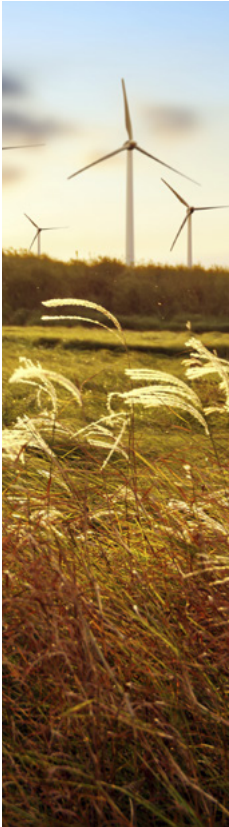




WHITE PAPER

MISO's Capacity Auction: Uncertainty Going Forward

By Himanshu Pande and Rachel Green



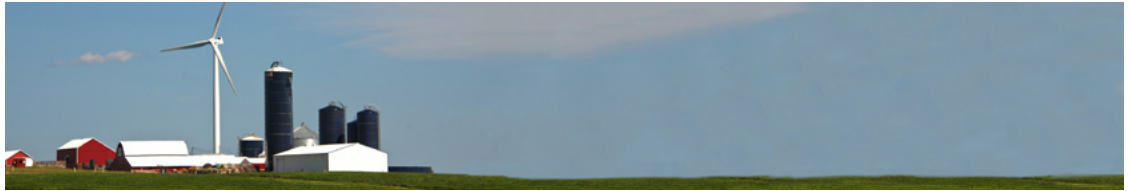
The Bottom Line

1. The Midcontinent Independent System Operator's (MISO's) recent capacity auction results reveal the impact of independent power producers (IPPs) on the market. Zone 4 (Illinois) cleared at \$150/MW-day, almost 10 times higher than the 2014–2015 auction price. This price supports the view that MISO capacity markets might work and deliver resource adequacy.
2. Zone 4's price spike was due to the large concentration of independent power producers (IPPs) and more retail load relying on the auction instead of bilateral contracts. In contrast, Zone 7 (Michigan) prices failed to spike in this auction because of a lack of uncontracted or not self-supplied load and supply.
3. Going forward, ICF International expects supply and demand balance to tighten in MISO. However, given the current capacity market structure and the fact the majority of the capacity in MISO already is contracted, this balance may not translate to a sustained recovery in capacity prices without MISO reforms. In the interim, more exit from MISO (including into neighboring markets) is possible. The lack of federal reform also could precipitate state intervention, which could exacerbate concerns about reliability.

Executive Summary

MISO's recent 2015–2016 capacity auction resulted in some significant shifts in pricing. Substantially lower clearing prices occurred across almost all of the system's nine zones, with the most notable exception of Zone 4 that saw a dramatic tenfold year-over-year increase.

In the most basic terms, these results were driven by relatively simple factors: higher opportunity cost-based bids in Zone 4, lower bids elsewhere, and more uncontracted competitive retail load. But at a more detailed level, several related dynamics underlaid bidding behavior. IPPs bid in capacity markets to cover their fixed and opportunity costs in contrast to utility-owned generation or contracted generation under a power purchase agreement (PPA) for which covering these costs is a far more secure proposition. The greater concentration of IPPs and uncontracted retail load in Zone 4—combined with higher expected costs for environmental compliance, lower expected energy margins for merchant generators, and a higher offer price threshold (i.e., set based on a higher opportunity cost)—drove prices up dramatically. Conversely, in other zones, a greater proportion of capacity existed under fixed resource adequacy plans and contracted, with effectively \$0/MW-day bids into the auction in each zone, thereby exerting downward pressure on prices. In Zone 7, in particular, a 320-MW decrease in planning reserve margin requirement added to price-lowering momentum, while a shift to less competitive bids and less uncontracted load dropped the clearing price further to \$3.48/MW-day.

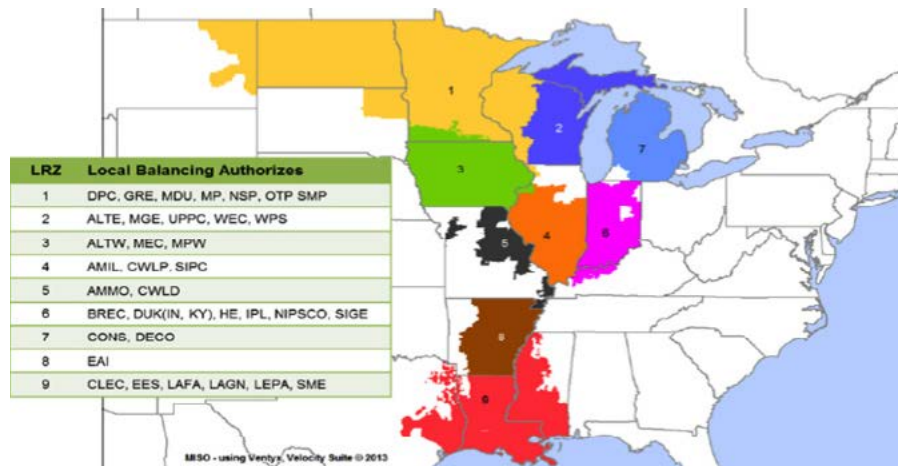


Going into the next auction, a number of factors will tighten the supply and demand balance. More than two GW of retirements already are anticipated, while a potential for 15 percent of the region's overall coal capacity remains to retire due to Mercury and Air Toxics Standards (MATS) compliance by 2016. Power plant operators in MISO are increasingly looking to interconnect to PJM Interconnection LCC (PJM) instead to benefit from higher capacity prices there. In Zone 7 particularly, capacity losses are expected to increase prices, albeit moderately. However, given inefficiencies in the current MISO capacity market structure—including the vertical demand curve, a lack of penalties for poor performance, a substantial number of low bids from regulated units, and volatility in the threshold for economic withholding—and the fact the majority of the capacity in MISO already is contracted, we do not expect a major recovery in capacity prices. This combination of factors may require eventual reform in the capacity market. In the interim, state intervention could translate into more opportunity for new assets to enter into PPAs with utilities.

How We Got Here: MISO Capacity Market Background

MISO is divided into nine local resource zones (LRZs) as seen in Exhibit 1.

Exhibit 1: MISO Local Resource Zones



Source: MISO

MISO's resource adequacy construct provides compensation for resources not under a fixed resource adequacy plan (FRAP) for the value of having available energy in a particular geographic location. This construct aims to improve the reliability of the MISO electricity grid, especially during peak times when supply can be scarce. The capacity auction is prompt rather than forward looking like the ISO New England Inc. (ISO-NE) and PJM markets, meaning that capacity for the June–May annual planning period is procured in April of that same year. Participants bid into the auction for zonal resource credits (ZRCs) that are equivalent to one MW of capacity. ZRCs are for one-year obligations. The bids are cleared through a single, sealed-bid clearing price auction against a vertical demand curve, unlike PJM and ISO-NE where bids are cleared against sloping demand curves. The RA construct began with the 2013–2014 auction period. Previously, MISO conducted a voluntary capacity market with significantly low capacity prices and no incentives for localization. The clearing price for each zone for the three RA auctions is outlined in Exhibit 2.

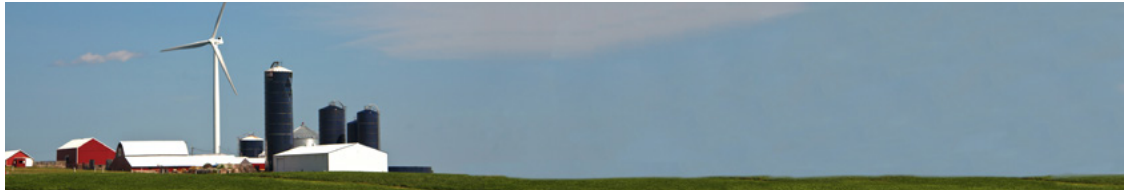


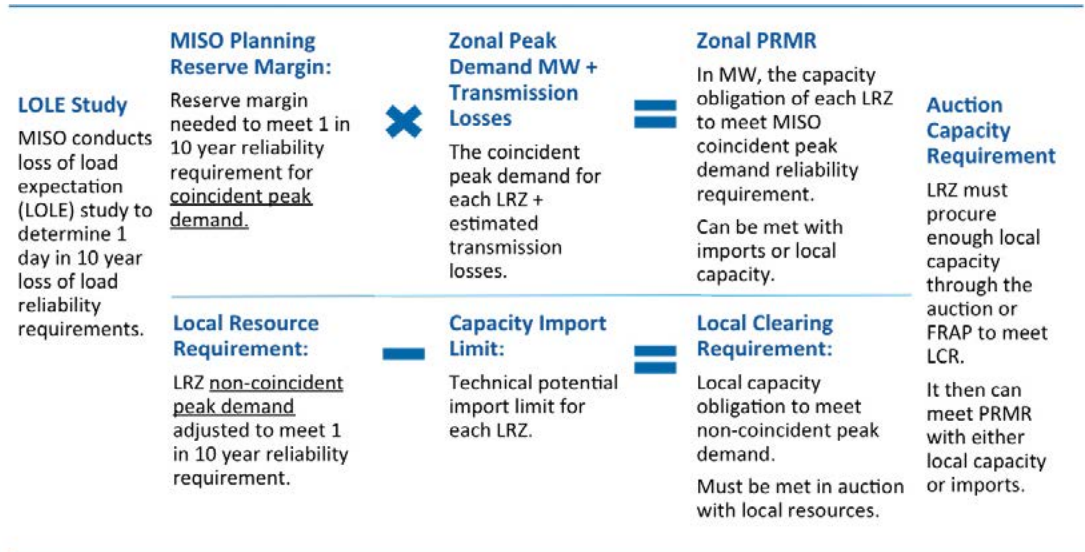
Exhibit 2: MISO Historical Capacity Prices (\$/MW-Day)

Auction Period	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
2013–2014	1.05	1.05	1.05	1.05	1.05	1.05	1.05	NA	NA
2014–2015	3.29	16.75	16.75	16.75	16.75	16.75	16.75	16.44	16.44
2015–2016	3.48	3.48	3.48	150	3.48	3.48	3.48	3.29	3.29

Source: MISO

Load serving entities (LSEs) and utilities must meet two reserve requirements in the RA auctions: the planning reserve margin requirement (PRMR) and the local clearing requirement (LCR). Exhibit 3 outlines how these requirements are determined and met in the auction. The LCR is the amount of capacity a zone must procure internally in order to meet its own peak demand requirements. The PRMR is the amount of capacity a zone must procure—which can include imports—to fulfill its obligation to meet MISO’s peak demand reliability requirements. Resources to meet these requirements include both merchant resources that offer competitive bids in the auction and resources either contracted or developed by utilities. LSEs also can procure some or all of their requirements via a FRAP instead of RA auctions. The amount of resources under a FRAP in a given LRZ either can be removed from the overall requirements or can be assumed to be available in auctions at zero price.

Exhibit 3: MISO Capacity Obligations



Source: ICF

2015–2016 Auction Results

As seen in Exhibit 4, MISO’s 2015–2016 auction resulted in significantly lower prices in most zones and a dramatic rise in Zone 4. The MISO north clearing price was \$3.48/MW-day, compared with \$16.75 in the 2014–2015 auction. Zone 4 separated from the rest of MISO north and had a clearing price of \$150/MW-day. MISO South, Zones 7 and 8, had a binding export limit of 1000 MW, so those zones cleared slightly lower than the rest of MISO at \$3.29/MW-day.

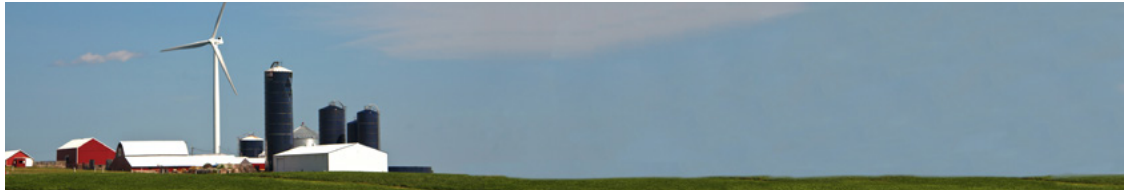


Exhibit 4: 2015–2016 Auction Results

	Key	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
Coincident Peak Demand	A	16,525	12,429	8,876	9,518	8,176	17,592	20,522	7,424	23,035
Transmission Losses	B	581	238	244	211	143	530	653	156	466
Planning Reserve Margin	C	7.1%	7.1%	7.1%	7.1%	7.1%	7.1%	7.1%	7.1%	7.1%
PRMR	(A+B) x C	18,321	13,566	9,768	10,420	8,910	19,409	22,678	8,118	25,170
Local Resource Requirement	D	19,717	15,235	10,667	11,982	10,426	20,326	25,255	9,924	26,929
Capacity Import Limit	E	3,735	2,903	1,972	3,130	3,899	5,649	3,813	2,074	3,320
Local Clearing Requirement	F= D – E	15,982	12,332	8,695	8852	6527	14,677	21,442	7850	23,609
Total Offer Submitted		4,867	3,071	5,922	11,156	7,926	14,832	14,103	9,562	26,193
Total FRAP		14,494	11,817	4,113	838	0	4,853	9,456	397	2,261
Offer Cleared + FRAP	H>= F	18,495	14,497	9,813	8,852	7,885	19,015	23,515	8,526	25,762
Imports/ Exports	G	-175	-193	-45	1568	1026	394	-837	408	-592
Total Resources	(H+G)>=PRMR	18,320	14,304	9,768	10,420	8,911	19,409	22,678	8,934	25,170
Clearing Price \$/MW-Day		\$3.48	\$3.48	\$3.48	\$150.00	\$3.48	\$3.48	\$3.48	\$3.29	\$3.29

Source: MISO and ICF

Key Price Drivers

- **Little change in overall capacity resulted in the 2015–2016 auction:** Little change was noted in overall capacity in MISO between the 2014–2015 and 2015–2016 auctions. In total, MISO had less than a one GW decline in capacity. Specifically, Zone 4 reported only a 250 MW loss in capacity.
- **Higher opportunity cost-based bidding occurred in Zone 4 than in previous years:** The bids in Zone 4 were higher than in the 2014–2015 auction. As seen in Exhibit 5, using the 2014–2015 supply curve, the loss of 250 MW of capacity and a 195 MW decline in PRMR in the 2015–2016 auction would have resulted in a price around \$20/MW-day if bidding behavior had remained the same—significantly lower than the actual clearing price of \$150/MW-day. Additionally, the highest bid for the 2014–2015 auction in Zone 4 (\$135/MW-day) also was lower than the 2015–2016 clearing price, further demonstrating that cost offers for Zone 4 in this auction were higher. The cleared price was close to the threshold for identifying economic withholding, which was set at \$155.79/MW-day, corresponding to the opportunity cost of participating in PJM’s capacity market in the 2015–2016 auction. Part of the change in bidding also was caused by more retail load relying on the auction to procure capacity instead of by bilateral contracts. This reliance resulted in more supply that was uncontracted going into the auction and that needed to bid at opportunity or other costs. Lower gas and power prices also may have raised capacity bids.

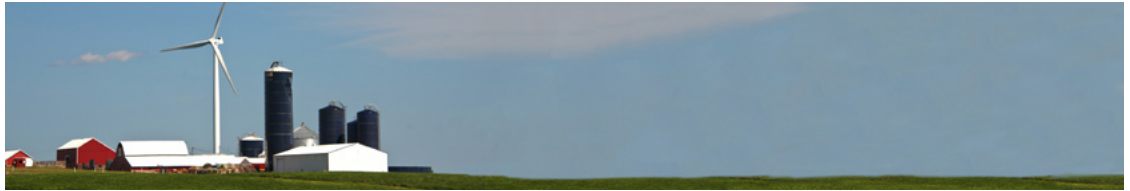
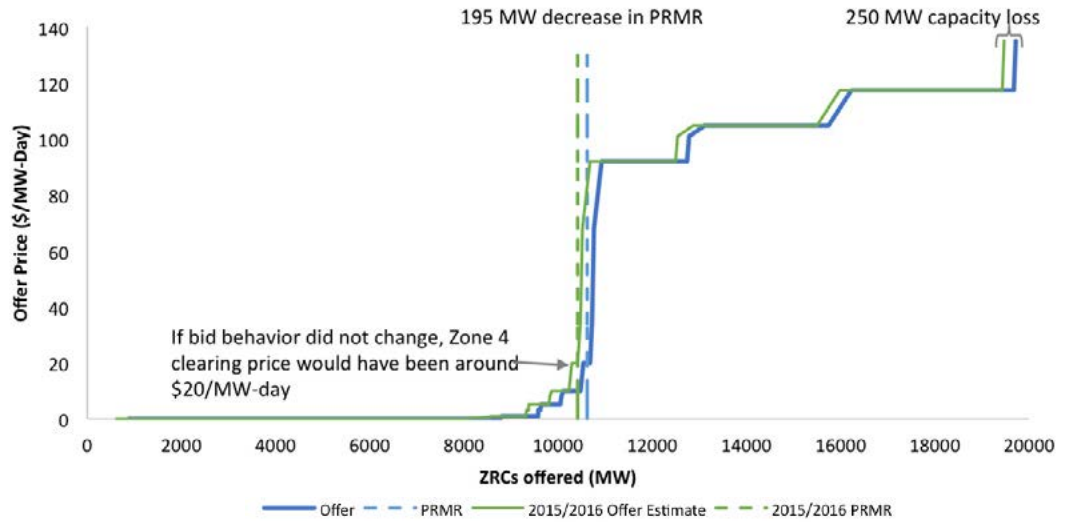


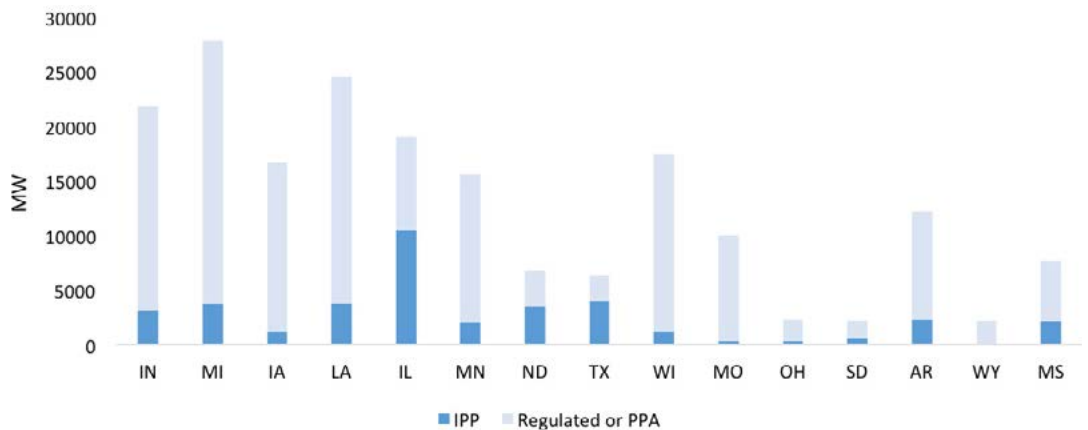
Exhibit 5: Zone 4 2014–2015 and 2015–2016 Illustrative Capacity Supply Curves



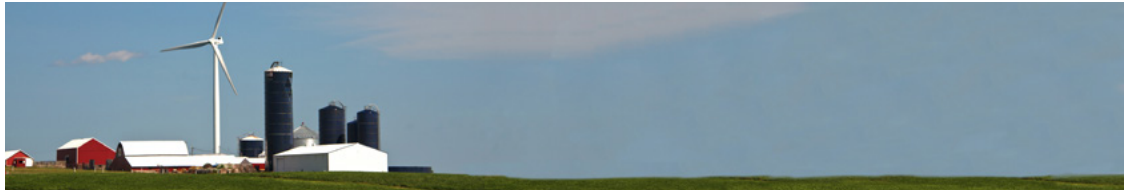
Source: MISO, ICF

- More IPPs and less contracted capacity led to higher cost-based bids in Zone 4:** Zone 4 is the only LRZ in which IPPs make up a greater portion of capacity than generation owned by or contracted with a utility. Exhibit 6 illustrates IPP capacity in MISO by state. In addition, as highlighted before, in this auction more retail load in Zone 4 procured capacity via auction rather than through bilateral contracts, resulting in less contracted IPP capacity compared with the previous auction. Because generators owned by a utility and generators with a power purchase agreement (contracted IPPs) know they will earn enough to cover their fixed costs, they generally bid low in the capacity market. In other words, such resources do not require a capacity market for cost recovery. Because un-contracted IPPs do not have this security, they generally submit more competitive cost-based bids. In other LRZs such as Zone 7 where a large portion of capacity is regulated or contracted (approximately 85 percent), the number of low bids is large. Therefore, the higher bids from uncontracted IPPs are less likely to clear.

Exhibit 6: IPP Capacity by State



Source: SNL Financial



Higher bids were likely seen in Zone 4 in this auction for three reasons:

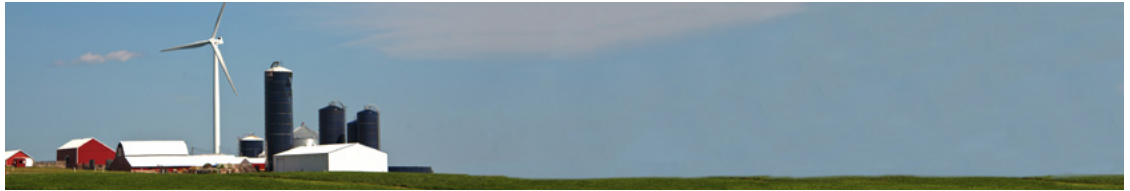
- 1) **Costs for environmental compliance are higher:** With the implementation of the MATS ruling coming in 2016, coal plants have and will face higher costs to comply with the new environmental standards such as installing selective catalytic reduction or paying for ash disposal. The need to recover these costs specifically by merchant generators may have influenced the higher bidding strategy in this auction. PJM experienced a spike in its 2014–2015 and 2015–2016 Base Residual Auctions for this reason. Regional transmission organization (RTO) capacity prices increased by approximately \$100/MW-day, compared with the 2013–2014 auction.
- 2) **Expected energy margins are lower for merchant generators:** Zone 4 is a coal-dominated region, with more than half of its capacity and generation coming from coal plants. However, in some peak hours, higher priced gas units set the marginal price. With gas prices declining, gas units' marginal cost is lower, leading to lower energy prices and lower energy margins for the price-taking coal units. In addition, with MATS implementation, all coal units will be required to operate their retrofits at full capacity. The result will be an increase in the units' variable cost, thus further lowering their energy margins. To make up for this lost revenue, generators bid higher in the capacity market.
- 3) **Offer price threshold (reference price) is higher:** As illustrated in Exhibit 7, MISO increased the offer price threshold for identifying economic withholding to \$155.79/MW-day, a nearly \$13/MW-day increase from the 2014–2015 auction. This threshold is tied to PJM capacity prices for each auction period. The PJM RTO clearing price increased to \$135/MW-day in the 2015–2016 auction largely because of increased costs from environmental compliance and lower expected energy margins. Thus, when PJM prices increased, these added price considerations were automatically taken into account in MISO's offer mitigation rule. However, as this threshold is linked to PJM capacity prices that change each auction period, it facilitates volatility in the MISO market. Based on the current MISO tariff and the fact PJM capacity prices plummeted in 2016–2017, ICF estimates that the reference price and the opportunity cost for supplying into neighboring markets in MISO will decrease from \$155.79/MW-day to \$71.7/MW-day.

Exhibit 7: MISO Reference Price (opportunity cost of exporting to PJM)

	2014–2015	2015–2016	2016–2017	2017–2018
PJM Clearing Price \$/MW-Day	125.5	136.2	59.4	120
MISO Bid Threshold	142.9	155.8	71.7	136.4

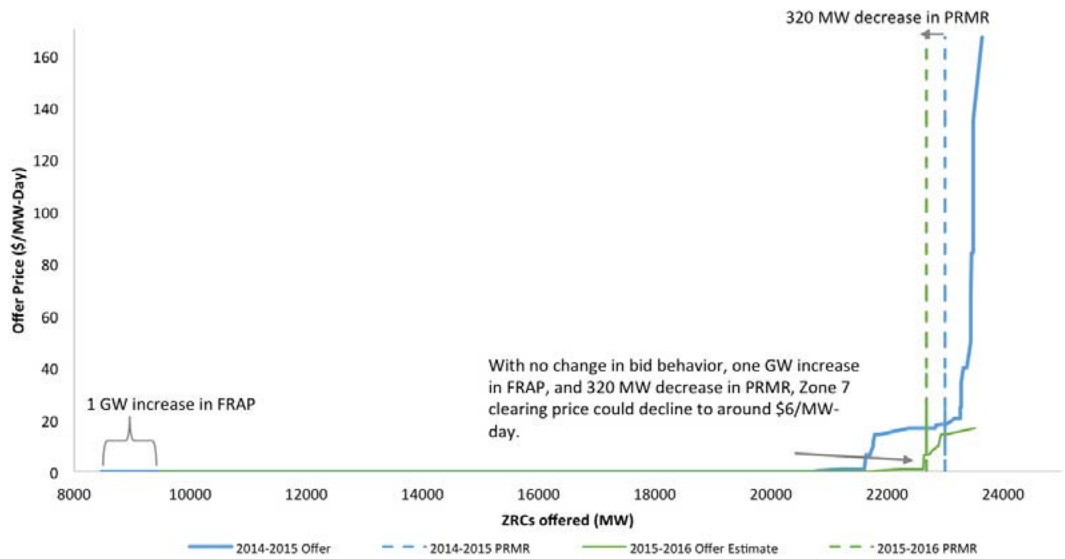
Source: MISO, ICF

- **More capacity under fixed resource adequacy plans and contracts leads to lower prices:** In the 2015–2016 auction, several zones (1, 3, 6, and 7) saw large increases in the amount of FRAP capacity. Because this capacity and other contracted capacity can be seen as effectively bidding \$0/MW-day into the auction in each zone, downward pressure was put on prices. In contrast, in Zone 4 the marginal decrease of 36 MW in self-supply resources did not have a material impact on capacity prices. However, more retail load in Zone 4 relied on the auction to procure capacity instead of bilateral contracts.
- **Zone 7 clearing price decline likely due to an increase in FRAP and decline in PRMR:** In the 2014–2015 auction, the unit that set the marginal price was in Zone 7 at \$16.75. Zone 7 saw one GW of capacity shift from offering in the auction to being a fixed resource. Moving one GW to a \$0 bid in using the 2014–2015 supply curve and clearing against the 2015–2016 PRMR would lead to a



clearing price in the zone around \$6/MW-day. Because this estimated price is slightly higher than the cleared price of \$3.48, Zone 7 most likely saw a shift to less competitive bids. The graph below demonstrates the capacity supply curve in the 2014–2015 auction and ICF’s illustrative 2015–2016 supply curve.

Exhibit 8: Zone 7 2014–2015 and 2015–2016 Estimate Capacity Supply Curves



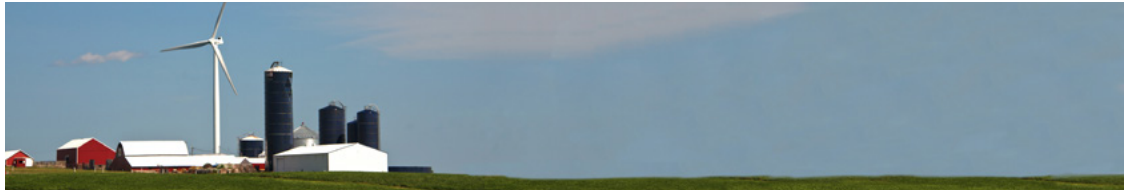
Source: MISO, ICF

Looking Ahead

More than two GW of retirements anticipated in the 2016–2017 auction: More than two GW of announced coal retirements will occur before the 2016–2017 planning period. These coal units have previously received a one-year extension for MATS compliance and have waivers from the Federal Energy Regulatory Commission to avoid retirement penalties in MISO.

Capacity committing to PJM: With MISO’s low capacity prices, power plants operators have an increasing incentive to interconnect to PJM. This incentive was seen in MISO when Covert, a 1.1 GW combined cycle unit in Zone 7, began the process of interconnecting to PJM and cleared in PJM’s 2016–2017 and 2017–2018 auctions. This trend also has been seen in other regions with low capacity prices as well. For example, Roseton, a plant located in New York Independent System Operator, cleared in ISO-NE’s higher-priced 2018–2019 auction. ICF expects that this movement will continue in MISO as PJM’s capacity prices continue to remain at levels higher than those in MISO.

Tightening supply and demand balance in Zone 7: Although prices declined in Michigan in this auction, going forward, capacity losses are expected to increase prices moderately. In the 2016–2017 auction, Zone 7 will face 1.1 GW of the ISO’s coal retirements due to MATS compliance. It also will realize the loss of 1.1 GW of Covert in the 2016–2017 auction period. Even though this loss will put a strain on the supply and demand balance in Zone 7, using the current estimated supply curve, it would only push Zone 7 prices back up to the \$16 to \$20/MW-day range.



Significant additional retirements and de-rates are possible: In the October 2014 Long Term Resource Adequacy Update, MISO estimated that 15 percent of the coal capacity in the ISO will retire due to MATS compliance by 2016. This proportion includes approximately three GW of announced retirements and seven GW of unannounced or confidential retirements. Units in MISO must file their retirement with MISO 26 weeks before their change in status date, so the 2016 MATS-related retirements may not be announced until the end of 2015. Approximately 35 GW of capacity are expected to install environmental retrofits in 2015 and 2016 to comply with MATS regulation which could potentially put upward pressure on the capacity price bids in the upcoming 2016 auction.

While MISO has historically had a significant amount of surplus capacity, these retirements will lead to a tighter supply and demand balance. In addition to MATS retirements, MISO projects that approximately 11 GW of coal capacity is at risk by 2020 due to the Clean Power Plan. In addition, the MISO market monitor reports that a 50 percent de-rate is appropriate for demand resources. This de-rate has yet to be implemented.

Due to system inefficiencies related to competitive entry in the MISO capacity market, that prices are unlikely to remain at the higher, stable level going forward necessary to make whole new builds in the system. These inefficiencies include the vertical demand curve, the voluntary nature of the auction for portions of a utility fleet (in contrast to PJM where the entire utility must be in or out), more clarity on minimum offer price rules, a substantial number of low bids from regulated units, a lack of forward commitment (as in PJM and ISO-NE), and volatility in threshold for economic withholding (linked to PJM capacity prices). Thus, the expected decline in reserve margin will either need to be met with reform in the capacity market or a greater amount of capacity contracted by utilities. This could translate into more opportunity for new assets to secure or enter into a PPA.



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