# **Evolving Planning Studies in MISO**

Winter 2023 NARUC Curriculum

December 5, 2023

## Purpose & Key Takeaways



Purpose: To Review MISO's Planning Studies and Processes

### Key Takeaways:

- MISO works in conjunction with other plans, both states and members to have visibility into both planning and operating horizons to ensure Resource Adequacy and Reliability
- MISO's Resource Adequacy framework establishes resource requirements, resource 'value', and helps provide visibility into local and regional capacity (resource) sufficiency, supplementing State and utility obligations
- On-going Resource Adequacy reforms continue to be near term priorities of MISO to ensure markets and requirements allow for operation of a reliable system
- MISO appreciates the ongoing engagement and collaboration from State Regulators on these critical components of planning to ensure a reliable energy transition



Grid transformation is progressing at an astonishing pace and will speed up over the next several years due to several factors

### **Fleet Changes**

MISO members and states have set ambitious goals to partially or fully decarbonize

### Energy Assurance

Availability of resources may be challenged by economic, supply chain or other issues

### **Extreme Weather**

Severe weather events are becoming more extreme and occurring more frequently

### Electrification

Demand for electricity will grow as electric vehicles increase, industry sectors trend towards renewables











### What is Resource Adequacy?



Ensuring there is enough supply to meet demand, at all times.



# Planning for Resource Adequacy and Reliability involves multiple planning and operating time horizons





## MISO's Regional Resource Assessment (RRA)



- MISO's Regional Resource Assessment (RRA) provides a collective view of the evolution of members' resource plans and aims to provide insights and implications that help members, states, and MISO prepare for the energy transition
- The RRA Survey indicates a continued capacity risk, highlighting the immediate importance of additional investment and regional awareness in resource planning
- Reliably achieving the decarbonization targets set by many MISO members and states will require a shared understanding of how operational risks emerge and shift over time. The RRA's objective is to improve this understanding and inform the proactive problem-solving that is needed to meet the region's Reliability Imperative.



A seasonal look at RRA Survey accredited capacity shows the variation by season, initially lowest in winter primarily due to the low accreditation value for solar



Regional Resource Assessment



### Transmission Planning Futures: MISO is not a resource planner; the goals of its utilities and states set the foundation for transmission planning

		<ul> <li>Actua</li> </ul>	ıl	Goal 🔵 0	%	100% Red	uction Metric	
Coordinating Owners	Manitoba Hydro	<b>•-29%</b>						.100%
Municipal/Coop/ Transmission-Dependent Utilities	Alliant Energy (Parent)	♦ -28	8%	-50%				.100%
	Basin Electric Power Cooperative	♦-32%						
	Consumers Energy Co. (CMS)	<b>◆</b> -45%	-60%			-100%		
	DTE Electric			-65%	-85%	-90%		.1009
	Interstate Power and Light (Alliant)	♦-5%		-50%				.1009
	Madison Gas and Electric (MGE)	♦ -20	0%	-80%				-100
	Municipal Energy Agency of Nebraska (MEAN							-1009
	WEC Energy Group (Parent)	♦ -4:	5% 🔵 -60%	-80%				-100
	WPPI Energy		-45%					
Transmission Owners	AEP (Indiana Michigan Power)			-80%		-76%		• -100%
	AES Indiana (fka IPL)			-68%		-100%	• -100%	
	Ameren (Parent)	♦ -32	2%	-60%		-85%		
	Ameren Missouri (fka Union Electric Co)	<b>♦</b> -32%		-60%		-85%	-100%	
	Big Rivers Electric Corp	<b>♦-71%</b>		-77%				
	Cedar Falls Municipal Electric Utility, IA	<b>•</b> -20	0%	-45%				
	CenterPoint Energy IN (FKA Vectren)		.54	% 🕘 -88%	-95%			
	CLECO Power			-60%				-100
	Dairyland Power Cooperative			-50%				
	Duke Energy Indiana	<b>♦</b> -42%		-53%		-83%		
	Entergy Arkansas			-50%				-100
	Entergy Corp (Parent)	-19	9%	-50%				-100
	Entergy Louisiana			-50%				-100
	Entergy Mississippi							-100
SO includes	Great River Energy			-60%	90%			
ls stated in	Hoosier Energy	•						
itegrated	MidAmerican Energy	<b>♦-30%</b>						-100
	Minnesota Power (ALLETE)				-80%	.80%		
	Muscatine Power and Water (MPW)		-25%	-65%				
egislation, as	Northern States Power Co. (Xcel)	♦ -38%	3%	-85%				
s announced	Otter Tail Power Company		.50%					• -97%
on-legislated	Wabash Valley Power Association			• -50%		-70%		• -1009
goals		2020	2025	2030	2035	2040	2045	2050

75% of MISO load served by members with ambitious decarbonization and/or renewable energy goals





### **MISO Transmission Planning Futures**

### The OMS-MISO Survey is voluntary and provides a summary of available generation compared to expected demand over a five-year horizon based on information from utilities

- Load serving entities within each zone must have sufficient resources to meet load and required reserves
- Surplus resources may be shared among load serving entities with resource deficits to meet reserve requirements





### **OMS-MISO Survey**

# The OMS-MISO Survey uses different categories of resources relative to levels of resource uncertainty

Committed Capacity	<ul> <li>Consists of installed generation resources and projects with interconnection agreements with commercial operation dates expected during survey horizon.*</li> <li>Survey assumes that these resources will be used to meet the Planning Reserve Margin Requirement (PRMR) in the zone and region they are physically located.</li> </ul>
Signed GIA Capacity- Alternative estimate	<ul> <li>Consists of projects with signed interconnection agreements with commercial operation dates expected during survey horizon.</li> <li>Cumulative capacity added from signed GIA projects assumed to be 2.5 GW/year based on historical trend of 2-3 GW energized annually.</li> </ul>
Potentially Unavailable Resources	<ul> <li>Consists of installed generation resources with unclear commitment to MISO.</li> <li>Survey assumes that these resources will NOT be used to meet the PRMR.</li> </ul>
Potential New Capacity	<ul> <li>Consists of projects in MISO's generation interconnection queue that do not have a GIA, with capacity weighted to reflect progress through the queue*</li> </ul>



### The OMS-MISO Survey shows declines in capacity over five-year survey window with potential resource deficits starting in PY 2025 'COC' Summer Seasonal Accredited Capacity Projections (GW)



Bracketed values indicate difference between Committed Capacity and projected PRMR. Capacity accreditation values and PRM projections are based on current practices (under revision).



#### OMS-MISO Survey

# MISO's three longer term outlooks provide a regional picture of the evolving resource mix and needs going forward

	OMS-MISO Survey	RRA	MISO Futures
Purpose	<ul> <li>Inform near-term resource planning decisions, e.g., next <u>Planning</u> <u>Resource Auction (PRA)</u></li> </ul>	Inform long-term resource planning decisions, e.g., utility IRPs	<ul> <li>Form basis of <u>transmission plans</u></li> <li>Inform other processes such as MISO's 5-Year corporate plan</li> </ul>
Description	<ul> <li>Survey collects demand forecasts and existing resource plans. Queries <u>Generator Interconnection</u> <u>Queue</u> for future capacity information</li> <li>Provides resource adequacy view of next five years based on member-provided data and existing accreditation practices</li> </ul>	<ul> <li>Survey collects publicly available member resource plans and clean energy goals</li> <li>Produces an aggregate picture of member- stated plans/goals</li> <li>Provides visibility on gap and risk analysis by filling the resource gap with capacity expansion modeling on one Future and performing analysis on future portfolios</li> </ul>	<ul> <li>Reflect members' and states' resource plans and clean energy goals, including updates and validation after the initial survey</li> <li>Establish ranges of economic, political, and technological possibilities</li> <li>Develop multiple scenarios that "bookend" potential outcomes, including energy mix and siting locations</li> <li>Provides visibility on gap and risk analysis by filling the resource gap with capacity expansion modeling on three Futures and performing analysis on sensitivities on assumptions</li> </ul>
Scope	<ul> <li>5-year horizon</li> <li>Annual study, seasonal results</li> <li>Changes require <u>OMS</u> agreement</li> <li>Detailed information confidential</li> <li>10-year history of use</li> </ul>	<ul> <li>20-year horizon</li> <li>Annual</li> <li>Flexible in scope</li> <li>Limited confidential information</li> <li>3-year history of use</li> </ul>	<ul> <li>20-year horizon, but also evaluates Year 5, Year 10, and Year 15</li> <li>Updated at least every three years w/ input "refresh" as needed</li> <li>Scope determined via stakeholder committee</li> <li>Can include more confidential detailed information with planned unit additions or retirements which are non-public</li> </ul>
Linkages	<ul> <li>Informs base assumptions for early years of RRA and Futures</li> <li>2023 OMS-MISO Survey results</li> </ul>	<ul> <li>Uses Futures load forecast and siting for planned resources (in 2023, also used Future 2A expansion modeling as a proxy) <u>RRA home page</u></li> </ul>	<ul> <li>Builds off the OMS and RRA Survey to gather useful state and member plans</li> <li>Uses Planning Reserve Margin Requirements and Local Clearing Requirements from the PRA <u>MISO Futures home page</u></li> </ul>

OMS-MISO Survey – RRA - Futures



The Planning Resource Auction uses MISO and participant inputs to assess resource adequacy and produce Auction Clearing Prices at the zonal level

### MISO

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

**INPUTS** 

#### 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



### Seasonal Assessments review a three-month forward period





#### Seasonal Assessment



# Seasonal Assessments evaluate operations leading into extreme weather and real time operations





Meet as System Ops to outlook seasonal risks and discuss readiness plan

Current Forecast (60% Chance)

Monitor upcoming weather system (extreme cold, icing, pressure system, etc.)



Dav(s) ahead

- Evaluate Operating reserve margin based on 7-day FRAC
- Scenario analysis to account for uncertainty
- Pre-position for tight operation conditions

Sufficiency Outlook based on the RA7 2022-06-10 MD FRAC Cas

# Hour(s) head

Update risks (e.g., wind drop, storm risk on load, etc.) and assess resource availability

 CSAT dynamically update available uncommitted and Emergency Resources





### Seasonal Assessment

## Multiday Operating Margin Forecast Reports and Real Time Reliability



MISO Multiday Operating Margin Forecast Report						
Publish Date: November 20, 2023						
Market Date: November 20, 2023						
	11/21/23 HE 19**	11/22/23 HE 20**	11/23/23 HE 11**	11/24/23 HE 19**	11/25/23 HE 20	11/26/23 HE 20
RESOURCE COMMITTED	62,283	60,561	58,913	60,578	67,495	66,287
Additional Emergency Headroom	2,407	2,229	1,391	1,109	1,013	1,013
RESOURCE UNCOMMITTED	39,205	41,414	42,456	42,130	35,134	36,337
Uncommitted >16 hr	8,991	8,633	11,025	11,425	9,281	9,281
Uncommitted 12-16 hr	612	2,624	1,488	1,488	708	708
Uncommitted 8-12 hr	2,947	2,377	2,740	1,968	1,947	1,982
Uncommitted 4-8 hr	5,716	5,981	6,392	6,519	5,666	5,666
Uncommitted < 4 hr	20,939	21,800	20,811	20,730	17,533	18,701
Additional Emergency Headroom	1,105	1,218	542	543	543	543
EMERGENCY RESOURCES						
Additional Emergency Headroom	1	0	0	0	0	0
Renewable Forecast	17,499	19,474	15,877	9,399	3,419	7,825
Wind Forecast	17,499	19,474	13,960	9,399	3,419	7,825
Solar Forecast	0	0	1,917	0	0	0
MISO resources available	118,987	121,449	117,246	112,107	106,048	110,449
NSI (+ export, - import)	-5,421	-2,524	-2,835	-2,525	-2,524	-2,523
Total Resources Available	124,408	123,973	120,081	114,632	108,572	112,972
Projected Load	77,789	77,475	70,149	70,534	70,793	74,053
Operating Reserve Requirement	2,410	2,410	2,410	2,410	2,410	2,410
Obligation	80,199	79,885	72,559	72,944	73,203	76,463
Resource Operating Margin *	44,209	44,088	47,522	41,688	35,369	36,509



### Multi-Day Operating Reports, Intra-Day, Real-Time Operations

# Higher variability and complexity have significant implications for reliability and energy adequacy in the region

	PAST	PRESENT	FUTURE		
RISK EVALUATION	<ul> <li>Capacity planned for single peak hour using 1-in-10 standard</li> </ul>	<ul> <li>Seasonal resource adequacy</li> <li>Energy adequacy in all hours</li> <li>Extreme weather</li> </ul>	<ul> <li>Expected unserved energy; days/ weeks</li> <li>Adequacy of key reliability attributes</li> </ul>		
MARKET EVOLUTION	<ul> <li>Energy</li> <li>Capacity</li> <li>Ancillary services</li> </ul>	<ul> <li>Seasonal accreditation</li> <li>Pricing/incentive</li> <li>Attribute definition</li> <li>Seams coordination</li> </ul>	<ul> <li>Hourly energy adequacy</li> <li>Accreditation of attributes</li> <li>Fuel assurance</li> <li>Seams optimization</li> </ul>		
TOOL ENHANCEMENT FOCUS	<ul> <li>Regional load and weather forecasting</li> <li>System efficiency</li> </ul>	<ul> <li>Extend visibility horizon</li> <li>Variable generation and weather forecasting</li> <li>Coordination with fuel suppliers and neighbors</li> </ul>	<ul> <li>Uncertainty management; artificial intelligence</li> <li>Granular weather forecasting</li> <li>Retail/wholesale coordination</li> </ul>		





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# Appendix



# MISO has developed two interactive tools to facilitate further exploration of the RRA data and results



The Juicebox platform displays publicly available generator information for the region. This year the tool was updated to include the Futures 1A, 2A, and 3A siting and expansion. The RRA side still hosts the 2022 RRA Modeling Results and will not be updated this year (<u>linked here</u>)



A pilot emissions portal, powered by Singularity, displays historical emissions compiled from EPA data as well as future estimated emissions for the MISO footprint based on the 2022 RRA Modeling Results simulations. Additional enhancements are in progress (<u>linked</u> <u>here</u>)



Changing resource portfolio with lower excess reserve margins and rapid growth of intermittent resources drives an increased need for accreditation to reflect reliability contribution during times of need



