



White Paper

Another Year of Depressed Capacity Prices in MISO

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Shareables

- The sixth capacity auction in MISO saw a large price jump, but it is a case of swapping nickels for dimes.
- The lack of an effective market mechanism to provide adequate payments combined with state policies will likely keep prices low going forward.
- Only further retirements or any policy intervention will lead to an increase in pricing.

Executive Summary

MISO's sixth capacity auction for planning year 2018/2019 cleared at \$10/MW-day for all zones except Zone 1, which cleared at a meager \$1/MW-day. Although prices are significantly higher than the previous 2017 auction price of \$1.5/MW-day, the clearance of \$10/MW-day remains a beggar's price compared to capacity prices in other ISOs (PJM's recent 2021/2022 clearing price was nearly \$140/MW-day). The clearing price is below the fixed Operations and Maintenance (O&M) of a typical Combined-Cycle (CC) generator (~\$68/MW-day) and Combustion-Turbine (CT) generator (~\$41/MW-day) in MISO and does not provide a meaningful capacity value to marginal resources. The continued low capacity price situation is especially challenging for Zones 4 and 7, which have competitive retail choice and greater merchant generation capacity. Sustained poor price signals may create reliability issues in MISO in the long-term future, as generation may be forced to retire.



A Market in Standstill

Several changes had the potential to impact the MISO 2018/19 capacity auction results, but most offset one another, resulting in no significant net changes taking place.

EXHIBIT 1

Factor	Impact on clearing price
Higher Planning Reserve Margin Requirement (PRMR)	Upward Driver
a. Higher Gross Peak Demand	Upward Driver
b. Lower Transmission Losses	Downward Driver
c. Higher Forced Outages	Upward Driver
Lower zero-cost supply - self-supply and Fixed Resource Adequacy Plan (FRAP)	Upward Driver
Higher Behind-The-Meter Generation (BTMG), demand response, and energy efficiency participation	Downward Driver
Relaxation in Capacity Import Limit (CIL), resulting in higher imports from MISO-South	Downward Driver

Similar to past auctions, a significant amount of utility-owned and bi-laterally contracted capacity (which bids in the auction at a price of zero) depressed pricing. In this auction, 94.6% of total PRMR capacity is either from self-supply or FRAP sources compared to 95.7% in 2017/18, 92.8% in 2016/17 and 91.2% in 2015/16 auctions. Recent capacity price trends suggest that when self-supply or FRAP is lower (or uncontracted capacity is higher), the payments made to generators tend to be higher.

With almost 90% of MISO's load served by vertically integrated utilities the prices across MISO zones are expected to stay low. Potential changes to the current capacity market construct (such as implementing a sloped demand curve, adopting non-performance penalties, or introducing regulations akin to a forward capacity requirement, such as those proposed in Michigan and Illinois), could set MISO on a new path, but this year's auction price increase of 1000% will likely do little to change prospects in the market for merchant generators. The continued low prices underline the urgency to resolve capacity pricing for unregulated capacity and competitive retail zones.



MISO's Resource Adequacy Construct

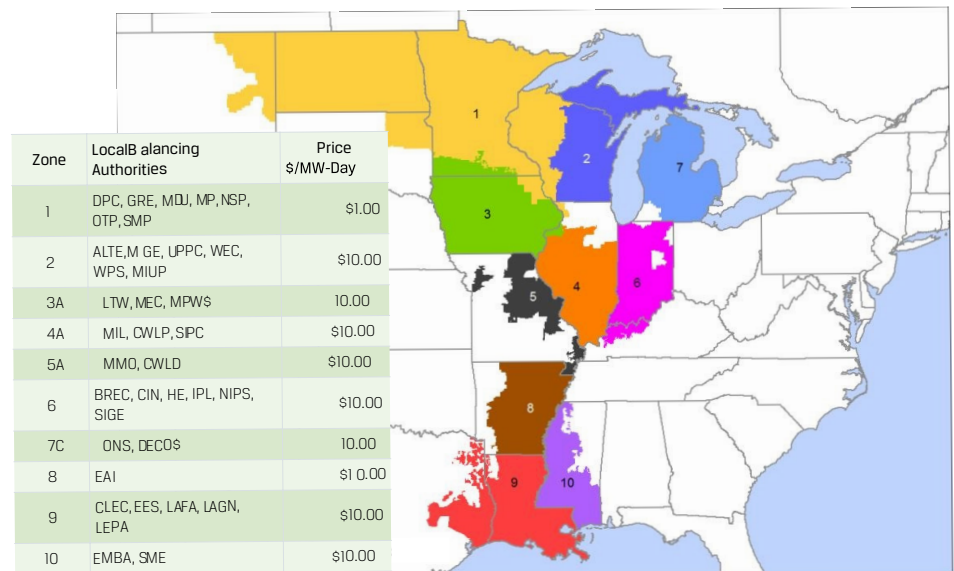
The Load Serving Entities (LSEs) within the MISO footprint are required to procure capacity to meet their Local Clearing Requirements (LCR) and the MISO-wide coincidental peak demand (the aforementioned PRMR). The procurement requirements can be achieved through self-supply, bilateral contracting, and market-based acquisition through the Planning Resource Auction (PRA).

Procurement done through the PRA is prompted on an annual basis (rather than forward-looking, like in the ISO-NE and PJM markets), meaning that capacity for the planning period from June to May is procured in April of the same year. This allows utilities and LSEs to procure some or all of their obligations from self-scheduling and FRAP generators, which can be assumed to offer capacity at \$0/ MW-day or be removed from the overall requirements in the PRA. Overall, the MISO market is more of a balancing construct than a "traditional market" to ensure capacity availability in advance.

MISO Capacity Auction 2018/19

The PRA auction in MISO is a residual auction for zones where they procure the remaining capacity after the self-scheduled and FRAP procurement. The trends in the previous MISO capacity auctions have been volatile, driven largely by the bids clearing against the vertical demand curve, variation in the zone-to-zone contracted capacity, and the volatile PRMR.

EXHIBIT 2. 2018/2019 AUCTION CLEARING PRICE OVERVIEW



Source: MISO

A Prevented Exodus

Most of the regions within MISO, except for Zones 4 and 7, are served by vertically integrated utilities that own and/or bilaterally contract most of their capacity requirements. Similar to the last auction, Zone 4, despite higher merchant cleared capacity, did not clear separately to a different and higher price, largely due to lower Local Capacity Requirement (LCR) driven by continued higher self-supply, and higher capacity import limits (CIL).

In areas with retail choice and more uncontracted capacity, prices in future auctions may go up if there is excess capacity withdrawal (either due to retirements or exporting to neighboring markets). However, in Zone 4, the impact of capacity withdrawal would be dampened (to an extent) by increasing energy efficiency and renewable mandates and a 10-year subsidy to nuclear generators under Illinois' Future Energy Jobs Act (FEJA). Additionally, increased capacity import limits will offset the impact of some capacity exit.

EXHIBIT 3: HISTORICAL AUCTION RESULTS - ZONE 4 AND MISO

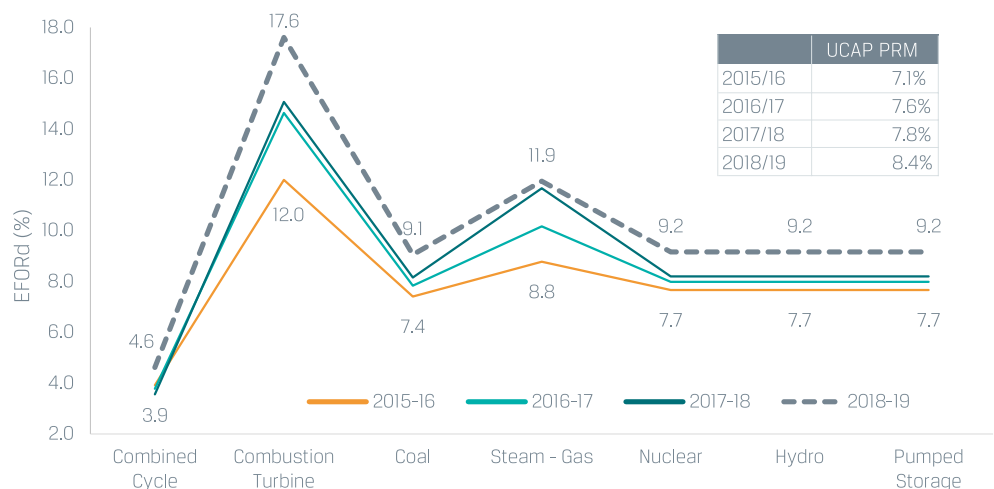
Recent PRA Results [Zone 4 and MISO]	Zone 4				MISO			
	2015/16	2016/17	2017/18	2018/19	2015/16	2016/17	2017/18	2018/19
Coincident Demand Peak, MW	9,518	9,433	8,951	9,100	124,097	124,097	121,630	121,816
Transmission losses, MW	211	209	227	180	3,222	2,877	3,371	1,887
PRM, %	7.1%	7.6%	7.8%	8.4%	7.1%	7.6%	7.8%	8.4%
PRMR, MW	10,420	10,375	9,984	10,060	136,359	135,483	134,753	135,179
Self Supply, MW	5,701	6,613	7,723	6,636	76,192	89,667	79,554	80,896
FRAP, MW	838	910	712	1,136	48,229	35,995	49,463	47,030
Uncontracted Merchant, MW	2,314	1,629	689	1,155	11,939	9,821	5,736	7,253
Total Cleared [incl. FRAP], MW	8,852	9,125	9,124	8,927	135,359	135,483	134,753	135,179
Merchant as % of total	26.1%	17.8%	7.6%	12.9%	8.8%	7.2%	4.3%	5.4%
Import / (Export), MW	1,568	1,224	771	1,33				
Clearing Price (\$/MW-day)	150.0	72.0	1.5	10.0	3.29-150.0	2.99-72.0	1.5	1.0-10.0

Source: MISO

Key Price Drivers for 2018/19 Auction:

- **Higher PRMR driven by slightly higher peak and reserve margin requirement; partially offset by lower transmission losses.** In the 2018/19 auction, coincident peak demand is higher by around 185 MW, while transmission losses are lower by around 485 MW, resulting in nearly 300 MW of lower demand. However, the 0.6% higher planning reserve margin (driven by higher forced outages) results in 425 MW of higher PRMR requirement.
- **Higher forced outages across the aging MISO fleet result in higher UCAP requirement.** Aging thermal plants comprise a large amount of existing capacity in MISO. Historically, there has been an increase in forced outage rates (Exhibit 2). The Equivalent Forced Outage Rate (EFOR) of baseload plants—including coal, combined cycle, and hydro units—has increased by 1-2% between the 2015/16 and 2018/19 auctions. Peaking unit forced outages, including oil-gas steam, combustion turbines, and pumped storage have increased by an even greater amount (2-6%) over the same period. This increasing trend in the forced outages increased the overall Unforced Capacity (UCAP) PRM from 7.8% in 2017/18 to 8.4% in 2018/19, offsetting the impact from the lower demand requirement and lower transmission losses. This is a growing concern and MISO's resource subcommittee continues to discuss the optimal treatment of forced and planned outages at time of peak while preparing for resource adequacy in coming years.

EXHIBIT 4: MISO SYSTEM-WIDE AVERAGE FORCED OUTAGE RATE BY RESOURCE TYPE

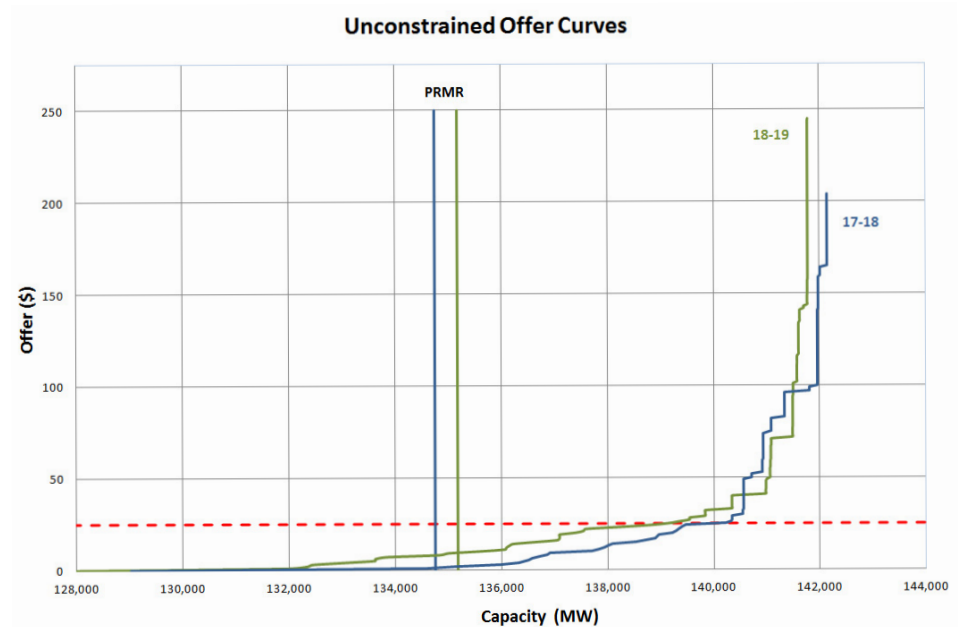


Source: MISO



- Lower zero cost supply - self-supply and FRAP – help put upward pressure.** Uncontracted merchant procurement in this year's auction was approximately 7.2 GW—approximately 1.5 GW higher than the 2017/18 auction. This result was largely driven by less participation from the self-supply and FRAP in the capacity auction and increased PRMR as compared to the previous year. Additionally, the overall bidding was slightly higher compared to the last auction (Exhibits 3 and 4). FRAP and the self-supply in the system reduced by approximately 2GW, and if PRMR had remained the same as in the 2017/18 auction, the cleared prices would have been higher. In the 2015/16 auction, the clearing price spiked in Zone 4 to \$150/MW-day with uncontracted merchant procurement of 2.3 GW, or approximately 2 GW higher than the 2017/18 auction and 1.2 GW higher than the 2018/19 auctions (Exhibit 4).

EXHIBIT 5: UNCONSTRAINED OFFER CURVES FOR 2017/18 AND 2018/19



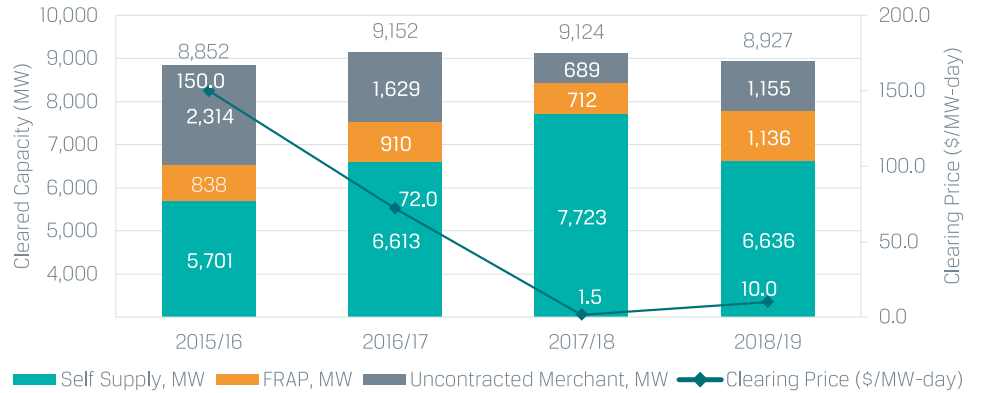
Source: MISO

MISO PRA is only for residual capacity; magnitude of self-supply or FRAP has significant potential to affect pricing. Historically, only 4-10% of total procurement is based on bids which are "truly" economic in nature or uncontracted merchant. This percentage is higher in Zone 4, which is open for retail competition and has relatively less contracted capacity; as such, it relies more on the MISO PRA auction for capacity procurement. The year-over-year trend suggests whenever more capacity is offered from self-supply or FRAP, the capacity pricing remains low. For example, in 2015/2016, Illinois Power Agency (IPA) procured 100% of its 2016 capacity requirements from PRA and so the prices in Zone 4 jumped to \$150/MW-day. In 2016/17 and 2017/18, respectively, IPA procured 50% and 25% from PRA; then prices went to \$72/MW-day and \$1.5/MW-day. While there are other factors



affecting the clearing prices, the impact of a lack of required economic capacity and excess self-supply or FRAP capacity is fairly visible. Thus, the structure of the MISO capacity market due to the concentration of utilities will continue to lead to result in lower cleared capacity prices.

EXHIBIT 6: MISO ZONE-4 CLEARED RESOURCES AND PRICE

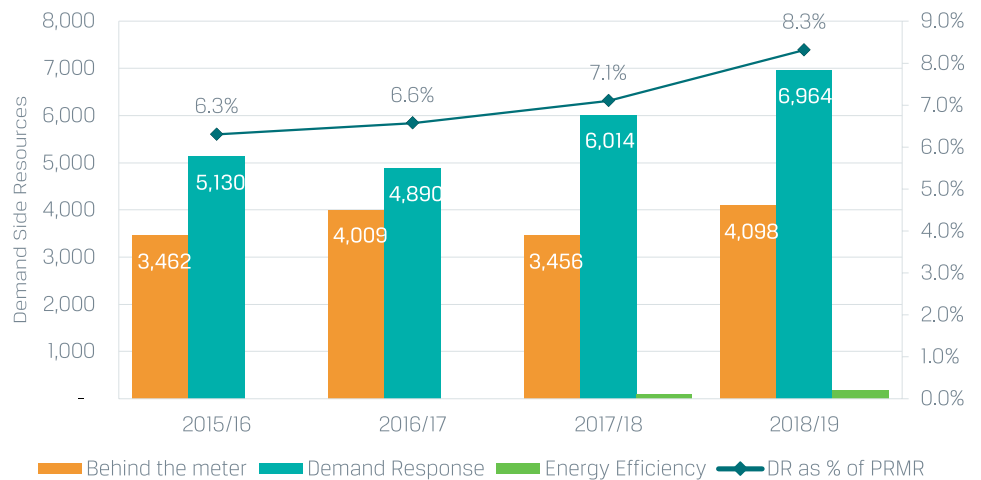


Source: MISO

■ Higher demand response participation driving down the market.

Participation of demand-side resources (e.g., DR, BTM, EE) has reduced the procurement of generating units in capacity auctions in the system (Exhibit 3). Due to increasing demand-side resources, the cleared DR increased by almost 1 GW from the 2017/18 auction to 2018/19, and the participation from energy efficiency almost doubled compared to the 2017/18 auction. A recent 2018 study for MISO projected demand-side management savings (largely from incremental EE) of 9.5 GW (7.5% of peak) by 2021, increasing to 14 GW (10.4% of peak) by 2028, and 23 GW (15% of peak) by 2038.

EXHIBIT 7: DEMAND RESPONSE PARTICIPATION IN MISO



Source: MISO



- Relaxation in the capacity import limits.** The CIL for the MISO zones has increased over the years, reducing the LCR procurement which allows more penetration of lower bids in the regions with less self-supply and FRAP capacity. Historically, Zones 4, 5, and 7 (having less self-supply and FRAP capacities) have been the major importers of capacity from Zones 1, 2, and 3 (having a higher base of self-supply and FRAP capacities). Moreover, with the transmission upgrades in MISO-South, there is a significant increase in export capacity from MISO-South to Zones 4 and 5. Exhibit 4 below summarizes the CIL, LCR and actual import/export capacities in the previous auctions. It is evident that when the CIL for Zone 4 was minimum, capacity prices cleared at \$150/MW-day and when the exchange constraints in the market relaxed, the clearing prices in the auctions reduced.

EXHIBIT 8: COMPARISON OF CIL, LCR AND IMPORT/EXPORT IN THE MISO CAPACITY MARKET

Capacity Import Limit, MW	1	2	3	4	5	6	7	8 to 10
2015/16	3735	2903	1972	3130	3899	5649	3813	5394
2016/17	3436	1609	1886	6323	4837	5610	3521	10670
2017/18	3531	2227	2408	5815	4096	6248	3320	8556
2018/19	4415	2595	3369	6411	4332	7941	3785	11144
LCR, MW	1	2	3	4	5	6	7	8 to 10
2015/16	15982	12332	8695	8852	6527	14677	21442	31459
2016/17	15918	12986	8715	5476	5026	13698	20851	27725
2017/18	15975	11980	7968	5839	5885	13005	21109	28892
2018/19	15832	12373	7374	4960	5693	12090	20628	28526
Import/(Export), MW	1	2	3	4	5	6	7	8 to 10
2015/16	-175	-931	-45	1,568	1,026	394	-837	-1,000
2016/17	-590	-1,315	-258	1,224	592	352	872	-875
2017/18	-613	-400	-503	771	648	-243	338	3
2018/19	-516	121	-651	1,133	606	-346	320	-666

Looking Ahead: Escape from the Capacity Market

It is expected that the MISO capacity market will continue to clear at low prices relative to other markets, at least in the near term. The following developments may impact the prices going forward, especially in areas with more uncontracted merchant capacity and retail choice.

- Demand growth has remained flat over the last few years and MISO expects the low growth to persist in the future.** According to the 2018 MISO Loss-of-Load-Expectation (LOLE) study, Zone 4 and Zone 7 may see negative peak demand growth (-0.1% per year) between 2018 and 2023. Additionally, MISO has significant demand-side management potential. A recent 2018 study for MISO projected DSM savings of 9.5 GW by 2021 (7.5% of peak, largely from

incremental EE) increasing to 14 GW by 2028 (10.4% of peak) and 23 GW by 2038 (15% of peak). This declining demand growth and increasing DSM will continue to cushion the impact of some of the potential retirements and any significant uptick in auction price.

- MISO 2018 Organization of MISO States (OMS) Survey shows decreasing reserves compared to what was projected in the 2017 OMS survey, but decreasing demand continues to suppress the erosion from the supply side (increasing outages and potential retirements). It indicates a growing resource adequacy concern with expected reserves of -0.1 GW to +7.3 GW (or -2.2 to +5.2 GW assuming the same load requirement as in the 2017 OMS) in 2020 compared to +3.2 to +7.3 GW reported in the 2017 OMS survey. The variation in demand and potential retirements/new builds creates a range of reserve scenario, but withdrawal of at-risk plants either in the form of retirement or potential exports to PJM could result in a capacity deficiency sooner than expected, as the procurement is done just two months ahead of time and there is very little time to react. Zone 4 and 7 are expected to have the lowest range of projected reserves.
- Michigan and Illinois are already looking for alternatives to the PRA auction. While Michigan has introduced a four-year forward capacity procurement requirement for all the retail electricity providers, Illinois recently introduced a bill for competitive, subsidy-free, fuel-neutral, and in-state procurement of capacity in downstate Illinois.
- FEJA (effective June 1, 2017) will increase renewable and energy efficiency penetration (and, in turn, lower demand growth) and will further weaken the prospects of uncontracted thermal capacity and offset the impact of some of the potential retirements.
- Over the last two years, around 1.2 GW of Zone 4 capacity switched to PJM to take advantage of stronger capacity pricing. Other merchant generators have also announced their plans to export another 2 GW of capacity from Zone 4 to PJM. This may not be a feasible option for all at-risk capacity, and some of the uncontracted merchant capacity may end up retiring, absent any intervention to the current auction construct. Since the rejection of its Competitive Retail Solution (CRS) proposal for separate forward capacity market in areas with retail choice, MISO has not reintroduced any measures related to competitive retail choice areas.

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