



2020/2021 Planning Resource Auction (PRA) Results

May 6, 2020

Resource Adequacy Sub-
Committee (RASC)

Purpose & Key Takeaways



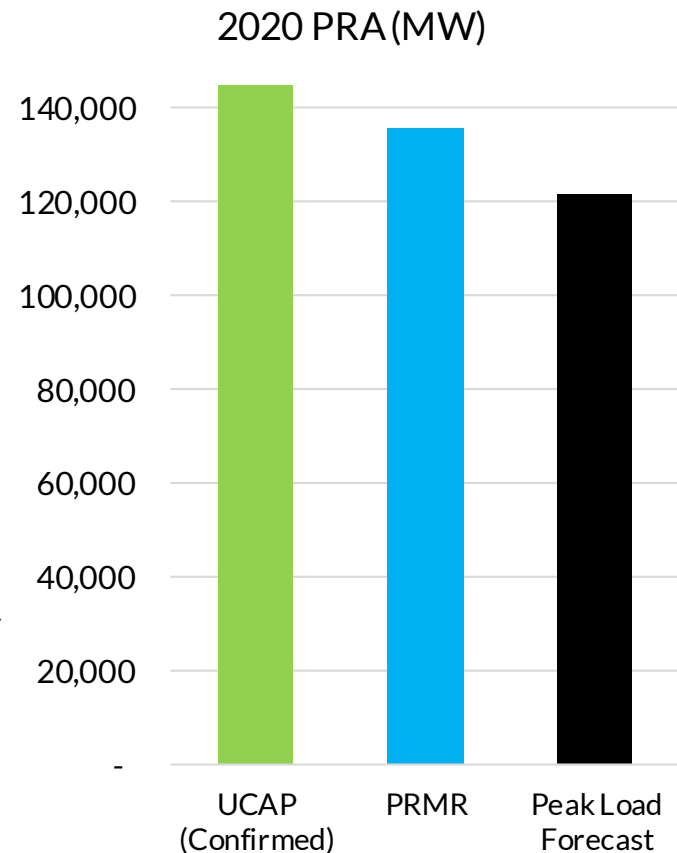
Purpose: Additional insight into the PRA results, with additional information on the Zonal Deliverability Benefits, and comparison to 2019 LOLE study.

Key Takeaways:

- Most zones cleared \$4.75-\$6.88/MW-day, with Zone 7 clearing at CONE
- Zonal Deliverability Benefit (ZDB) distribution ranges from \$0.01 to \$2.51 / MW-day for importing benefitting zones
- 2019 LOLE study results consistent with 2020 PRA, and MISO to conduct a sensitivity analysis on Zone 7

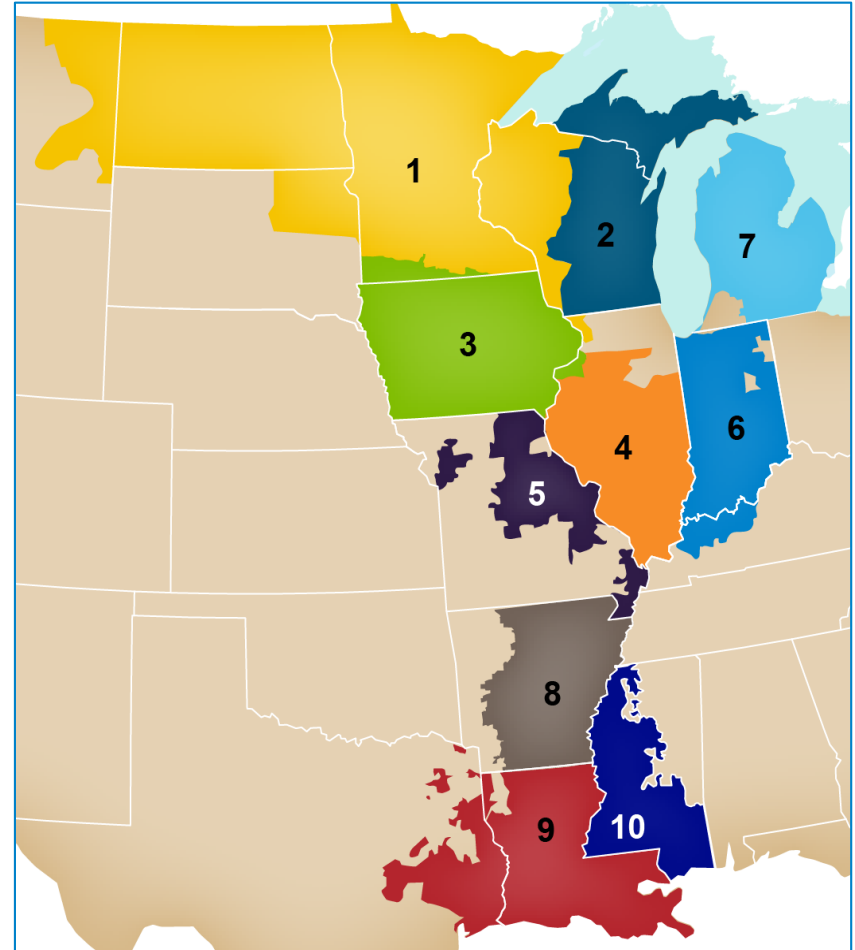
MISO region has adequate reserves to meet its 136 GW Planning Reserve Requirement

- Most zones cleared **\$4.75-\$6.88/MW-day**
- Zone 7 (MI) cleared at Cost of New Entry (CONE) **\$257.53/MW-day**
 - Insufficient local capacity to meet Local Clearing Requirement (LCR)
- South to North capacity reached limit causing price separation of \$0.25
- Zonal Deliverability Benefit (ZDB) distribution:
 - Zones 1-6: **\$0.01**, Zone 7: **\$2.51**, Zone 9: **\$0.07** / MW-day
- Regional generation supply consistent with the 2019 OMS-MISO Survey
- Independent Market Monitor has reviewed and validated results. No instances of physical or economic withholding.



Auction Clearing Prices ~\$5/MW-day with exception of Zone 7, which cleared at CONE

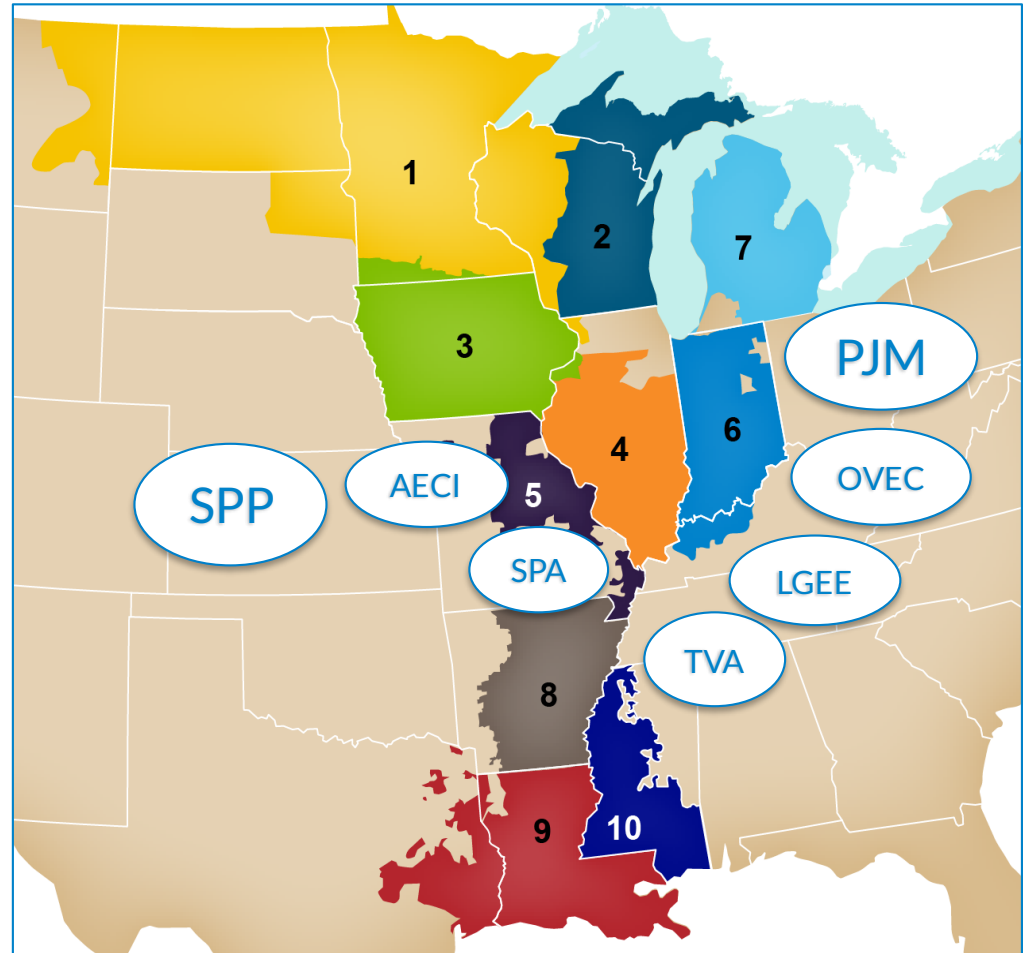
Zone	Local Balancing Authorities	Price \$/MW-Day
1	DPC, GRE, MDU, MP, NSP, OTP, SMP	\$5.00
2	ALTE, MGE, UPPC, WEC, WPS, MIUP	\$5.00
3	ALTW, MEC, MPW	\$5.00
4	AMIL, CWLP, SIPC, GLH	\$5.00
5	AMMO, CWLD	\$5.00
6	BREC, CIN, HE, IPL, NIPS, SIGE, HMPL	\$5.00
7	CONS, DECO	\$257.53
8	EAI	\$4.75
9	CLEC, EES, LAFA, LAGN, LEPA	\$6.88
10	EMBA, SME	\$4.75
ERZ	SPP, PJM, OVEC, LGEE, AECI, SPA, TVA	\$4.89-5.00



ERZ = External Resource Zones

MISO imported 1500MW from External zones which cleared at sub-regional or blended pricing

External Resource Zone	Export (MW)	Price (\$/MW-Day)
SPP	347	\$4.90
PJM	633	\$5.00
OVEC	30	\$5.00
LGEE	148	\$5.00
AECI	24	\$4.92
SPA	199	\$4.89
TVA	227	\$4.90
Total	1578	



Zonal Deliverability Benefit amount to \$56,950/day surplus due to price separation and capacity importing from lower priced zones

Zones	PRMR (MW)	Cleared Resources (MW)	ACP (\$/MW-day)	DEBIT (ACP * PRMR)	CREDIT (ACP * Cleared Resources)
1	18,476.0	18,742.0	5.00	\$ 92,380.00	\$ 93,710.00
2	13,728.2	13,590.0	5.00	\$ 68,641.00	\$ 67,950.00
3	10,129.1	10,551.0	5.00	\$ 50,645.50	\$ 52,755.00
4	9,794.6	8,462.1	5.00	\$ 48,973.00	\$ 42,310.50
5	8,456.3	7,952.8	5.00	\$ 42,281.50	\$ 39,764.00
6	18,720.6	17,054.6	5.00	\$ 93,603.00	\$ 85,273.00
7	21,945.3	21,727.5	257.53	\$ 5,651,573.11	\$ 5,595,483.08
8	7,986.9	10,183.1	4.75	\$ 37,937.78	\$ 48,369.73
9	21,711.7	20,893.7	6.88	\$ 149,376.50	\$ 143,748.66
10	5,030.6	5,244.2	4.75	\$ 23,895.35	\$ 24,909.95
PJM	0.0	633.8	5.00	\$ -	\$ 3,169.00
OVEC	0.0	30.1	5.00	\$ -	\$ 150.50
LGEE	0.0	148.4	5.00	\$ -	\$ 742.00
SPP	0.0	347.2	4.90	\$ -	\$ 1,701.28
TVA	0.0	226.5	4.90	\$ -	\$ 1,109.85
AECI	0.0	24.0	4.92	\$ -	\$ 118.08
SPA	0.0	168.3	4.89	\$ -	\$ 822.99
Totals	135,979.3	135,979.3		\$ 6,259,306.73	\$ 6,202,087.60
				Surplus Sub Total	\$ 57,219.13
				FRAP/HUC	\$ (268.51)
				Total Surplus	\$ 56,950.62

Surplus revenue will be distributed to HUCs and pro rata to LSEs in the importing Deliverability Benefitting Zones (DBZ):

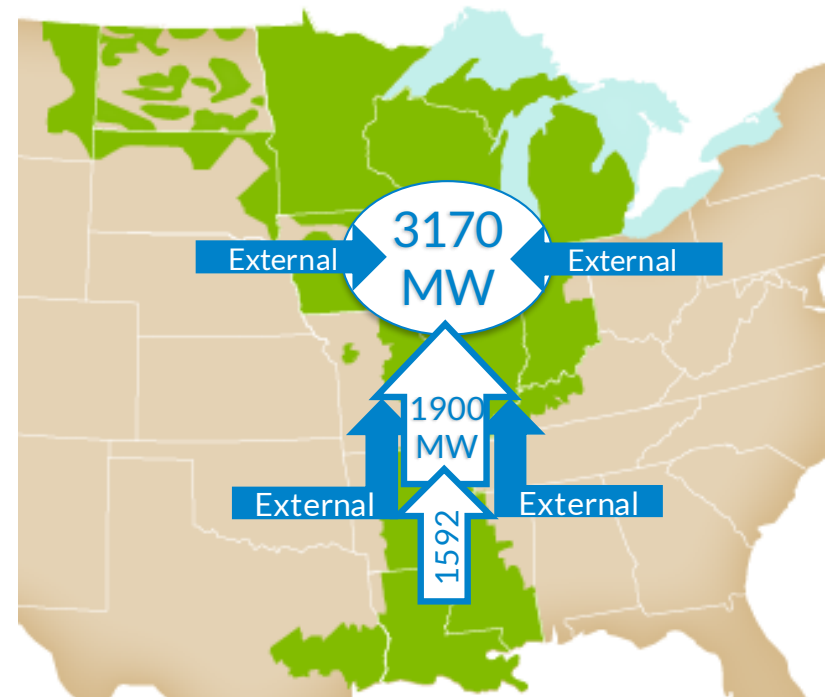
DBZ	ZDB \$/MW-day
1-6	\$0.01
7	\$2.51
9	\$0.07

MISO North zones imported over 3000MW while the South to North limit was reached causing a modest \$0.25 clearing price separation

MISO North imported 3170 MW, comprised of:

- 1270 MW External Resources
- 1900 MW from MISO South
 - 1592 MW Internal Resources
 - 308 MW External Resources

The South-to-North limit was determined through the annual Sub-Regional Import/Export Limit analysis to be 1900 MW in advance of this year's PRA. This South-to-North limit previously bound in the 2016 auction.



340MW of capacity met Long Term Outage criteria, therefore unable to be used towards Resource Adequacy requirements in this year's PRA

In January 2020, FERC approved MISO's filing ER20-129 where resources with planned outages or derates that were reasonably expected to last more than 90 of the first 120 days in a Planning Year would be ineligible for participation in that associated PRA.

Breakdown by Zone:

Zone	MW
1	1.3
3	1
7	337.3
Total	339.6

Capacity used in the 2019 LOLE Study was slightly higher as compared to 2020 PRA

Slight variation in capacity driven by:

- Approved Attachment Y retirements after LOLE cut-off date (June 1 2019)
- Generator Variables (GVTC, XEFORd etc.)
 - LOLE used 2018 GVTC PRA used 2019 GVTC
 - LOLE used 5 year XEFORd (2014-2018) PRA used 3 year XEFORd (2016-2019)

	2020/21 LOLE UCAP	2020/21 PRA UCAP	Delta UCAP	Delta (%)
Generation	129,015	125,341	(3,674)	-3%
Behind the Meter Generation	4,416	3,997	(419)	-10%
Demand Response	7,836	7,754	(82)	-1%
External Resources	4,450	3,832	(618)	-16%
Energy Efficiency	312	650	338	52%
Total	146,029	141,574	(4,455)	-3%

LOLE peak demand forecasts consistent with PRA

MISO coincident peak demand from LOLE study used to set the 2020/21 PY PRM.

MISO Coincident Peak				
Zone	2020/21 PY LOLE (MW)	2020/21 PY PRA (MW)	Delta (MW)	Delta (%)
MISO	124,659	124,865	206	0%

LRZ zonal coincident peak demands from LOLE study used to set the 2020/21 PY Local Reserve Requirement.

Zonal Coincident Peak				
Zone	2020/21 PY LOLE (MW)	2020/21 PY PRA (MW)	Delta (MW)	Delta (%)
LRZ-1	17,815	17,483	(332)	-2%
LRZ-2	12,728	12,787	59	0%
LRZ-3	9,558	9,496	(62)	-1%
LRZ-4	9,185	9,174	(11)	0%
LRZ-5	7,830	7,966	136	2%
LRZ-6	17,585	17,471	(114)	-1%
LRZ-7	21,226	20,963	(263)	-1%
LRZ-8	7,685	7,584	(101)	-1%
LRZ-9	20,885	20,880	(6)	0%
LRZ-10	4,673	4,694	21	0%

To better understand the impact of insufficient local capacity to meet Zone 7's Local Clearing Requirement, MISO to conduct a sensitivity loss of load probability analysis on Zone 7

Sensitivity analysis scope:

Conduct Loss of Load Expectation sensitivity comparing two (2) scenarios:

- Zone 7 2019 PRA Results with application of Long Term Outage policy to planning resources
- Zone 7 2020 PRA Results

MISO to present the results at the June RASC meeting

Next Steps

- MAY 15 – Posting of PRA masked offer data
- MAY 25 – MISO published cleared LMRs to the MCS
- MAY 29 – LSE submit ICAP Deferral info
- JUN 1 – New Planning Year starts

Appendix

MISO's RA construct combines regional and local criteria to achieve a least-cost solution for the region

Multiple options exist for Load-Serving Entities to demonstrate Resource Adequacy:

- Submit a Fixed Resource Adequacy Plan (FRAP)
- Utilize bilateral contracts with another resource owner
- Participate in the Planning Resource Auction (PRA)

The Independent Market Monitor (IMM) reviews the auction results for physical and economic withholding

Inputs

- Local Clearing Requirement (LCR) = capacity required from within each zone
- MISO-wide reserve margin requirements, which can be shared among the Zones, and Zones may import capacity to meet this requirement above LCR
- Capacity Import/Export Limits (CIL/CEL) = Zonal transmission limitations
- Sub-Regional contractual limitations such as between MISO's South and Central/North Regions

Outputs

- Commitment of capacity to the MISO region, including performance obligations
- Capacity price (ACP = Auction Clearing Price) for each Zone
- ACP price drives the settlements process
- Load pays the Auction Clearing Price for the Zone in which it is physically located
- Cleared capacity is paid the Auction Clearing Price for the Zone where it is physically located

Three primary changes since 2019 Auction

- **Preclude Resources on Long Term Outages from Participation in the PRA (ER20-129)**

In January 2020, FERC approved MISO's filing to limit the ability of Resources to participate in a Fixed Resource Adequacy Plan ("FRAP") and MISO's Planning Resource Auction ("PRA"), if the Resource has expected full or partial outages that last for any ninety (90) or more of the first 120 Calendar Days of the Planning Year which is consistent with the highest period of LOLE risk.

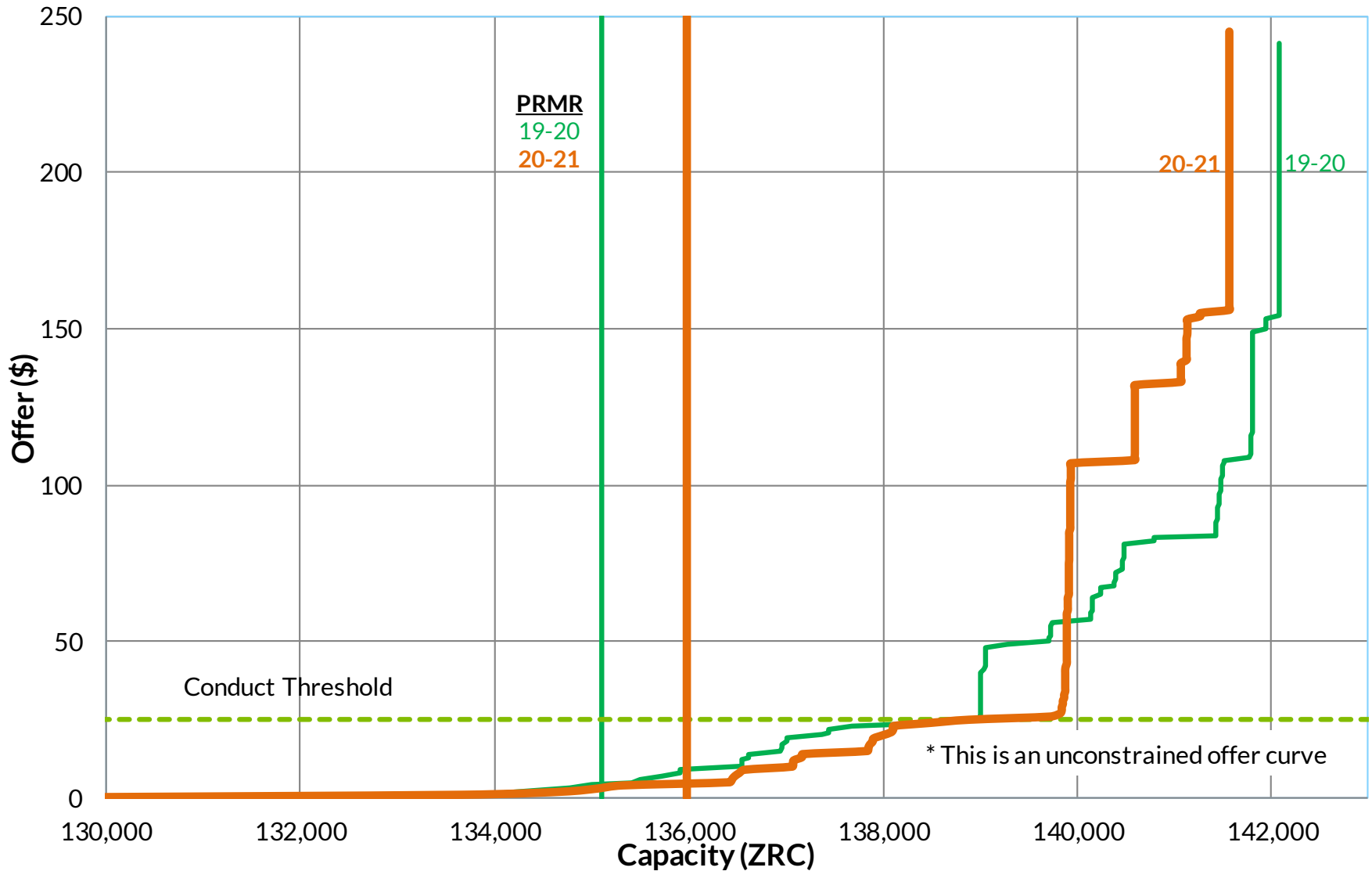
- **Load Modifying Resource (LMR) Testing Requirement Refinements (ER19-650)**

In Feb. 2019, FERC approved part of MISO's Resource Availability and Need initiative related to Load Modifying Resource (LMR) availability. Further LMR Business Practice refinements clarified LMRs must now provide actual real power test results or performance data from a previous event during the LMR registration process to avoid a potential underperformance penalty. An LMR could opt-out of providing test or performance, but would be subject to a penalty if it failed to perform during an emergency event.

- **Ongoing Fleet Change**

- The auction results reflect the industry's ongoing shift away from coal-fired generation and an increasing reliance on gas-fired resources and non-traditional resources, such as intermittent renewable resources and various demand-based resources. These trends are the basis for MISO's current Resource Availability and Need efforts.

2020-21 Offer Curve* generally similar to 2019-20



2020/21 PRA Results by Zone

	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Z9	Z10	ERZ	System
PRMR	18,476.0	13,728.2	10,129.1	9,794.6	8,456.3	18,720.6	21,945.3	7,986.9	21,711.7	5,030.6	N/A	135,979.3
Offer Submitted (Including FRAP)	20,296.4	14,056.1	10,822.0	10,281.4	7,952.8	17,134.6	21,727.5	10,573.5	21,800.7	5,300.2	1,629.0	141,574.2
FRAP	14,198.3	11,473.4	4,143.6	705.1	0.0	1,515.4	12,034.4	501.4	174.0	1,402.7	171.9	46,320.2
Self Scheduled (SS)	3,800.1	2,116.5	6,031.5	6,005.9	7,952.8	13,563.9	9,619.9	9,255.0	19,123.9	3,454.5	1,316.0	82,240.0
Non-SS Offer Cleared	743.6	0.1	375.9	1,751.1	0.0	1,975.3	73.2	426.7	1,595.8	387.0	90.4	7,419.1
Committed (Offer Cleared + FRAP)	18,742.0	13,590.0	10,551.0	8,462.1	7,952.8	17,054.6	21,727.5	10,183.1	20,893.7	5,244.2	1,578.3	135,979.3
LCR	17,058.9	13,331.9	7,671.9	6,744.2	4,453.3	12,778.3	21,850.7	6,243.1	20,893.7	3,688.3	-	N/A
CIL	2,902	1,603	3,284	6,003	5,424	7,326	3,200	3,824	3,410	3,160	-	N/A
ZIA	2,900	1,603	3,171	5,085	5,424	7,041	3,200	3,776	3,410	3,160	-	N/A
Import	0.0	138.2	0.0	1,332.5	503.5	1,666.0	217.8	0.0	818.0	0.0	-	4,676.0
CEL	4,101	-	-	3,859	-	4,622	-	-	1,918	1,658	-	N/A
Export	266.0	0.0	421.9	0.0	0.0	0.0	0.0	2,196.2	0.0	213.6	1,578.3	4,676.0
ACP (\$/MW-Day)	5.00	5.00	5.00	5.00	5.00	5.00	257.53	4.75	6.88	4.75	4.90*	N/A

Values displayed in MW UCAP, * = average ACP

With few exceptions, historical auction clearing prices continue to remain low, reflective of MISO regional makeup

PY	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	ERZs	
2014-2015	\$3.29	\$16.75							\$16.44		N/A	N/A
2015-2016		\$3.48		\$150.00	\$3.48			\$3.29		N/A	N/A	
2016-2017	\$19.72	\$72.00							\$2.99		N/A	
2017-2018	\$1.50										N/A	
2018-2019	\$1.00	\$10.00									N/A	
2019-2020	\$2.99					\$24.30	\$2.99					
2020-2021	\$5.00					\$257.53	\$4.75	\$6.88	\$4.75	\$4.89-\$5.00		

IMM Conduct Threshold	25.61	25.17	25.02	25.46	26.08	25.49	25.75	24.56	23.66	24.50	26.08
Cost of New Entry	256.08	251.67	250.22	254.68	260.79	254.88	257.53	245.64	236.58	244.96	260.79

- Auction Clearing Prices shown in \$/MW-day
- Conduct Threshold is 10% of Cost of New Entry (CONE)

A three year comparison demonstrates fairly consistent amount supply offered & cleared in aggregate, while demand side resources continue to rise

	Offered (ZRC)			Cleared (ZRC)		
Planning Resource	2018-19	2019-20	2020-21	2018-19	2019-20	2020-21
Generation	126,159	125,290	125,341	120,855	119,779	120,143
External Resources	3,903	4,402	3,832	3,089	3,183	3,736
Behind the Meter Generation	4,176	4,202	3,997	4,098	4,097	3,892
Demand Resources	7,370	7,876	7,754	6,964	7,372	7,557
Energy Efficiency	173	312	650	173	312	650
Total	141,781	142,082	141,574	135,179	134,743	135,979

Variations in Resource Adequacy requirements are largely attributed to changing resource mix, performance and load shapes even though peak load forecasts remain steady

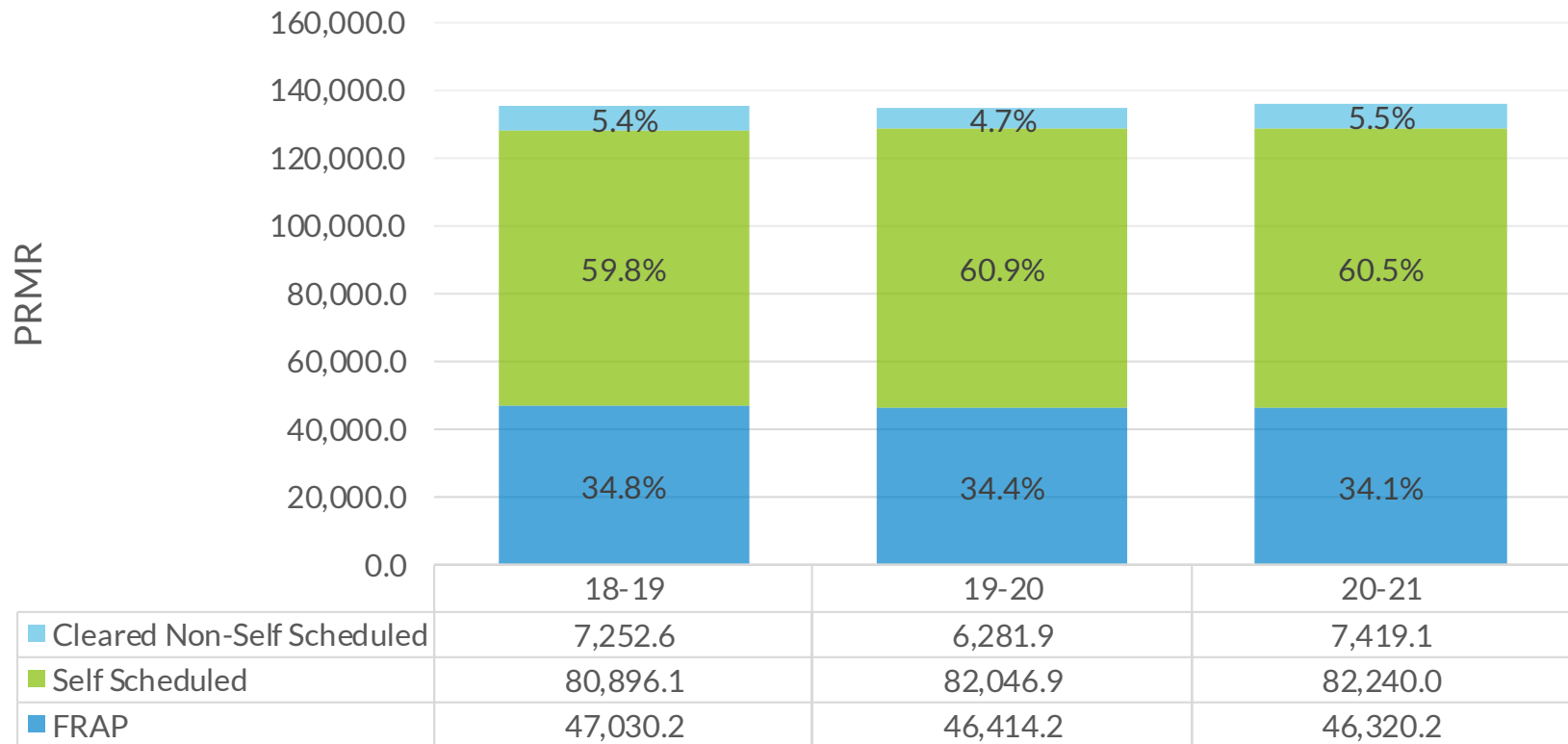
Local Resource Zone	Local Clearing Requirement (LCR) in MW		Planning Reserve Margin Requirement (PRMR) in MW		Coincident Peak Demand Forecast (CPDF) in MW	
	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21
1	16,589	17,059	18,375	18,476	16,541	16,403
2	13,018	13,332	13,450	13,728	12,258	12,353
3	7,960	7,672	9,882	10,129	8,966	8,997
4	6,222	6,744	9,792	9,795	8,923	8,820
5	4,860	4,453	8,297	8,456	7,551	7,630
6	13,226	12,778	18,660	18,721	16,820	16,720
7	21,812	21,851	21,976	21,945	19,759	19,575
8	6,116	6,243	7,964	7,987	7,194	7,169
9	19,525	20,894	21,350	21,712	19,330	19,508
10	3,049	3,688	4,997	5,031	4,505	4,504

Year over year comparison reflects the industry's ongoing shift away from coal-fired generation and an increasing reliance on gas-fired resources and non-traditional resources

Planning Year	2019-20		2020-21		Change	
GADS Fuel Type	System (MW)	% Fuel	System (MW)	% Fuel	Delta (MW)	Delta (%)
Coal	47,059	34.93%	46,576	34.25%	-483	-1.03%
Gas	51,317	38.08%	52,247	38.42%	930	1.81%
Nuclear	12,274	9.11%	12,034	8.85%	-240	-1.96%
Load Modifier (DR/EE)	7,722	5.73%	8,208	6.04%	486	6.29%
Water	6,176	4.58%	6,021	4.43%	-155	-2.51%
Oil	3,528	2.62%	3,411	2.51%	-117	-3.32%
Wind	2,698	2.00%	3,275	2.41%	577	21.39%
Waste Heat	1,125	0.83%	1,204	0.89%	79	7.03%
Other-Solid(Tons)	814	0.60%	838	0.62%	24	2.89%
Distillate Oil	604	0.45%	582	0.43%	-22	-3.58%
Other-Liquid(BBL)	49	0.04%	48	0.04%	-1	-1.43%
Other-Gas(Cu Ft)	553	0.41%	542	0.40%	-11	-2.06%
Wood	144	0.11%	143	0.11%	-1	-0.76%
Solar	680	0.50%	850	0.63%	170	25.06%
SYSTEM	134,743	100%	135,978	100%	1,235	0.92%

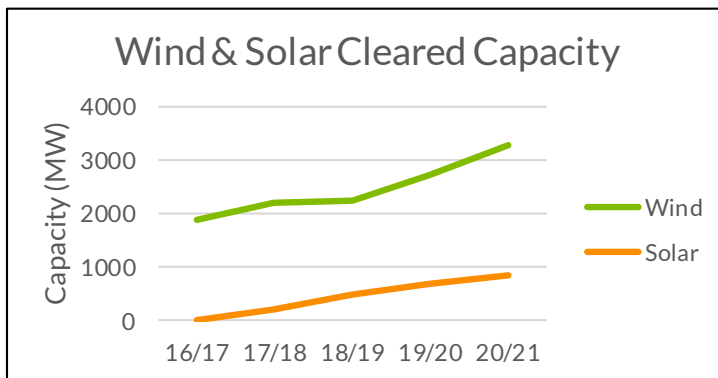
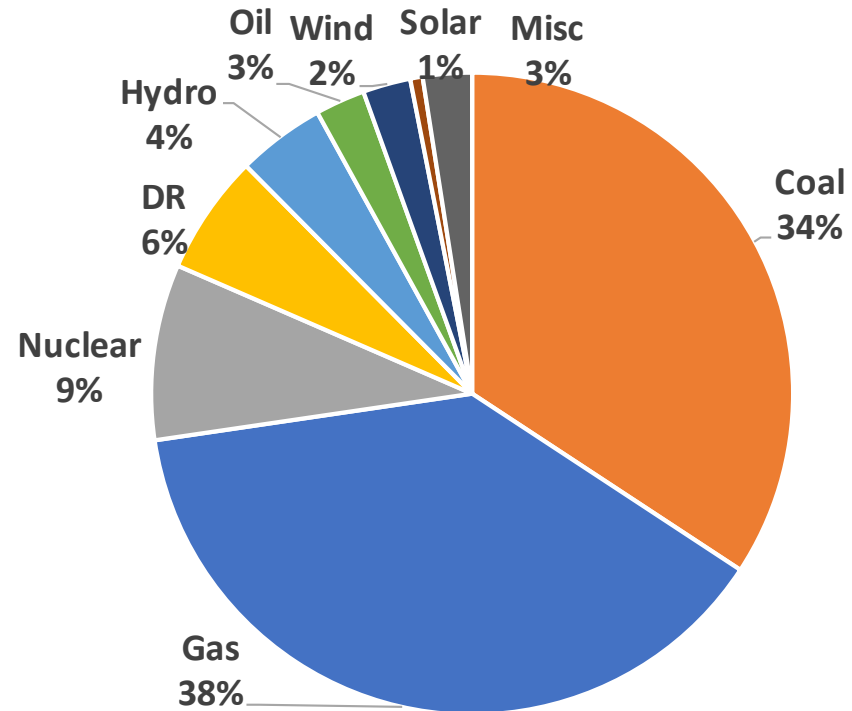
Members continue to utilize FRAP and Self Schedule to meet Resource Adequacy Requirements

% OF PRMR

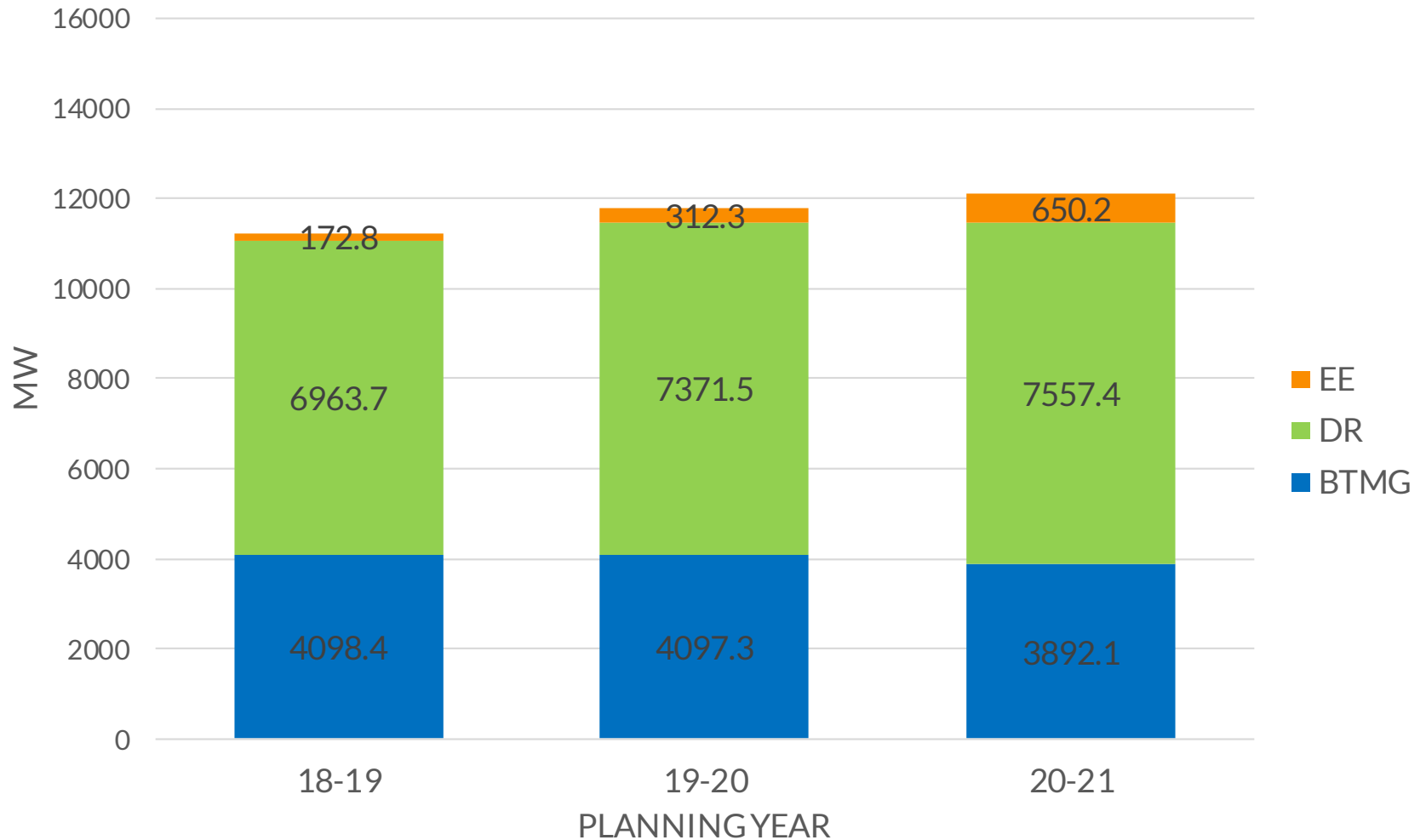


While conventional generation provides 80% of resources, wind and solar are growing...

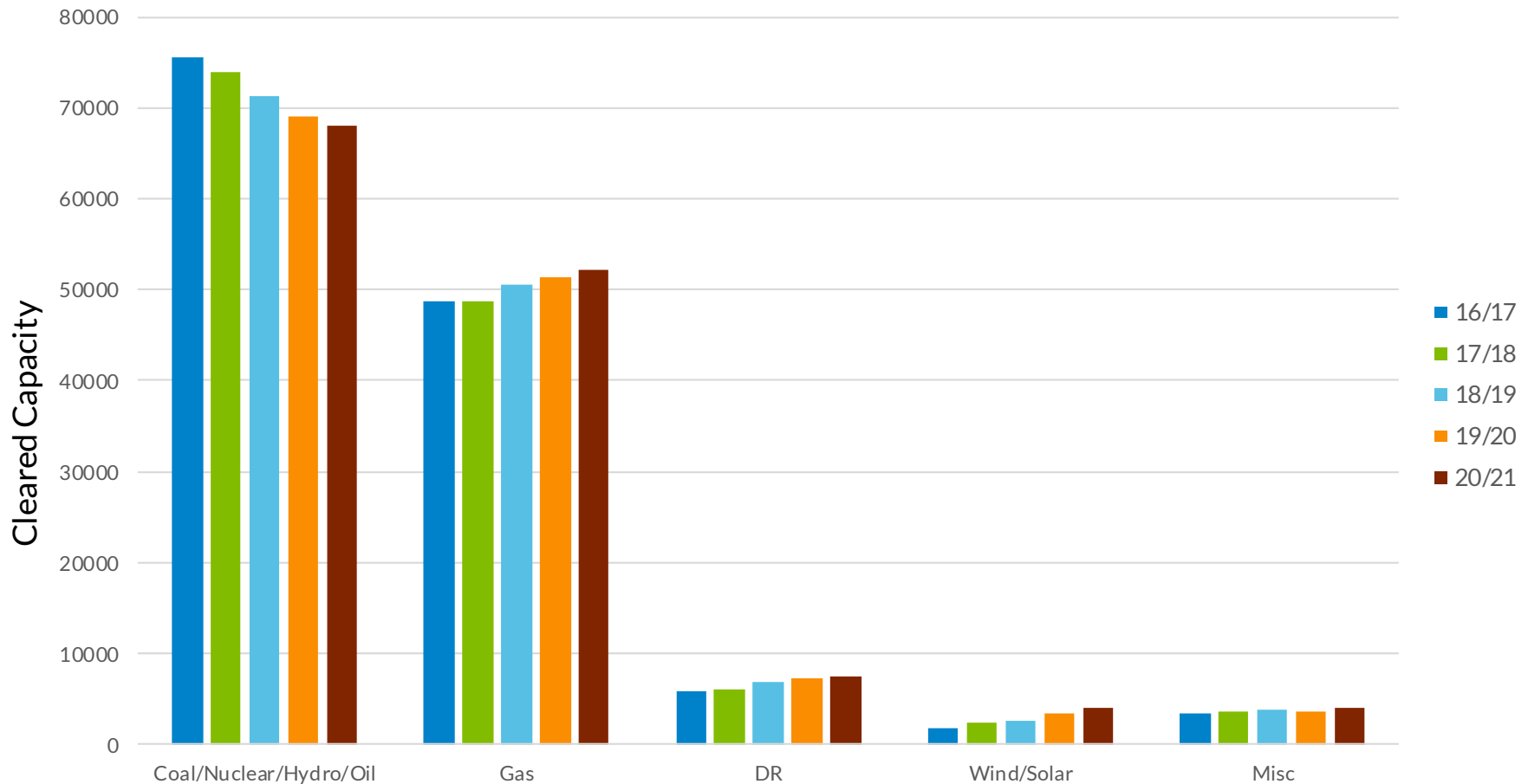
- 850MW of solar cleared this year's auction—an increase of 25% from PY 2019-20 (680 MW).
- Similarly, 3,275 MW of wind cleared this year, an increase of 21% compared to last year (2,697 MW).



...as have demand-based resources...



...which continues the trend of non-conventional resource gains over at least the past 5 years



UCAP Confirmation and Conversion

LRZ	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	ERZ	Total	Formulas
UCAP Total	20,919	14,081	11,816	11,779	7,957	17,457	21,826	10,843	22,736	5,322	1,693	146,428	A
UCAP (Confirmed)	20,835	14,081	11,462	11,356	7,957	17,457	21,781	10,843	21,926	5,322	1,693	144,712	B
UCAP (Unconfirmed)	85	-	354	423	-	-	45	-	810	-	-	1,716	C=A-B
Converted UCAP (ZRC)	20,507	14,074	10,843	10,762	7,957	17,411	21,604	10,726	21,822	5,322	1,686	142,713	D
Unconverted UCAP	328	7	619	594	-	46	177	117	104	-	7	1,999	E=B-D
FRAP + ZRC Offer	20,251	14,056	10,796	10,248	7,953	17,135	21,559	10,574	21,798	5,294	1,629	141,290	F
ZRC Not Offered/FRAP	257	18	47	514	4	276	45	153	24	28	57	1,423	G=D-F
MW/ZRC not participating in MISOPRA	669	25	1,020	1,531	4	322	267	269	938	28	64	5,137	H=C+E+G

- Common reasons why ZRCs may not participate in a PRA:
 - Capacity sales to other markets
 - Suspensions not participating in PRA
 - Exclusion granted by the IMM
 - General withholding from the PRA within the Physical Withholding Threshold

Supplemental Data for PRMR and LCR Calculations

Local Resource Zone	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Z9	Z10	SYSTEM
CPDF (Coincident Peak Demand Forecast)	16,403	12,353	8,997	8,820	7,630	16,720	19,575	7,169	19,508	4,504	121,680
CPDF + Transmission Losses	16,966	12,606	9,301	8,994	7,765	17,190	20,152	7,334	19,937	4,620	124,865
Planning Reserve Margin (PRM)	8.90%										
PRMR (Planning Reserve Margin Requirement)	18,476	13,728	10,129	9,795	8,456	18,721	21,945	7,987	21,712	5,031	135,979
ZCPDF (Zonal Coincident Peak Demand Forecast)	17,059	12,539	9,304	8,978	7,813	16,956	20,237	7,436	20,454	4,591	125,367
ZCPDF + Zonal Trans. Losses	17,483	12,787	9,496	9,174	7,966	17,471	20,963	7,584	20,880	4,694	128,498
LRR (Local Reliability Requirement) Factor	1.142	1.168	1.15	1.292	1.24	1.149	1.195	1.33	1.164	1.459	N/A
LRR	19,966	14,935	10,921	11,853	9,877	20,074	25,051	10,087	24,304	6,848	N/A
ZIA (Zonal Import Ability)	2,900	1,603	3,171	5,085	5,424	7,041	3,200	3,776	3,410	3,160	N/A
Non-Pseudo Tied Exports	7	0	78	24	0	255	0	68	0	0	432
LCR (Local Clearing Requirement)	17,059	13,332	7,672	6,744	4,453	12,778	21,851	6,243	20,894	3,688	N/A
LCR as a % of PRMR	92%	97%	76%	69%	53%	68%	100%	78%	96%	73%	N/A

Forecasted requirements from LOLEWG were consistent with PRA

Zone	Capacity Import Limit (CIL), MW		Local Clearing Requirement (LCR), MW	
	2020/21 LOLE	2020/21 PRA	2020/21 LOLE	2020/21 PRA
LRZ-1	3,231	2,902	17,127	17,059
LRZ-2	1,603	1,603	13,259	13,332
LRZ-3	3,406	3,284	7,759	7,672
LRZ-4	6,092	6,003	6,971	6,744
LRZ-5	5,424	5,424	4,283	4,453
LRZ-6	7,188	7,326	13,161	12,778
LRZ-7	3,200	3,200	22,170	21,851
LRZ-8	3,919	3,824	6,247	6,243
LRZ-9	3,712	3,410	20,908	20,894
LRZ-10	3,432	3,160	3,658	3,688

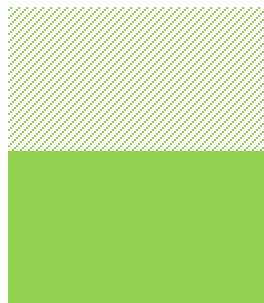
LOLE study capacity was slightly higher than the PRA

Zone	2020/21 LOLE UCAP	2020/21 PRA UCAP	Delta UCAP	Delta (%)
LRZ-1	20,332	20,296	(36)	0%
LRZ-2	14,252	14,056	(196)	-1%
LRZ-3	11,371	10,822	(549)	-5%
LRZ-4	12,128	10,281	(1,846)	-18%
LRZ-5	7,848	7,953	104	1%
LRZ-6	17,846	17,135	(711)	-4%
LRZ-7	22,111	21,728	(384)	-2%
LRZ-8	10,876	10,574	(302)	-3%
LRZ-9	23,090	21,801	(1,289)	-6%
LRZ-10	4,602	5,300	698	13%
External	1,572	1,629	57	3%

In 2020, regional surpluses are sufficient to cover areas with potential resource deficits

2020 Outlook, ICAP GW (% Reserves)

5.8 (21.4%)



3.0 (19.2%)

1 day in 10
PRM (16.8%)

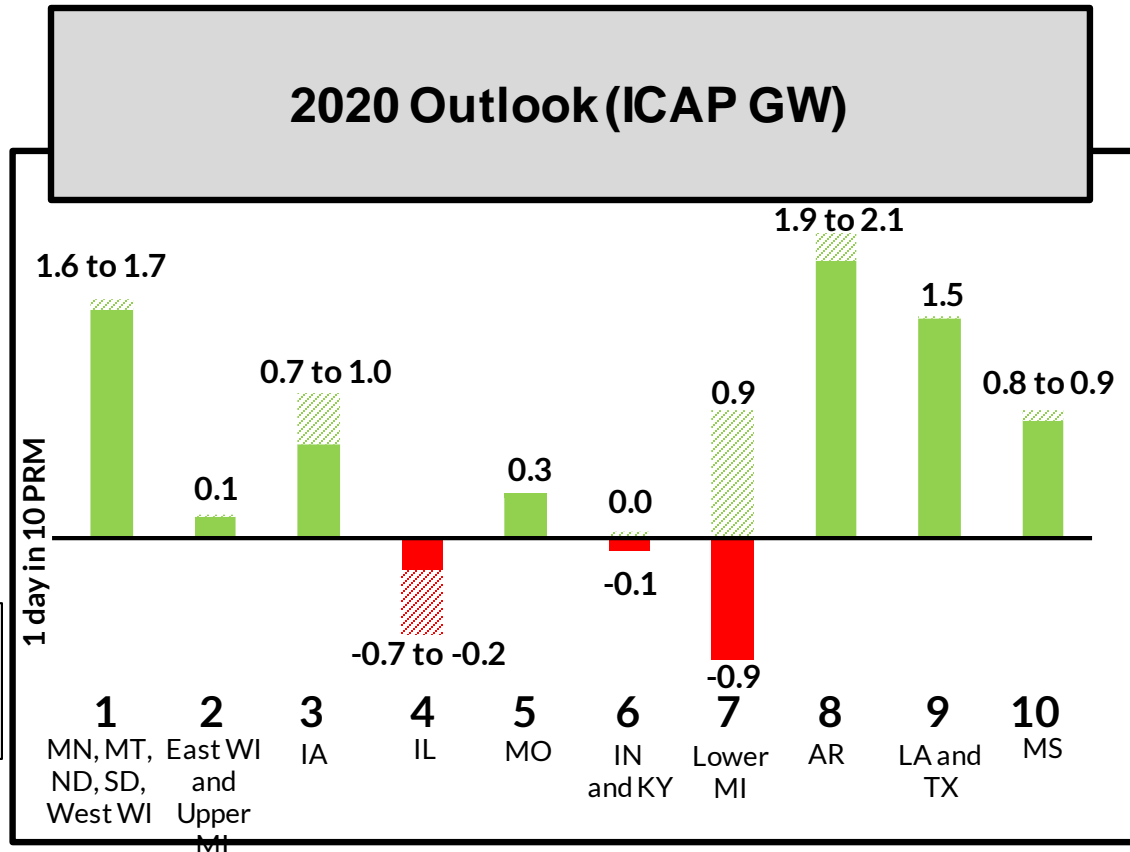


Potential Capacity Projection



Committed Capacity Projection

2020 Outlook (ICAP GW)



- The Michigan Public Service Commission Staff recently filed a report finding that the Michigan LSEs have adequate owned or contracted resources to meet projected resource adequacy requirements through 2022, this aligns with the OMS MISO survey projections for Zone 7
- Regional surpluses and potential resources are sufficient for all zones to serve their deficits while meeting local requirements
- Positions include reported inter-zonal transfers, but do not reflect other possible transfers between zones
- Exports from Zones 8, 9, and 10 were limited by the Sub-regional Power Balance Constraint

Acronyms

ACP: Auction Clearing Price

ARC: Aggregator of Retail Customers

BTMG: Behind the Meter Generator

CIL: Capacity Import Limit

CEL: Capacity Export Limit

CONE: Cost of New Entry

DR: Demand Resource

EE: Energy Efficiency

ER: External Resource

ERZ: External Resource Zones

FRAP: Fixed Resource Adequacy Plan

ICAP: Installed Capacity

IMM: Independent Market Monitor

LCR: Local Clearing Requirement

LMR: Load Modifying Resource

LRR: Local Reliability Requirement

LRZ: Local Resource Zone

LSE: Load Serving Entity

PRA: Planning Resource Auction

PRM: Planning Reserve Margin

PRMR: Planning Reserve Margin Requirement

RASC: Resource Adequacy Sub-Committee

SS: Self Schedule

SFT: Simultaneous Feasibility Test

UCAP: Unforced Capacity

ZIA: Zonal Import Ability

ZRC: Zonal Resource Credit



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