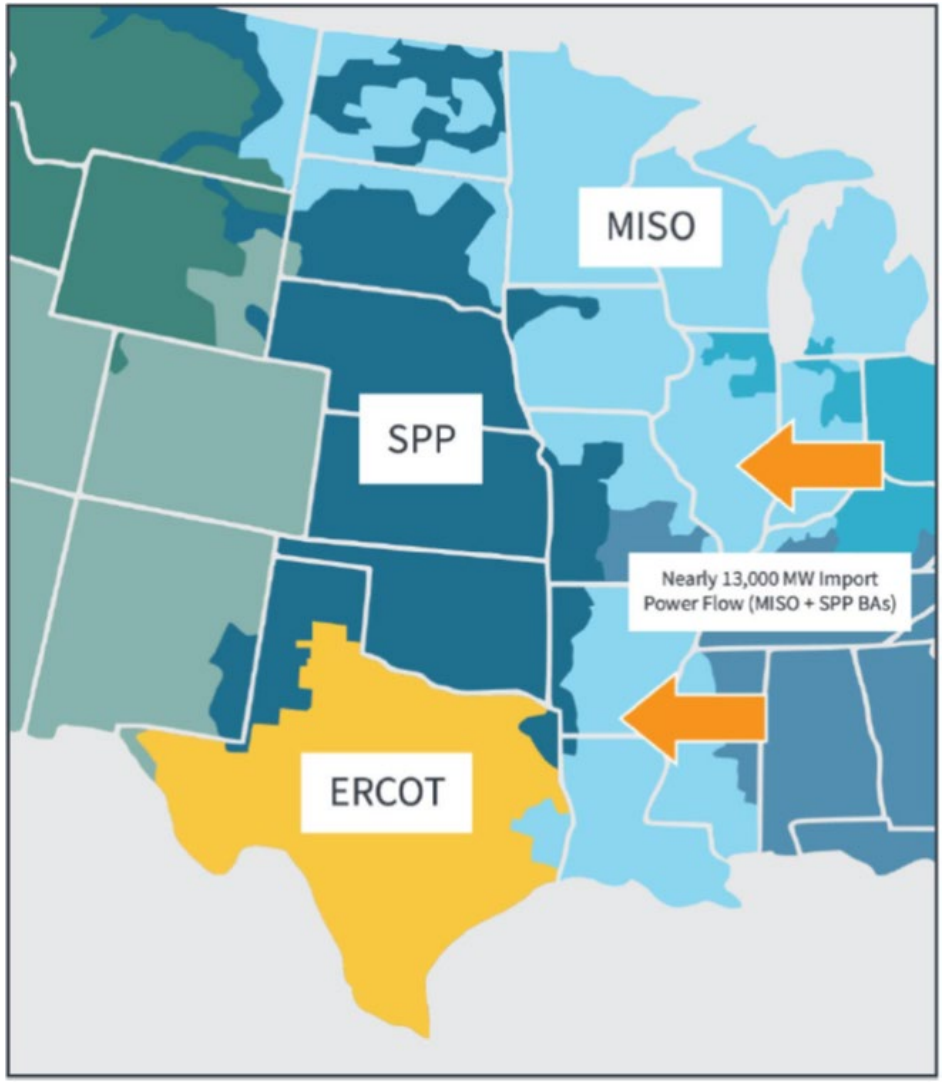
The top of the 90/10 demand obligation with the operating reserves has a 11 percent probability that Demand Response will be required during high demand and high outages.

Resource Adequacy – Transfer Dependability

- During February 2021 Cold Weather event, SPP and MISO imported 13,000 MW from entities in the east to make up for generation shortfalls

RF Observations:

- There is a contractual transfer limit from MISO South to MISO North of 2,500 MW (600 MW of firm Transmission Service Requests leaving 1,900 MW for resource sharing)
- As MISO approaches potential resource limitations in the future, it is anticipated that the following is likely to occur:
  a) Increase use and implementation of demand management programs
  b) Increased transfers from PJM into MISO to compensate for resource losses



https://www.ferc.gov/media/february-2021-cold-weather-grid-operations-preliminary-findings-and-recommendations-full

https://www.ferc.gov/sites/default/files/2020-05/E-5_94.pdf

RF Winter Transfer Analysis

- **Review import capability from PJM into MISO during anticipated 2022/23 and 2023/24 winter conditions**

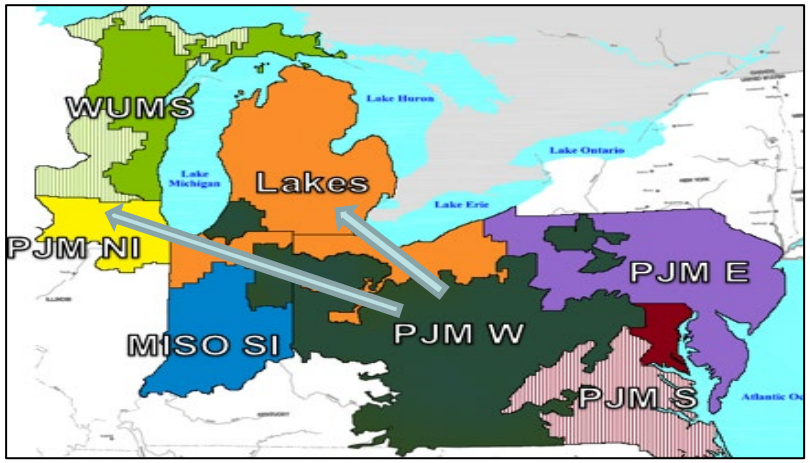
- **Transfer Analysis (results focus on east to west imports)**
  - Amount of electric power that can be moved reliably
  - RF analysis for point-to-point and simultaneous transfers

Low likelihood for restricted imports from PJM to MISO for anticipated winter conditions

Potential for reduced transfers in 2023/24 winter from PJM to MISO only

Point-to-point Transfer

Simultaneous Transfer



Winter Resource Adequacy – Summary

PJM is projected to have adequate resources to satisfy their respective forecasted reserve margin requirement and has a **negligible** concern during extreme demand (90/10) based on our random generator outage risk analysis.

MISO is projected to have adequate resources to satisfy their respective forecasted reserve margin requirement and has an **elevated** concern during an extreme demand (90/10) based on our random generator outage risk analysis.

- Consistent concern with MISO regarding resource adequacy and extreme demand scenarios documented in previous studies (Seasonal and Long-Term Reliability Assessment)
- Low likelihood for restricted imports from PJM

Long-Term Reliability Assessment (LTRA)

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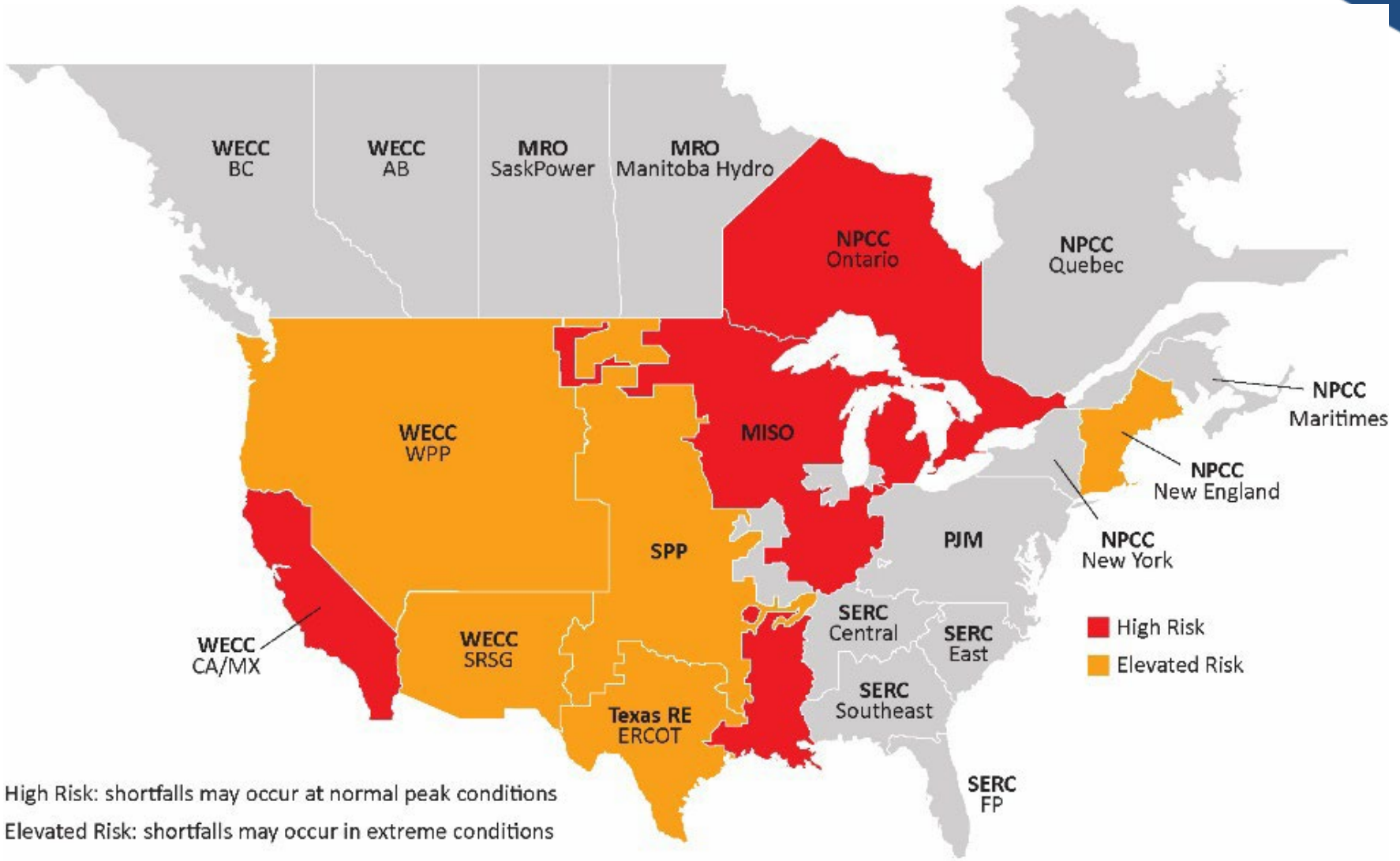
NERC's Risk Area Summary 2023 - 2027



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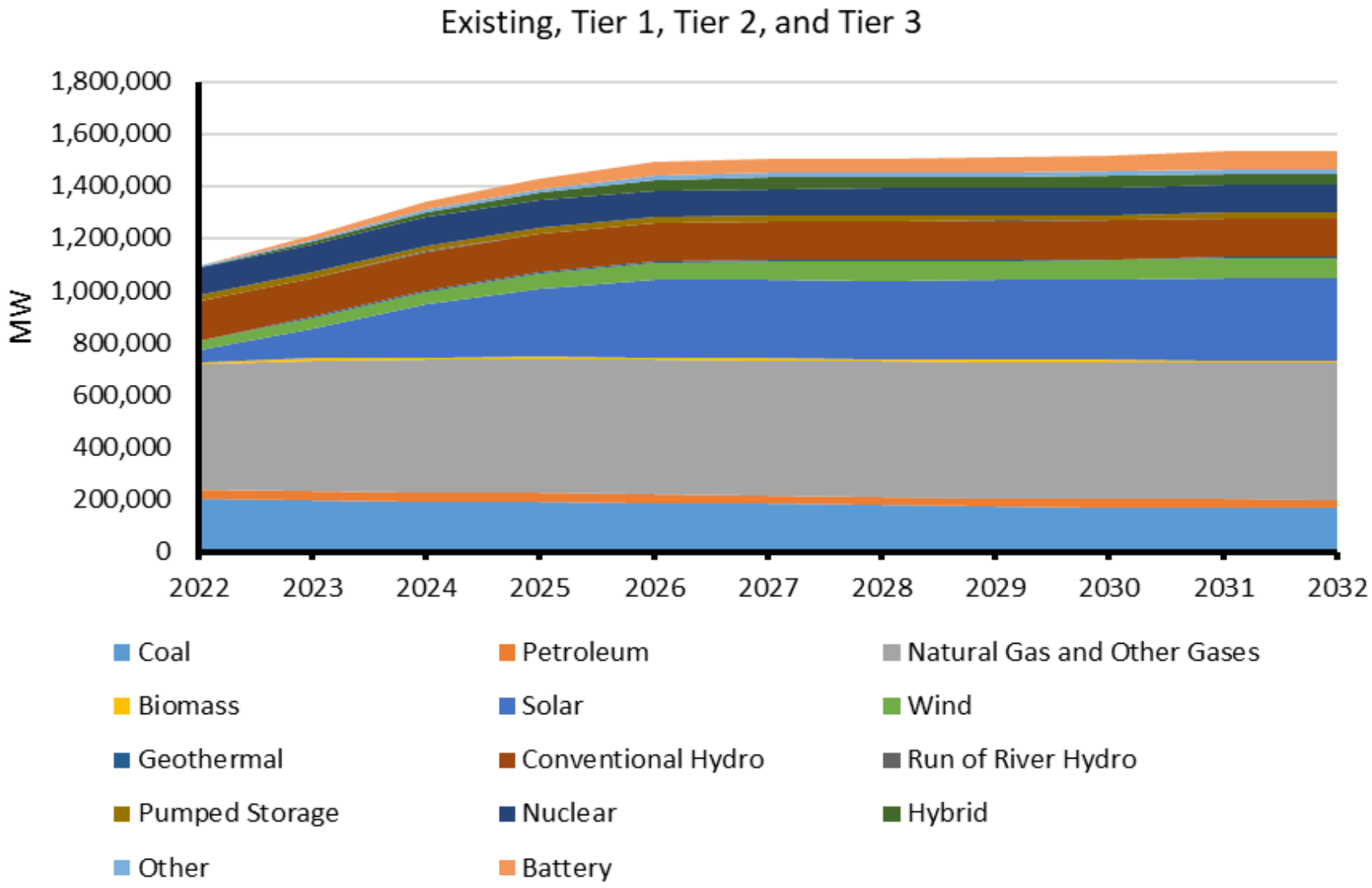
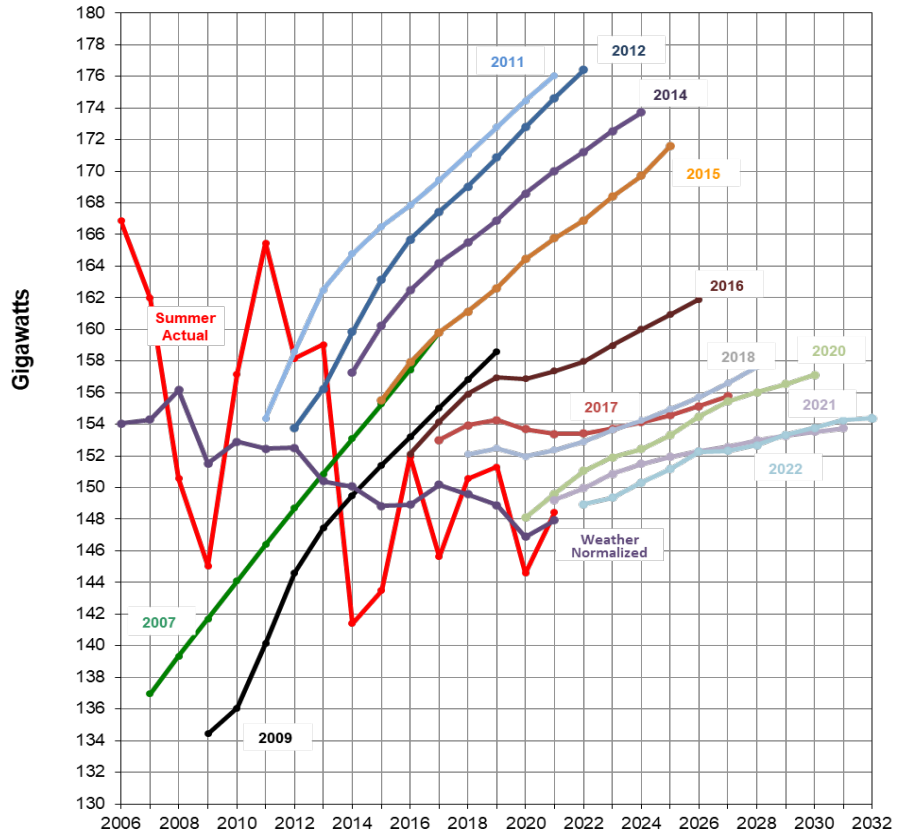
NERC wide Capacity Resources



RF Forecasted Peak Demand Data

PJM RTO Peak Demand Data

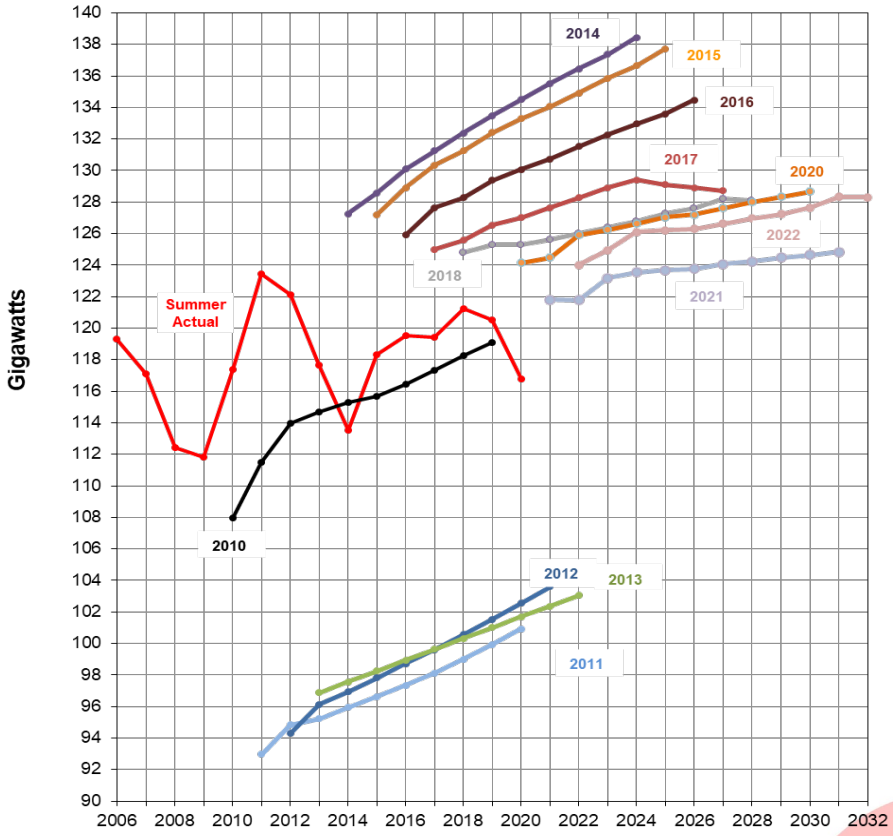
Actual 2006 - 2021
Select 10 Year TID Forecasts Through 2032



2011 Includes the expansion of the PJM RTO footprint with First Energy (ATSI) and Duke Energy Ohio and Kentucky
2013 Includes the expansion of the PJM RTO footprint with East Kentucky Power Cooperative
2019 Includes the expansion of the PJM RTO footprint with Ohio Valley Electric Cooperative

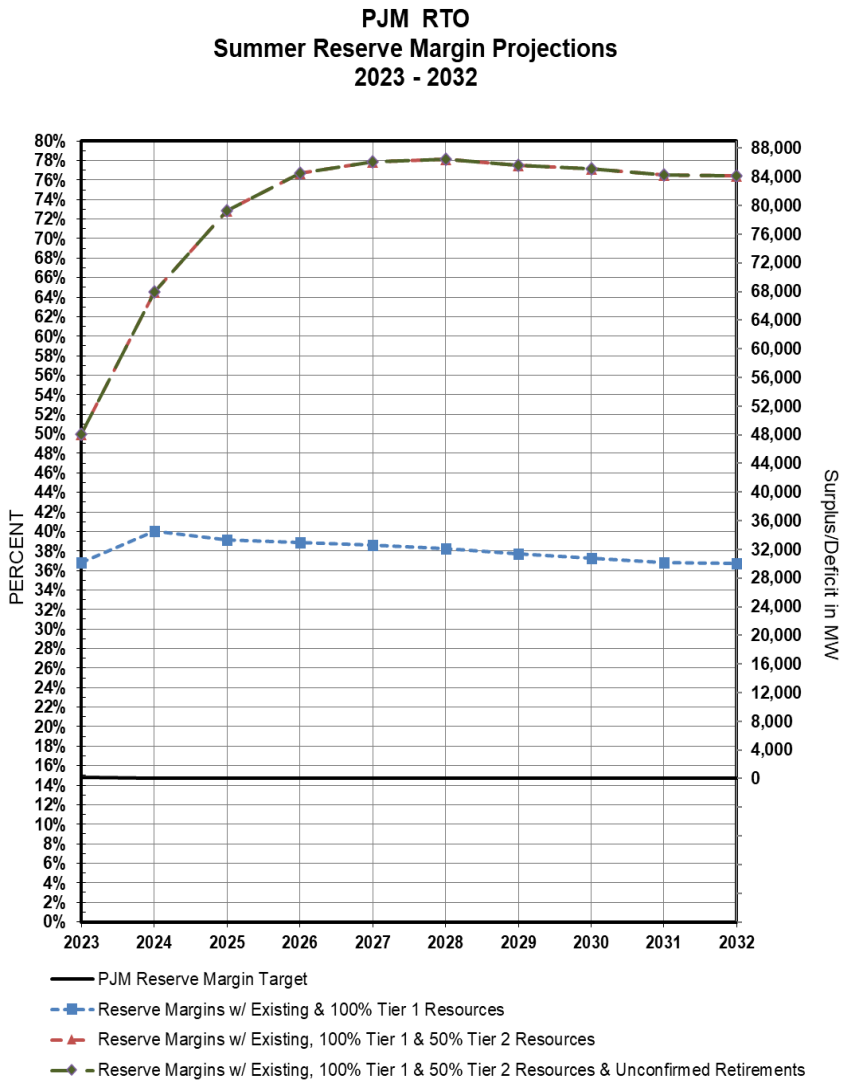
MISO RTO Peak Demand Data

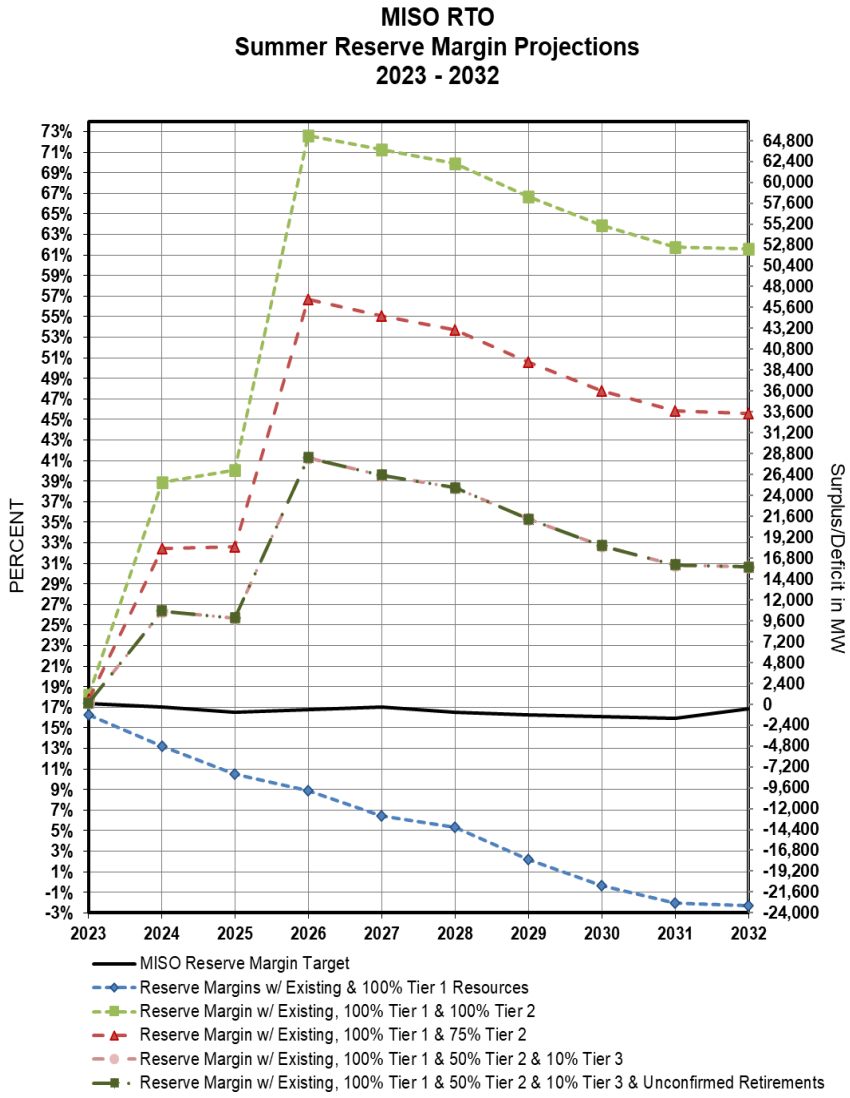
Actual 2006 - 2021
Select 10 Year TID Forecasts Through 2032



2011 Includes the reduction of the MISO RTO footprint with First Energy (ATSI), Cleveland Public Power and Duke Energy Ohio and Kentucky moving to PJM RTO
2014 Includes the expansion of MISO RTO footprint with MISO South

Reserve Margin





MISO Reserve Margin

MISO projects a regional deficit of 1,319 MW in 2023 even with adding 6.5 GW of new generation with signed interconnection agreements

These results are driven by several factors:

- Slight increase in reserve requirement due to changes in load shape and fleet make up
- Since last year, 5,000 MW of generation has retired (mostly coal-fired generators) and 1,500 MW of ***on peak*** new generation has been added (approximately 700 MW natural gas-fired, 400 MW Solar, 100 MW wind and 300 MW pumped storage).
- More additions from the planning queue are not likely to be completed in sufficient quantity to make up for the capacity shortfall.

ReliabilityFirst LTRA – Summary

PJM

- Projected to have a 0.37% load growth rate over the next 10 years
- Meet target reserve margin requirement of approximately 15%

MISO

- Projected to average a 0.30% load growth rate for 2023 through 2032
- For the entire 10-year time period, projected reserve margin is below the target reserve margin requirement
- The largest reserve margin deficit was identified in 2032, which was 23,454 MW below the target reserve margin
- The projected reserve deficits start next year, it is probable that up to 29% of Tier 2 and Tier 3 resources will be needed to meet their target reserve margin requirement
- The extreme weather events of the past several years continue to stress the importance of ensuring the MISO Resource Adequacy construct sends the appropriate planning and operating signals that ensure members continue to perform reliably

Questions & Answers

Forward Together ReliabilityFirst