MISO Resource Adequacy Reforms

PJM Resource Adequacy Senior Task Force

November 30, 2022

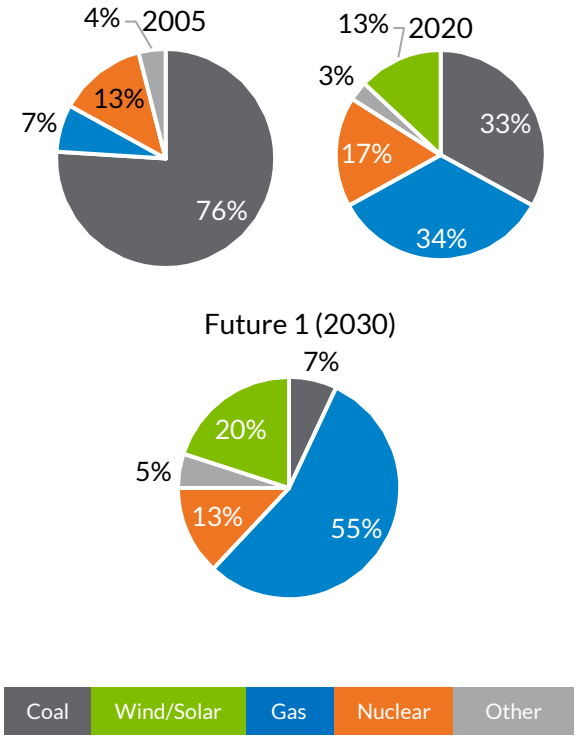
Purpose & Key Takeaways

Purpose: Review and discuss the foundational elements of MISO's Resource Adequacy (RA) reforms.

Focus areas:

- Evolving system needs and MISO's Reliability Imperative
- FERC Approved Resource Adequacy reform:
  - Seasonal requirements
  - Resource accreditation
  - Planning Resource Auction and Day-Ahead Performance Obligation

MISO's response to the Reliability Imperative requires coordinated efforts in markets, planning, operations, and systems



MISO FORWARD

RELIABILITY IMPERATIVE

Market Redefinition
Long-Range Transmission Planning
Operations of the Future
Market System Enhancement

List is not representative of all efforts

MISO is actively pursuing multiple workstreams to ensure ongoing reliability and value creation

Since 2018, the Resource Availability and Need program has worked to increase system reliability and will continue to do so through market redefinition

	Identify Reliability Needs	Planning Horizon	Operating Horizon
Progress to Date	• Five RAN whitepapers • Stakeholder engagement and workshops	• Outage coordination • Load Modifying Resources (LMR) • LMR accreditation • ICAP deliverability	• Multiday Operating Margin (MOM) forecast • Emergency pricing filing
2020-21 Focus	• Define system reliability needs and capabilities	• Develop sub-annual planning and PRA reform • Resource accreditation reform	• Further enhancements to MOM forecast • Propose emergency and scarcity pricing reforms
Ongoing Market Redefinition Focus	• Improved modeling approaches and risk characterization • Evaluation of severe weather risk • Evaluation of other required capabilities/ attributes	Accreditation • Evaluation of ELCC for renewables • LMR/ DR availability • AME resources	• Additional scarcity pricing reforms • Uncertainty management market approaches • Seams improvements

ICAP = Installed Capacity
PRA = Planning Resource Auction
ELCC = Effective Load Carrying Capability

DR = Demand Response
AME = Available Maximum Emergency

MISO's declaration of emergencies more frequently and during non-traditional times is evidence of the changing risk profile and need for RA reforms

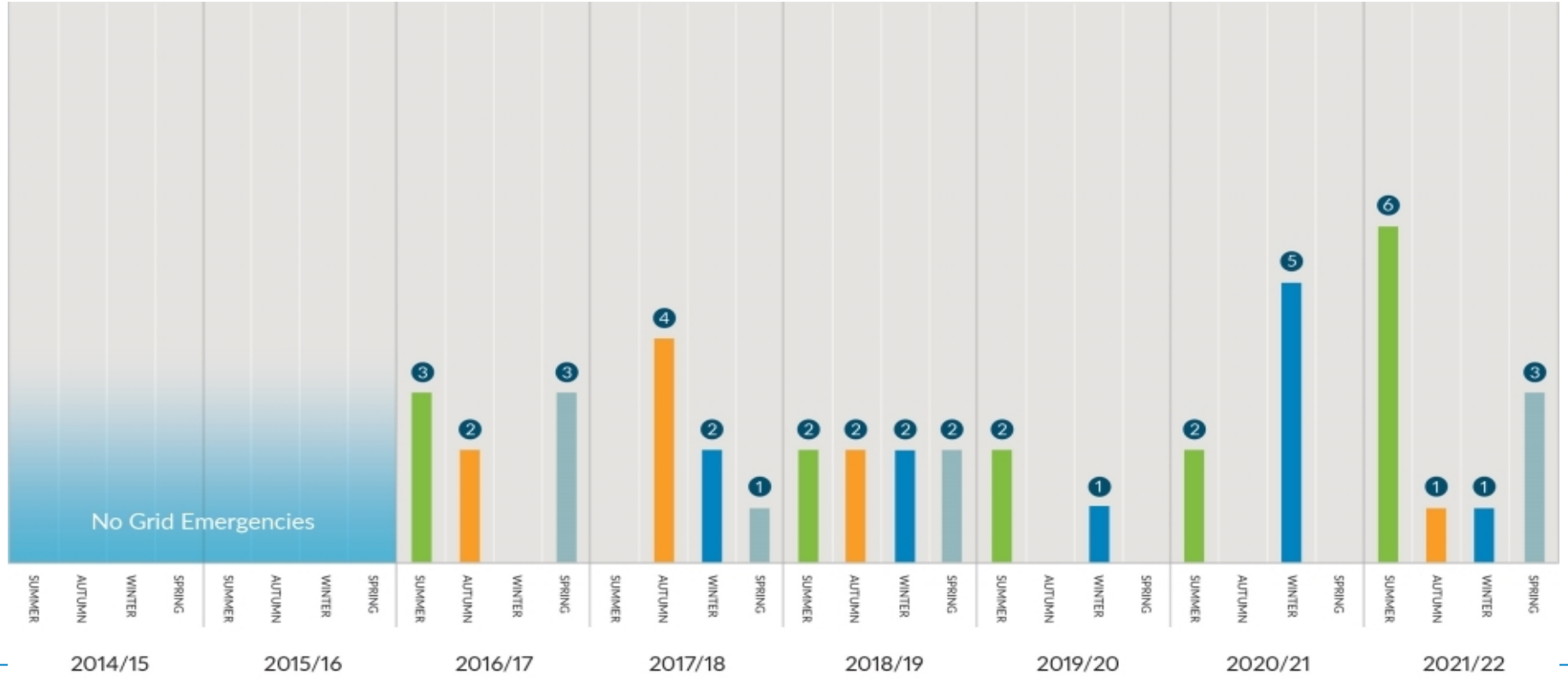


Chart indicates the number of days under a max gen alert, warning or event.

The Resource Adequacy Construct reforms continue to better position MISO to meet the challenges of the Reliability Imperative

Sub-annual construct: Change from current annual summer-based construct to four distinct seasons

Outcomes: (1) Identify reliability needs unique to each season (2) Align resource availability with seasonal needs (3) Facilitate seasonal outages or partial year operations

Improved accreditation: Align resource accreditation with availability in the highest risk periods

Outcomes: (1) Increase confidence in capacity that MISO can count on (2) Provide improved signals for availability and coordination (3) Improve outage coordination processes

The Planning Resource Auction and performance obligation will be aligned and enhanced

Planning Resource Auction

Demonstrate compliance

- Auction timing
- Participation, monitoring and mitigation

Day-Ahead Performance Obligation

Ensure availability

- Must offer requirement
- Capacity market power protections

Current Annual Construct	New Seasonal Construct
MISO conducts annual Planning Resource Auction (PRA) to meet annual PRM/LCR requirements	MISO will conduct independent auctions for all seasons at one time to meet seasonal PRM/ LCR requirements
PRA cleared resources have a year-round, must-offer obligation, except for outages reported in the Control Room Operations Window (CROW)	PRA-cleared resources have a must-offer obligation for the seasons for which they are cleared, except for outages reported in the CROW during those seasons

PRM = Planning Reserve Margin
LCR = Local Capacity Resource

MISO will calculate PRM/LRR requirements on a seasonal basis instead of one annual value for the current annual construct

Seasonal Requirements

Establish RA requirements

- Season definition
- LOLE study requirements
- Seasonal capacity import/ export limits (CIL/CEL)

Current Annual Construct	New Seasonal Construct
MISO performs annual LOLE analysis to determine annual PRM/LRR requirements with realistic planned outage scheduling.	MISO will calculate four explicit PRM/LRR requirements on a seasonal basis with flexible planned outage scheduling, while monitoring impacts from accreditation changes and refining planned outage method.

LOLE = Loss of Load Expectation
CIL = Capacity Import Limits
CEL = Capacity Export Limits

PRM = Planning Reserve Margin
LRR = Local Reliability Requirement

MISO proposes to accredit resources based on availability during times of greatest system need, reducing risk by aligning planning and real-time operations

Resource Accreditation

Register resources and qualification

- Thermal resources
  - Defining RA hour
  - Tiered approach and weighting
  - Deliverability
- Intermittent and LMR resources
- Coordinated planned outage and exemptions

Current Annual Construct	New Seasonal Construct
MISO accredits conventional resources annually based on a 3-year XEFORd excluding planned outages	• MISO will accredit by season based on resources' availability (SAC) with a two-tiered weighting structure to reflect general availability while emphasizing availability during times of need and utilize a UCAP/ ISAC conversion ratio to align requirements and accreditation • Well-coordinated and long lead planned outages will continue to have exemptions, but accreditation impacts will be strengthened in some circumstances

UCAP = Unforced Capacity
SAC = Seasonal Accredited Capacity
XEFOR = Equivalent Forced Outage Rate Demand Excluding Outside Management Control Events

Regulatory filings and resource links

- Seasonal, availability-based accreditation filing
  - Answer to comments and protests
  - Response to FERC Deficiency letter
- Conceptual Design document
- Posted Q&A
- Resource Adequacy Subcommittee (RASC) link

Contact Information

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Appendix

MISO's accreditation proposal reflects findings from impact analysis and stakeholder discussion

Design Elements		Proposal
Hour Selection	Top X% of tightest margin hours	Tier 1: All hours, excluding tight hours in Tier 2 Tier 2: MaxGen hours supplemented with top 3% of tight margin hours per season
	Margin threshold	Yes
	Seasons with no/ limited RA hours to meet 3% per season (65 hours)	Supplement deficient number of hours with annual average offered capacity over top 3% of tightest margin hours per year
	Regionality (N+C/S) (tight margin and MaxGen hours)	Yes
	Leadtime for offline units (tight margin calc)	12 hours
Accreditation Calculation	Annual verses seasonal	4 season
	Tiered weighting	Tier 1 20%; Tier 2 80%
	Leadtime for offline units	24 hours Tier 2 only
	Real-time offer considered	Tier 1 & Tier 2 Emergency Max
Planned Outage Exemption	RAN Phase I Enhancement	Yes, with proposed three-level structure

Seasonal alignment for non-thermal resources is considered in the proposal; MISO will pursue further enhancements post-filing

Resource Category	Current Annual Accreditation	Proposal	Further Enhancements Post-Filing
Wind	Annual ELCC and then allocate to individual wind resources based on performance over 8 peak summer days per year	Seasonal ELCC and then allocate to individual wind resources based on performance over 8 peak days per season	Develop ELCC methodologies or similar availability-based accreditation approaches
Non-wind intermittent resources, including solar	Three-year, historical availability-based hours 15,16,17 EST from June to August	Three-year, historical availability-based hours 15,16,17 EST for spring, summer and fall. Hours 8, 9, 19, 20 EST for winter	
LMRs*	Lead time > 6 ≤ 12 hour credited 50% for ≥ 10 calls until 2023; Annual calls ≥ 5 <10 credited 80% Annual calls ≥ 10 credited 100%	Seasonal accreditation based on call limits. Thermal BTMG accredited based on seasonal EFORd	

* LMR accreditation enhancements with implementation starting with PY22/23

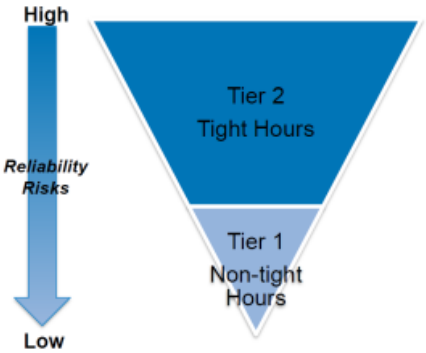
LMR = Load Modifying Resource
ELCC = Effective Load Carrying Capability

BTMG = Behind The Meter Generation
EFORd = Equivalent Forced Outage Rate Demand

MISO proposes a three-level exemption process and considers timely submissions and the Maintenance Margin to support reliability

	Maintenance Margin >=0 for duration of outage	Maintenance Margin <0 for any day in the duration of outage
>120 days, no outage in previous 120 days	Exempt Tier 1 & 2	Exempt Tier 1 Only
>120 days, outage in previous 120 days, or between 30-119 days	Exempt Tier 1 Only	No Exemption
14-30 days and no harm*	Exempt Tier 1 Only	No Exemption
Outage moved per MISO request	Fully Exempt*	
	Rescheduled to a better margin	N/A

Tier Exemption
Tier 1 & 2 (Full)
Tier 1 Only (Partial)
No Exemption



*Weather, forced, conditions in BPM-008 section 4.3