

MISO Quarterly Update: Resource Adequacy Topics

North Dakota Public Service Commission

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Resource Adequacy Topics



- Planning Resource Auction (PRA)
- Operations overview
 - Summer performance
 - Winter preparation
- Seasonal resource adequacy construct and accreditation reforms
- Managing reliability risk during the resource transition ("Mind the gap")





2022/2023 Planning Resource Auction (PRA)

The PRA has three participation models where Load-Serving Entities designate how they meet requirements, with a majority having no (or very little) price exposure



Because most participants have little to no price exposure, the PRA is referred to as a "residual auction."

⁴ * Utilities bring load and affiliated capacity into the PRA where both have price exposure, but the positions largely net with one another, resulting in only limited "net" price exposure



The PRA uses MISO and participant inputs to verify resource adequacy and produce Auction Clearing Prices at the zonal level

INPUTS

MISO

- MISO-wide reserve margin requirement
- Zonal requirements
- Transmission limitations

Participants

- Load forecast from Load-Serving Entities
- Resources and offers (\$) from suppliers

Planning Resource Auction

OUTPUTS

- "Cleared" commitment of capacity to the MISO region to meet load and reserve margin requirements
- An Auction Clearing Price (ACP) for each zone



2022-23 PRA demonstrated capacity shortfalls in MISO North/Central resulting in capacity prices equal to CONE





While total installed capacity has steadily trended up, accredited capacity is moving in the opposite direction due to the capabilities of the resource types selected





Last year's OMS-MISO survey projected tight conditions in Zones 4-7 for 2022, and post-COVID load increases drove even higher requirements for this year's auction

- The 2021 OMS-MISO survey projected surplus capacity overall for 2022 with Zones 4-7 experiencing tight conditions. However, The OMS-MISO Survey is a "snapshot in time,"
- Increased load forecasts led to a 1.4 GW increase in PRMR for 2022.
- Combined with reduced generation capacity, the auction resulted in a 1.3 GW shortfall, as opposed to the projected minimum survey surplus.







Operations Overview: Summer Performance, Winter Preparation

MISO's Market Capacity Emergency Procedures





Summer 2022 is tracking better than past summers in terms of emergency declarations...



Number of Days Under a Max Gen "Alert, Warning, or Event"



Lessons learned from the 2021 cold weather event continue to inform MISO's evolution of operations practices





MISO is planning to continue fuel assurance surveys started in 2021 to better inform winter operations

2021 Gas Fuel Survey Results



FT is Firm Transportation, IT is Interruptible Transportation





Seasonal Resource Adequacy Construct and Accreditation Reforms

The MISO resource adequacy construct establishes planning requirements, assesses accredited resource value, and helps provide visibility into local and regional capacity sufficiency

Requirements	Accreditation	Visibility
What is needed for reliability	How resources are counted, including thermal and non- thermal resources	Portfolio trends in short-term and long-term, including resource retirements and investments
		 Planning Resource Auction OMS-MISO Survey Seasonal Assessments Regional Resource Assessment



Recently filed reforms to the Resource Adequacy construct will help address today's reliability challenges and prepare for the future

	Current Annual Construct	Filed Sub-annual Construct Proposal
RA Requirements	MISO performs annual LOLE analysis to determine <u>annual resource adequacy</u> <u>requirements</u> .	MISO will calculate <u>4 distinct sub-annual</u> <u>resource adequacy requirements on a seasonal</u> <u>basis</u> .
Resource Accreditation	MISO <u>accredits conventional resources</u> <u>annually based on a 3-year forced outage</u> <u>rate.</u> excluding planned outages and other exceptions.	MISO will <u>accredit by season based on resource's</u> <u>availability (SAC) to align resource accreditation</u> <u>with availability in the highest risk periods</u> .
Planning Resource Auction	MISO <u>conducts annual Planning Resource</u> <u>Auction</u> to meet annual resource adequacy requirements.	MISO will <u>conduct independent auctions for all</u> seasons at one time to meet seasonal resource <u>adequacy requirements</u> and will require <u>a</u> <u>Minimum Capacity Obligation (MCO) prior to the</u> <u>auction.</u>

LOLE = Loss of Load Expectation | UCAP = Unforced Capacity | SAC = Seasonal Accredited Capacity "Outages" includes forced and planned outages, or de-rates reported in the MISO Outage Scheduler.



A number of key changes have been proposed, or are in the Market Redefinition workplan

Filed at FERC				
Improved Resource Accreditation	Thermal changes filed in 2021			
Resource Adequacy Construct	Proposed move from annual to seasonal filed in 2021			
Pricing	Initial scarcity price reforms were filed in 2021			
Current Activities				
Improved Resource Accreditation	Renewable and Load Modify Resources the focus in 2022			
Resource Adequacy Construct	Potential improvements to the Planning Resource Auction			
Pricing	Continued refinement of scarcity price reforms			
Resource Attributes	Considering approaches to valuing resource attributes critical to reliably operating the evolving portfolio			
Future Activities				
Pricing	Improved modeling, such as a sloped demand curve, to achieve more efficient market outcomes and price signals			





Managing Reliability Risk during the Resource Transition ("Mind the gap")

There are different definitions of reliability and different customer reactions to outage depending on causes





MISO's resource portfolio is on track for continued decarbonization in the future, necessitating controllable resources to balance weather-dependent resources





And we will continue experience a growing and widening gap between resources and availability if the transition continues outpacing our ability to adapt



Decline in dispatchable generation

(from 84% in 2020 to as little as 57% in 2030, Future 3)



Growing fuel uncertainty for coal and gas (25% of coal units had concerns about winter fuel supply in 2021)



Less certainty around imports from neighbors

(as their regions experience the same challenges as MISO)



Increased forced outage rates

(driven by aging thermal units and increased weather-dependent units)



Public policy driving the pace

of change

(e.g., EPA and state commissions driving fleet change and electrification)



The preliminary 2022 Regional Resource Assessment shows addition of largely renewable resources, coupled with retirement of controllable resources...

Nameplate Capacity RRA 2022 Survey Results Preliminary



The assessment includes information provided by members representing 75% of MISO's load



Looking at accredited capacity, planned additions are not on pace to make up for planned retirements





Estimated accredited capacity: 16.6% for wind; 35% for solar, 87.5% for battery, 90% for coal, 90% for gas, and 95% for nuclear



Despite capacity additions, accredited capacity is projected to decline due to the rapid pace of retirements of controllable resources



*Future projections calculated as change from Future 1 2022 load assumption Estimated accredited capacity: 16.6% for wind; 35% for solar, 87.5% for battery, 90% for coal, 90% for gas, and 95% for nuclear



While energy and capacity are given significant attention, there are actually many critical attributes that are required to reliably operate the system

Illustrative Attributes

- Controllability Ramp rate up Ramp rate down
 - Rapid start up
 - Minimum downtime

Available in all seasons

Fuel availability

Energy adequacy / Output sustainability

Run time limitations

Inertia

Certainty

Carbon reducing

Note: MISO and the industry as a whole are still defining attributes. This list is illustrative and not exhaustive.



Different resource types each bring a unique mix of those attributes – while every resource does not need to bring all attributes, the system will need an "adequate" supply of each

	Attribute	Battery	Coal	Gas	LMR	Nuclear	Solar	Wind
Controllability	Ramp rate up				٠	O	O	O
	Ramp rate down				٢	٠	•	4
	Rapid start up		O		O	O		•
	Minimum downtime	O			٢	٠		
Certainty	Available in all seasons				O		•	4
	Fuel availability	O	4		٢			O
	Energy adequacy / Output sustainability	O	•	•	٠	•		
	Run time limitations	O	٢	•	٢			
	Inertia	O		•	٠		O	O
	Carbon reducing	?	0					

Key: Weak Provider of Attribute - •

Strong Provider of Attribute - 🔵

Note: MISO, and the industry as a whole, are still defining Attributes. This list is illustrative and not exhaustive.



We collectively need to be prudent in our actions to ensure sufficient resources and flexibility during the fleet transition

States

- Factor regional considerations into state resource adequacy, resource attribute, and market construct requirements
- > Inform the broader policy and statutory discussion at the state level
- Consider NERC recommendations for resiliency and reliability

Members

- Collaborate with MISO and States on timely resource adequacy, market enhancements and regional transmission
- > Share resource plans with MISO to enable accurate regional view

MISO

- > Enhance transparency of resource evolution and regional outlook
- Improve Resource Adequacy construct
- > Visibility into and reviewing impacts of resource retirements
- > Inform the broader policy discussion with federal policymakers and agencies





Appendix/Backup

Most members continue to meet resource adequacy requirements through fixed plans and self-scheduling, despite fixed plans decreasing by over 10,000 MW this year





The planning resource mix shows the continuation of a multiyear trend toward less solid fuel and increased gas and nonconventional resources





Committed accredited capacity projections show deficits starting in 2023, with increasing shortage over survey period



31 DRAFT

MISO conducts annual Effective Load Carrying Capability analysis to determine capacity values for wind resources

Effective load carrying capability (ELCC): The amount of incremental load a resource can dependably and reliably serve, while considering the probabilistic nature of generation shortfalls and random forced outages as driving factors to load not being served^{*}

- Leverages probabilistic methods
- Accounts for uncertainties that affect resource's availability
- Requires numerous years of historical weather data
- Renewable hourly profiles



* MISO's Planning Year 2021-2022, Wind & Solar Capacity Credit, December 2020



MISO is pursuing further renewable accreditation enhancements post Seasonal alignment for non-thermal resources proposed in 2021 RAN filing

Resource Category	Current Annual Accreditation	Seasonal Accreditation proposed in 2021 RAN filing	Further Enhancements currently underway 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	Evaluate ELCC methodology	
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	based accreditation approaches	

ELCC = Effective Load Carrying Capability



The electric industry is experiencing a rapid transition; new resources have different characteristics than retiring resources, putting reliability at risk if the transition is not managed

Wind

- Growing wind portfolio increases the volatility and variability of its output
- Wind utilization maximized when complimented by flexible and dispatchable resources



Solar

- Solar outputs steep daily ramps
- The impact will grow as MISO's solar capacity grows from 2.4 GW to as high as 30 GW in 2039



Thermal Resources

- Thermal resources have predictable output and flexibility characteristics
- However, thermal resources are declining rapidly, from over 70% today to around 36% in 2040

