Market Redefinition: LMR Reforms

RASC-2019-9

Dec 17, 2024

Purpose & Key Takeaways

Purpose:

Present final design for Demand Response and Emergency Resources Reforms*

Key Takeaways:

- Demand Response and Emergency Resources Reforms revise the participation model and accreditation rules of Emergency Resources participating in the Planning Resource Auction
- LMRs are split into two instruments, one with flexible response during Maximum Generation Warning and one with rapid response during Energy Emergency Alert Stage 2
- Accreditation is done through the underlying resource type so that Market Participants are not incentivized to select a participation model based on accreditation considerations

**This effort has been titled LMR Reforms previously. MISO has revised the name to make clear that the effort encompasses more than just LMRs.*

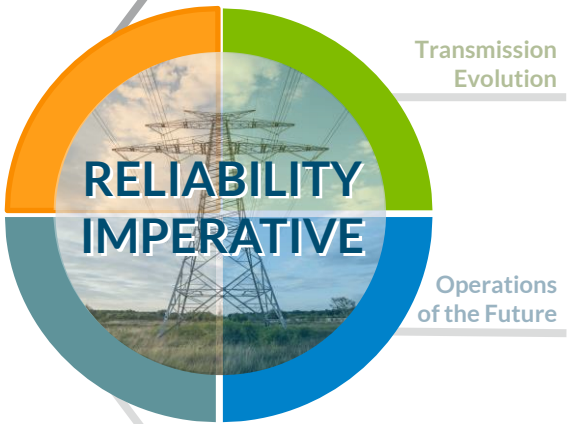
Overview

MISO has renamed this reform effort to better reflect its scope

~~LMR Reforms~~ → **DEMAND RESPONSE AND EMERGENCY RESOURCES REFORMS**

- The "LMR Reforms" name does not capture the breadth of the effort that encompasses all emergency resources and demand response resources
- Initial effort addressed accreditation of LMRs only and split LMRs into non-emergency and emergency instruments
- As part of the Available Maximum Emergency (AME) Resource filing, MISO committed to addressing accreditation of these resources at a future date
    - Given the scope of the LMR Reforms, it makes sense to combine these efforts

The increasing risk and complexity MISO faces require significant transformational changes to our grid, markets, operations and technology



Transmission Evolution

Operations of the Future

System Enhancements

Market Redefinition

- Uncertainty & Variability
- Resource Models & Capabilities
- Location
- Coordination

Modernize the Resource Adequacy Construct

Accreditation of resources that reflects resource availability during times of highest need and matches value delivered

Emergency Only and Load Modifying Resources

Crucial for maintaining grid stability during emergencies

The current Demand Response and Emergency Resources framework has proven inadequate for managing grid emergencies and integrating renewable energy sources effectively

KEY CHALLENGES AND DRIVERS

Lack of Speed & Reliability

- LMRs require 6 hours notification, AME Resources may have longer response times
- Can clear the Planning Resource Auction without making themselves available
- Real-time availability data indicates far less capacity (~6-7 GW of 9.5 GW participating) than the Planning Resource Auction's cleared quantity (12 GW)

Accreditation Doesn't Reflect Performance Levels

- Accreditation is currently 100% for Demand Resources, regardless of whether actual reliability needs are during the peak conditions or whether the resource ever consumed 100% of its capacity rating
- Accreditation for Emergency Resources does not account for response time

Demand Will Increase Due to Evolving Risk

- Intermittent resources, changing weather patterns and growing electrification drive uncertainty and complexity
- Will be relied on more in the future

DRR: Demand Response Resource; BTMG: Behind-the-Meter Generation

Proposed changes will improve operational effectiveness, appropriately verify performance, and accredit resources based on availability when reliability is crucial

Load Modifying Resources

LMRs are emergency resources that can reduce their demand on the bulk electric system by reducing energy consumption and turning on behind-the-meter generation

Improve Operational Effectiveness

- Split into LMR Type I (6 hours) and Type II (30 minutes), reserving Type II for higher steps in emergency procedures
- Standardize enrollment
- Eliminate dual registration as LMR/DRR

Verify & Measure Performance

- Introduce new testing requirements
- LMR Type 1 & DRR: at least 1 test/3 years
- LMR Type 2: 1 test/year (opt out available)
- Improved enforcement of penalty structure for testing and real-time availability

Accredit LMRs Based on Availability

- Captures the actual availability of resources during times when reliability is crucial
- Performance-based to ensure resources can reliably respond during critical periods
- Seasonal assessments adjust accreditation based on performance across different times of year

DRR: Demand Response Resource; BTMG: Behind-the-Meter Generation

Proposed changes will improve operational effectiveness, appropriately verify performance, and accredit resources based on availability when reliability is crucial

AME Resources

Emergency Resources are Generation and DRR Resources that have submitted a Commitment Status of Emergency, thus qualifying as Available Max Emergency (AME) Resources

Improve Operational Effectiveness

- AME Resources may have deployment times longer than 6 hours
- Proposed changes incentivize rapid performance enabling these resources to be used during Emergencies

Background FERC Filing

- MISO filed AME Resource participation changes in 2023
- Market Participants indicated a desire to revise accreditation for AME Resources during this filing

Accredit AME Resources

- Incentivizes fast response for AME Resources to improve Emergency operation
- Accreditation accounts for Hours these Resources are usable
- Ensures Resources accredited consistently and transparently

Accurate availability, accreditation and operational effectiveness are the three major focus areas

	CURRENT STATE	FUTURE STATE OF LMRs
Availability	• A single resource may submit real-time availability in one of three different locations when dual-registered • MUI, DSRI, EDR • Availability and accreditation are independent – no incentive to provide accurate availability data	• A resource may submit offers in only one location • Inaccurate availability information will negatively impact accreditation
Accreditation	• Season peak-hour-based accreditation may not reflect risky hours • Different methodologies depending on resource type and participation option chosen	• Historic capabilities and offers during Capacity At Risk Hours and RA Hours determine accredited values* • Accreditation is no longer determined by participation option • Both DRR and LMR will be accredited in the same way
Operational Effectiveness	• Deployment only during EEA 2 events, greater uncertainty of coming conditions, and long lead times for resources result in difficulty using LMRs effectively during tight system conditions	• Moving LMR–Type I resources to be deployed during the Maximum Generation Warning stage ensures all LMRs are capable of being used as emergencies unfold • Having fast-acting LMR – Type II resources ensures these types of Load Modifying Resources are available during all EEA 2 events • These changes result in greater certainty and improved reliability during all stages of an emergency

Response to RASC Motion

MISO has deferred the filing to Q1 2025 and will continue to discuss the three items identified in the RASC Motion* starting with today's RASC meeting

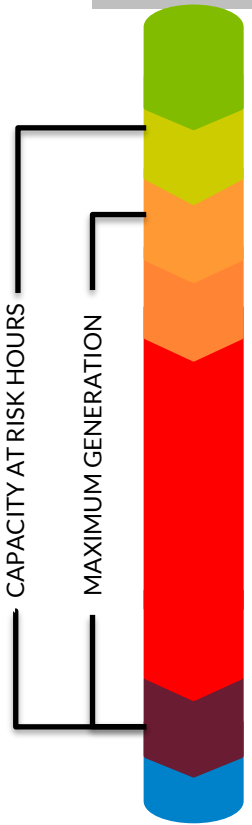
	REQUEST	RESPONSE
1	**Change proposed emergency procedure timing**	MISO updated the proposal to deploy the LMR – Type I resources during the Maximum Generation Warning stage
2	**Specifying that the accreditation level of a DR would be consistent with how the corresponding demand is accounted for in the LSEs Load Obligation calculation**	MISO recognizes the need for alignment between accreditation and obligation. MISO has begun work to address the PRMR Allocation at the October RASC and will continue these efforts in the coming year. MISO will indicate in the Tariff filing that it recognizes this need for alignment
3	**Remove Tier 1 hours from consideration in LMR DR accreditation**	MISO has considered an alternative option (Resource Adequacy or RA hours only) for the selection of hours to be used in the accreditation calculation of all emergency resources, but recommends using Capacity At Risk Hours for accreditation

*Motion Presented at the Nov 6 RASC

MISOs Response to proposed emergency procedure timing

- MISO initially proposed eliminating any LMR with longer than a 30-minute response time.
- Based on Stakeholder feedback concerning response time capabilities, MISO proposed a new type of LMR, the LMR – Type I, that allowed for longer response time.
- To accommodate the longer required response time, the LMR – Type I resource needed to be moved up the Emergency Operating Procedure (EOP) ordering
- MISO initially proposed deploying LMR – Type I resources during the Maximum Generation Alert stage to ensure these resources could be properly utilized
- After further deliberation and review of the MISO EOP, MISO is proposing deployment of LMR - Type I resources at the Maximum Generation Warning stage

MARKET CAPACITY EMERGENCY PROCEDURE STEPS



Normal Operations		Normal Pricing
Capacity Advisory	Advance notice of forecasted capacity shortage, requests Stakeholders update offer data	
Alert	Define boundaries/suspend maintenance	Emergency Pricing Tier 0
Warning	Schedule in external resources, curtail export transactions, activate reconfiguration, implement Load Modifying Resources (LMRs) Type – I resources, Commit Emergency Resources	Emergency Pricing Tier I Offer Floor
Event Step 1	~~Commit emergency resources~~, declare NERC (Energy Emergency Alert) EEA 1, activate emergency limits	
Event Step 2	Declare NERC EEA 2, implement LMR – Type II, Load Management Measures (LMMs) Stage 1, commit Emergency Demand Response (EDR) resources, emergency energy purchases, public appeals	Emergency Pricing Tier II Offer Floor
Event Step 3	Utilize operating reserves and LMM Stage 2	
Event Step 4	Reserve call and emergency reserve purchases	
Event Step 5	Declare NERC EEA 3, firm load shed, and set Locational Marginal Prices (LMPs) and Market Clearing Prices (MCPs) to the VOLL	Value of Lost Load (VOLL) Pricing
Termination	Terminate Max Gen and possibly Capacity Advisory	Normal Pricing

Emergency Procedure Steps are currently being reviewed by MISO and this chart may change.

MISO will use resource's response time along with other applicable system parameters to deploy LMRs during Max Gen events

Data from Market Portal/State Estimator/ Forecasting tools/ DSRI

Input data

Commitment Process

- Potential Capacity Shortage in an LBA/Sub-Region/System-wide
- Transmission Constraints
- Location of resources
- Offer parameters of resources
  - Lead-time or response-time of resources
  - Offer price

Commitment Recommendations

Deployment Decision by Operators based on:

- Capacity Need
- Location
- Response-time of recommended resources for commitment

LMR Deployment Instructions sent to MPs

MISOs Response to Including PRM Allocation with the Demand Response and Emergency Resources Reforms

2

- MISO agrees with Stakeholders that there should be alignment of the PRM Allocation and accreditation of all resources

- Resource adequacy reforms have been a series of discrete and deliberate efforts (such as Seasonal accreditation, slopped demand curves, etc.) and MISO views the PRMR allocation as the next important step in the overall evolution of its RA construct.

- MISO will indicate in the Tariff Filing a need to ensure alignment between the accreditation of resources and load obligation assigned to LSEs; and MISO welcomes stakeholder feedback regarding the appropriate methodology through the parallel effort on PRMR allocation

MISO Considered Two Options regarding which Hours to use for accreditation

Both options measure Capability during times of risk

Design Element	Option 1	Option 2
Accreditation Methodology	Identical methodology for either option	
Selection of Hours for Accreditation Calculation	Capacity At Risk Hours + All RA Hours	All RA Hours
When will Capacity Availability impact Capability?	Only during Capacity At Risk Hours, see the Availability section for more information	All RA Hours
Accreditation penalty when declaring oneself unavailable	Inherent in accreditation calculation 0 MWs of Capability are used during Hours in which the resource was unavailable for deployment No additional penalty required	Same provisions as Option 1 with an additional penalty term added. Penalty to be applied as a scalar = $\frac{Number\ of\ Times\ Available\ during\ LMR\ deployments}{Total\ Times\ Deployment\ instruction\ issued\ by\ MISO}$

*Capability and Capacity Availability are new proposed Module A definitions; see Appendix

Two examples demonstrate why a penalty is necessary under Option 2

Scenario 1	Scenario 2
• Summer Scenario • 100 MW Resource • Deployed once already • Capacity Advisory declared from 9am day 1 until 11 pm day 2 – 38 hours • The resource does not deploy during this event • Four of these hours are RA Hours • There are 61 RA Hours that occur outside of this Capacity Advisory during the Season	• Winter Scenario • 100 MW Resource • Deployed once already • A winter storm occurs, necessitating two deployments in a single day • The resource deploys in the morning event, does not deploy in the evening event • There are 53 RA Hours that occur outside of this Emergency event

Example of accreditation Scenario 1

																													Scheduling Instruction									
Time	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	RA Hours				19	20	21	22
Metered Output	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Capacity Availability	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	0	0	0	0	0	0	0	0	100	100
Option 1 Capability	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Option 2 Capability	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	-	-	-	-

- The resource is unavailable during the Scheduling Instruction, which occurs during hours 15 – 18 and these are the only RA Hours that occur
- Under Option 1, the entire Capacity Advisory period receives 0 MW Capability
- Under Option 2, only the RA Hours receive 0 MW as the other hours are not included in the accreditation

Option 1: Capacity At Risk + RA Hours

- ISAC = $\frac{61}{99} * 100 + \frac{38}{99} * 0 = \mathbf{61.6\ MW}$

Option 2: RA Hours Only

- Without penalty

ISAC = $\frac{61}{65} * 100 + \frac{4}{65} * 0 = \mathbf{93.8\ MW}$

- With penalty

ISAC = $\frac{1}{2}\left(\frac{61}{65} * 100 + \frac{4}{65} * 0\right) = \mathbf{46.9\ MW}$

Under Option 2, without the penalty, a resource that performs once takes a very small accreditation penalty significantly distorting the incentive to perform.

Example of accreditation Scenario 2

			Scheduling Instruction				RA Hours			Scheduling Instruction							
Time	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Metered Output	100	100	0	0	0	100	100	100	100	100	100	100	100	100	100	100	100
Capacity Availability	100	100	100	100	100	100	100	0	0	0	0	0	0	0	0	100	100
Option 1 Capability	-	-	100	100	100	0	0	0	0	0	0	0	0	0	0	0	0
Option 2 Capability	-	-	100	100	100	0	0	0	0	0	0	0	0	0	0	0	0

- The resource is available during the first Scheduling Instruction, and unavailable during the second
- Under both options, all hours after the end of the first Scheduling Instruction receive 0 Capability

Option 1: Capacity At Risk + RA Hours

- ISAC = $\frac{53}{65} * 100 + \frac{12}{65} * 0 = \mathbf{81.5\ MW}$

Option 2: RA Hours Only

- Without penalty

  ISAC = $\frac{53}{65} * 100 + \frac{12}{65} * 0 = \mathbf{81.5\ MW}$
- With penalty

  ISAC = $\frac{1}{2}(\frac{53}{65} * 100 + \frac{12}{65} * 0) = \mathbf{40.8\ MW}$

Under Option 2, the penalty for failing to perform a 2nd time in a single day may be too high.

One of the design objectives of the current reforms is to capture the availability of resources during times when reliability is crucial

- Market Participants prefer to have the flexibility to make its resource less available than its maximum capability – this should be accredited accordingly
- Over-estimation of Capacity Availability of a resource creates a threat to the reliable operation of the Bulk Electric System – resources over-stating their Capability in real-time results in fewer LMRs being deployed than necessary
- Option 1 ties Capacity Availability to Hours known in real-time by Market Participants
    - This ensures information is available to MISO operators in a timely manner when emergency conditions occur
- Option 2 ties Capacity Availability to Hours that may not be known in real-time by MPs

MISO recommends Option 1 for the following reasons:

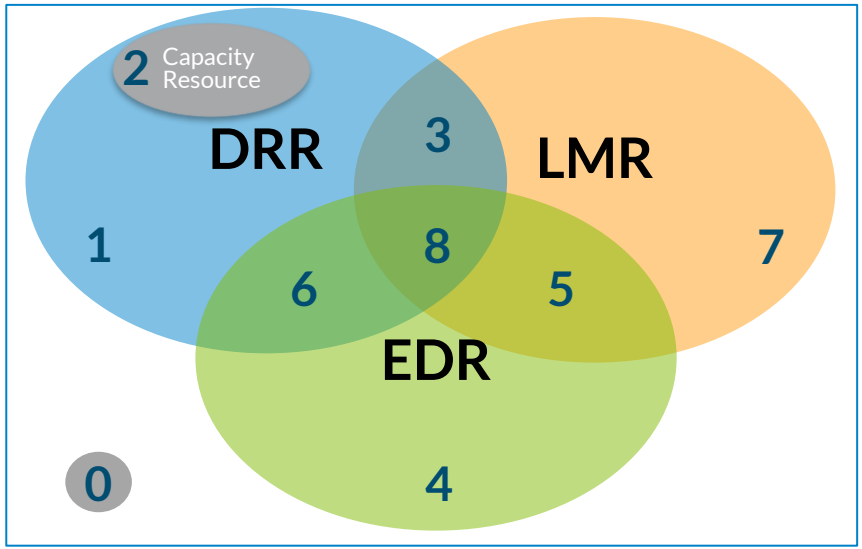
- Option 1 meets MISO's need to ensure availability of accurate capacity information for deployment decisions, while minimizing the burden on stakeholders to report availability for each hour of the year

- Option 1 incentivizes a resource to perform without being overly penalized due to its unavailability

- Option 1 provides all Hours included in Option 2, and additional hours representing periods of higher reliability risk, stabilizing accreditation

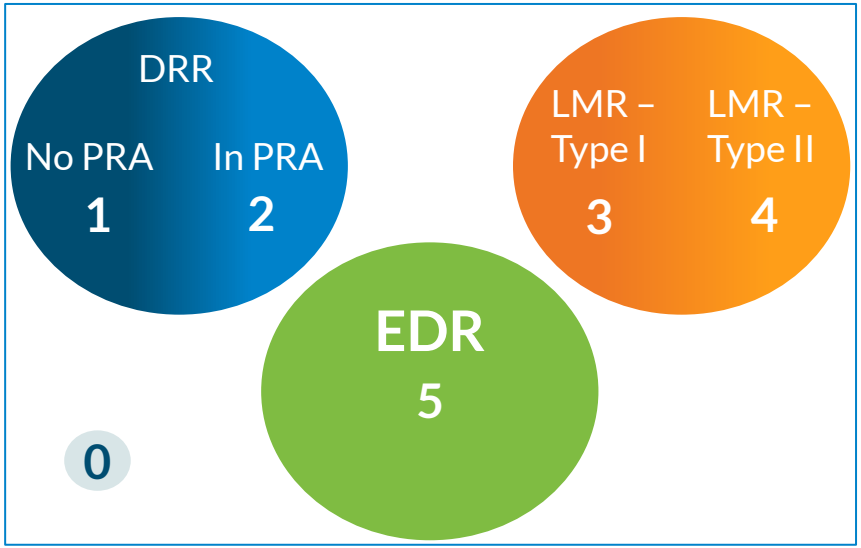
Participation Options

Current Participation Options



#	Comments/Notes
0	Not MISO registered
1	There is no DRR "must offer" requirement since there are no capacity credits
2	Uncommon approach for DRR; resource "must offer" in Energy & AS markets
3	LMR receives capacity credits and resource can optionally offer into the Energy & AS markets
4	EDR only; no capacity credits or "must offer" requirement
5	LMR that optionally provides an EDR offer for emergency energy
6	Similar to "1" but can optionally participate in emergencies
7	LMR only; not involved in Energy and AS markets
8	Similar to "5" but can optionally participate in Energy & AS markets

Proposed Participation Options



#	Comments/Notes
0	Not MISO registered
1	DRR that has chosen not to participate in the PRA, deployed economically, any lead-time, 100% voluntary
2	DRR that is participating in the PRA, deployed economically, 6 – hour lead time, deploy at least once
3	LMR – Type I deploy during Maximum Generation Warning Stage, 6-hour lead time, deploy at least once
4	LMR – Type II deploy during EEA 2 Stage, 30-minute lead time, deploy to all Scheduling Instructions
5	EDR only; no capacity credits or "must offer" requirement

- The proposed design simplifies the participation options by eliminating dual registration
- LMR – Type I resources created to allow resources with a 6-hour response time to participate and be effectively used
- Removes accreditation incentive on the choice of which instrument to participate as

Participation requirements, obligations, and economic implications are tied to the four participation options

DRR

- Economic Deployment
- Receives Locational Marginal Price (LMP)
- May provide ancillary services
- 6-hour response
- Must deploy once
- May become unavailable at the cost of accreditation
- Test 1x/3yr

LMR – Type I

- Max Gen Warning
- No LMP
- 6-hour response
- Must deploy once
- May become unavailable at the cost of accreditation
- Test 1x/3yr

LMR – Type II

- EEA 2
- No LMP
- 30-minute response
- Must deploy for all events
- Test 1x/1yr
- Testing opt out available

Deployment ordering is based on participation type

1 — Demand Response Resources

- Economic deployment
- Least-cost dispatch

2a — LMR – Type I

- Max Gen Warning
- Longest lead time resources deployed first

2b — AME Resources

- Max Gen Warning
- Least-cost dispatch

3 — LMR – Type II

- May be deployed in anticipation of or beginning with EEA2 events
- Locational Dispatch

MISO is evaluating Emergency Operating Procedures, and this slides ordering reflects current operating practices.

Available Max Emergency Resources

"MISO plans a follow-up filing in the near future to further refine how MISO uses these Resources to increase reliability…and would consist of the following provisions:

- *Account for restricted availability in accreditation as suggested by stakeholders; and*
- *Allow Operators to call on AME Resources in anticipation of Emergency Declarations when their lead time is greater than 2 hours.*

The addition of different accreditation for AME Resources, based on Resource lead time and suggested by stakeholders, will help align the capacity value of these Resources with their availability."

Qualifications

1) The resource has offered using an Emergency Commitment Status at least 110 Hours in a Season in the Day Ahead Energy and Operating Reserve Market.

2) The resource has offered using an Emergency Commitment Status for at least 110 Hours in a Season in the Real Time Energy and Operating Reserve Market.

Obligations

Same as any other Capacity Resource with following modifications:

1) The resource may have a maximum response lead time of six hours. Longer lead times will receive NO accreditation

2) No outage exemptions permitted in Seasons operating as an AME Resource.

The 2023 AME Resource filing was accepted by delegated letter order in *Midcontinent Independent System Operator, Inc.*, FERC Docket No. ER23-1523-000 (May 31, 2023).

Participation Options are aligned with MISO's Market Design Guiding Principles

- These participation options:
  - Facilitate non-discriminatory market participation regardless of resource type, business model, sector or location
  - Support Market Participants in making efficient operational and investment decisions
  - Maximize alignment of market requirements with system reliability requirements

Testing

Need for testing reforms arises due to resources clearing the PRA whose ability to perform is unclear

Current Testing

- Self Performed
- Does not test for response time
  - IMM has concerns with how resources are enrolling
- Resources only need to test to 50% of enrolled value
- Rules regarding how much a resource must test to and enroll for are being abused

Proposed Testing

- Near-term changes to address how self tests are performed*
  - Response time explicitly defined
  - Rules regarding the tested value are being clarified and put into effect immediately
- Long-term changes include a MISO initiated test to verify the enrolled parameters of resources
  - MISO initiated testing is required to verify load customers are paying for resources that can perform to the stated parameters

*MISO plans to have more discussion on proposed near-term changes as a stand-alone topic at the January 15, 2025, RASC meeting

Testing Requirements

- At enrollment, all DRR and LMR resources need to perform a self-test
  - All newly enrolled resources will be tested by MISO after clearing the PRA
- MISO-initiated testing will be as follows:
  - **DRR and LMR – Type I** that are *not using* a statistical M&V process — 1 test every 3 PY
  - **DRR and LMR – Type I** *using* a statistical M&V method — 1 test per PY
  - **LMR – Type II** — 1 test per PY*
- Successful deployment in response to scheduling instructions satisfy this requirement

M&V: Measurement and Verification

PY: Planning Year

* LMR – Type II that opt-out will be required to test once every 3 PY

Testing Procedure

Enrolled response time and stated Capacity Availability will be tested

The Capacity Availability is whatever the resource is capable of providing at the time of the test and must drop to or below the Firm Service Level (i.e., a resource is not obligated to increase load to be tested)

- Tests may be performed in any season in which an LMR has cleared zonal resource credits (ZRCs)
- Resources will be informed of a test one day in advance
- A test may be rescheduled once without penalty
- Resources may not Self Schedule during tests
- A test is fully passed if a resource achieves its stated Capacity Availability, reduces to or below its Firm Service Level, and does so within the total enrolled response time

Response time = Start-Up/Shut-Down Time + Start-Up/Shut-Down Notification Time

Test Consequences – Partial Failure

Partial failure – producing greater than 50% and less than the Tolerance Band within the enrolled time or failing to reduce to or below the Firm Service Level

- A resource experiencing a partial failure may elect to participate in a retest within 90 days of failing the test
- If at least 50% has been achieved within the enrolled time, and the resource achieves 100% within 6 hours, then the enrolled time will be changed to the tested time and no penalties will be applied

Penalty: ACP * "Shortfall amount" until a retest, not to exceed cleared ZRCs

Response time = Start-Up/Shut-Down Time + Start-Up/Shut-Down Notification Time

Test Consequences – Complete Failure

Complete failure – defined as producing less than 50% of the stated capability within the enrolled response time

- A resource experiencing a complete failure will be retested within 90 days of failing the test
- Two complete failures in a Planning Year results in disqualification for the remainder of the Planning Year

Penalties are ACP * Cleared ZRC for entire Season the test was failed in plus the days in the next Season, until the resource passes the retest

Response time = Start-Up/Shut-Down Time + Start-Up/Shut-Down Notification Time

MISO Market Design Guiding Principles
Testing

- These participation options:
  - Support an economically-efficient wholesale market system that minimizes cost to distribute and deliver electricity
  - Support Market Participants in making efficient operational and investment decisions
  - Maximize alignment of market requirements with system reliability requirements

Penalty Provisions

Current penalties need to be strengthened

Current Penalty Provisions

- Partial and Complete failures to perform are ill-defined
- MISO is aware of resources that are enrolling that may not perform – no MISO initiated test or issued Scheduling Instruction means these resources cannot be removed
- With rising PRA prices, real-time penalties are not sufficient to disincentivize enrolling resources that cannot perform to the enrolled parameters

Proposed Penalty Provisions

- Well-defined criteria to determine partial and complete failure to perform
- Testing and penalties work together to ensure resources that are deployed infrequently are capable of performing to the value they are being paid for
- Inclusion of capacity payment penalties increases the likelihood that penalties are a deterrent to enrolling resources that cannot perform

There are three types of Tolerance Bands to consider

1. Performance Tolerance Band

The Tolerance Band is defined in 40.3.4 and is equal to ± 12%, with a minimum tolerance of 6 MW and a maximum tolerance of 30 MW for resources above 10 MW. For resources below 10 MW, the tolerance is ±1 MW.

2. Firm Service Level Tolerance Band

A resource achieves its Firm Service Level if it reduces load to within the minimum of 10% or 1 MW of the Firm Service Level. A resource with 0 Firm Service Level will have a Tolerance Band of 0.1 MW.

3. Capacity Availability Tolerance Band (for accreditation)

A resource will receive full Capability during an Hour if it submits an Availability offer within ±12% of the Load less Firm Service Level, with a minimum tolerance of 6 MW and a maximum tolerance of 30 MW for resources above 10 MW. For resources below 10 MW, the maximum tolerance is ±1 MW.

Increased Penalties Logic

- Strengthening penalty provisions is necessary to ensure truly reliable resources clear
- Penalties will be applied for two scenarios:
    1. **Partial failure to perform**: achieving at least 50% of the stated Capacity Availability within the enrolled response time
    2. **Complete failure to perform**: achieving less than 50% of the stated Capacity Availability within the enrolled response time
- Penalties impacting accreditation will only apply to the cleared ZRC portion
- Real-time penalties may apply regardless of how many ZRC cleared

ZRCs: Zonal Resource Credits

Performance Penalties for a Partial Failure to Perform

- **Real-Time Penalties**
  - DRR subject to excessive/deficient energy charges
  - LMR charged ACP * “Shortfall amount” + RSG
    - LMR will not be charged for excessive energy
  - DRR remain eligible for excessive energy charges, LMR are not
- **Accreditation Penalties**
  - DRR and LMR will be charged ACP * “Shortfall amount” until tested or successfully respond to a scheduling instruction
  - Accreditation penalties apply only to deficient energy, never excessive

RSG: Revenue Sufficiency Guarantee; ACP: Auction Clearing Price

Performance Penalties for a Complete Failure

- Must replace cleared ZRCs that are disqualified
- Resource that is used to replace will receive a MISO-initiated test immediately
- If no replacement, or the replacement resource does not completely pass its test, then Capacity Replacement Non-Compliance Charge shall be applied for the entire Season(s)
    - This charge continues into other seasons during the planning year that the resource was disqualified in at the amount of cleared ZRCs per Season
- If a resource completely fails 2 times in 3 years (2 failed tests in 1 planning year count as 1 complete failure for these purposes), it will be disqualified from the PRA for three (3) PRAs

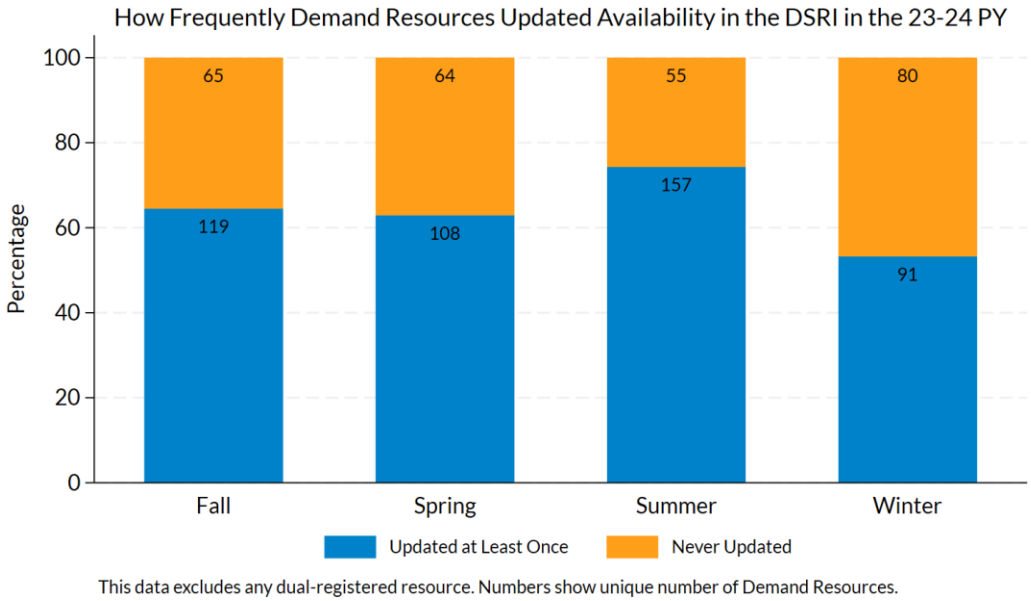
PRA: Planning Resource Auction; ZRCs: Zonal Resource Credits

MISO Market Design Guiding Principles
Penalties

- These participation options:
  - Develop transparent market prices reflective of marginal system cost and cost allocation reflective of cost-causation and service beneficiaries
  - Maximize alignment of market requirements with system reliability requirements

Capacity Availability and Firm Service Level

Availability information is not being updated



This data excludes any dual-registered resource. Numbers show unique number of Demand Resources.

- In the Summer, 25% of non-dual-registered DR LMRs did not update information in the DSRI, despite there being two Emergency declarations in this Summer
- In other Seasons the number of DR never updating the DSRI varies between 33 and 50%
- Between 100 and 120 thermal BTMG, representing 40%-50% of all enrolled thermal BTMG do not update information in the DSRI
  - MISO has no indication these resources were on outage at any time during the Season and must assume they were 100% Available
- These numbers highlight the need to change market rules

Capacity Availability

Capacity Availability: The amount of real time Energy a DRR or LMR makes available to the Transmission Provider for deployment during a Capacity At Risk Hour.

- A resource is expected to update its Capacity Availability during all Hours of the Season – this is the current Tariff requirement
    - Capability will be reduced during all Capacity At Risk that the Capacity Availability is outside of the Tolerance Band (examples shown in accreditation section)

Firm Service Level

Firm Service Level: The amount of customer Load, in MW, that is intended to always be consumed by an end-use customer.

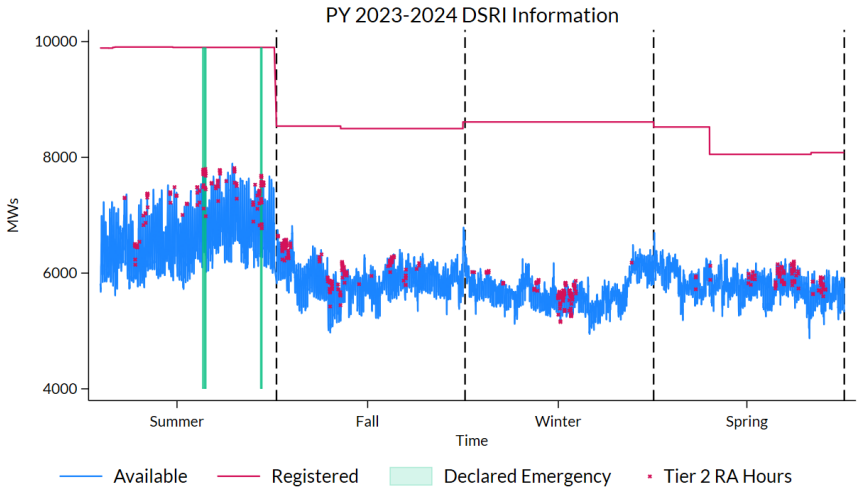
- Firm Service Level will be an enrollment parameter submitted by ALL market participants enrolling demand resources
  - Statistical methodology demand resources should enroll 0 for the Firm Service Level
- Tariff language was clarified that ALL accredited MWs need to be included in the load forecasts to prevent double counting MWs
  - MISO will provide LSEs with accreditation values of DRR and LMR assets by October 1 for the following year's Planning Resource Auction

MISO Market Design Guiding Principles
Capacity Availability

- These participation options:
  - Support an economically-efficient wholesale market system that minimizes cost to distribute and deliver electricity
  - Facilitate non-discriminatory market participation regardless of resource type, business model, sector or location
  - Support Market Participants in making efficient operational and investment decisions
  - Maximize alignment of market requirements with system reliability requirements

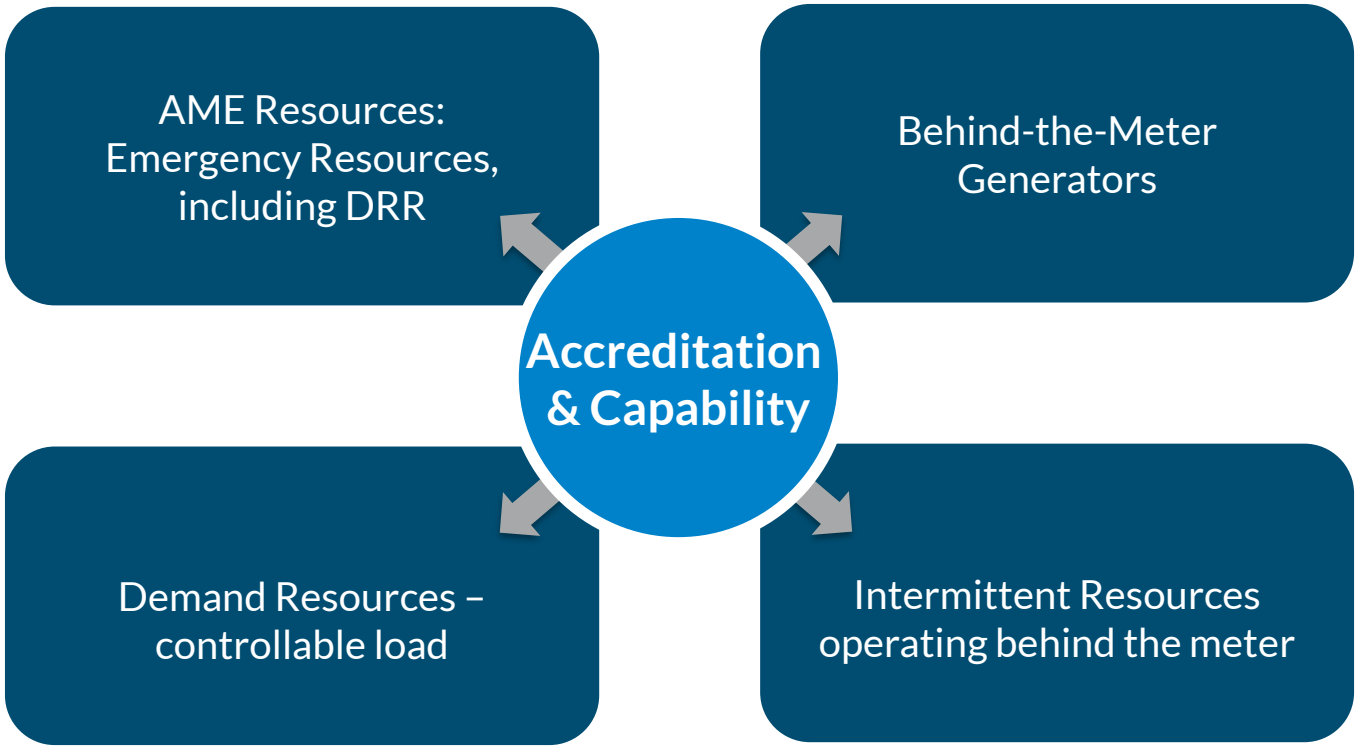
Accreditation

DSRI information indicates ~2 GW is being accredited that is never Available or Self Scheduled



- This gap does not include the extra gross up from line losses and PRM
- This means approximately 2 GW of capacity is being accredited that does not exist
- Assumes all information in the DSRI is accurate

Accreditation and Capability depends on the type of underlying resource enrolled



Capability Logic

- Capability answers the questions:
  - What could the resource have provided had it been deployed?
  - How to accredit a resource that has deployed?
- Generator analog to capability is the offer that these resources submit
  - Generators may or may not operate at full offer, but are accredited based on their offers
- Capability varies by underlying resource
- Each hour has a capability value

Accreditation of DRR and LMR backed by BTMG

- BTMG can participate as a DRR or LMR
  - BTMG must be able to respond continuously for at least 4 hours
  - If contractual run time limits are reached, cleared ZRCs backed by BTMG must be replaced
- When operating, capability is the amount of energy being produced
- When not operating, capability is the amount of availability submitted to MISO
- Capacity At-Risk Hours and RA hours will be used
  - No weights will be applied
- Resource Class UCAP and Resource Class ICAP values come from the same Resource Class as Schedule 53A Resources, but DRR and LMR backed by BTMG will not be included in the Resource Class values
- BMTG will continue to have line losses added

Accreditation of Intermittent BTMG

- Intermittent BTMG accreditation is calculated across all hours of the planning year
- Hours are weighted using same Tier 1 and Tier 2 RA hour weights for Schedule 53A Resources
- Resource Class UCAP and Resource Class ICAP values come from the same Resource Class as Schedule 53A Resources, but Intermittent BTMG will not be included in the Resource Class values
- No outage exemptions are permitted
- Actual metered data is used for each hour
    - Hours without metered values will be treated as zeros

Accreditation of AME Resources

- AME Resources are generation resources with a commitment status of available during emergency only
- Accreditation changes from Schedule 53A:
  - Replace Tier 1 and Tier 2 RA Hours with Capacity At Risk Hours and Tier 2 RA Hours only
  - No outage exemptions
  - AME resources will be excluded from Resource Class calculations like BTMG
- A resource may be subject to Schedule 53A in some seasons and Schedule 53B in others

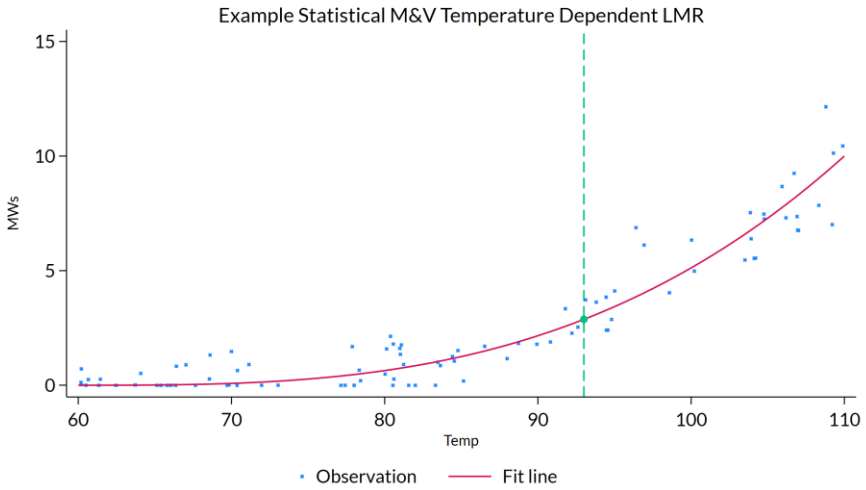
Accreditation of DRR and LMR backed by Demand Resources

- Demand Resources can participate as a DRR or LMR
- Demand Resources are broken into two categories
    1. Statistical M&V
    2. Direct M&V
- Statistical M&V specified in Attachment TT
    - Accreditation described below
- Direct M&V
    - Capability described below

Statistical M&V Demand Resources

- At enrollment, a Demand Resource using a statistical M&V methodology as defined in Attachment TT will be required to submit an expected load curve
    - This type of methodology is currently being used as a Custom Baseline and under one of the current Consumption Baseline processes
- Accreditation will be determined using this expected load curve and any relevant parameters
- Resources are tested each planning year
    - Test may lower accreditation, will never raise
    - No opt-out for these resources regardless of participation model
- Firm Service Level for these resources is always zero
    - MISO does not expect these resources to have zero load, rather the methodology to measure their performance will handle the performance calculation so no FSL is required
- Line losses and the PRM will continue to be included in the accreditation of all Demand Resources

Example of a Statistical M&V Load Curve



- Market Participants are required to submit a Load Curve when participating in a Statistical M&V process as defined in Attachment TT
- This is a temperature dependent resource
- When tested on a 93˚ day, MISO expects performance of ~2.9 MWs to be successful
- Accreditation will be built off of the curve and weather normalized temperature for each Capacity At Risk and RA Hour within a Season

Direct M&V Demand Resource

- At enrollment, a Demand Resource will submit a Capacity Rating (maximum Load), Load Factor, and Firm Service Level among other parameters
    - These are used to set the bounds around the Capability calculations
- Newly registered resources will use the Load Factor times Capacity Rating (a MP may request lower accreditation) to determine initial accreditation
    - This will be based on Capacity At Risk Hours and RA Hours when possible
- Accreditation uses Capacity At-Risk Hours and RA hours
    - No weights are applied to these hours
- Line losses and the PRM will continue to be included in the accreditation of all Demand Resources
    - The RBDC Opt Out adder is not applicable in this context as the main purpose for RBDC Opt Out adder is to reflect expected MW cleared in the PRA and not to overly incentivize or disincentivize LSEs to use RBDC Opt Out option.

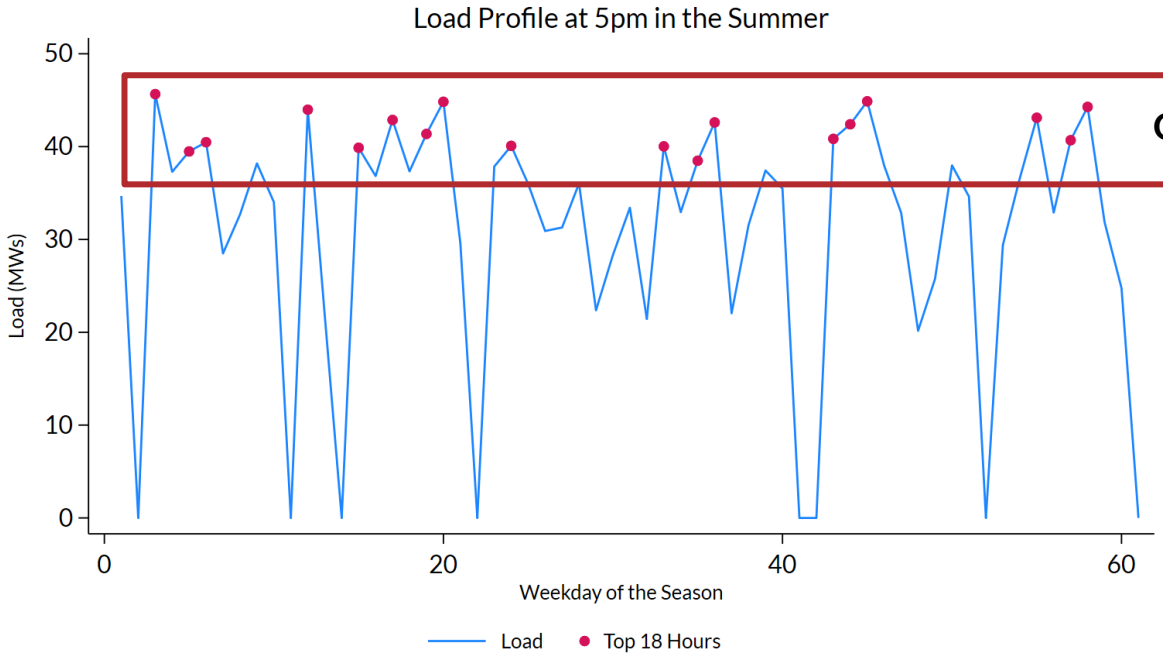
Seasonal Capability

WHY: The logic of seasonal capability comes from the problem that the accreditation design incentivizes increasing load during the highest risk hours

- MISO will accredit Demand Resources that reduce load at a very high rate to remove this incentive
- Ideally, each hour of the day will use the largest load consumed in the season during that hour of the day for the seasonal capability
- Enough hours need to be used to make it expensive to artificially increase load

SOLUTION: Take the average of the top 18 hours which is equivalent to the average load across a 3-week span for each hour. This gives enough hours to prevent gaming, while providing a large enough incentive to lower Load to or below the Firm Service Level if a Market Participant wishes to obtain more accreditation

Visual example of seasonal capability calculation with a resource that has a Firm Service Level of zero

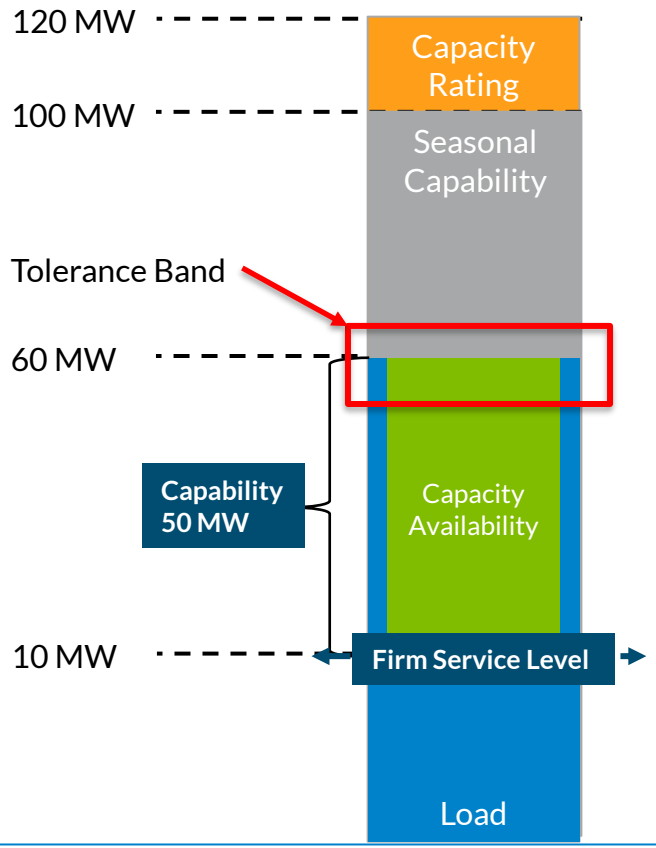


Of the 61 hours, the top 18 are chosen

- The average value becomes the seasonal capability for the 5 p.m. hour on weekdays
- 42 = avg. seasonal capability

If there was a Firm Service Level of 10 MW, the Seasonal Capability would be 32

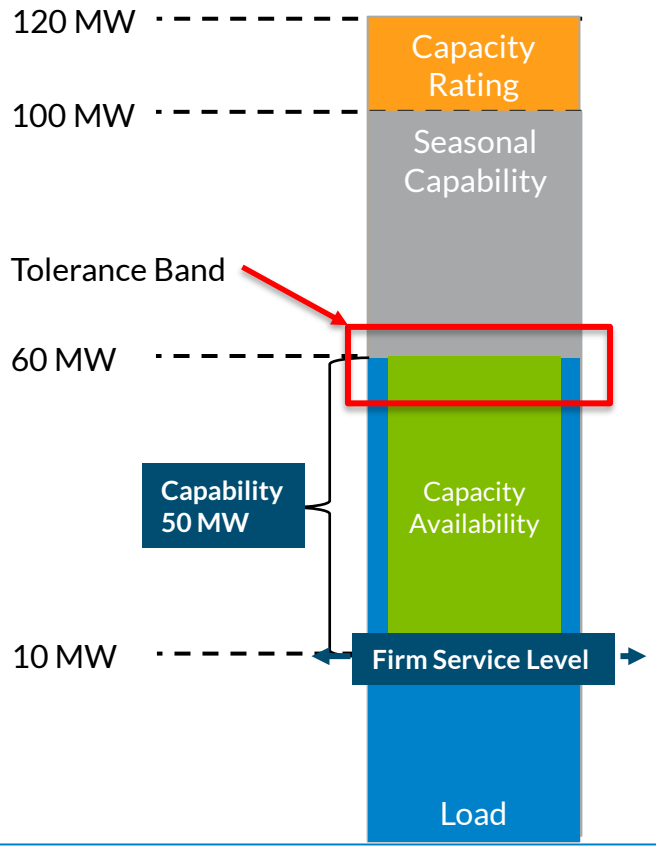
Demand Resource Capability Examples



- The registered capacity of a Demand Resource.
- Seasonal Capability is the average of the top 20% of actual Load within a Season, by Hour with separate profiles for weekends and weekdays.
- Capacity Availability is the amount of Load reduction availability submitted by the Market Participant and is used as the basis to deploy these assets.
- Load is the amount of Load that is Metered in the Hour.
- Firm Service Level is the amount of customer Load that is intended to always be consumed. The Firm Service Level is achieved if the resource is at or below 0.1 MW if the Firm Service Level is 0 and the maximum of 10% or 1 MW if it is above 0.
- Tolerance Band is the allowed deviation from the Load less Firm Service Level. Deviations outside of the Tolerance Band will result in reduced accreditation.

This example represents a single Hour. Every Hour occurring during a Capacity At Risk Hour or RA Hour will have its own calculated value.

Demand Resource Capability Example: Base Case



Load: 60 MW

Capacity Availability: 50 MW

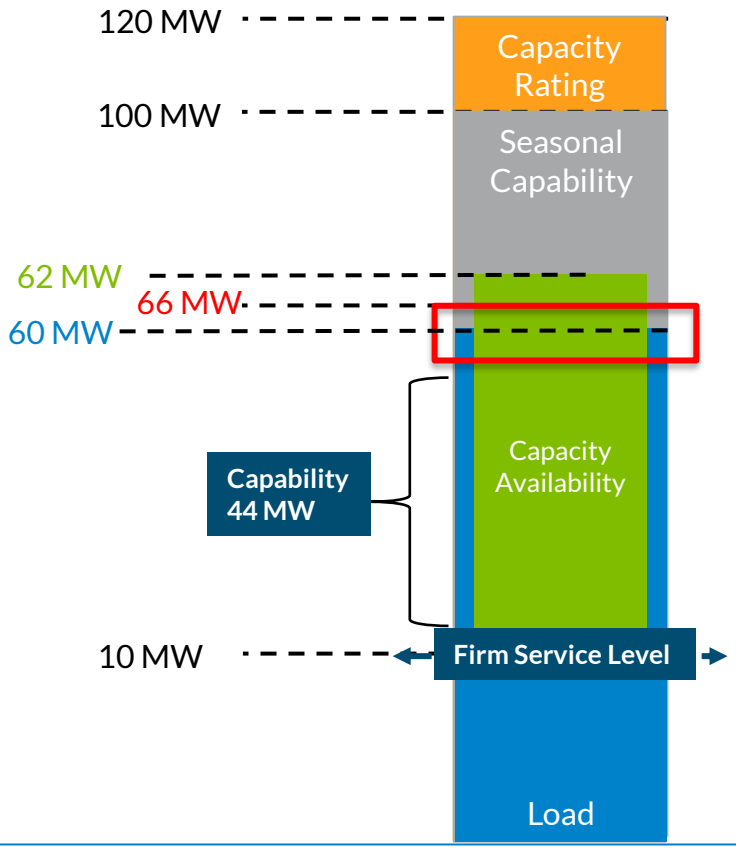
Under this scenario, the Load being consumed is greater than the Firm Service Level and the Capacity Availability is within the Tolerance Band.

This Hour would receive 50 MW of Capability.

It is always the Load that determines the final accreditation, not the stated Capacity Availability, unless the Capacity Availability is outside of the Tolerance Band.

This example represents a single Hour. Every Hour occurring during a Capacity At Risk Hour or Tier 2 RA Hour will have its own calculated value.

Demand Resource Capability Example: Availability – Overstate



Load: 60 MW

Submitted Capacity Availability: 62 MW (72 MW – 10 MW)

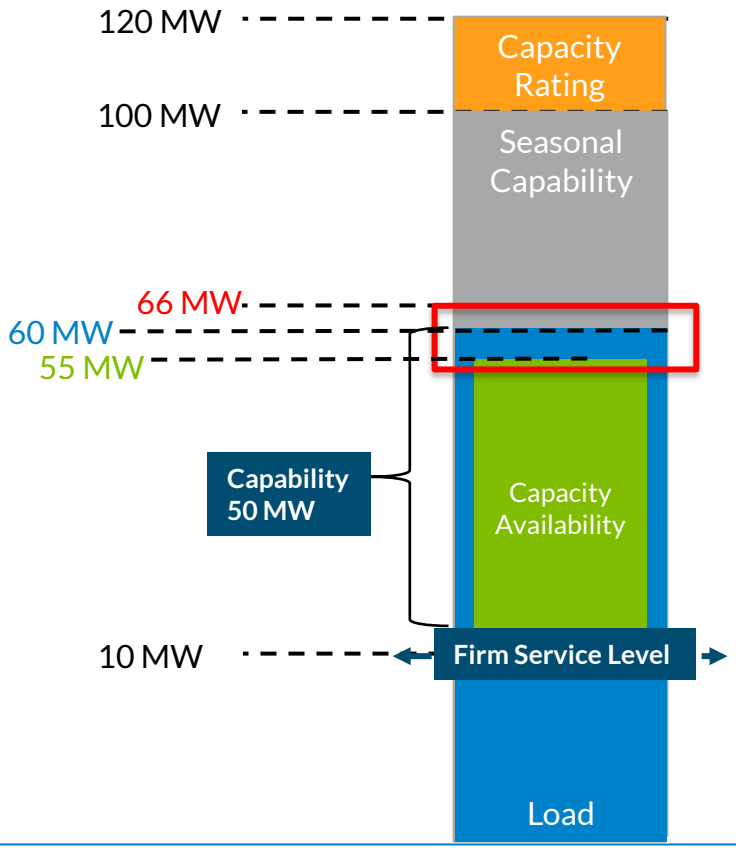
Same scenario, but now the Capacity Availability is outside of the Tolerance Band of 6 MW (50*0.12=6 MW)

- The 50 is the Load (60) less the Firm Service Level (10)

Because the offered Capability Availability (62 MW) is 6 MW above the upper bound of the Tolerance Band (62 MW– 56 MW), this hour would receive 50 MW – 6 MW = 44 MW of Capability.

This example represents a single Hour. Every Hour occurring during a Capacity At Risk Hour or RA Hour will have its own calculated value.

Demand Resource Capability Example: Availability – Understate



Load: 60 MW

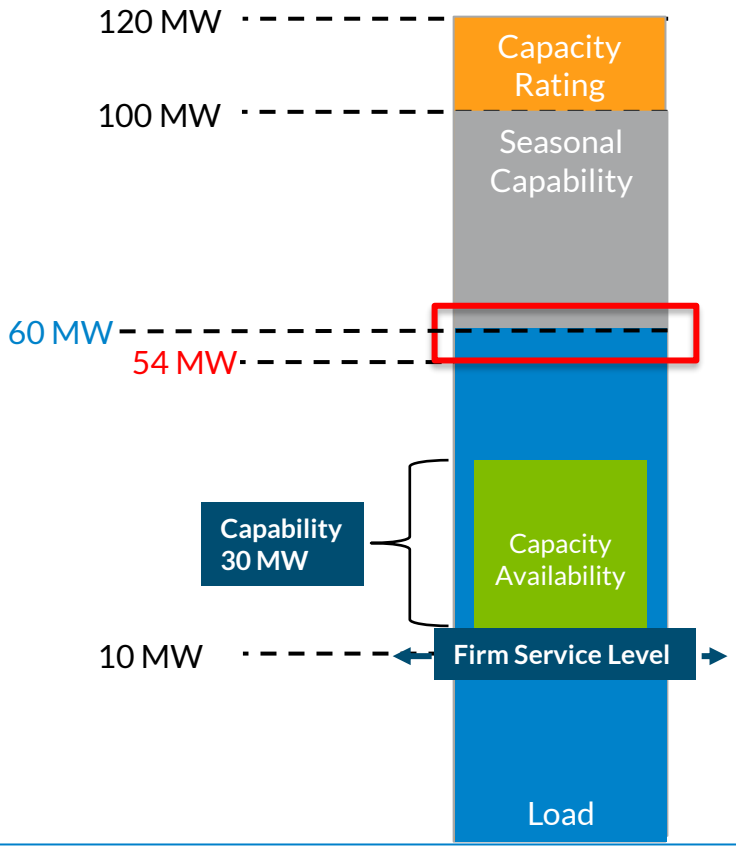
Submitted Capacity Availability: 45 MW (55 MW – 10 MW)

The Capacity Availability is short of the true Capability but within the Tolerance Band of 6 MW

Because the offered Capability Availability, 45 MW, is within the Tolerance Band, it will be considered a full Availability offer and the resource will be given a Capability of 50 MW.

This example represents a single Hour. Every Hour occurring during a Capacity At Risk Hour or RA Hour will have its own calculated value.

Demand Resource Capability Example: Availability - Understate



Load: 60 MW

Submitted Capacity Availability: 30 MW

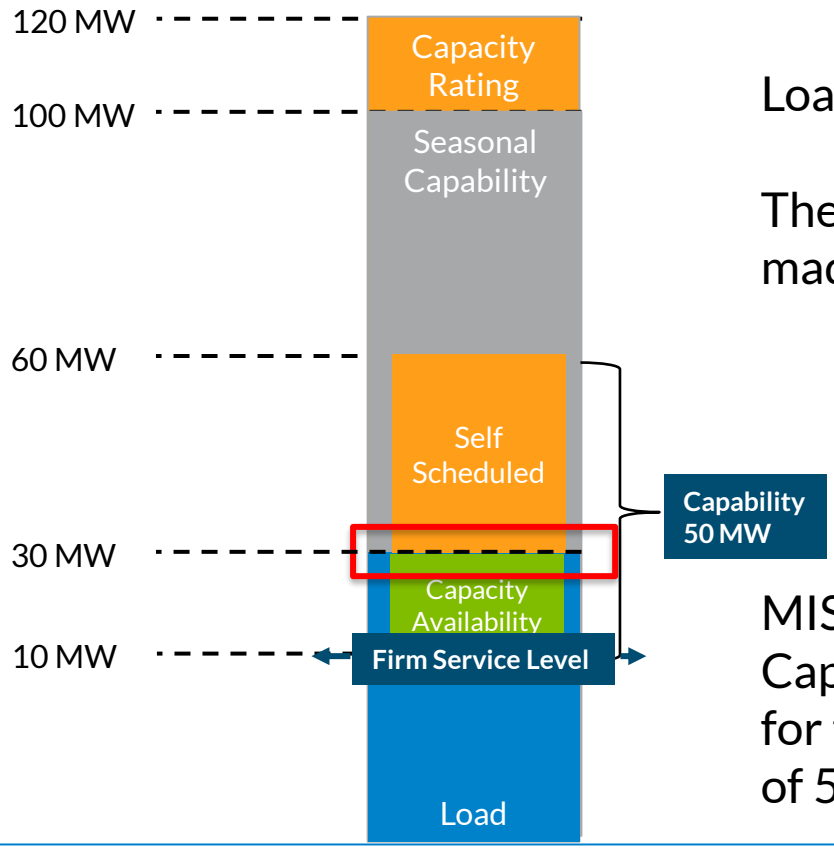
Because the resource has submitted a Capacity Availability below what the total Load they could provide, MISO assumes the resource does not wish to provide the full Load in reduction and gives the submitted Capacity Availability as the accredited value.

This example represents a single Hour. Every Hour occurring during a Capacity At Risk Hour or Tier 2 RA Hour will have its own calculated value.

MISO's design includes accreditation credit for Self Scheduling

- A resource may receive Capability credit for the Self Schedule under the following circumstances:
  - It is a BTMG operating
  - It is a Demand Resource that meets the following criteria:
    - The Self Schedule occurred during a Capacity At Risk Hour
    - The Self Schedule can be verified using the appropriate M&V methodology
    - The Self Schedule was not preceded by an increase in Load
    - The Self Schedule is maintained for at least 4-hours

Demand Resource Capability Example: Self Schedule I



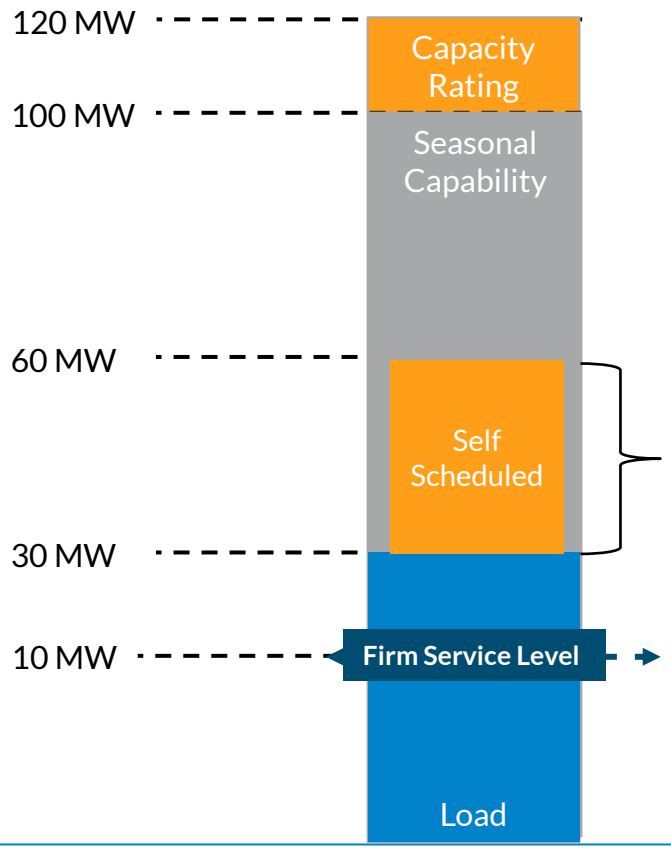
Load: 60 MW

The Resource has Self Scheduled 30 MW and made the remaining 20 MW available.

MISO will count both the Self Schedule and Capacity Availability towards the Capability for this Hour resulting in a Capability value of 50 MW.

This example represents a single Hour. Every Hour occurring during a Capacity At Risk Hour or RA Hour will have its own calculated value.

Demand Resource Capability Example: Self Schedule II



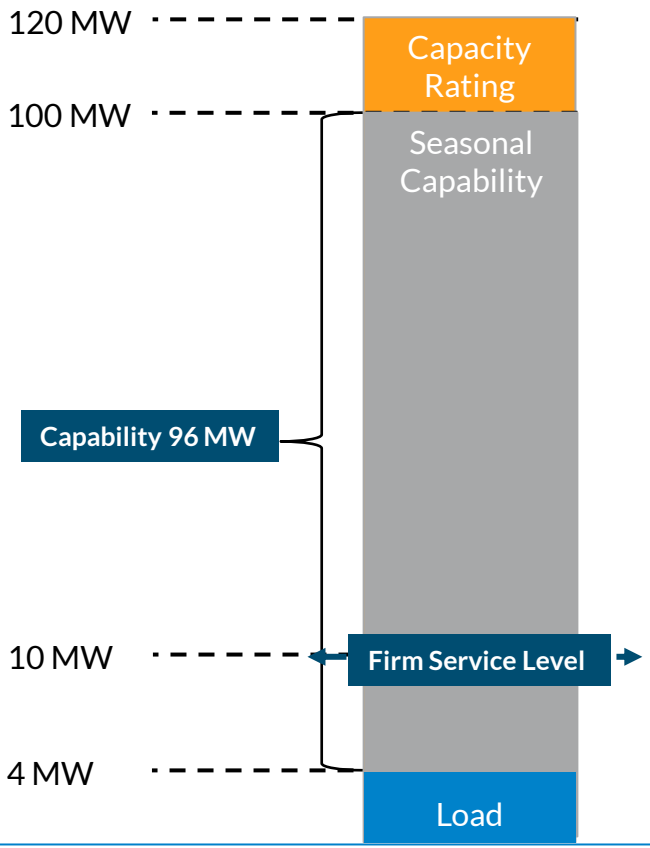
Load: 60 MW

The Resource has Self Scheduled 30 MW and has made itself unavailable for the remainder.

MISO will only count the Self Scheduled for this Hour resulting in a Capability value of 30 MW.

This example represents a single Hour. Every Hour occurring during a Capacity At Risk Hour or Tier 2 RA Hour will have its own calculated value.

Demand Resource Capability Example: Load Curtailed



Load: 4 MW

The Resource is operating at or below its Firm Service Level. In this case, at 4 MW.

MISO will incentivize having Load at or below the Firm Service Level through the use of the Seasonal Capability calculation.

In this scenario, the resource would receive a Capability of 96 MW for the Hour provided MISO has calculated Seasonal Capability of 90 MW.

This scenario occurs when a resource is operating below its Firm Service Level for any reason

Resource Deploying

Example 1										
Time	-1	0	1	2	3	4	5	6	7	8
Metered Output	47	42	40	20	5	0	20	48	47	27
Capability	37	32	50	50	55	60	50	38	37	27

- This resource has a Seasonal Capability of 50 and Firm Service Level of 10 MW. Deployment signal is sent to this resource in hour 0 and requires 3 hours to fully deploy
- Assuming the resource achieves its FSL by hour 3, it will receive the Seasonal Capability for each Hour during which it is deploying and deployed, hence 50 MW of Capability in Hours 1 and 2
- In Hour 3, the resource is operating at 5 MW, and so receives 5 additional MW of Capability (55 MW). In Hour 4, it is receiving 10 extra MW of Capability (60 MW) for operating at 0 .
- The resource does not need to go below 10 MW to receive the 50 MW of Capability
- At Hour 5, the resource is released. For this Hour, it also receives 50 MW of Capability while it ramps back up to normal production. At Hour 6, its production has returned to normal and its accreditation returns to the usual methodology.

Resource Deploying after submitting less than what they could have done

Example 2										
Time	-1	0	1	2	3	4	5	6	7	8
Metered Output	47	42	40	37	20	20	20	48	47	27
Capability	20	20	20	20	20	20	20	20	20	20

- This resource has a Seasonal Capability of 50 and Firm Service Level of 10 MW. Deployment signal is sent to this resource in hour 0 and requires 3 hours to fully deploy and only wishes to provide 20 MW of reduction.
- In this case, the resource provides 20 MW of reduction capability, and so is accredited the 20 MW for all hours.
- Hours -1, 6, 7, and 8 are accredited 20 because the resource submitted 20 MW of Capacity Availability.
- Hours 3, 4, and 5 are accredited 20 because the resource is deploying/repowering after deploying and has achieved a 20 MW reduction.
- Hours 1 and 2 are accredited 20 because the resource was in the process of deploying, successfully, and so retains the full 20 MW accreditation.
- Hours 1, 2, 3, 4, and 5 are not eligible to receive Seasonal Capability of 50 since offering less than their capability.

Impact of Response Time On Accreditation

Deployment Start

Example 3	Max Gen Warning								
Time	-3	-2	-1	0	1	2	3	4	5
Metered Output	47	53	40	42	40	30	20	10	10
Capability	37	43	30	50	50	50	50	50	50

Example 4				Max Gen Warning					
Time	-3	-2	-1	0	1	2	3	4	5
Metered Output	47	53	40	42	40	30	20	10	10
Capability	37	43	30	0	0	50	50	50	50

Orange indicates a Capacity At Risk Hour.
Red represents when the resource was deployed for.

- In both examples, a 5-hour response time resource that deploys perfectly and the resource is issued a Scheduling Instruction at Time = 0.
- In Example 3, the event began with enough time to commit the 5-hour resource.
  - Because the event began with enough time to commit the 5-hour resource, it will receive full credit
- In Example 4, the event began only 3 hours before the resource was needed
  - Because the resource has a 5-hour response time, but only had 3 hours to respond, it takes 2 zeros. MISO could not have deployed this resource rapidly enough if it had wanted to, resulting in reduction in accreditation.
  - Had it been deployable in 3 hours or less, it would not recieve any zeros.
  - Even if this resource were not deployed, it would receive 2 hours of 0 accreditation if other resources within the same LBA were deployed.

Note: MISO always strives to declare events with enough time to deploy resources effectively however, not all Emergencies can be foreseen with long lead time.

Examples for Self Scheduling but no Deployment

Example 5										
Time	12	13	14	15	16	17	18	19	20	21
Metered Output	47	42	41	30	29	27	19	16	28	39
Availability	47	42	40	30	29	27	19	16	28	39
Self Schedule	0	0	0	11	11	11	11	11	11	0
Capability	47	42	40	30	29	27	19	16	37	39

- In this example, the resource Self Schedules before the Capacity At Risk period begins.
- Therefore, the Self Schedule does not count towards Capability.

Example 6										
Time	12	13	14	15	16	17	18	19	20	21
Metered Output	47	42	40	41	40	29	19	16	28	39
Availability	47	42	40	41	40	29	19	16	28	39
Self Schedule	0	0	0	0	0	11	11	11	11	0
Capability	47	42	40	41	40	40	30	27	37	39

- In this example, the resource Self Schedules during the Capacity At Risk period and holds this value for at least 4 hours.
- It receives the 11 Self Scheduled, plus additional MWs for being available.
- If it made itself unavailable during any of the Hours in which it was Self Scheduled, it would still receive 11 MWs of accreditation.
- In no case does this count towards the resources required response to a Scheduling Instruction, as no Scheduling Instruction was received.

MISO Market Design Guiding Principles
Capacity Availability

- These participation options:
  - Support an economically-efficient wholesale market system that minimizes cost to distribute and deliver electricity
  - Facilitate non-discriminatory market participation regardless of resource type, business model, sector or location
  - Support Market Participants in making efficient operational and investment decisions
  - Maximize alignment of market requirements with system reliability requirements

Tariff Revisions

Proposed Tariff Revisions

- Module A (new definitions to the Tariff)
  - Capacity Advisory Hour
  - Capacity At Risk Hour
  - Capacity Availability
  - Energy Emergency Alert Level 1 (EEA1)
  - Firm Service Level
  - Intermittent Behind the Meter Generation
  - Load Modifying Resource – Type I
  - Load Modifying Resource – Type II

Proposed Tariff Revisions

- Module E-1
  - Conforming changes, specifically addressing references to Load Modifying Resources and Demand Response Resources
- Schedule 53A
  - Conforming changes to reflect accreditation of Schedule 53B Resources
- Attachment TT
  - Conforming changes related to meter data and Firm Service Level

Proposed Tariff Revisions

- Schedule 53B
  - Creating a new schedule to address accreditation for Schedule 53B Resources (Load Modifying Resources, Demand Response Resources, Intermittent Behind the Generation Resources, and AME Resources).
  - Adding new defined terms specifically relevant to accreditation of Schedule 53B Resources.

Timeline and Next Steps

Timeline and Next Steps

Q1 2025 FILING

- The need for a rapid filing is driven by the expected increase in data centers and other large-load additions
- Market participants have begun negotiating and signing contracts, and need clarity on the performance obligations of these resources

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Appendix

Helpful Links

- MISO Dashboard
- LMR White Paper
- Tariff Redlines
- MISO Response to Feedback