MISO RA & Reliability Based Demand Curve Update

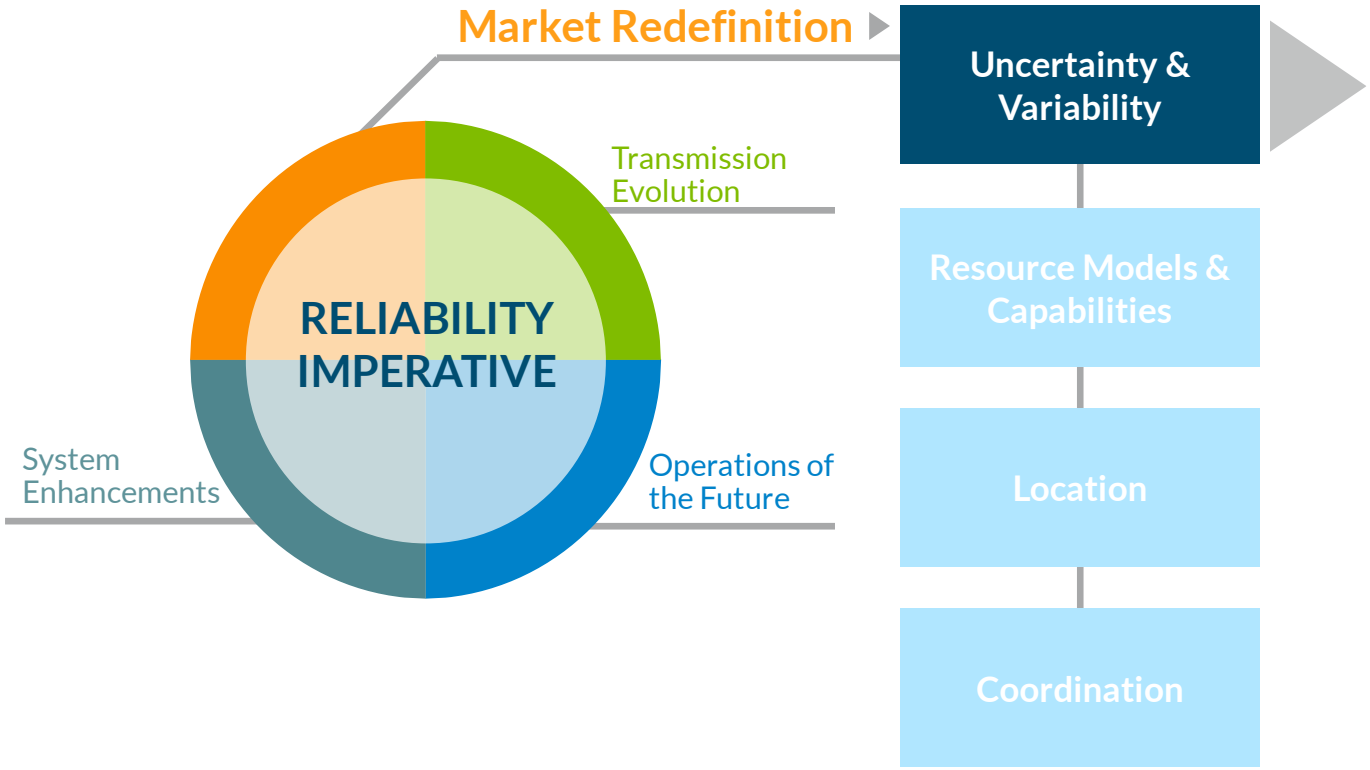
ESIG Conference, Nashville TN

June 24th 2025

Executive Summary

- MISO continues to evolve its resource adequacy construct to meet the needs of the changing operating paradigm and associated risk profile
- Reliability Based Demand Curve (RBDC), as one of MISO's resource adequacy reform initiatives, aims to send adequate price signals for the capacity market and incentivize proper investments
- MISO has developed the system wide and sub-regional demand curves per season, and implemented them in its 2025-2026 Planning Resource Auction (PRA)
- Th PRA Auction outcomes are consistent with the design intent of the Reliability-Based Demand Curve

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



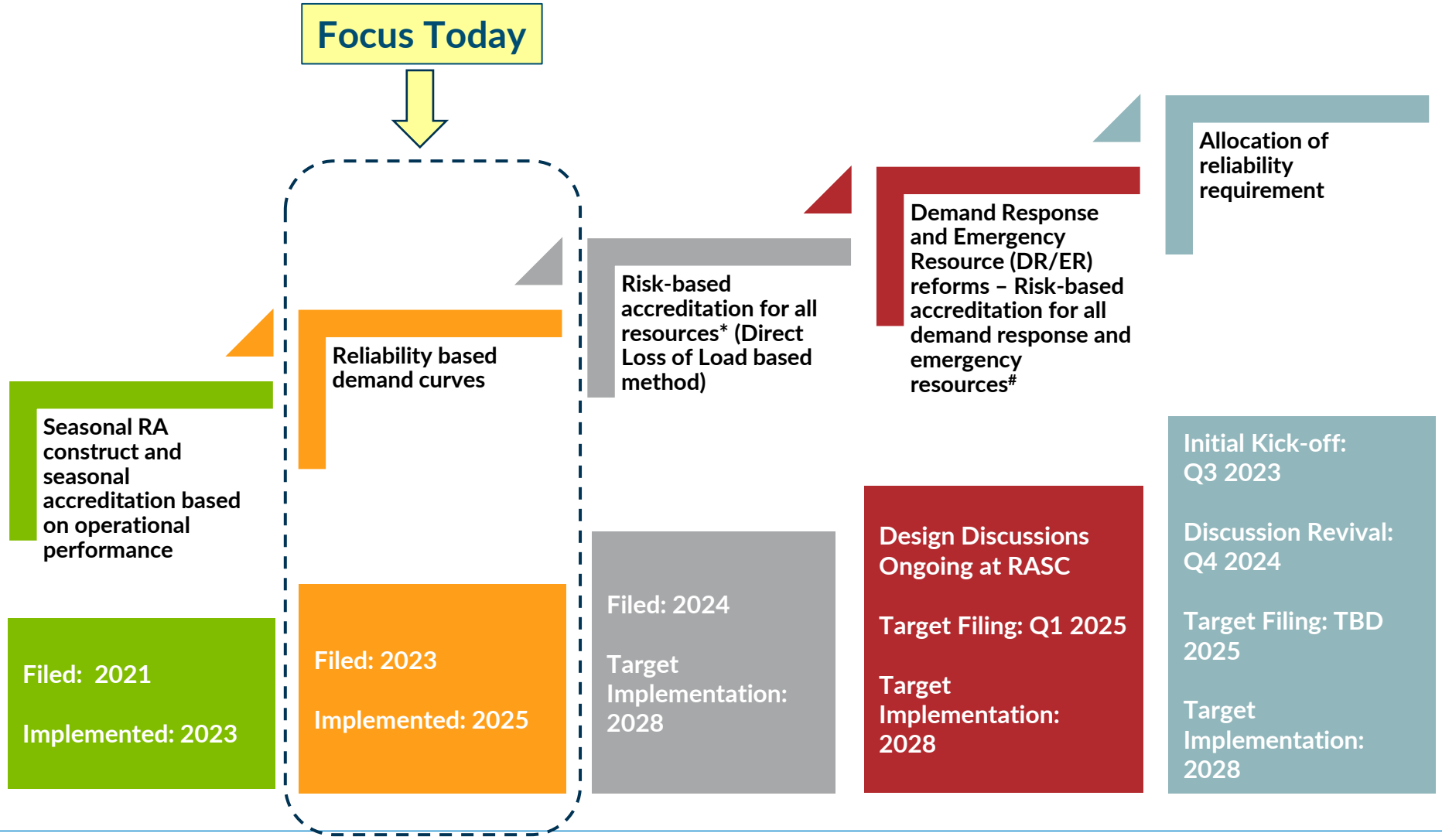
Modernize the Resource Adequacy Construct

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

Demand Response & Emergency Resources

Crucial for maintaining grid stability during emergencies

MISO continues to evolve its Resource Adequacy construct to meet the needs of the changing operating paradigm and associated risk profile



*Excludes LMRs and External resources

#Excludes External resources

Historic Industry Standard

0.1 LOLE

The industry standard regarding resource adequacy has, for a long time, been based on a Loss of Load Expectation (LOLE) of 1 day in 10 years ("0.1" per year)

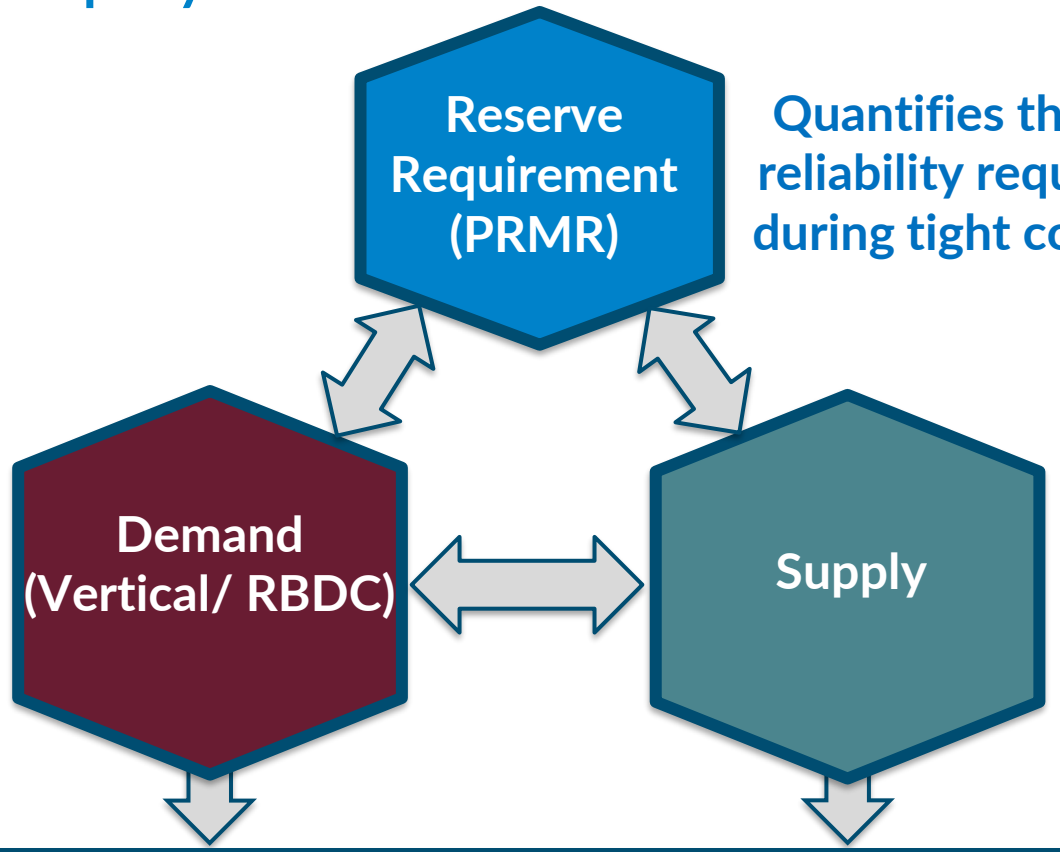
- It reflects the odds of not having enough capacity available to serve load, given the variability of load and variability of resources
- Capacity varies from lumpiness, regulatory uncertainty, unexpected retirements and construction, and forced outages
- Load varies because of weather and economic uncertainty

15%*

A 0.1 LOLE is converted into a target reserve margin – such as 15 % – above peak demand

- LOLE does not translate to an unchanging reserve margin. The margin depends on the variability in load and resources; hence, the reserve margin to meet 0.1 LOLE can change every year

The primary objective for the resource adequacy construct is to ensure sufficient resources to provide customers with a continuous supply of electricity in the prompt year



Quantifies the target reliability requirement during tight conditions

Models the value to reliability of procuring additional capacity

Resource's contribution when they are needed the most

Mechanism to ensure that for the prompt year, Loading Serving Entities (LSEs) portfolio meets the established requirement, and if needed, helps facilitate the procurement of capacity to meet their requirement at an economically efficient price

RBDCs were introduced in the PY 25-26 PRA to address five key challenges in **the vertical requirement-based PRA**

Price Ineffectiveness

- Fails to reflect reliability value of additional capacity beyond the reliability target
- Leads to over- or underpricing, misguiding market behavior

Inadequate Price Signals

- Doesn't show extent of surplus or shortfall
- Limits informed investment or retirement decisions

Weak Investment Incentives

- Price insensitivity deters new capacity investments
- High uncertainty worsens investor hesitation

Inefficient Resource Planning

- Risk of overbuilding (unnecessary cost) or underbuilding (shortages)
- Doesn't align capacity with actual system needs

Increased Reliability Risks

- Fails to procure enough capacity for peak demand
- Raises chances of future supply shortfalls and blackouts

MISO met the planning year 2025/26 resource adequacy requirements, but pressure persists with reduced capacity surplus across the region and is reflected through improved price signals in this year's auction

Summer
$666.50
–
Fall
$91.60 (North/Central)
$74.09 (South)
–
Winter
$33.20
–
Spring
$69.88
–
Annualized
$217 (North/Central)
$212 (South)

- MISO's Reliability-Based Demand Curve (RBDC) improves price signals, reflecting the increased value of accredited capacity beyond the seasonal Planning Reserve Margin (PRM) target
  - For example, the auction cleared 1.9% above the 7.9% summer PRM target
- Summer price reflects the lowest available surplus capacity
  - Fall price varied slightly due to transfer limitations between the North and South
- Consistent with past years, most Load Service Entities (LSEs) self-supplied or secured capacity in advance and are hedged with respect to auction prices
- Surplus above the target PRM dropped 43% compared to last summer, despite the slightly lower PRM target (7.9% vs. 9.0% last year)
  - New capacity additions did not keep pace with reduced accreditation, suspensions/retirements and slightly reduced imports
- The results reinforce the need to increase capacity, as demand is expected to grow with new large load additions

Auction outcomes are consistent with the design intent of the Reliability-Based Demand Curve (RBDC), and MISO and its members can expect more stable and predictable capacity pricing, especially in surplus situations

In the 2025 PRA, the RBDC…

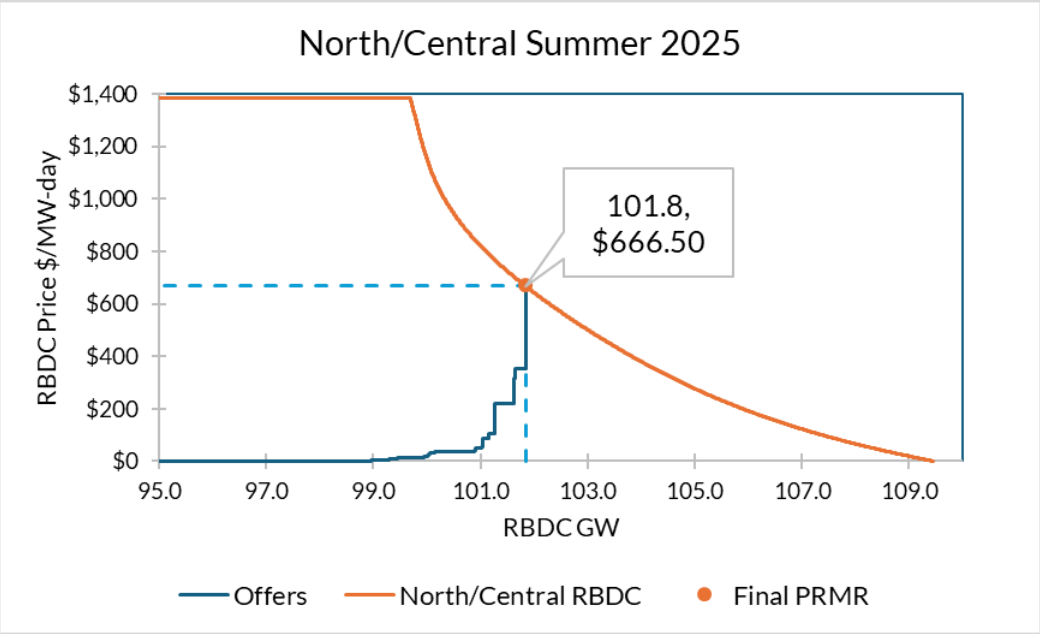
- Delivers competitive prices aligned with seasonal risks and tightening surplus
  - Prioritizes summer availability, the system's highest-risk season (based on 1-in-10 LOLE)
- Values incremental capacity above and below the LOLE target based on its reliability
  - Clears capacity above target Planning Reserve Margin based on its reliability value in each season
- Stabilizes prices in non-summer seasons, avoiding extreme volatility

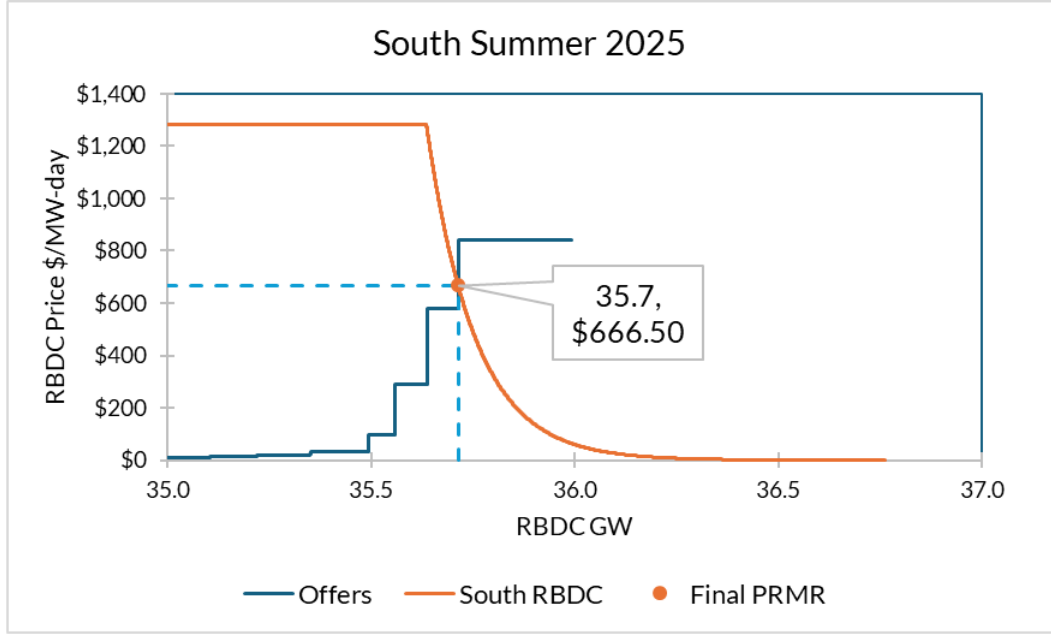
Why it Matters

- Sends clear and stable investment signals across the system, including to external resources
- Provides transparent value for capacity that exceeds the Planning Reserve Margin target
- Reflects subregional capacity needs and clears accordingly across all seasons

LOLE: Loss of Load Expectation

Auction pricing outcomes with the Reliability-Based Demand Curve (RBDC) better reflect value of capacity and resource adequacy risk across seasons



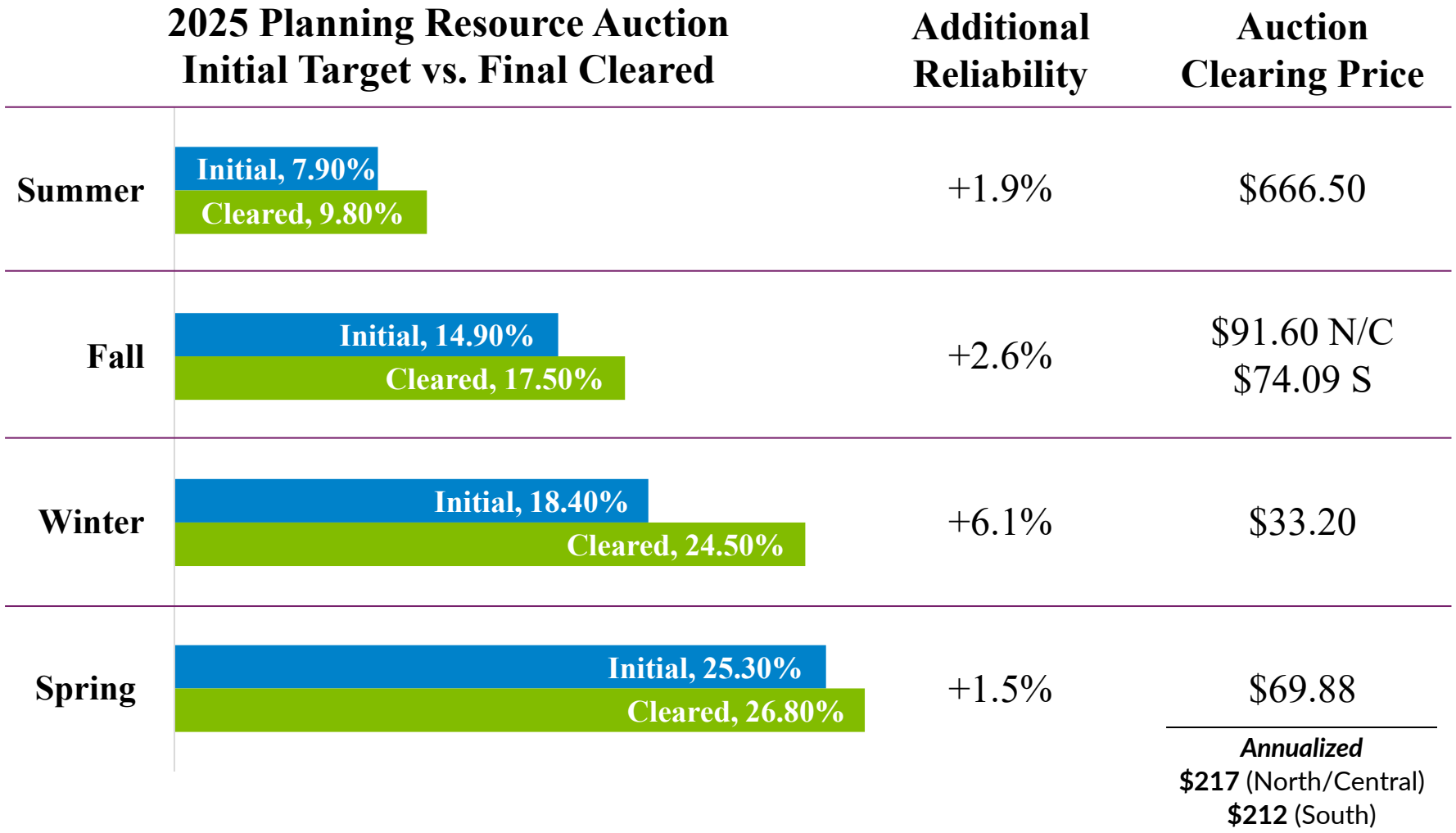


- Summer clearing of $666.50 reflects highest reliability risk and reducing surplus capacity year-over-year
  - Surplus capacity in the summer has reduced from approximately 6.5 GW in 2023, to 4.6 GW in 2024, to 2.6 GW in 2025
- Incremental capacity cleared beyond the target Planning Reserve Margin based on the value it adds to reliability (e.g., North/Central "effective" summer margin at 10.1% and South at 8.7% vs. target 7.9%)
  - A small quantity of capacity, that was offered at a price higher than the reliability value indicated through the demand curve, did not clear

LOLE: Loss of Load Expectation

MISO's Reliability-Based Demand Curve (RBDC) improves price signals, reflecting the increased value of accredited capacity beyond seasonal reliability targets

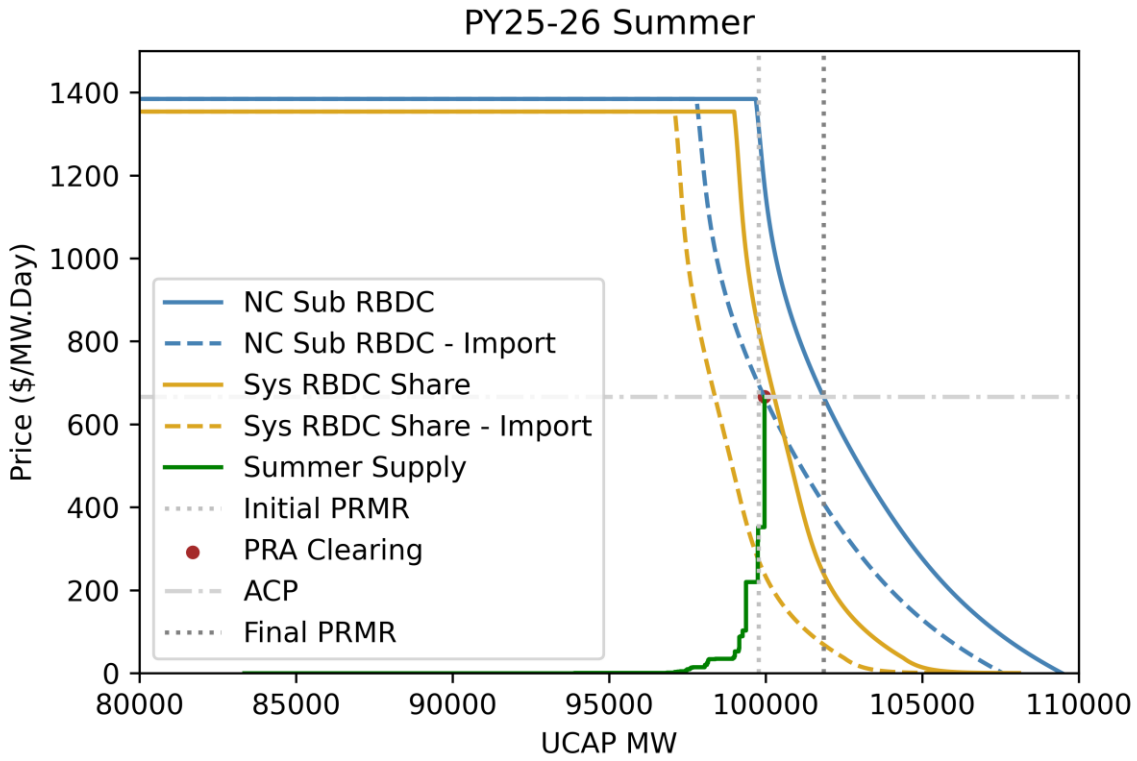
- Under RBDC, each season has an initial reliability target (PRM%)
- Auction cleared above seasonal final reliability target, representing additional reliability value at cost-competitive prices

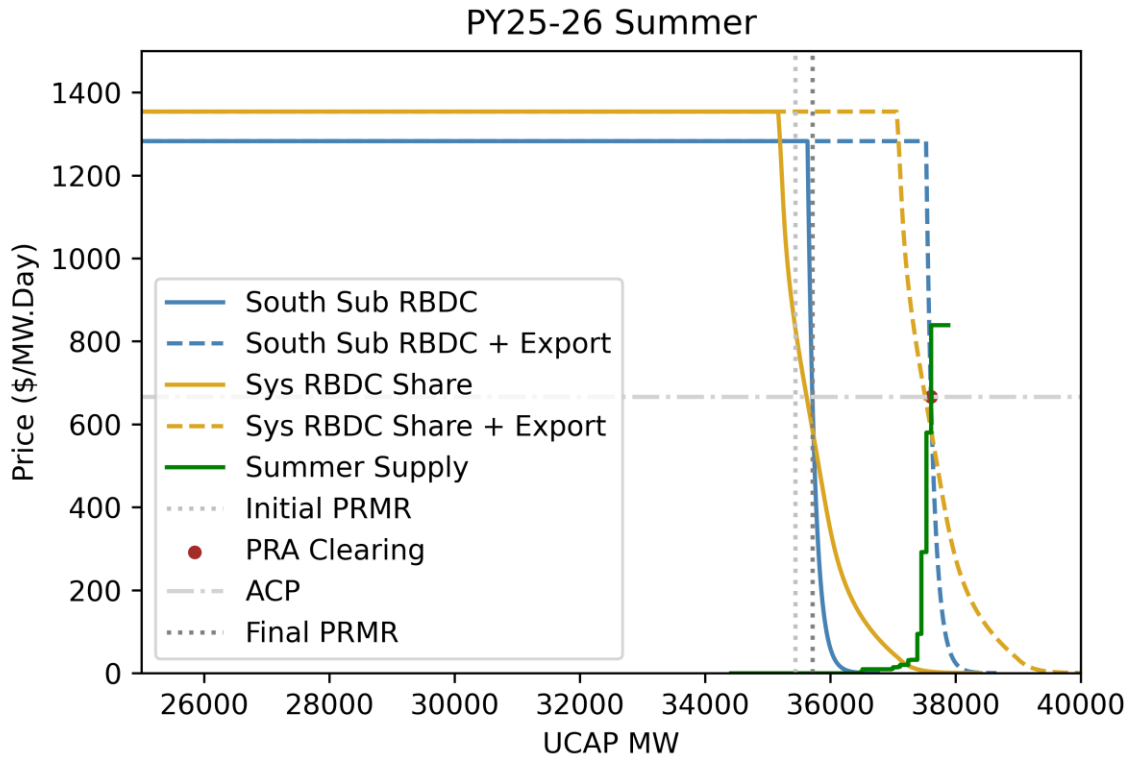


PRM: Planning Reserve Margin

Appendix - PRA 2025 Clearing Details

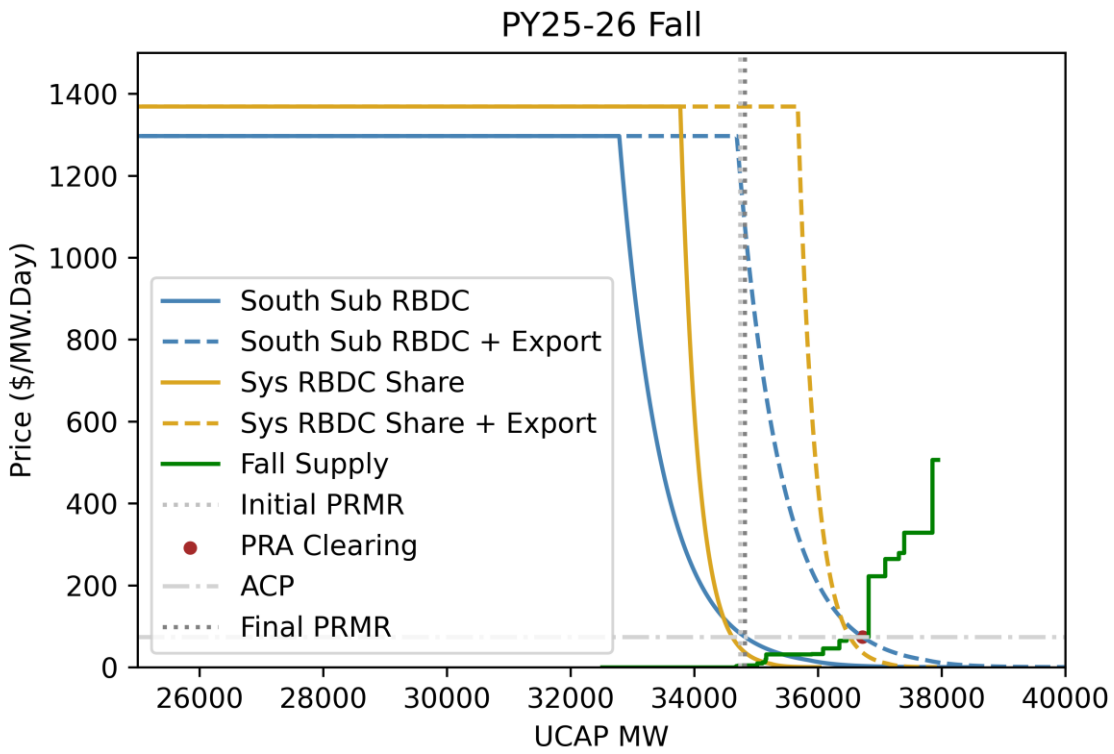
PY 25-26 Summer PRA clearing details

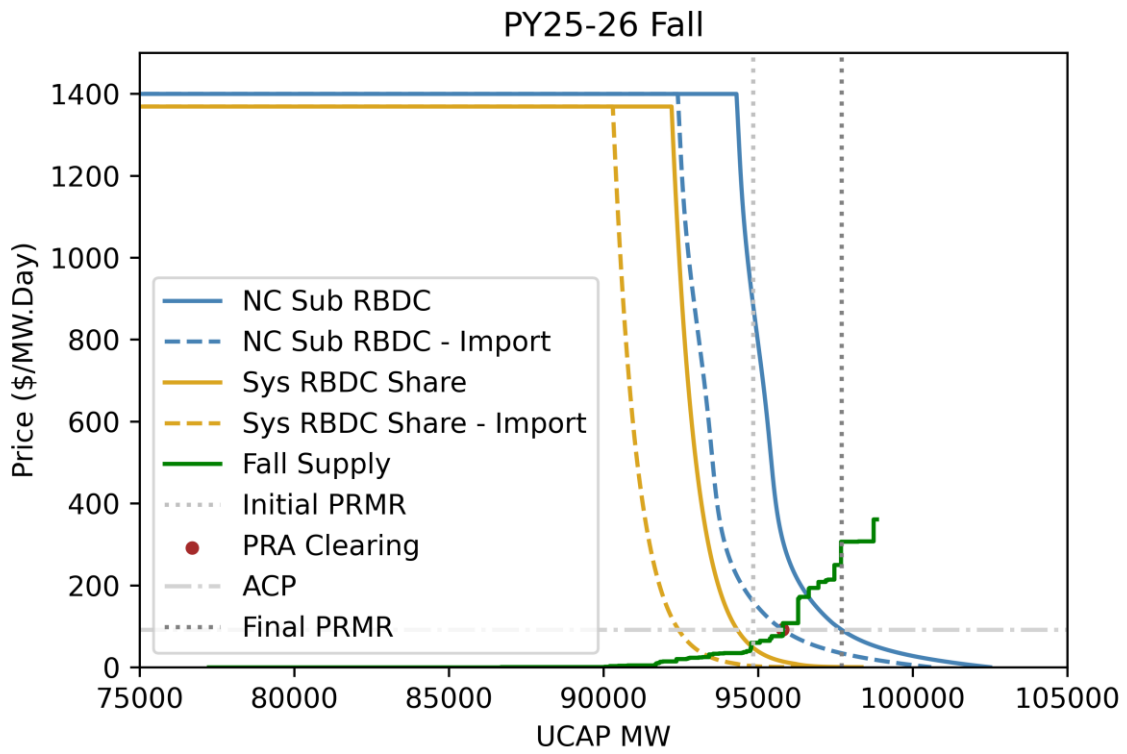




- Summer ACP of $666.50/MW.Day reflects highest reliability risk and reducing surplus capacity year-over-year
- Incremental capacity cleared beyond the target Planning Reserve Margin based on the value it adds to reliability (e.g., North/Central "effective" summer margin at 10.1% and South at 8.7% vs. target 7.9%)
- System and subregional RBDCs both are used in the PRA clearing, however, subregional RBDCs set the requirement in the Summer season

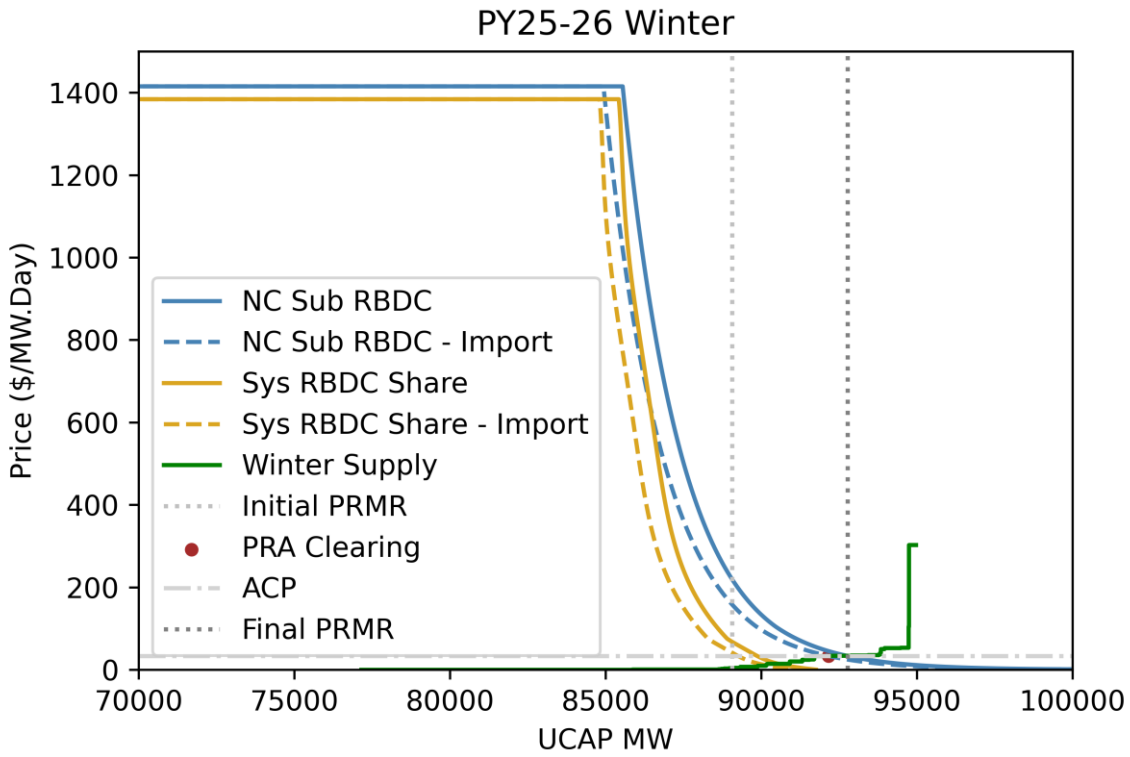
PY 25-26 Fall PRA clearing details

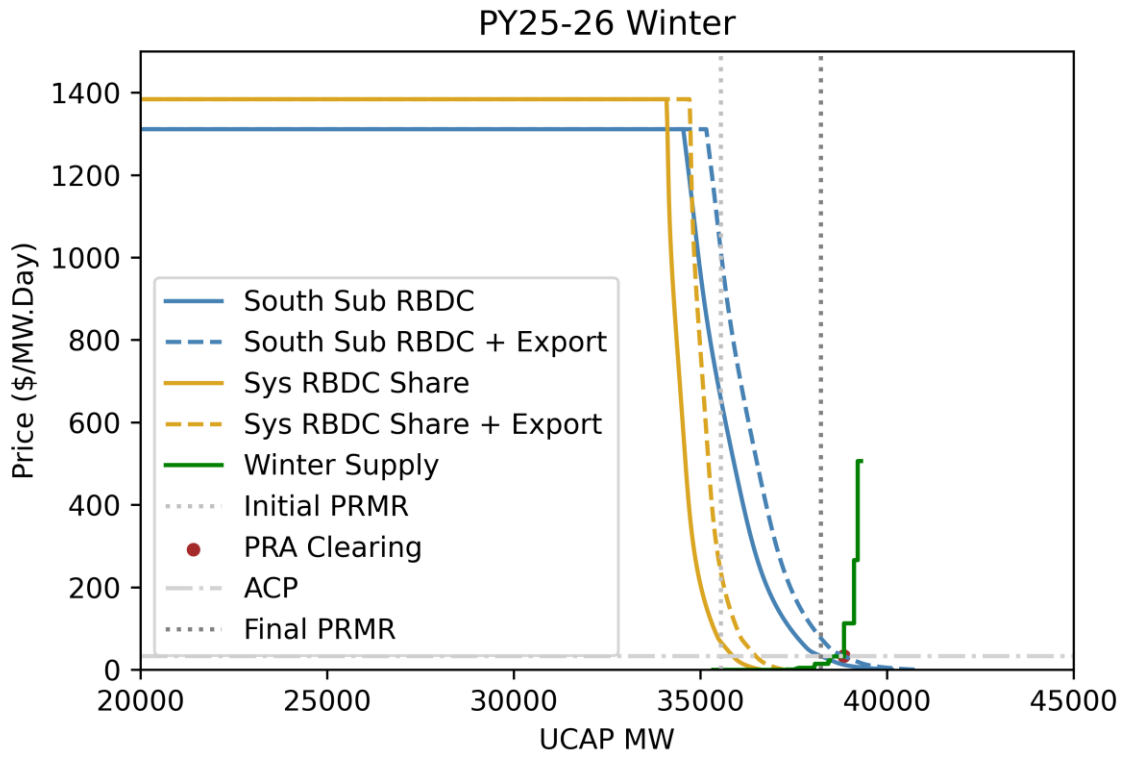




- Subregional Power Balance Constraint (SRPBC), South to North, is binding, resulting in price separation between North/Central and South subregions in Fall season
    - **ACP for North subregion is $91.6/MW.Day, and $74.09/MW.Day South subregion**
- In fall season, “effective” margin for North/Central subregion is at 18.4% and 15.2 % for South subregion vs. target of 14.9%

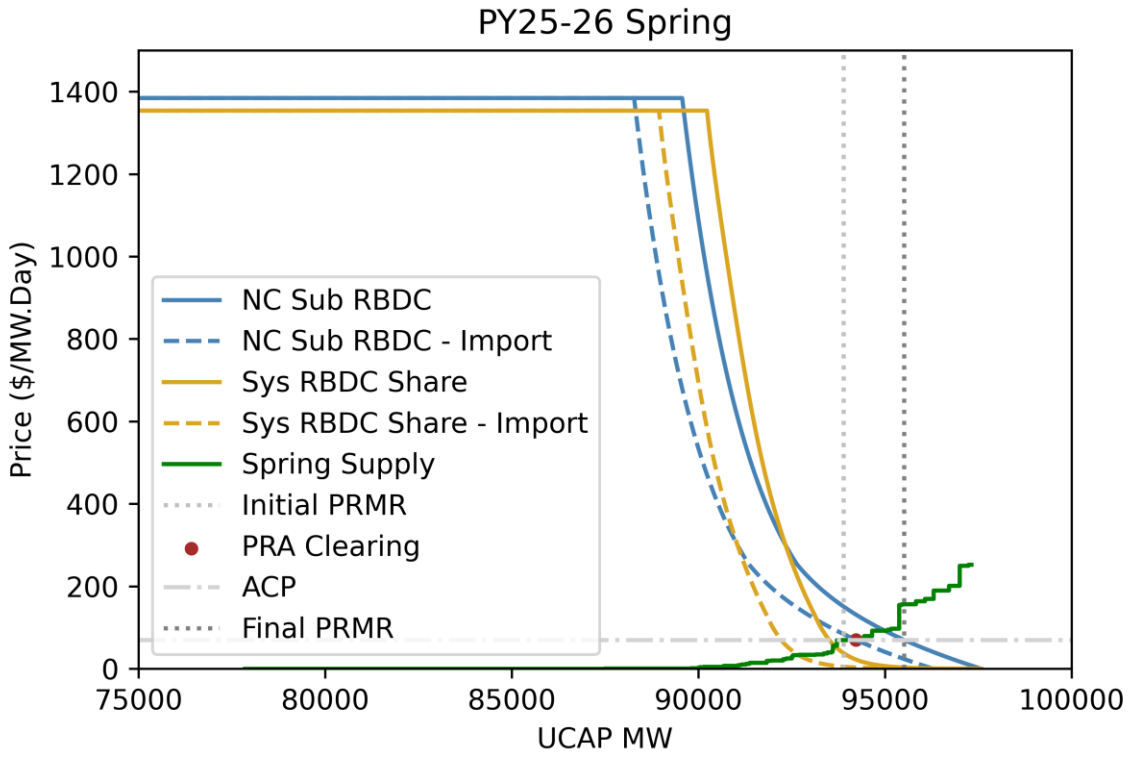
PY 25-26 Winter PRA clearing details

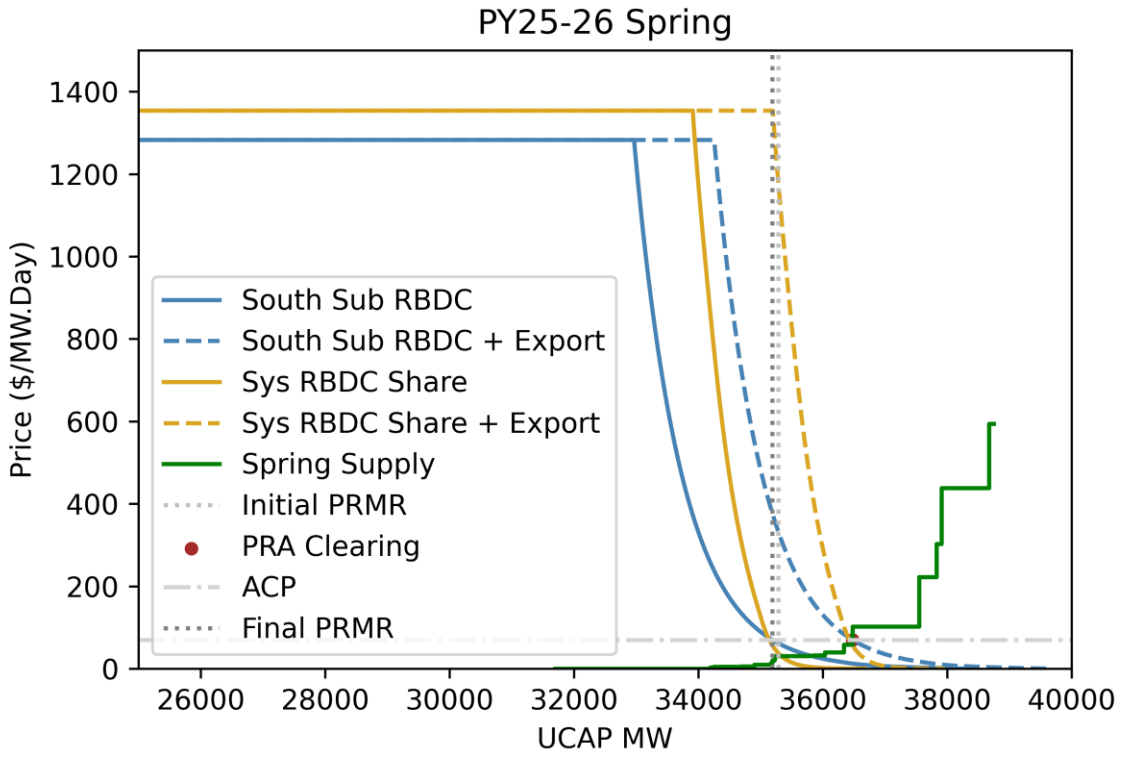




- No price separation between North/Central and South subregions in winter
  - **ACP for both subregions is $33.20 /MW.Day**
- In winter, “effective” margin for North/Central subregion is at 23.2% and 27.2% for South subregion vs. target of 18.4%

PY 25-26 Spring PRA clearing details





- No price separation between North/Central and South subregions in spring
  - **ACP for both subregions is $69.88 /MW.Day**
- In spring, “effective” margin for North/Central subregion is at 27.5% and 24.9% for South subregion vs. target of 25.3%

MISO's RBDC improves price signals, reflecting the increased value of accredited capacity beyond the seasonal PRM target

- At system level, MISO cleared more capacity beyond the seasonal PRM
  - Auction cleared above seasonal final reliability target, representing additional reliability value at cost competitive prices
  - For all seasons, Subregional RBDCs set the requirement for both subregions
- Summer price reflects the lowest available surplus capacity
  - MISO observes most reliability risk in the Summer season

	PRM	Initial PRMR (MW)		PRA Price ($/MW.Day)		Binding RBDC		Final PRMR (MW)	
		N/C	South	LRZ 1-7	LRZ 8-10	N/C subregion	S subregion	N/C subregion	S subregion
Summer	7.9%	99,771	35,443	$666.5		Sub-regional	Sub-regional	101,846	35,714
Fall	14.9%	94,838	34,740	$91.6	$74.1			97,697	34,819
Winter	18.4%	89,070	35,546	$33.2				92,777	38,223
Spring	25.3%	93,892	35,286	$69.9				95,511	35,189

Final PRMR calculation for PY 2025-2026

- For PY 2025-2026, for all seasons subregional RBDCs set the requirement
- Final PRMR is determined based on RBDC clearing and CPD
  - Final PRMR = CPD w/ TL, FRS, and FRP * (1 + Effective Margin)
- Detail procedure to determine Final PRMR from the RBDC clearing is presented in BPM-011 Resource Adequacy, Section 5.6

		[A]	[B]	[C]	[D] = [B]*[1+A]	[E]	F=[E]/[B]-1
	Subregion	**MISO PRM**	**Total CPD w/ TL, FRS, and FRP (MW)**	**FRAP MW**	**Initial PRMR (MW)**	**RBDC Cleared MW**	**Effective Margin**
Summer	N/C Subregion	7.9%	92,466	17,779	99,770	101,846	10.1%
	South Subregion		32,848	2,168	35,443	35,714	8.7%
Fall	N/C Subregion	14.9%	82,540	16,403	94,838	97,697	18.4%
	South Subregion		30,235	2,138	34,740	34,819	15.2%
Winter	N/C Subregion	18.4%	75,228	15,771	89,069	92,711	23.2%
	South Subregion		30,022	2,402	35,546	38,194	27.2%
Spring	N/C Subregion	25.3%	74,933	16,877	93,891	95,511	27.5%
	South Subregion		28,161	2,089	35,285	35,189	24.9%

Appendix – MRI Curve

RBDCs reflect reliability value of additional capacity effectively

RBDCs are based on Marginal Reliability Impact (MRI) curves

- MRI curves are developed based on rigorous Loss of Load Expectation (LOLE) studies
- Each point on raw MRI curve is determined by conducting about 7,500 simulations

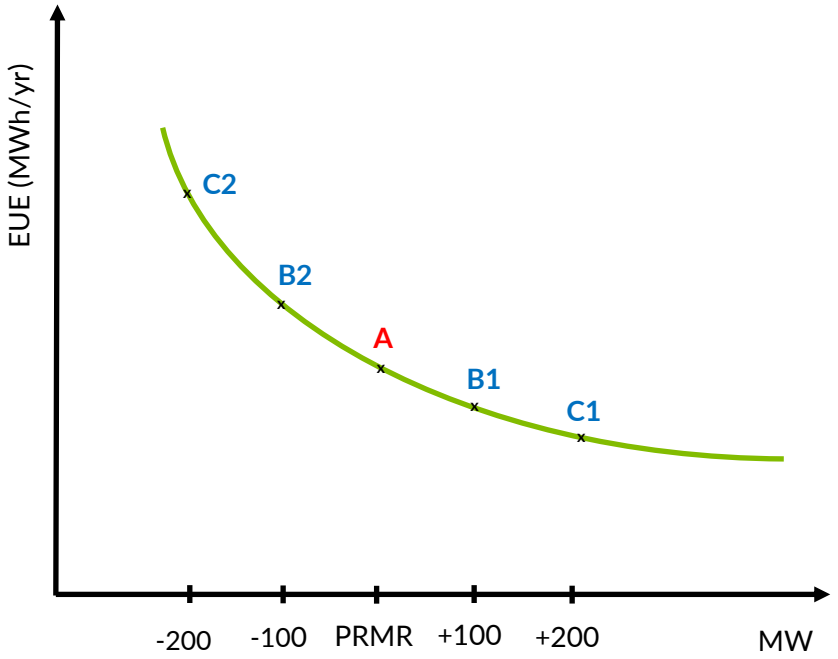
Reliability value of RBDC is determined based on Net CONE+

- Net CONE represents resources' expected revenue need from the capacity market
- Net CONE is determined based on historical actual settlement data

+ Net CONE = CONE – Inframarginal Rent

Marginal Reliability Impact Curves (MRI)

Should reflect the incremental reliability value to consumers of additional capacity



MRI Process:

- Start with PRMR established based on .1 LOLE for summer and .01 for other seasons (pt A)
- LOLE models also calculate LOLH/LOLP/EUE
- EUE measured as MWH/MW-season
- Add (delete) perfect capacity in increments of 100 (100) MW to the LOLE model and calculate EUE (pt B1, B2)
- Add (delete) another 100 (100) MW and continue on (pt C1,C2)
- MRI is a smoothed curve representation of reliability changes as measured by EUE
- Done for each season

Contact:
Zhaoxia Xie (zxie@misoenergy.org)
Director, Market Design and Development MISO

Capacity Market Reforms

Moving towards Prompt Seasonal Market

Tongxin Zheng

CHIEF TECHNOLOGIST

ISO NE achieves resource adequacy through the capacity market construct

- The main objective of the capacity market is to procure enough capacity to meet the long-term resource adequacy need for the region at the least cost fashion.
  - Facilitate the capacity entry and exit
  - Recover the missing-money from energy and ancillary service markets
- ISO runs the capacity market in a series of auctions.
  - Primary capacity auction runs annually on a 3-year forward basis
  - Annual reconfigure auction and monthly bilateral trading
- All resources both existing and new must be qualified to participate in the capacity auctions.
- Capacity demand curves are constructed based on the marginal reliability impact (MRI) and the expected cost of new entry at the 1-in-10 reliability standard.
- Resources cleared at the auction take on the capacity supply obligation and face performance penalty during scarcity conditions in the real-time operation.

Clean energy transition creates new challenges, jeopardizing the efficiency of capacity market

- A long lead time for new resource qualification may prevent new resource types such as PV and storage to enter the market in a timey fashion.
- Failures and delays in the development of new capacity resources result in phantom capacity in the forward capacity market, increasing the market uncertainty.
- Continuous load growth and energy constraints in the winter season start shifting resource adequacy risk more towards winter, which cannot be efficiently captured in an annual market .
- The qualified capacities traded in the capacity market do not have the same reliability impact on the system, resulting in inefficient capacity substitution.

ISO NE is moving towards a prompt seasonal capacity market design

- ISO started an effort on the resource capacity accreditation in 2021.
  - The design is to change resource's accredited capacity based on resource's annual reliability contributions.
  - Challenges emerged in the modeling of winter season (gas availability) and the accreditation for resources with different seasonal performance. Seasonality played a critical role in such an annual construct.
- In 2023, ISO collaborated with Analysis Group to conduct a study of prompt and seasonal market constructs.
  - Various benefits were identified (a08b_mc_2024_01_09_11_agi_updated_report.pdf)
- ISO NE is currently working on the detailed design of the prompt seasonal capacity market.

The prompt seasonal capacity market design focuses on three key areas

- Forward to Prompt Auction
  - Capacity auction will be held several months before the capacity commitment period rather than roughly four-year ahead.
- Annual to Seasonal Auction
  - Meeting seasonal capacity demand
- Installed Capacity-based to MRI-based Capacity Accreditation
  - Resources will be accredited based on their seasonal reliability contribution through MRI

The new design is going to improve market efficiency

- Prompt auction
  - Use of up-to-date information improves accuracy and market efficiency (removal of phantom capacity)
  - Equal treatment for technologies with different development timelines
  - Reduce the implementation complexity
- Seasonal auction
  - Better capture the seasonal need of reliability
  - Provide better incentives for fuel procurement
- MRI-based accreditation
  - Better alignment between capacity supply and demand
  - Improve capacity substitutability

Key Design Elements for Prompt Market

- Capacity auction timeline will be moved closer to the capacity commitment period.
  - Only one capacity auction
  - No reconfiguration auction is needed
- Seal-bid auction format will be adopted.
- All resources must be commercial to participate in the capacity auction.
- Resource deactivation process is independent of and separated from the capacity auction

Key Design Elements for Seasonal Market

- Two seasonal auctions will be held for each capacity commitment period.
  - Winter Market (May – October)
  - Summer Market (November – April)
- Each seasonal auction will be conducted several moths before the season independently.
  - Seasonal capacity offers will be cleared against the season demand curves and auction parameters
- A gas capacity constraint will be enforced in the winter auction.
  - Capture the reliability impact of gas supply limitation
  - Gas resources without firm gas contracts may receive a lower capacity market clearing price

Key Design Elements for Capacity Accreditation

- All resources will be accredited based on their marginal contributions to resource adequacy or MIRI, which reflects the change of expected unserved energy.
- MRI will be calculated using a probabilistic resource adequacy assessment framework, which evaluates the system behavior under a large number of scenarios.
- Various resource models such as PV and storage will be enhanced to better capture resources' performance, improving the accuracy for both resource adequacy assessment and accreditation.
- Accredited capacity will reflect resource' energy limitation.

Questions