Market Monitoring Unit

Analysis of the 2008/2009 Third Incremental RPM Auction

PJM Market Monitoring Unit

July 3, 2008

Introduction

This report, prepared by the PJM Market Monitoring Unit (MMU), reviews the functioning of the 2008/2009 third incremental Reliability Pricing Model (RPM) auction (IA). The MMU will prepare a similar report for each RPM auction.

Under RPM, for a given delivery year, four auctions may be held. The base residual auction (BRA) is held in May three years before the beginning of the delivery year which runs from June 1 through May 31. The first incremental auction, which is held in June two years before the delivery year, allows capacity resource owners to buy and sell capacity to accommodate adjustments to participants' resource positions as a result of resource retirements, cancellations, delays or changes in a unit's forced outage rate (EFORd). The demand curve in the first incremental auction is entirely a function of demand bids. There is no administrative market demand curve. The second incremental auction, which is held in April one year before the delivery year, is held only if an increased obligation is 100 MW more than the capacity which cleared in the BRA. The demand curve in the second incremental auction is an administrative demand curve. The obligation would increase due to an increase in the peak load forecast. The third incremental auction, which is held in January prior to the start of the delivery year, is similar to the first incremental auction. The demand curve in the third incremental auction is entirely a function of demand bids. There is no administrative market demand curve. In the first and third incremental auctions, buyers pay suppliers with no change in the locational reliability charge assessed to load serving entities (LSEs) during the delivery year. Costs of procurement from the second incremental auction are allocated to LSEs serving load during the delivery year through the locational reliability charge.

The first four RPM Base Residual Auctions comprised the RPM transition period. Three RPM Base Residual Auctions were held during 2007 in April, July and October for the delivery years 2007/2008, 2008/2009 and 2009/2010, respectively. The fourth transition period BRA was held in January 2008 for the delivery year 2010/2011. First incremental auctions were not held for any of these delivery years. Second incremental auctions were not held for the delivery years 2007/2008, 2008/2009 and 2009/2010. The third incremental auction for 2008/2009 was held in January 2008.

The capacity market is, by design, always tight in the sense that total supply is generally only slightly larger than demand. While the market may be long at times, that is not the

equilibrium state. Capacity in excess of demand is not sold and, if it does not earn or does not expect to earn adequate revenues in other markets or does not have value as a hedge, may be expected to retire. The demand for capacity includes expected peak load plus a reserve margin. Thus, the reliability goal is to have total supply equal to or slightly above the demand for capacity. Demand is almost entirely inelastic because the market rules require loads to purchase their share of the system capacity requirement. The level of elasticity built into the RPM demand curve (VRR) is not adequate to modify this conclusion. The result is that any supplier that owns more capacity than the typically small difference between total supply and the defined demand is pivotal and therefore has structural market power.

The market design for capacity leads, almost unavoidably, to structural market power in the capacity market. The capacity market is unlikely ever to approach a competitive market structure in the absence of a substantial and unlikely structural change that results in much greater diversity of ownership. Nonetheless a competitive outcome can be assured by appropriate market power mitigation rules. Detailed market power mitigation rules are included in the RPM tariff. This represents a significant advance over the prior capacity market design. Reliance on the RPM design for competitive outcome means reliance on the market power mitigation rules. Attenuation of those rules will mean that market participants will not be able to rely on the competitiveness of the market outcomes.

These general conclusions may not apply to every incremental auction. As incremental auctions reflect only incremental supply and demand, the ownership structure of both supply and demand are unpredictable. Under the current rules, any participant may enter a demand bid into the auction for any reason. Suppliers may enter demand bids when they do not require additional capacity to meet their obligations. The MMU recommends that the PJM stakeholder process consider an explicit market power test for the Incremental Auctions related to market power on the buyer side. Market power could be exercised either to suppress the price below the competitive level or to increase the price above the competitive level. Recent changes to the rules for Incremental Auctions address the issue of suppressing the price.[1] The issue of whether demand bids

[1] 122 FERC ¶ 61,007 (2008).

could be used to exercise market power by increasing the price above the competitive level remains to be addressed. A clear rule is required to cover the use of demand bids by owners of capacity in order to prevent the exercise of market power in incremental auctions.

In the capacity market, as in other markets, market power is the ability of a market participant to increase the market price above the competitive level or to decrease the market price below the competitive level. In order to evaluate whether actual prices reflect the exercise of market power, it is necessary to evaluate the competitive market offers. In first and third incremental auctions, both supply offers and demand bids must be evaluated.

The MMU verified the reasonableness of offer data and calculated the derived offer caps based on submitted data, calculated unit net revenues, verified capacity exports, verified the reasons for MW not offered, verified the maximum EFORd rates used, verified clearing prices based on the demand curves and verified that the market structure tests were applied correctly. In the RTO market, 22 of 40 participants failed the market structure test as did all three participants in the SWMAAC market. Offer caps were applied to those sellers that failed the test. The offer caps are designed to reflect the marginal cost of capacity. The MMU verified that the demand bids of sellers did not inappropriately affect the clearing price. Based on these facts, the MMU concludes that the results of the 2008/2009 third incremental RPM auction were competitive.

Offer Caps

Except for updated EFORds, avoidable cost rate (ACR) data which were submitted by capacity resource owners for the 2008/2009 BRA in July 2007 were used for the 2008/2009 third incremental auction. If a capacity resource owner failed the market power test for the incremental auction, avoidable costs were used to calculate offer caps for that owner's resources.[2] The maximum EFORd which could be used in this auction was the EFORd for the 12 months ending September 30, 2007.

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[2] For a more detailed explanation of avoidable costs, see: "Analysis of the 2008-2009 RPM Auction" (November 30, 2007) < http://www.pjm.com/markets/market-monitor/reports.html.>

All volumes which were offered but did not clear in the 2008/2009 BRA and which had not been used as replacement capacity were required to be offered into the 2008/2009 third incremental auction. Total offered volumes declined from 131,880.6 MW in the 2008/2009 BRA to 2,339.4 MW in the incremental auction. As shown in Table 1, 327 generating units and nine demand resources (DR) submitted offers.[3] The total includes two new wind units (59.4 MW), one new diesel unit (5.2 MW) and four reactivated units (166.9 MW) which were not offered into the 2008/2009 BRA. Except for 0.4 MW, all of the DR (23.2 MW) was new to this auction. Unit-specific offer caps were calculated for 24 units (7.3 percent). Owners submitted unit-specific cost data and net revenue data for these units and the MMU calculated the unit-specific offer caps based on that data. Offer caps of all kinds were calculated for 170 units (51.9 percent), of which 123 (37.6 percent) were the default ("proxy") offer caps calculated and posted by the MMU. Of the 327 generating units, the remaining 154 (47.2 percent) units were price takers while 3 (0.9 percent) were uncapped new units. The transition adder was part of the offers on 90 units, of which offers on 20 units included only the transition adder. All of the 14 units which were marginal at $10.00 per MW-day had the transition adder as their offer caps.

As shown in Table 2, the weighted-average ACRs for units with APIR and the weighted average offer caps for units with APIR were higher than for units without an APIR component, including units for which the default value was selected. The APIR component added $113.75 per MW-day to the ACR value of the APIR units.[4] The default ACR values include an average APIR of $0.91 per MW-day. The maximum APIR effect ($209.26 per MW-day) was the maximum amount by which an offer cap was increased by APIR.

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[3] Some resources had multiple associated offers.

[4] Note that the net revenue offset for an individual unit could exceed the corresponding ACR. In that case, the offer cap would be zero.

Table 1 ACR statistics: 2008/2009 third incremental RPM auction[5] [6]

Calculation Type	Number of Units	Percent of Generating Units Offered
Default ACR selected	123	37.6%
ACR data input (non-APIR)	8	2.4%
ACR data input (APIR)	16	4.9%
Opportunity cost input	3	0.9%
Transition adder only	20	6.1%
Offer caps calculated	170	51.9%
Uncapped new units	3	0.9%
Generator price takers	154	47.2%
Generating units offered	327	100.0%
Demand resources offered	9	
Total capacity resources offered	336	

[5] ACR data input (non-APIR) does not include an APIR component in the ACR data submission. ACR data input (APIR) does include an APIR component in the ACR data submission.

[6] Planned units are not subject to the same mitigation rules as existing units. See PJM. "Open Access Transmission Tariff (OATT)," "Attachment DD: Reliability Pricing Model," Original Sheet No. 617 (Effective June 1, 2007), section 6.5 (a) ii.

Table 2 APIR statistics: 2008/2009 third incremental RPM auction[7, 8]

	Weighted-Average ($ per MW-day UCAP)
ACR (non-APIR units)	$70.48
Net revenues (non-APIR units)	$125.46
Offer caps (non-APIR units)	$24.28
ACR (APIR units)	$259.45
Net revenues (APIR units)	$136.18
Offer caps (APIR units)	$132.74
APIR (APIR units)	$113.75
Maximum APIR effect (APIR units)	$209.26

RPM Auction Results

MMU Methodology

The MMU reviewed the following inputs to and results of the 2008/2009 third incremental RPM auction:[9]

- **Offer Cap –** Verified that the avoidable costs, opportunity costs and net revenues used to calculate offer caps were reasonable and properly documented;
- **Net Revenues –** Calculated actual unit-specific net revenue from PJM energy and ancillary service markets for each PJM capacity resource for the period from 2001 through 2006;

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7 The weighted-average offer cap can still be positive even when the weighted-average net revenues are higher than the weighted-average ACR due to the offer-cap minimum being zero. On a unit basis, if net revenues are greater than ACR, net revenues in an amount equal to the ACR are used in the calculation and the offer cap is zero.

8 The weighted-average APIR is only for those units which had an APIR component, while the weighted-average values for ACR, net revenues and offer caps are for all units which submitted ACR data.

9 All volumes and prices are in terms of unforced capacity (UCAP), which is calculated as installed capacity (ICAP) times (1-EFORd).

- **Excused Resources** – Verified the specific reasons that capacity resources were excused from offering into the auction;

- **Maximum EFORd** – Verified that the maximum equivalent demand forced outage rate (EFORd) used in base offer segments was the one-year EFORd ending September 30, 2007;

- **Clearing Prices** – Verified that the auction clearing prices were accurate, based on submitted sell offers and buy bids;

- **Market Structure Test** – Verified that the market power test was properly defined using the three pivotal supplier (TPS) test, that offer caps were properly applied and that the TPS test results were accurate.

Market Structure Tests

As shown in Table 3, 22 of 40 participants in the total PJM market as well as all three participants in the SWMAAC RPM markets failed the TPS test. [10] In the 2008/2009 BRA, all market participants failed the TPS test in all markets. Some participants passed the test in the incremental auction as a result of the substantially different ownership structure of incremental supply. Only those suppliers with incremental supply participated in the incremental auction. This reduced the number of participants from 65 in the 2008/2009 BRA to 40 in the corresponding third incremental auction and the offered volumes from 131,880.6 MW to 2,339.4 MW. Only those participants that failed the market power test were offer capped. The RTO market includes all supply which cleared at or below the unconstrained clearing price. The SWMAAC market includes the incremental supply inside SWMAAC which was required to meet the demand for capacity in SWMAAC and which cleared at a price higher than the unconstrained price.

Table 3 presents the results of the TPS test using the Residual Supply Index (RSI_x) as the metric. A generation owner or owners are pivotal if the capacity of the owners'

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[10] See the *2007 State of the Market Report*, Volume II, Section 2, "Energy Market, Part 1," for a more detailed discussion of market structure tests. See also the *2007 State of the Market Report*, Volume II, Appendix L, "Three Pivotal Supplier Test."

generation facilities is needed to meet the demand for capacity. The RSI_x is a general measure that can be used with any number of pivotal suppliers. The subscript denotes the number of pivotal suppliers included in the test. If the RSI_x is less than or equal to 1.0, the supply owned by the specific generation owner, or owners, is needed to meet market demand and the generation owners are pivotal suppliers with a significant ability to influence market prices. If the RSI_x is greater than 1.0, the supply of the specific generation owner or owners is not needed to meet market demand and those generation owners have a reduced ability to unilaterally influence market price. For example, all participants in the RTO market passed the one pivotal supplier test using a market definition that includes all offers with costs less than or equal to 1.05 times the clearing price. [11]

Table 3 RSI results: 2008/2009 third incremental RPM auction[12, 13]

	$RSI_{1\ 1.05}$	RSI_3	Total Participants	Failed RSI_3 Participants
RTO/EMAAC	1.04	0.87	40	22
SWMAAC	0.01	0.00	3	3

RTO

As shown in Table 4 and Figure 1, 2,339.4 MW were offered into the incremental auction while buy bids totaled 2,251.8 MW. The offered volumes came from uncleared offers from the 2008/2009 BRA (2,283.0 MW), three new units (64.6 MW), four reactivated units (166.9 MW), nine new DR resources (22.8 MW), net derates to existing DR resources (-179.2 MW), net derates to existing generating units (-171.7 MW) and higher UCAP values due to improved EFORds (153.0 MW). Of the 904.3 MW with zero priced offers,

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11 The market definition used for the TPS test includes all offers with costs less than or equal to 1.50 times the clearing price. The appropriate market definition to use for the one pivotal supplier test includes all offers with costs less than or equal to 1.05 times the clearing price. See *2007 State of the Market Report* (March 11, 2008), Appendix L, "Three Pivotal Supplier Test" for additional discussion.

12 Participants are defined as parent companies.

13 The RSI shown is the lowest RSI in the market.

872.2 MW had zero priced offer caps. Buy bids were submitted to cover short positions due to deratings and EFORd increases or because participants wished to purchase additional capacity. No EFORd offer segments were permitted in this auction because the delivery year EFORds were known for this auction and the EFORd risk was therefore zero. Cleared volumes in the RTO were 1,011.6 MW, resulting in an RTO clearing price of $10.00 per MW-day compared to the RTO clearing price of $111.92 per MW-day in the 2008/2009 BRA. The price was set by the transition adder. The 1,307.2 MW of uncleared volumes can be used as replacement volumes or traded bilaterally.

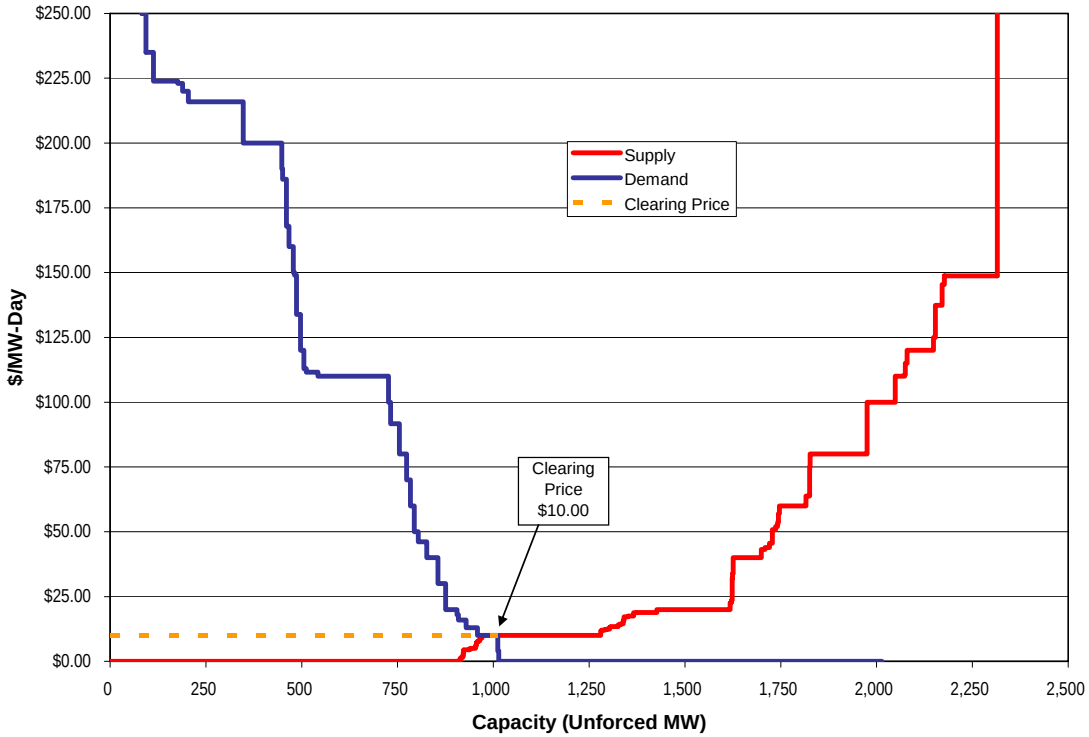
Although EMAAC was constrained in the 2008/2009 BRA, supply offers in the incremental auction in EMAAC (1,142.8 MW) exceeded EMAAC demand bids (191.0 MW). The offered volumes came from uncleared offers from the 2008/2009 BRA (1,148.1 MW), one new unit (5.2 MW), three reactivated units (9.7 MW), net derates to existing DR resources (-174.4 MW), net uprates to existing units (66.5 MW) and higher UCAP values due to improved EFORds (87.7 MW). Supply and demand curves resulted in a price less than the RTO clearing price. The result was that all of EMAAC supply which cleared received the RTO clearing price.

Table 4 RTO offer statistics: 2008/2009 third incremental RPM auction[14]

	Offered (Supply) ICAP (MW)	Offered (Supply) UCAP (MW)	Bid (Demand) UCAP (MW)
Generation	2,468.3	2,316.2	
DR	22.6	23.2	
Total	2,490.9	2,339.4	2,251.8
Cleared in RTO	1,046.4	1,011.6	1,011.6
Cleared in SWMAAC	23.0	20.6	20.6
Total cleared	1,069.4	1,032.2	1,032.2
Uncleared in RTO	1,421.5	1,307.2	1,002.7
Uncleared in SWMAAC	0.0	0.0	216.9
Total uncleared	1,421.5	1,307.2	1,219.6
Resource clearing price ($ per MW-day)	$10.00		

[14] Prices are only for those generating units outside of SWMAAC.

Figure 1 PJM RTO market supply/demand curves: 2008/2009 third incremental RPM auction[15]



SWMAAC

As shown in Table 5 and Figure 2, 20.6 MW in SWMAAC were offered into the auction while buy bids in SWMAAC totaled 237.5 MW. Except for 0.1 MW of new DR, the offered volumes came from capacity modifications (14.6 MW) and higher UCAP values due to improved EFORds (5.9 MW). SWMAAC was a constrained LDA for the 2008/2009 delivery year, so the only supply which could meet the demand was the 20.6 MW in SWMAAC. Since these offered volumes were less than buy bids, the price was set by a vertical extension of the supply curve to meet demand, resulting in a clearing price of $223.85 per MW-day compared to the SWMAAC clearing price of $188.54 per MW-day in the 2008/2009 BRA.

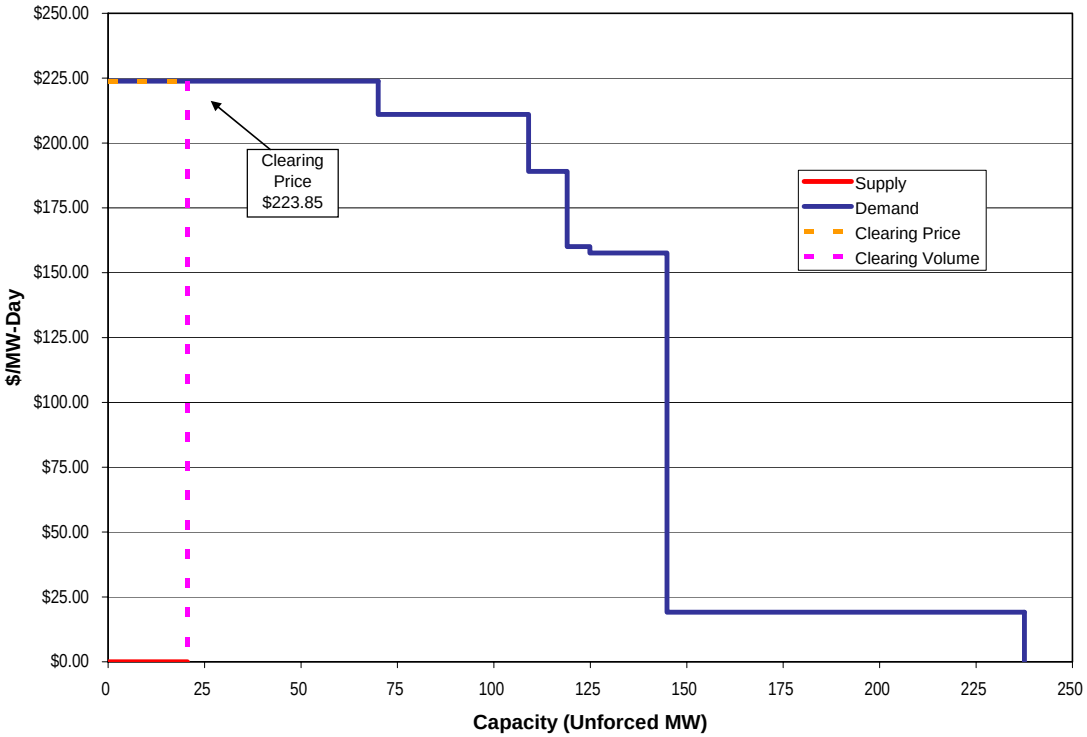
[15] The supply curve includes all supply offers at the lower of offer price or offer cap.

Table 5 SWMAAC offer statistics: 2008/2009 third incremental RPM auction[16]

	Offered (Supply) ICAP (MW)	Offered (Supply) UCAP (MW)	Bid (Demand) UCAP (MW)
Generation	22.9	20.5	
DR	0.1	0.1	
Total	23.0	20.6	237.5
Cleared in RTO	0.0	0.0	0.0
Cleared in SWMAAC	23.0	20.6	20.6
Total cleared	23.0	20.6	20.6
Uncleared	0.0	0.0	216.9
Resource clearing price ($ per MW-day)	$223.85		

[16] The resource clearing price is only for those generating units inside of SWMAAC.

Figure 2 SWMAAC supply/demand curves: 2008/2009 third incremental RPM auction[17]



17 The supply curve includes all supply offers at the lower of offer price or offer cap.