Monitoring Analytics

Analysis of the 2011/2012 RPM First Incremental Auction

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The Independent Market Monitor for PJM

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Introduction

This report, prepared by the Independent Market Monitor for PJM (IMM or MMU), reviews the functioning of the 2011/2012 Reliability Pricing Model (RPM) First Incremental Auction (IA). The MMU prepares a report for each RPM auction.

Under RPM, the Base Residual Auction (BRA) is held in May three years prior to the beginning of the delivery year, which runs from June 1 through May 31. After the BRA, Incremental Auctions are conducted. Prior to the 2012/2013 delivery year, Incremental Auctions are conducted to allow for replacement resource procurement and incremental procurement of resource commitments due to a load forecast increase. For the 2012/2013 delivery year and beyond, Incremental Auctions are conducted to allow for replacement resource procurement, procurement or release of capacity due to reliability requirement adjustments, and deferred Short-Term Resource Procurement. Prior to the 2012/2013 delivery year, up to three Incremental Auctions are held for each delivery year. Effective the 2012/2013 delivery year, First, Second, and Third Incremental Auctions are held for each delivery year, and in addition, a conditional incremental auction may be held to address significant unexpected changes that occur after the BRA, such as a delay in planned large transmission upgrades that results in the need for procurement of additional capacity. Prior to January 31, 2010, First, Second, and Third Incremental Auctions are conducted 23, 13, and four months, respectively, prior to the delivery year. Effective January 31, 2010, First, Second, and Third Incremental Auctions are conducted 20, 10, and three months prior to the delivery year.

Prior to the 2012/2013 delivery year, the First and Third Incremental Auctions are conducted to allow capacity resource providers to buy and sell capacity to accommodate adjustments to resource positions as a result of capacity and DR modifications to existing capacity resources, new capacity resources, resource retirements, resource cancellations or delays, changes in a generation resource's equivalent demand forced outage rate (EFORd), or cancellations or delays of a Qualifying Transmission Upgrade. Prior to the 2012/2013 delivery year, the demand curves in the First and Third Incremental Auctions are entirely a function of resource provider demand bids, and there is no administrative market demand curve. Effective the 2012/2013 delivery year, the demand curves in the First, Second, and Third Incremental Auctions may be comprised of buy bids submitted by participants; a buy bid created by PJM and submitted at 1.5 times net Cost of New Entry (CONE) to procure the increase in the RTO reliability requirement that exceeds a threshold of 500 MW or one percent of the reliability requirement in First and Second Incremental Auctions or a threshold of zero in Third Incremental Auctions; a buy bid submitted by PJM at 1.5 times net CONE to procure the designated RTO Short-Term Resource Procurement Target Allocation Share; or the increment of the updated Variable Resource Requirement (VRR) Curve if capacity committed in all prior auctions for the given delivery year is less than the PJM or LDA

reliability requirement less the PJM or LDA Short Term Resource Procurement Target in the most recent auction by 500 MW or one percent of the reliability requirement.

Prior to the 2012/2013 delivery year, the Second Incremental Auction is held only if PJM determines that an unforced capacity resource shortage exceeds 100 MW of unforced capacity due to a load forecast increase, and the demand curve in the Second Incremental Auction is an administrative demand curve. Effective the 2012/2013 delivery year, the Second Incremental Auction is not contingent upon a load forecast increase and is conducted in the same manner as the First and Third Incremental Auctions.

Prior to the 2012/2013 delivery year, the cost of the incremental commitments in the First and Third Incremental Auctions is allocated to resource owners that cleared buy bids in the auction, with no change in the locational reliability charge assessed to Load Serving Entities (LSEs) during the delivery year, and the costs of procurement from the Second Incremental Auction are allocated to LSEs serving load during the delivery year through the locational reliability charge. Effective with the 2012/2013 delivery year, the cost of the incremental commitments are allocated to resource providers that cleared buy bids in the auction and to LSEs, where buy bids submitted by PJM were cleared.

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, and points on the VRR curve exceed peak load plus the reserve margin. Thus, the reliability goal is to have total supply equal to or slightly above the demand for capacity. The level of purchased demand under RPM has generally exceeded expected peak load plus the target reserve margin, resulting in reserve margins that exceed the target. 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, called the Variable Resource Requirement (VRR) curve, 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. However, the market power rules are not perfect and, as a result, competitive outcomes require continued improvement of the rules and ongoing monitoring of market participant behavior and market performance. 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 RPM Incremental Auctions, both supply offers and demand bids must be evaluated.

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 could be used to exercise market power by increasing the price above the competitive level remains to be addressed.

Recent changes to the rules for the RPM auctions address the treatment of historical equivalent demand forced outage rates (EFORd) in determining the level of unforced capacity that must be offered.[2] These changes applicable in the Base Residual, First Incremental Auction, and Second Incremental Auction include the option to submit unforced capacity based on an EFORd up to the greater of the EFORd based on 12 months of outage data ending September 30 prior to the auction or the EFORd based on five years of data ending on September 30 prior to the auction. Under the previous rules, participants were required to submit unforced capacity based on an EFORd less than or equal to the EFORd based on 12 months of outage data.

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1 See 122 FERC ¶ 61,007 (January 4, 2008).

2 See 126 FERC ¶ 61,275 (March 26, 2009).

Effective for the 2012/2013 delivery year, the default Avoidable Cost Rates (ACR) were increased. The MMU disagreed that the revised rates were applicable to the 2011/2012 First IA.

For First Incremental Auctions and, effective the 2012/2013 delivery year, Second Incremental Auctions, Minimum and Maximum Available installed capacity (ICAP) Positions are calculated. A capacity market seller's resource-specific Available ICAP Position is determined by reducing the ICAP owned by unoffered ICAP MW in a previous RPM auction, RPM committed ICAP MW, and FRR committed ICAP MW, while considering other transactions, such as unit-specific bilateral sales/purchases, and locational unforced capacity (UCAP) transactions, that occur for the given planning year. For generation resources, the distinction between the Minimum and Maximum Available ICAP Position is based on how the RPM commitments, which are stated in UCAP terms, are converted back to ICAP in order to determine the quantities eligible and required to be offered into subsequent auctions. Capacity market sellers must offer the Minimum Available ICAP Position for a given resource in RPM Incremental Auctions occurring prior to EFORds being finalized for the delivery year. The Minimum Available ICAP Position is determined by converting the RPM commitments to ICAP using the greater of the one-year EFORd at the time of the BRA, the five-year EFORd at the time of the BRA, or the sell offer EFORd from the BRA. The Maximum Available ICAP Position is determined by converting the RPM commitments to ICAP using an EFORd of zero.

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 supply and demand curves and verified that the market structure tests were applied correctly. All participants in the RTO market failed the market structure test. The result was that offer caps were applied to those sellers that failed the test, excluding sell offers for planned generation resources for the first delivery year. The offer caps are designed to reflect the marginal cost of capacity. Based on these facts, the MMU concludes that the results of the 2011/2012 RPM First Incremental Auction were competitive.

Offer Caps

Capacity resource owners that intended to have a non-zero offer cap were required to submit ACR or opportunity cost data to the MMU by two months prior to the 2011/2012 First Incremental Auction reflecting the most current best information and updates since

the 2011/2012 BRA.[3] If a capacity resource owner failed the market power test for the auction and the submitted sell offer exceeded the offer cap, market power mitigation measures were applied such that the sell offer was set equal to the defined offer cap. The maximum sell offer EFORd which could be used in this auction was the greater of the one-year EFORd or the five-year EFORd for the period ending September 30th prior to the 2011/2012 BRA, which was held in May of 2008.

All existing generation resources with positive Minimum Available ICAP Positions were required to be offered into the 2011/2012 First Incremental Auction. Total offered volumes declined from 137,720.3 MW in the 2011/2012 BRA to 2,842.5 MW in the First Incremental Auction. As shown in Table 1, 129 generation resources and zero demand resources (DR) submitted offers. The total includes three new diesel resources (7.1 MW) which were not offered into the 2011/2012 BRA. Unit-specific offer caps were calculated for 19 resources (14.8 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 68 resources (52.8 percent), of which 47 (36.4 percent) were based on the technology specific default (proxy) ACR values. [4] Of the 129 generation resources, one planned generation resource (0.8 percent) had an uncapped offer while the remaining 60 resources (46.4 percent) were price takers, of which the offers for 36 generation resources were zero and the offers for 24 resources were set to zero because no data were submitted.

As shown in Table 2, the weighted-average gross ACRs for units with APIR ($326.57 per MW-day) and the weighted-average offer caps, net of net revenues, for units with APIR ($197.67 per MW-day) were higher than for units without an APIR component, including units for which the default value was selected. The APIR component added an average of $170.61 per MW-day to the ACR value of the APIR units.[5] The default ACR values include an average APIR of $1.31 per MW-day. The highest APIR for a technology ($324.31 per MW-day) was for subcritical/supercritical coal units. The maximum APIR effect ($468.26 per MW-day) was the maximum amount by which an offer cap was increased by APIR.

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[3] For a more detailed explanation of avoidable costs, see "Analysis of the 2011/2012 RPM Auction Revised" (October 1, 2008) < http://www.monitoringanalytics.com/reports/Reports/2008/20081002-review-of-2011-2012-rpm-auction-revised.pdf>.

[4] Three resources had both ACR based and opportunity cost based offer caps calculated.

[5] 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: 2011/2012 RPM First Incremental Auction

Calculation Type	Number of Resources	Percent of Generation Resources Offered
Default ACR selected	44	34.1%
ACR data input (APIR)	18	14.0%
ACR data input (non-APIR)	1	0.8%
Opportunity cost input	2	1.6%
Default ACR and opportunity cost input	3	2.3%
Generation resources with offer caps	68	52.8%
Uncapped planned generation resources	1	0.8%
Generation price takers	60	46.4%
Generation resources offered	129	100.0%
Demand resources offered	0	
Total capacity resources offered	129	

Table 2 APIR statistics: 2011/2012 RPM First Incremental Auction[6, 7]

	Weighted-Average ($ per MW-day UCAP)					
	Combined Cycle	Combustion Turbine	Oil or Gas Steam	Subcritical/ Supercritical Coal	Other	Total
Non-APIR units						
ACR	$54.15	$29.43	NA	$284.63	$30.04	$169.77
Net revenues	$220.31	$44.98	NA	$298.96	$0.07	$195.83
Offer caps	$2.66	$2.64	NA	$150.63	$29.97	$83.01
APIR units						
ACR	$220.20	$152.28	$194.25	$583.59	NA	$326.57
Net revenues	$81.72	$6.94	$23.64	$328.71	NA	$128.90
Offer caps	$138.48	$145.34	$170.62	$254.88	NA	$197.67
APIR	$220.19	$120.84	$82.87	$324.31	NA	$170.61
Maximum APIR effect						$468.26

RPM Auction Results

MMU Methodology

The MMU reviewed the following inputs to and results of the 2011/2012 RPM First Incremental Auction: [8]

- **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 2005 through 2007;

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6 The weighted-average offer cap can be positive even when the weighted-average net revenues are higher than the weighted-average ACR, because the unit-specific offer caps are never less than zero. On a unit basis, if net revenues are greater than ACR, the offer cap is zero.

7 For reasons of confidentiality, the APIR statistics do not include opportunity cost based offer cap data.

8 Unless otherwise specified, all volumes and prices are in terms of unforced capacity (UCAP), which is calculated as installed capacity (ICAP) times (1-EFORd) for generation resources and as ICAP times the Demand Resource Factor and the Forecast Pool Requirement (FPR) for DR and EE resources. The EFORd values in this report are the EFORd values used in the 2011/2012 RPM First Incremental Auction.

- **Exported Resources –** Verified that capacity resources exported from PJM had firm external contracts or made documented opportunity cost offers;

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

- **Maximum EFORd –** Verified that the sell offer equivalent demand forced outage rate (EFORd) levels were less than or equal to the greater of the one-year EFORd or the five-year EFORd for the period ending September 30th prior to the 2011/2012 BRA, which was held in May of 2008;

- **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, all participants in the RTO market failed the TPS test.[9] The result was that offer caps were applied to all sell offers of participants that did not pass the test, excluding sell offers of planned generation resources. In the 2011/2012 BRA, all market participants failed the TPS test in the RTO market as well. Only those suppliers with incremental supply participated in the incremental auction. This reduced the number of participants from 76 in the 2011/2012 BRA to 30 in the corresponding First Incremental Auction and the offered volumes from 137,720.3 MW to 2,842.5 MW. The supply considered in the TPS test for the RTO market includes all supply offered at less than or equal to 150 percent of the RTO cost-based clearing price. The supply considered in the TPS test for the constrained LDA markets includes the incremental supply inside the constrained LDAs which was offered at a price higher than the unconstrained clearing price for the parent LDA market and less than or equal to 150 percent of the cost-based clearing price for the constrained LDA. The demand consists of the incremental MW needed in the LDA to relieve the constraint.

Table 3 presents the results of the TPS test using the Residual Supply Index (RSI_3) as the metric. A generation owner or owners are pivotal if the capacity of the owners' generation facilities is needed to meet the demand for capacity. The results of the TPS

[9] See the *2009 State of the Market Report for PJM* (March 11, 2010), Volume II, Section 2, "Energy Market, Part 1," and Volume II, Appendix L, "Three Pivotal Supplier Test" for a more detailed discussion of market structure tests.

test are measured by the Residual Supply Index (RSI_3). The RSI_x is a general measure that can be used with any number of pivotal suppliers. The TPS test uses three 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.[10]

Table 3 RSI results: 2011/2012 RPM First Incremental Auction[11, 12]

	$RSI_{1\ 1.05}$	RSI_3	Total Participants	Failed RSI_3 Participants
RTO	0.86	0.62	30	30

RTO

As shown in Table 4, 2,842.5 MW were offered into the 2011/2012 First Incremental Auction while buy bids totaled 11,968.5 MW. Because the auction occurred prior to EFORds being finalized for the delivery year, capacity market sellers were obligated to offer the Minimum Available ICAP Position for a given resource. The offered volumes came from uncleared offers from the 2011/2012 BRA, new generation or DR, capacity modifications (cap mods) to existing generation, and DR modifications to existing DR, while taking into consideration the EFORd level used for UCAP conversion. Buy bids were submitted to cover short positions due to deratings and EFORd increases or because participants wished to purchase additional capacity. Cleared volumes in the RTO were 361.1 MW, resulting in an RTO clearing price of $55.00 per MW-day compared to the RTO clearing price of $110.00 per MW-day in the 2011/2012 BRA. The price was set by a buy bid.

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10 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 *2009 State of the Market Report for PJM* (March 11, 2010), Appendix L, "Three Pivotal Supplier Test" for additional discussion.

11 Participants are defined as parent companies.

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

PJM did not model any LDAs as constrained for the 2011/2012 delivery year. The MMU performed an analysis that accounted for economic price separation in the 2011/2012 Base Residual Auction.[13] The results of the analysis accounting for economic price separation could not be reproduced for the 2011/2012 First Incremental Auction. Buy bids in Incremental Auctions must specify an LDA. Because no LDAs were modeled for the 2011/2012 delivery year, all buy bids in the 2011/2012 First Incremental Auction submitted by market participants were at the RTO level and could not be defined at a more granular LDA level.

Table 5 shows Demand Resource and Energy Efficiency (EE) Resource statistics for RPM Incremental Auctions. No DR or EE resources were offered in the 2011/2012 First Incremental Auction.

Table 4 RTO offer statistics: 2011/2012 RPM First Incremental Auction

	Offered (Supply)		Bid (Demand)
	ICAP (MW)	UCAP (MW)	UCAP (MW)
Generation	3,268.1	2,842.5	
DR	0.0	0.0	
Total	3,268.1	2,842.5	11,968.5
Total cleared in RTO	375.2	361.1	361.1
Total uncleared in RTO	2,892.9	2,481.4	11,607.4
Resource clearing price ($ per MW-day)			$55.00

Table 5 DR and EE statistics: RPM Incremental Auctions

	2008/2009 Third IA		2009/2010 Third IA		2010/2011 Third IA		2011/2012 First IA		2012/2013 First IA	
	ICAP (MW)	UCAP (MW)	ICAP (MW)	UCAP (MW)	ICAP (MW)	UCAP (MW)	ICAP (MW)	UCAP (MW)	ICAP (MW)	UCAP (MW)
DR Offered	22.6	23.2	514.6	531.4	1,402.9	1,451.6	0.0	0.0	2,310.0	2,398.1
EE Offered	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	16.6
DR Cleared	22.6	23.2	0.0	0.0	23.3	23.9	0.0	0.0	460.7	477.5
EE Cleared	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

[13] See "Analysis of the 2011/2012 RPM Auction" (Revised October 1, 2008) <http://www.monitoringanalytics.com/reports/Reports/2008/20081002-review-of-2011-2012-rpm-auction-revised.pdf>.