

LARGE FILING SEPARATOR SHEET

CASE NUMBER: 14-1297-EL-SSO

FILE DATE: JULY 26, 2016

SECTION: 4 OF 4

NUMBER OF PAGES: 64

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EXHIBITS (HEARING 7/12/16)

**BEFORE
THE PUBLIC UTILITIES COMMISSION OF OHIO**

In the Matter of the Application of Ohio Edison Company, The Cleveland Electric Illuminating Company and The Toledo Edison Company for Authority to Provide for a Standard Service Offer Pursuant to R.C. §4928.143 in the Form of an Electric Security Plan.

Case No. 14-1297-EL-SSO

**RESPONSES OF OHIO ENERGY GROUP TO
FIRST SET OF INTERROGATORIES
AND REQUESTS FOR PRODUCTION OF DOCUMENTS ON REHEARING
BY THE OFFICE OF THE OHIO CONSUMERS' COUNSEL**

REHEARING REQUEST FOR PRODUCTION NO. 1-4: Please provide a worksheet displaying the numbers associated with Figure 2 on page 7 of Witness Baron's testimony.

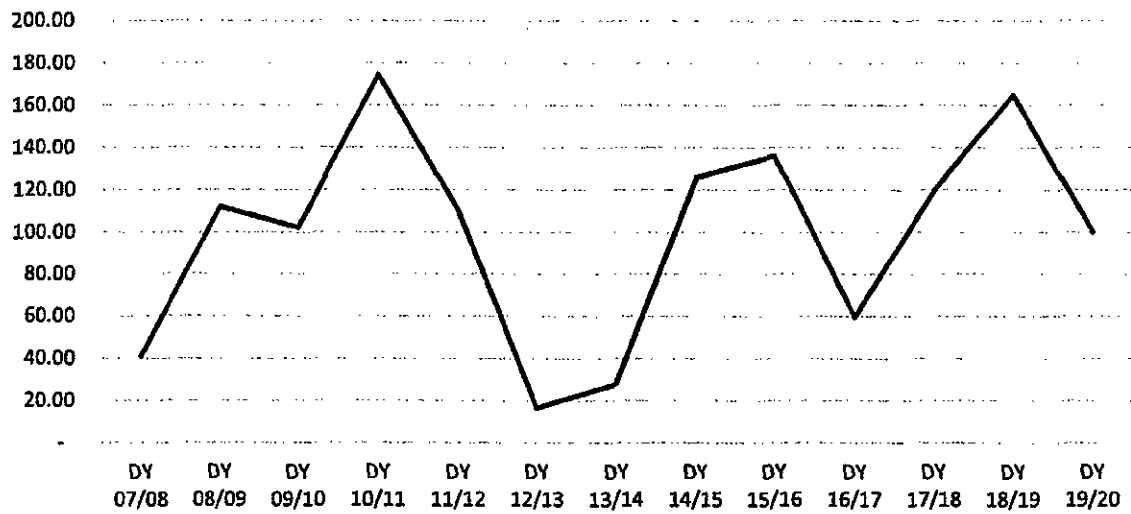
RESPONSE: Please see Attachment 2 to these responses.

Person Responsible: Stephen J. Baron

ATTACHMENT 2

Figure 2
PJM Base Residual Auction Results
RTO RPM Prices

\$/MW-Day



Resource Clearing Prices for all RPM Auctions held to date

DOCS # 72686

	Capacity Product Type *	RTO	MAAC	MAAC + APS	EMAAC	SWMAAC	PS	PS NORTH	DPL SOUTH	PEPCO	ATSI	ATSI-CLEVELAND
DY 07/08												
BRA	*	\$40.80	**	**	\$197.67	\$188.54	**	**	**	**	N/A	N/A
DY 08/09												
BRA	*	\$111.92	**	**	\$148.80	\$210.11	**	**	**	**	N/A	N/A
3IA	*	\$10.00	**	**	\$10.00	\$223.85	**	**	**	**	N/A	N/A
DY 09/10												
BRA	*	\$102.04	**	\$191.32	**	\$237.33	**	**	**	**	N/A	N/A
3IA	*	\$40.00	**	\$86.00	**	**	**	**	**	**	N/A	N/A
DY 10/11												
BRA	*	\$174.29	**	**	**	**	**	**	\$186.12	**	N/A	N/A
3IA	*	\$50.00	**	**	**	**	**	**	\$50.00	**	N/A	N/A
DY 11/12												
BRA	*	\$110.00	**	**	**	**	**	**	**	**	N/A	N/A
1IA	*	\$55.00	**	**	**	**	**	**	**	**	N/A	N/A
3IA	*	\$5.00	**	**	**	**	**	**	**	**	N/A	N/A
DY 12/13												
BRA	*	\$16.46	\$133.37	**	\$139.73	\$133.37	**	\$185.00	\$222.30	**	N/A	N/A
1IA	*	\$16.46	\$16.46	**	\$153.67	\$16.46	**	\$153.67	\$153.67	**	N/A	N/A
2IA	*	\$13.01	\$13.01	**	\$48.91	\$13.01	**	\$48.91	\$48.91	**	N/A	N/A
3IA	*	\$2.51	\$2.51	**	\$2.51	\$2.51	**	\$2.51	\$2.51	**	N/A	N/A
DY 13/14												
BRA	*	\$27.73	\$226.15	**	\$245.00	\$226.15	\$245.00	\$245.00	\$245.00	\$247.14	**	**
1IA	*	\$20.00	\$20.00	**	\$178.85	\$54.82	\$178.85	\$178.85	\$178.85	\$54.82	**	**
2IA	*	\$7.01	\$10.00	**	\$40.00	\$10.00	\$40.00	\$40.00	\$40.00	\$10.00	**	**
3IA	*	\$4.05	\$30.00	**	\$188.44	\$30.00	\$188.44	\$188.44	\$188.44	\$30.00	**	**
DY 14/15												
BRA	Annual	\$125.99	\$136.50	**	\$136.50	\$136.50	\$136.50	\$225.00	\$136.50	\$136.50	**	**
BRA	Ext Summer	\$125.99	\$136.50	**	\$136.50	\$136.50	\$136.50	\$225.00	\$136.50	\$136.50	**	**
BRA	Limited	\$125.47	\$125.47	**	\$125.47	\$125.47	\$125.47	\$213.97	\$125.47	\$125.47	**	**
1IA	Annual	\$5.54	\$16.56	**	\$16.56	\$16.56	\$16.56	\$410.95	\$16.56	\$16.56	**	**
1IA	Ext Summer	\$5.54	\$16.56	**	\$16.56	\$16.56	\$16.56	\$410.95	\$16.56	\$16.56	**	**
1IA	Limited	\$0.03	\$5.23	**	\$5.23	\$5.23	\$5.23	\$399.62	\$5.23	\$5.23	**	**
2IA	Annual	\$25.00	\$56.94	**	\$56.94	\$56.94	\$56.94	\$310.00	\$56.94	\$56.94	**	**
2IA	Ext Summer	\$25.00	\$56.94	**	\$56.94	\$56.94	\$56.94	\$310.00	\$56.94	\$56.94	**	**
2IA	Limited	\$25.00	\$56.94	**	\$56.94	\$56.94	\$56.94	\$310.00	\$56.94	\$56.94	**	**
3IA	Annual	\$25.51	\$132.20	**	\$132.20	\$132.20	\$132.20	\$256.76	\$132.20	\$132.20	**	**
3IA	Ext Summer	\$25.51	\$132.20	**	\$132.20	\$132.20	\$132.20	\$256.76	\$132.20	\$132.20	**	**
3IA	Limited	\$25.51	\$132.20	**	\$132.20	\$132.20	\$132.20	\$256.76	\$132.20	\$132.20	**	**
DY 15/16												
BRA	Annual	\$136.00	\$167.46	**	\$167.46	\$167.46	\$167.46	\$167.46	\$167.46	\$167.46	\$357.00	**
BRA	Ext Summer	\$136.00	\$167.46	**	\$167.46	\$167.46	\$167.46	\$167.46	\$167.46	\$167.46	\$322.08	**
BRA	Limited	\$118.54	\$150.00	**	\$150.00	\$150.00	\$150.00	\$150.00	\$150.00	\$150.00	\$304.62	**
1IA	Annual	\$43.00	\$111.00	**	\$111.00	\$111.00	\$122.95	\$122.95	\$111.00	\$111.00	\$168.37	**
1IA	Ext Summer	\$43.00	\$111.00	**	\$111.00	\$111.00	\$122.95	\$122.95	\$111.00	\$111.00	\$168.37	**
1IA	Limited	\$43.00	\$111.00	**	\$111.00	\$111.00	\$122.95	\$122.95	\$111.00	\$111.00	\$168.37	**
2IA	Annual	\$136.00	\$153.56	**	\$153.56	\$153.56	\$167.46	\$167.46	\$153.56	\$153.56	\$216.54	**
2IA	Ext Summer	\$136.00	\$153.56	**	\$153.56	\$153.56	\$167.46	\$167.46	\$153.56	\$153.56	\$216.54	**
2IA	Limited	\$123.58	\$141.12	**	\$141.12	\$141.12	\$155.02	\$155.02	\$141.12	\$141.12	\$204.10	**
3IA	Annual	\$163.20	\$184.77	**	\$184.77	\$184.77	\$185.00	\$185.00	\$184.77	\$184.77	\$163.20	**
3IA	Ext Summer	\$163.20	\$184.77	**	\$184.77	\$184.77	\$185.00	\$185.00	\$184.77	\$184.77	\$163.20	**
3IA	Limited	\$100.76	\$122.33	**	\$122.33	\$122.33	\$122.56	\$122.56	\$122.33	\$122.33	\$100.76	**
DY 16/17												
BRA	Annual	\$59.37	\$119.13	**	\$119.13	\$119.13	\$219.00	\$219.00	\$119.13	\$119.13	\$114.23	\$114.23
BRA	Ext Summer	\$59.37	\$119.13	**	\$119.13	\$119.13	\$219.00	\$219.00	\$119.13	\$119.13	\$114.23	\$114.23
BRA	Limited	\$59.37	\$119.13	**	\$119.13	\$119.13	\$219.00	\$219.00	\$119.13	\$119.13	\$84.45	\$94.45
1IA	Annual	\$60.00	\$119.13	**	\$119.13	\$119.13	\$244.22	\$244.22	\$119.13	\$119.13	\$100.52	\$100.52
1IA	Ext Summer	\$60.00	\$119.13	**	\$119.13	\$119.13	\$244.22	\$244.22	\$119.13	\$119.13	\$100.52	\$100.52
1IA	Limited	\$53.93	\$89.35	**	\$89.35	\$89.35	\$214.44	\$214.44	\$89.35	\$89.35	\$84.45	\$94.45
DY 17/18												
BRA	Annual	\$120.00	\$120.00	**	\$120.00	\$120.00	\$215.00	\$215.00	\$120.00	\$120.00	\$120.00	\$120.00
BRA	Ext Summer	\$120.00	\$120.00	**	\$120.00	\$120.00	\$215.00	\$215.00	\$120.00	\$120.00	\$120.00	\$120.00
BRA	Limited	\$106.02	\$106.02	**	\$106.02	\$106.02	\$201.02	\$201.02	\$106.02	\$106.02	\$106.02	\$106.02

* The Annual, Extended Summer and Limited capacity product types were implemented starting with the 2014/2015 Delivery Year

** LDA was not modeled



2018/2019 RPM Base Residual Auction Results

Executive Summary

The 2018/2019 Reliability Pricing Model (RPM) Base Residual Auction (BRA) cleared 166,836.9 MW of unforced capacity in the RTO. Accounting for load and resource commitments under the Fixed Resource Requirement (FRR) the reserve margin for the entire RTO for the 2018/2019 Delivery Year as procured in the BRA is 19.8%, or 4.1% higher than the target reserve margin of 15.7%.

The 2018/2019 RPM BRA was conducted under several new RPM design elements that were approved by FERC since last year's BRA. On June 9, 2015, in Docket No. ER15-623, FERC accepted a series of tariff reforms proposed in PJM's Capacity Performance ("CP") filing of December 12, 2014, to establish Capacity Performance Resources to ensure PJM's capacity market provides adequate incentive for resource performance. Also, on November 28, 2014, in Docket No. ER14-2940, FERC approved revisions to the Variable Resource Requirement (VRR) curve shape and Gross Cost of New Entry (CONE) values as proposed in PJM's September 25, 2014 filing. This filing was made following last year's stakeholder review of the shape of the VRR curve and key inputs to that curve, where such review is required by PJM Tariff on a specified periodic basis. The impact of Tariff revisions associated with these two filings as they relate to the setup and clearing of the 2018/2019 BRA are discussed in more detail in the "Discussion of Factors Impacting the RPM Clearing Prices" section of this report.

Under the CP provisions, for the 2018/2019 Delivery Year, PJM will procure two capacity product types through RPM auctions, Capacity Performance and Base Capacity. CP Resources must be capable of sustained, predictable operation, and are expected to be available and capable of providing energy and reserves when needed throughout the entire Delivery Year; whereas, Base Capacity Resources may not be capable of sustained, predictable operation and/or may not be expected to provide energy and reserves outside of the summer period. Base Capacity Resources include Base Capacity Demand Resources (DR), which are expected to be available only during the summer months, and Base Capacity Energy Efficiency (EE) Resources, which are expected to provide permanent continuous load reduction only during the summer months. Base Capacity Resources also include Base Capacity Generation Resources, which are expected to be available throughout the Delivery Year like all Capacity Performance Resources. But, unlike Capacity Performance Resources, Base Capacity Generation Resources will be subject to non-performance charges only when they fail to perform when needed during the summer months.

Base Capacity Resources do not provide the same level of availability as CP Resources, therefore constraints are imposed on the quantity of Base Capacity Resources that can be procured in each RPM auction. A Base Capacity DR Constraint which places a maximum limit on the total quantity of Base Capacity DR and Base Capacity EE that can be procured in the auction is established for the entire RTO and each modeled LDA. A Base Capacity Resource Constraint which places a maximum limit on the total quantity of Base Capacity DR, Base Capacity EE and Base Capacity Generation Resources that can be procured in the auction is established for the entire RTO and each modeled LDA. If these constraints are reached in the auction then these less-available resources will clear the auction at a lower clearing price than the clearing price associated with similarly located more-available resources.



2018/2019 RPM Base Residual Auction Results

2018/2019 BRA Resource Clearing Prices

Resource Clearing Prices (RCPs) for the 2018/2019 BRA are shown in the table below. The EMAAC LDA and ComEd LDA were constrained LDAs in the 2018/2019 BRA. The RCP for CP Resources located in the rest of RTO outside of these LDAs is \$164.77/MW-day. The RCP for CP Resources in the EMAAC LDA is \$225.42/MW-day and RCP for CP Resources in the COMED LDA is \$215.00 /MW-day. For comparison purposes, the Annual RCP in the 2017/2018 BRA across the entire RTO was \$120/MW-day with the exception of the PSEG LDA where the Annual RCP was \$215/MW-day.

Capacity Type	2018/19 BRA Resource Clearing Prices (\$/MW-day)					
	Rest of RTO	EMAAC	SWMAAC	PEPCO	COMED	PPL
Capacity Performance	\$164.77	\$225.42	\$164.77	\$164.77	\$215.00	\$164.77
Base Generation	\$149.98	\$210.63	\$149.98	\$149.98	\$200.21	\$75.00
Base DR/EE	\$149.98	\$210.63	\$59.95	\$41.09	\$200.21	\$75.00

The Base Capacity Resource Constraint is a binding constraint in the auction for the PPL LDA, as well as, for the overall RTO, resulting in a price decrement for Base Capacity Generation located in PPL of \$89.77/MW-day relative to the RCP of CP resources located in the PPL LDA, and a price decrement of \$14.79/MW-day for Base Capacity Generation located in the rest of RTO outside of the PPL LDA. Additionally, the Base Capacity DR Constraint is a binding constraint in the BGE LDA and the PEPCO LDA resulting in price decrements for Base Capacity DR and EE located in the BGE LDA and the PEPCO LDA of \$90.03/MW-day and \$108.89/MW-day, respectively. These price decrements for Base Capacity DR and EE are relative to the RCP of Base Capacity Generation Resource located in these LDAs

The RCP for Base Capacity Resources located in the rest of RTO outside of the EMAAC, SWMAAC and COMED LDAs is \$149.98/MW-day. The RCP for Base Capacity Resources located in the EMAAC LDA is \$210.63/MW-day. The RCP for Base Capacity DR & EE Resources, Base Capacity Generation Resources and CP Resources located in the SWMAAC LDA outside of the PEPCO LDA is \$59.95/MW-day, \$149.98/MW-day and \$164.77/MW-day, respectively. The RCP for Base Capacity DR & EE Resources, Base Capacity Generation Resources and CP Resources located in the PEPCO LDA is \$41.09/MW-day, \$149.98/MW-day and \$164.77/MW-day, respectively. The RCP for Base Capacity Resources located in the COMED LDA is \$200.21/MW-day. The RCP for Base Capacity Resources and CP Resources located in the PPL LDA is \$75.00/MW-day and \$164.77/MW-day, respectively.

2018/2019 BRA Cleared Capacity Resources

As seen in the table below, the 2018/2019 BRA procured 2,919.3 MW of capacity from new generation and 587.8 MW from uprates to existing or planned generation. The quantity of capacity procured from external Generation Capacity Resources in the 2018/2019



2018/2019 RPM Base Residual Auction Results

BRA is 4,687.9 MW which is an increase of 162.4 MW from that procured in last year's BRA when Capacity Import Limits (CIL) were first implemented. All external generation capacity that has cleared in the 2018/19 BRA has met the requirements for the CIL exception. The total quantity of DR procured in the 2018/2019 BRA is 11,084.4 MW which is an increase of 109.6 MW from that procured in last year's BRA; and, the total quantity of EE procured in the 2018/2019 BRA is 1,246.5 MW which is a decrease of 92.4 MW from that procured in last year's BRA.

Megawatts of Unforced Capacity Procured by Type

BRA Delivery Year	New Generation	Generation Upgrades	Imports	Demand Response	Energy Efficiency
2018/2019	2,919.3	587.6	4,687.9	11,084.4	1,246.5
2017/2018	5,927.4	339.9	4,525.5	10,974.8	1,338.9
2016/2017	4,281.6	1,181.3	7,482.7	12,408.1	1,117.3
2015/2016	4,898.9	447.4	3,935.3	14,832.8	922.5
2014/2015	415.5	341.1	3,016.5	14,118.4	822.1



2018/2019 RPM Base Residual Auction Results

Introduction

This document provides information for PJM stakeholders regarding the results of the 2018/2019 Reliability Pricing Model (RPM) Base Residual Auction (BRA). The 2018/2019 BRA opened on August 10, 2015, and the results were posted on August 21, 2015.

In each BRA, PJM seeks to procure a target capacity reserve level for the RTO in a least cost manner while recognizing the following reliability-based constraints on the location and type of capacity that can be committed:

- Internal PJM locational constraints are established by setting up Locational Deliverability Areas (LDAs) with each LDA having a separate target capacity reserve level and a maximum limit on the amount of capacity that it can import from resources located outside of the LDA.
- Constraints on the procurement of the more limited capacity product types are established for the RTO and each modeled LDA. The Base Capacity DR Constraint limits the quantity of Base Capacity DR and EE that can be procured in each LDA or in total across the entire RTO; and the Base Capacity Resource Constraint limits the quantity of the sum of Base Capacity DR and EE and Base Capacity Generation Resources that can be procured in each LDA or in total across the entire RTO.
- Capacity Import Limits (CILs) are established on the amount of external generation capacity that can be reliably committed to PJM. A separate CIL is established for each of five external source-zones and a single total CIL is established for the overall RTO. As described in more detail later in this report, external generation resources may seek exception to the CIL by meeting all three of the following conditions prior to the start of the auction: (1) they are committed to being pseudo-tied generation resources prior to the start of the Delivery Year; that is, they will be treated like internal generation, subject to redispatch and locational pricing; (2) they have long-term firm transmission service confirmed on the complete transmission path from such resource into PJM; and (3) they agree to be subject to the same capacity must-offer requirement as PJM's internal resources.

The auction clearing process commits capacity resources to procure a target capacity reserve level for the RTO in a least-cost manner while recognizing and enforcing these reliability-based constraints. The clearing solution may be required to commit capacity resource out-of-merit order but again in a least-cost manner to ensure that all of these constraints are respected. In those cases where one or more of the constraints results in out-of-merit commitment in the auction solution, resource clearing prices will be reflective of the price of resources selected out of merit order to meet the necessary requirements.

This document begins with a high-level summary of the BRA results followed by sections containing detailed descriptions of the 2018/2019 BRA results and a discussion of the results in the context of the ten previous BRAs.



2018/2019 RPM Base Residual Auction Results

Summary of Results

The 2018/2019 Reliability Pricing Model (RPM) Base Residual Auction (BRA) cleared 166,836.9 MW of unforced capacity in the RTO representing a 20.2% reserve margin. The reserve margin for the entire RTO is 19.8%, or 4.1% higher than the target reserve margin of 15.7%, when the Fixed Resource Requirement (FRR) load and resources are considered.

Resource Clearing Prices (RCPs) for the 2018/2019 BRA are shown in Table 4. The RCP for CP Resources is \$164.77/MW-day for CP Resources located in the rest of RTO outside of the EMAAC LDA and the ComEd LDA. The EMAAC LDA and ComEd LDA were constrained LDAs in the 2018/2019 BRA. The RCP for CP Resources in the EMAAC LDA is \$225.42/MW-day and the RCP for CP Resources in the ComEd LDA is \$215.00 /MW-day. For comparison purposes, the Annual RCP in the 2017/2018 BRA across the entire RTO was \$120/MW-day with the exception of the PSEG LDA where the Annual RCP was \$215/MW-day.

The Base Capacity Resource Constraint is a binding constraint in the auction for the PPL LDA, as well as, for the overall RTO, resulting in a price decrement (relative to the RCP of similarly located CP Resources) for Base Capacity Generation located in the PPL of \$89.77/MW-day, and a price decrement for Base Capacity Generation located in the rest of RTO outside of the PPL LDA of \$14.79/MW-day. Additionally, the Base Capacity DR Constraint is a binding constraint in the SWMAAC LDA and the PEPCO LDA resulting in price decrements (relative to the RCP of similarly located Base Capacity Generation Resources) for Base Capacity DR and EE located in the SWMAAC LDA and the PEPCO LDA of \$90.03/MW-day and \$108.89/MW-day, respectively.

The RCP for Base Capacity Resources and CP Resources located in the rest of RTO outside of the EMAAC, SWMAAC and COMED LDAs is \$149.98/MW-day and \$164.77/MW-day, respectively. The RCP for Base Capacity Resources and CP Resources located in the EMAAC LDA is \$210.63/MW-day and \$225.42/MW-day, respectively. The RCP for Base Capacity DR & EE Resources, Base Capacity Generation Resources and CP Resources located in the SWMAAC LDA outside of the PEPCO LDA is \$59.95/MW-day, \$149.98/MW-day and \$164.77/MW-day, respectively. The RCP for Base Capacity DR & EE Resources, Base Capacity Generation Resources and CP Resources located in the PEPCO LDA is \$41.09/MW-day, \$149.98/MW-day and \$164.77/MW-day, respectively. The RCP for Base Capacity Resources and CP Resources located in the COMED LDA is \$200.21/MW-day and \$215.00/MW-day, respectively. The RCP for Base Capacity Resources and CP Resources located in the PPL LDA is \$75.00/MW-day and \$164.77/MW-day, respectively.

The total quantity of new Generation Capacity Resources offered into the auction was 4,132.6 MW (UCAP) comprised of 3,447.4 MW of new generation units and 685.2 MW of uprates to existing generation units. The quantity of new Generation Capacity Resources cleared was 3,506.9 MW (UCAP) comprised of 2,919.3 MW (UCAP) from new generation units and 587.6 MW from uprates to existing generation units.



2018/2019 RPM Base Residual Auction Results

The quantity of capacity procured from external Generation Capacity Resources in the 2018/2019 BRA is 4,687.9 MW which is an increase of 162.4 MW from that procured in last year's BRA when Capacity Import Limits (CIL) were first implemented. All external generation capacity that has cleared in the 2018/19 BRA has met the requirements for CIL exception. These requirements help to ensure that external resources offering into the RPM auction have reasonable expectation of physically delivering on any RPM commitment and have high likelihood of being available for PJM when needed. External generation resources may seek exception to the CIL by meeting three requirements prior to the start of the auction: (i) they are committed to being pseudo-tied generation resources prior to the start of the Delivery Year; that is, they will be treated like internal generation, subject to redispatch and locational pricing; (ii) they have long-term firm transmission service confirmed on the complete transmission path from such resource into PJM; and (iii) they agree to be subject to the same capacity must-offer requirement as PJM's internal resources. These requirements help to ensure that external resources offering into the RPM auction have reasonable expectation of physically delivering on any RPM commitment and have high likelihood of being available for PJM when needed.

The total quantity of DR procured in the 2018/2019 BRA is 11,084 MW which is an increase of 109.6 MW from that procured in last year's BRA; and, the total quantity of EE procured in the 2018/2019 BRA is 1,246.5 MW which is a decrease of 92.4 MW from that procured in last year's BRA.

All existing generation sell offers into the 2018/2019 BRA were subject to market power mitigation through the application of the Market Structure Test (i.e., the Three-Pivotal Supplier Test). The RTO as a whole failed the Market Structure Test, resulting in mitigation of any existing generation resources. Mitigation was applied to a supplier's existing generation resources resulting in utilizing the lesser of the supplier's approved offer cap for such resource or the supplier's submitted offer price for such resource in the RPM Auction clearing.

All Generation Capacity Resources (including uprates to existing resources) of 20 MW or greater that are based on combustion turbine, combined cycle and integrated gasification combined cycle technologies that have not cleared an RPM Auction prior to February 1, 2013 are subject to the Minimum Offer Price Rule (MOPR). External Generation Capacity Resources meeting the above criteria and that have entered commercial operation on or after January 1, 2013 and that require sufficient transmission investment for delivery into PJM are also subject to MOPR. To avoid application of the MOPR, Capacity Market Sellers may request exemption through either a Competitive Entry Exemption request or a Self-Supply Exemption request. The table below shows the requested, granted and cleared aggregate quantity (in ICAP MW) of each exemption type received and processed by PJM. While there were over 13,000 MW of MOPR exemption requests, making a request does not obligate a resource to offer into the BRA.



2018/2019 RPM Base Residual Auction Results

LDA	Exemption Type	Requested Quantity (ICAP MW)	Granted Quantity (ICAP MW)	Cleared Quantity (ICAP MW)
RTO*	Competitive Entry	7,177.0	7,177.0	2,311.2
RTO*	Self-Supply	0.0	0.0	0.0
MAAC	Competitive Entry	6,353.5	6,353.5	1,206.8
MAAC	Self-Supply	0.0	0.0	0.0
Total		13,530.5	13,530.5	3,518.0

*RTO values exclude MAAC

A further discussion of the 2018/2019 BRA results and additional information regarding the 2018/2019 RPM BRA are detailed in the body of this report. The discussion also provides a comparison of the 2018/2019 auction results to the results from the 2007/2008 through 2017/2018 RPM Auctions.



2018/2019 RPM Base Residual Auction Results

2018/2019 Base Residual Auction Results Discussion

Table 1 contains a summary of the RTO clearing prices resulting from the 2018/2019 RPM BRA in comparison to those from 2007/2008 through 2017/2018 RPM BRAs.

Table 1 –RPM Base Residual Auction Resource Clearing Price Results in the RTO

Auction Results	RTO											
	2007/2008	2008/2009	2009/2010	2010/2011	2011/2012 ¹	2012/2013	2013/2014 ²	2014/2015 ³	2015/2016 ⁴	2016/2017 ⁵	2017/2018	2018/2019
Resource Clearing Price	\$40.80	\$111.92	\$102.04	\$174.29	\$110.00	\$16.46	\$27.73	\$125.99	\$136.00	\$59.37	\$120.00	\$164.77
Cleared UCAP (MW)	129,409.2	129,597.6	132,231.8	132,190.4	132,221.5	136,143.5	152,743.3	149,974.7	164,561.2	169,159.7	167,003.7	166,836.9
Reserve Margin	19.1%	17.4%	17.6%	16.4%	17.9%	20.5%	19.7%	18.8%	19.3%	20.3%	19.7%	19.8%

1) 2011/2012 BRA was conducted without Duquesne zone load.

2) 2013/2014 BRA includes ATSI zone

3) 2014/2015 BRA includes Duke zone

4) 2015/2016 BRA includes a significant portion of AEP and DEOK zone load previously under the FRR Alternative

5) 2016/2017 BRA includes EKPC zone

The 2018/2019 Reliability Pricing Model (RPM) Base Residual Auction cleared 166,836.9 MW of unforced capacity in the RTO representing a 20.2% reserve margin. The reserve margin for the entire RTO is 19.8%, or 4.1% higher than the target reserve margin of 15.7%, when the Fixed Resource Requirement (FRR) load and resources are considered. The Reserve Margin presented in Table 1 represents the percentage of installed capacity cleared in RPM and committed by FRR entities in excess of the RTO load (including load served under the Fixed Resource Requirement alternative).

New Generation Resource Participation

The 2018/2019 Base Residual Auction results reflect a continuation of strong participation by new Generation Capacity Resources mostly in the form of new (or uprates to existing) gas-fired combustion turbine and combined cycle generation units. The total quantity of new Generation Capacity Resources offered into the auction was 4,132.6 MW (UCAP) comprised of 3,447.4 MW of new generation units and 685.2 MW of uprates to existing generation units. The quantity of new Generation Capacity Resources cleared was 3,506.9 MW (UCAP) comprised of 2,919.3 MW (UCAP) from new generation units, predominantly natural gas combined cycle and combustion turbines, and 587.6 MW from uprates to existing generation units.

Table 2A shows the breakdown, by major LDA, of capacity in UCAP terms of new units and uprates at existing units offered in the auction and capacity actually clearing in the auction. 84.9% of the new generation capacity that offered into the 2018/2019BRA cleared the auction.



2018/2019 RPM Base Residual Auction Results

Table 2A – Offered and Cleared New Generation Capacity by LDA (in UCAP MW)

LDA	Offered			Cleared		
	Uprate	New Unit	Total	Uprate	New Unit	Total
EMAAC	79.7	1,036.1	1,115.8	79.6	561.7	641.3
MAAC	439.9	1,054.8	1,494.7	439.6	561.7	1,001.3
Total RTO	685.2	3,447.4	4,132.6	587.6	2,954.3	3,541.9

*All MW Values are in UCAP Terms

*MAAC includes EMAAC

**RTO includes MAAC

Capacity Import Participation

The quantity of capacity imports cleared in the 2018/2019 BRA were 4,687.9 MW (UCAP) which represents an increase of 162.4 MW from the imports that cleared in the 2017/2018 BRA. The majority of the imports are from resources located in regions west of the PJM RTO. All external generation capacity that has cleared in the 2018/19 BRA has met the requirements for the CIL exception.

Table 2B – Offered and Cleared Capacity Imports (in UCAP MW)

	External Source Zones					Total
	NORTH	WEST 1	WEST 2	SOUTH 1	SOUTH 2	
Offered MW (UCAP)	252.0	1,238.5	2,729.9	656.5	258.9	5,135.8
Cleared MW (UCAP)	252.0	1,163.2	2,359.9	656.5	256.3	4,687.9
Resource Clearing Price (\$/MW-day)	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	

Note: All Cleared MW quantities include resources that received CIL exception and those associated with pre-OATT grandfathered transmission, therefore, clearing at RTO clearing price

Demand Resource Participation

The total quantity of DR offered into the 2018/2019 BRA was 11,675.5 MW (UCAP), representing an increase of 3.4% over the DR that offered into the 2017/2018 BRA. Of the 11,675.5 MW of total DR that offered in this auction, 11,084.4 MW cleared. The cleared



2018/2019 RPM Base Residual Auction Results

DR is 109.6 MW more than that which cleared in the 2017/2018 BRA. Table 3A contains a comparison of the DR Offered and Cleared in 2017/2018 BRA & 2018/2019 BRA represented in UCAP.

Energy Efficiency Resource Participation

An EE resource is a project that involves the installation of more efficient devices/equipment or the implementation of more efficient processes/systems exceeding then-current building codes, appliance standards, or other relevant standards at the time of installation as known at the time of commitment. The EE resource must achieve a permanent, continuous reduction in electric energy consumption (during the defined EE performance hours) that is not reflected in the peak load forecast used for the BRA for the Delivery Year for which the EE resource is proposed. The EE resource must be fully implemented at all times during the Delivery Year, without any requirement of notice, dispatch, or operator intervention. Of the 1,306.1 MW of energy efficiency that offered into the 2018/2019 BRA, 1,246.5 MW of EE resources cleared in the auction.

Table 3B contains a summary of the DR and EE resources that offered and cleared by zone in the 2018/2019 BRA. Approximately 94.9% of the demand resources and 95.4% of the energy efficiency resources that were offered into the BRA cleared. The uncleared resources were offered at a price above the applicable clearing price for the LDA in which the resource was offered.

Figure 1 illustrates the demand side participation in the PJM Capacity Market from 2005/2006 Delivery Year to the 2018/2019 Delivery Year. Demand side participation includes active load management (ALM) prior to 2007/2008 Delivery Year, Interruptible Load for Reliability (ILR) and DR offered into each BRA and nominated in FRR Plans, and EE resources starting with the 2012/2013 Delivery Year. The demand side participation in the capacity market has increased dramatically since the inception of RPM in the 2007/2008 Delivery Year through the 2015/2016 BRA, but as shown in Figure 1, total demand side participation and cleared resources for the 2018/2019 BRA have fallen below the levels seen in the 2014/2015 BRA.



2018/2019 RPM Base Residual Auction Results

Table 3A – Comparison of Demand Resources Offered and Cleared in 2017/18 BRA & 2018/19 BRA represented in UCAP

LDA	Zone	Offered MW (UCAP)			Cleared MW (UCAP)		
		2017/2018	2018/2019	Increase in Offered MW	2017/2018	2018/2019	Increase in Cleared MW
EMAAC	AECO	134.8	165.1	30.3	134.7	162.1	27.4
EMAAC/DPL-S	DPL	372.9	422.7	49.8	369.7	418.2	48.5
EMAAC	JCPL	169.8	206.4	36.6	159.4	200.1	40.7
EMAAC	PECO	494.1	513.0	18.9	480.0	504.5	24.5
PSEG/PS-N	PSEG	392.7	386.6	(6.1)	388.4	382.2	(6.2)
EMAAC	RECO	3.4	7.6	4.2	3.4	7.5	4.1
EMAAC Sub Total		1,567.7	1,701.4	133.7	1,535.6	1,674.6	139.0
PEPCO	PEPCO	619.8	667.1	47.3	608.4	523.1	(85.3)
BGE	BGE	803.2	813.9	10.7	791.2	660.0	(131.2)
MAAC	METED	306.6	334.9	28.3	298.9	327.4	28.5
MAAC	PENELEC	367.7	392.6	24.9	356.8	384.7	27.9
PPL	PPL	812.7	873.6	60.9	686.2	716.2	30.0
MAAC** Sub Total		4,477.7	4,783.5	305.8	4,277.1	4,286.0	8.9
RTO	AEP	1,445.5	1,441.5	(4.0)	1,426.1	1,417.6	(8.5)
RTO	APS	940.8	990.7	49.9	928.9	976.8	47.9
ATSI/ATSI-C	ATSI	1,064.4	891.9	(172.5)	1,020.2	877.0	(143.2)
COMED	COMED	1,499.6	1,901.2	401.6	1,478.1	1,876.7	398.6
RTO	DAY	211.9	234.9	23.0	209.4	231.6	22.2
RTO	DEOK	194.0	205.7	11.7	192.4	203.8	11.4
RTO	DOM	1,157.8	827.8	(330.0)	1,141.1	817.3	(323.8)
RTO	DUQ	161.9	263.0	101.1	161.4	262.3	100.9
RTO	EKPC	140.1	135.3	(4.8)	140.1	135.3	(4.8)
Grand Total		11,293.7	11,675.5	381.8	10,974.8	11,084.4	109.6

**MAAC sub-total includes all MAAC Zones



2018/2019 RPM Base Residual Auction Results

Table 3B – Comparison of Demand Resources and Energy Efficiency Resources Offered versus Cleared in the 2018/19 BRA

LDA	Zone	Offered MW (UCAP)			Cleared MW (UCAP)		
		DR	EE	Total	DR	EE	Total
EMAAC	AECO	165.1	3.0	168.1	162.1	3.0	165.1
EMAAC/DPL-S	DPL	422.7	11.3	434.0	418.2	11.0	429.2
EMAAC	JCPL	206.4	11.4	217.8	200.1	11.4	211.5
EMAAC	PECO	513.0	14.7	527.7	504.5	14.7	519.2
PSEG/PS-N	PSEG	386.6	14.5	401.1	382.2	14.1	396.3
EMAAC	RECO	7.6	0.1	7.7	7.5	0.1	7.6
EMAAC Sub Total		1,701.4	55.0	1,756.4	1,674.6	54.3	1,728.9
PEPCO	PEPCO	667.1	67.3	734.4	523.1	66.4	589.5
BGE	BGE	813.9	134.1	948.0	660.0	95.9	755.9
MAAC	METED	334.9	4.6	339.5	327.4	4.6	332.0
MAAC	PENELEC	392.6	12.4	405.0	384.7	12.4	397.1
PPL	PPL	873.6	25.0	898.6	716.2	25.0	741.2
MAAC** Sub Total		4,783.5	298.4	5,081.9	4,286.0	258.6	4,544.6
RTO	AEP	1,441.5	106.5	1,548.0	1,417.6	106.5	1,524.1
RTO	APS	990.7	10.5	1,001.2	976.8	10.5	987.3
ATSI/ATSI-C	ATSI	891.9	38.8	930.7	877.0	38.8	915.8
COMED	COMED	1,901.2	744.4	2,645.6	1,876.7	744.4	2,621.1
RTO	DAY	234.9	52.7	287.6	231.6	32.9	264.5
RTO	DEOK	205.7	18.5	224.2	203.8	18.5	222.3
RTO	DOM	827.8	12.9	840.7	817.3	12.9	830.2
RTO	DUQ	263.0	23.4	286.4	262.3	23.4	285.7
RTO	EKPC	135.3	-	135.3	135.3	-	135.3
Grand Total		11,675.5	1,306.1	12,981.6	11,084.4	1,246.5	12,330.9

**MAAC sub-total includes all MAAC Zones

Any resource that can qualify as a CP Resource may submit separate but coupled sell offers for CP and Base Capacity product types. When sell offer segments of both capacity product types are coupled with different offer prices, the auction clearing engine will clear only one of the products at most and will clear the product that results in the lowest cost solution for the system. Any Generation Capacity Resource with a unit-specific MSOC above the CP default MSOC must submit separate but coupled sell offers for CP and Base Capacity product types. Table 3C shows a breakdown of offered and cleared capacity for each resource type grouped by



2018/2019 RPM Base Residual Auction Results

coupling scenario. As shown on Table 3C, 138,228.9 MW or 89.5% of the total cleared generation capacity cleared as CP; 1,484.2 MW or 13.4% of the total cleared DR capacity cleared as CP; and, 887.3 MW or 71.2% of total cleared EE capacity cleared as CP.

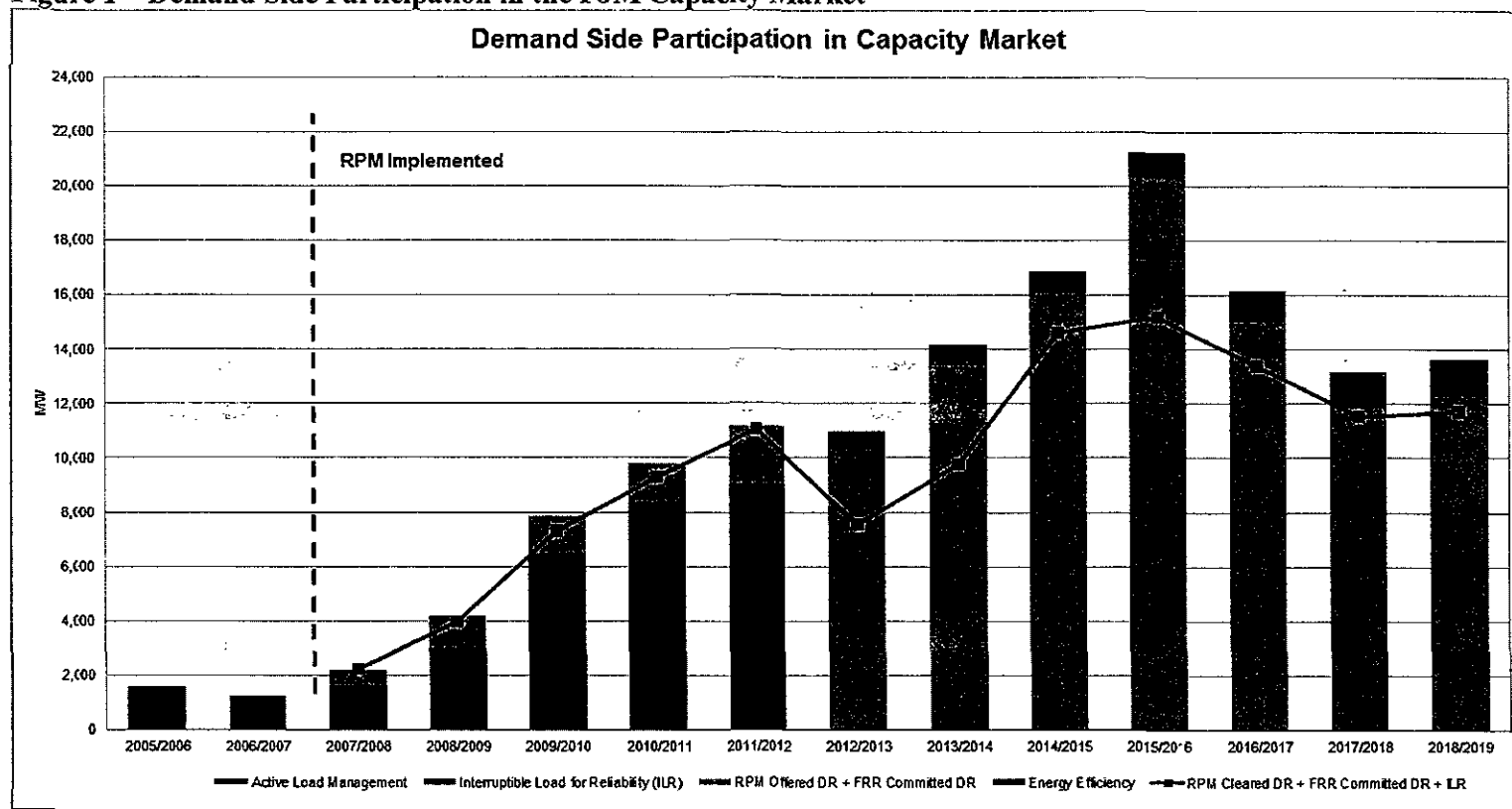
Table 3C – Breakdown of Demand Resources Offered versus Cleared by Product Type in the 2018/19 BRA in UCAP

Resource Type	Product Coupling Scenario	Offered MW (UCAP)		Cleared MW (UCAP)	
		Base Product Type	Capacity Performance Product Type	Base Product Type	Capacity Performance Product Type
GEN	Capacity Performance and Base	22,255.8	22,477.7	11,194.3	9,554.7
GEN	Capacity Performance Only	-	139,204.5	-	128,674.2
GEN	Base Only	5,224.2	-	5,082.8	-
GEN Sub Total		27,480.0	161,682.2	16,277.1	138,228.9
DR	Capacity Performance and Base	4,467.5	3,528.5	3,688.8	548.2
DR	Capacity Performance Only	-	936.0	-	936.0
DR	Base Only	6,252.4	-	5,911.4	-
DR Sub Total		10,719.9	4,464.5	9,600.2	1,484.2
EE	Capacity Performance and Base	652.9	657.4	65.1	592.4
EE	Capacity Performance Only	-	314.7	-	294.9
EE	Base Only	332.7	-	294.1	-
EE Sub Total		985.6	972.1	359.2	887.3
Grand Total		39,185.5	167,118.8	26,236.5	140,600.4



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Figure 1 – Demand Side Participation in the PJM Capacity Market





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Renewable Resource Participation

857.2 MW of wind resources were offered into and cleared the 2018/2019 BRA as compared to 803.7 MW of wind resources that offered into and cleared the 2017/2018 BRA. The capacity factor applied to wind resources is 13%, meaning that for every 100 MW of wind energy, 13 MW are eligible to meet capacity requirements. The 857.2 MW of cleared wind capacity translates to 6,593.8 MW of wind energy nameplate capability that is expected to be available in the 2018/2019 Delivery Year.

183.7 MW of solar resources were offered into and cleared the 2018/2019 BRA as compared to 116.4 MW of solar resources that offered into and cleared the 2017/2018 BRA. The capacity factor applied to solar resources is 38%, meaning that for every 100 MW of solar energy, 38 MW are eligible to meet capacity requirements. The 183.7 MW of cleared solar capacity translates to 484.4 MW of solar energy that is expected to be available in the 2018/2019 Delivery Year.

LDA Results

An LDA was modeled in the BRA and had a separate VRR Curve if (1) the LDA has a CETO/CETL margin that is less than 115%; or (2) the LDA had a locational price adder in any of the three immediately preceding Base Residual Auctions; or (3) the LDA is likely to have a locational price adder based on a PJM analysis using historic offer price levels; or (4) the LDA is EMAAC, SWMAAC, and MAAC.

As a result of the above criteria, MAAC, EMAAC, SWMAAC, PSEG, PS-NORTH, DPL-SOUTH, PEPCO, ATSI, ATSI-Cleveland, COMED, BGE and PL were modeled as LDAs in the 2018/2019 RPM Base Residual Auction. The EMAAC LDA and the ComEd LDA were binding constraints in the auction resulting in a Locational Price Adder for these LDAs. A Locational Price Adder represents the difference in Resource Clearing Prices for the Limited capacity product between a resource in a constrained LDA and the immediate higher level LDA. The EMAAC CETL for the 2018/2019 BRA is 940 MW lower than the 2017/2018 BRA CETL value. This reduction is primarily attributable to the addition of a significant amount of planned generation capacity in the Peach Bottom/Rock Springs area contributing to increased loading on the Rocks Spring–Keeney 500 kV line which aggravates the post-contingency voltage profile in the EMAAC area for the loss of the line. The ComEd CETL for the 2018/2019 BRA is 1,793 MW lower than the 2017/2018 BRA CETL. This reduction is primarily due to external system limitations that reduced the import capability into ComEd from outside of PJM. These external system limitations were caused by changes to the transmission system configuration anticipated for the 2018/2019 Delivery Year as well as changes to Firm transmission service reservations. The reduction in the ability to import from outside of PJM required that the imports in the CETL test for the ComEd LDA were sourced increasingly from inside PJM, resulting in the identification of transmission limitations at a lower overall transfer value.



2018/2019 RPM Base Residual Auction Results

Table 4 contains a summary of the clearing results in the LDAs from the 2018/2019 RPM Base Residual Auction.

Table 4 –RPM Base Residual Auction Clearing Results in the LDAs

Auction Results	RTO	MAAC	SWMAAC	PEPCO	BGE	EMAAC	DPL-SOUTH	PSEG	PS-NORTH	ATSI	ATSI-CLEVELAND	PPL	COMED
Offered MW (UCAP)	179,891.2	73,545.7	12,621.2	5,991.2	4,224.9	33,840.0	1,695.9	6,939.3	3,645.3	11,085.7	2,590.4	11,157.6	26,275.6
Cleared MW (UCAP)	166,836.9	66,071.2	11,180.7	5,478.7	3,296.9	31,069.0	1,693.5	5,300.8	3,168.0	10,171.6	2,258.1	9,526.9	23,320.4
System Marginal Price	\$164.77	\$164.77	\$164.77	\$164.77	\$164.77	\$164.77	\$164.77	\$164.77	\$164.77	\$164.77	\$164.77	\$164.77	\$164.77
Locational Price Adder*	-	-	-	-	-	\$60.65	-	-	-	-	-	-	\$50.23
Base Capacity Resource Price Decrement**	(\$14.79)	(\$14.79)	(\$14.79)	(\$14.79)	(\$14.79)	(\$14.79)	(\$14.79)	(\$14.79)	(\$14.79)	(\$14.79)	(\$14.79)	(\$89.77)	(\$14.79)
Base DR/EE Capacity Price Decrement	-	-	(\$90.03)	(\$108.89)	(\$90.03)	-	-	-	-	-	-	-	-
RCP for Base DR/EE Resources	\$149.98	\$149.98	\$59.95	\$41.09	\$59.95	\$210.63	\$210.63	\$210.63	\$210.63	\$149.98	\$149.98	\$75.00	\$200.21
RCP for Base Generation Resources	\$149.98	\$149.98	\$149.98	\$149.98	\$149.98	\$210.63	\$210.63	\$210.63	\$210.63	\$149.98	\$149.98	\$75.00	\$200.21
RCP for Capacity Performance Resources	\$164.77	\$164.77	\$164.77	\$164.77	\$164.77	\$225.42	\$225.42	\$225.42	\$225.42	\$164.77	\$164.77	\$164.77	\$215.00

*Locational Price Adder is with respect to the immediate parent LDA

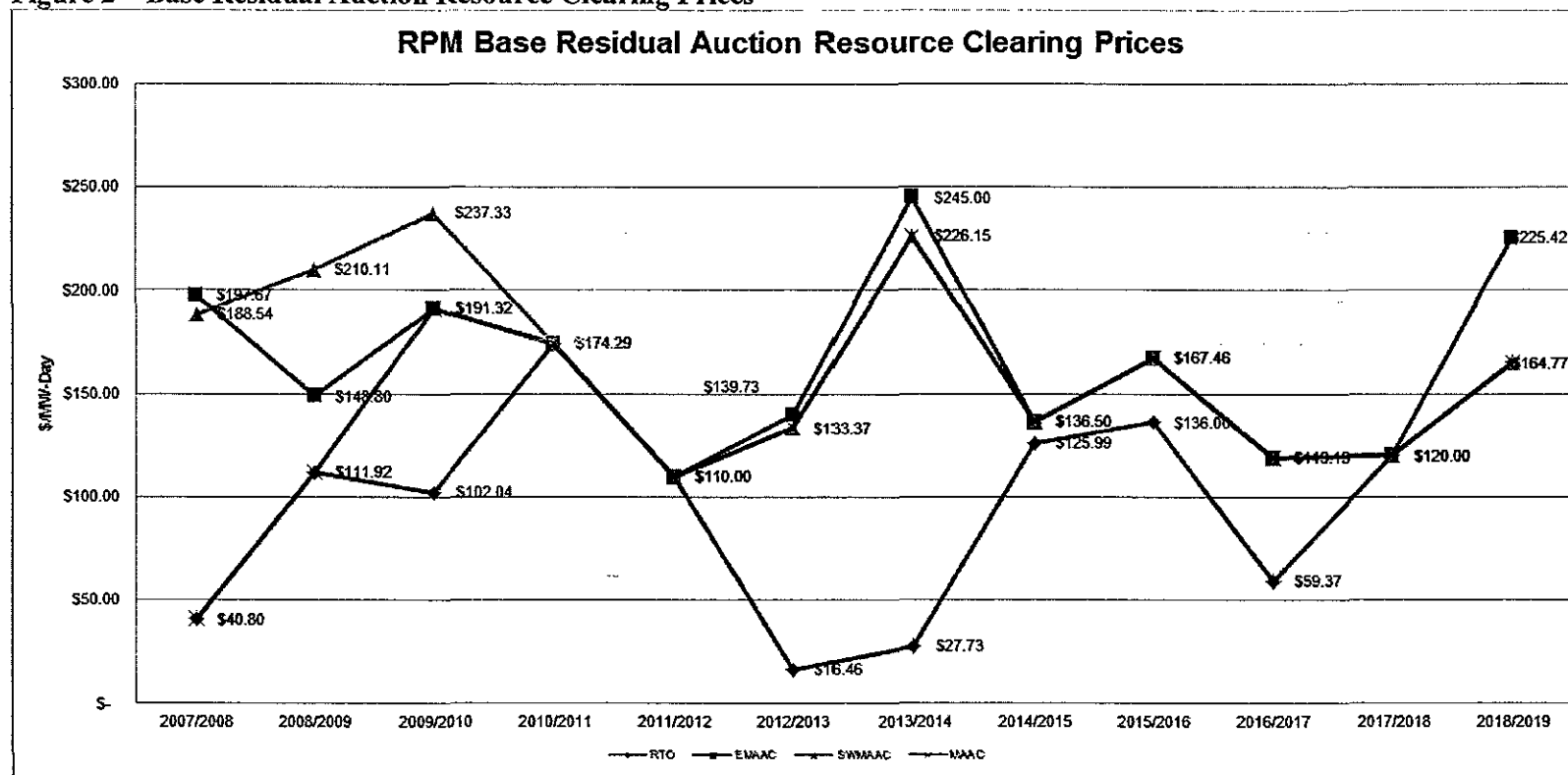
**Base Generation and Base DR/EE receive the Base Capacity Resource Price Decrement

Since the EMAAC LDA and ComEd LDA were constrained LDAs, Capacity Transfer Rights (CTRs) will be allocated to loads in these constrained LDA for the 2018/2019 Delivery Year. CTRs are allocated by load ratio share to all Load Serving Entities (LSEs) in a constrained LDA that has a higher clearing price than the unconstrained region. CTRs serve as a credit back to the LSEs in the constrained LDA for use of the transmission system to import less expensive capacity into that constrained LDA and are valued at the difference in the clearing prices of the constrained and unconstrained regions.



2018/2019 RPM Base Residual Auction Results

Figure 2 – Base Residual Auction Resource Clearing Prices



*2014/2015 through 2018/2019 Prices reflect the Annual Resource Clearing Prices.



2018/2019 RPM Base Residual Auction Results

Table 5 contains a summary of the RTO resources for each cleared BRA from 2008/2009 through the 2018/2019 Delivery Years. The summary includes all resources located in the RTO (including FRR Capacity Plans).

A total of 209,025.2 MW of installed capacity was eligible to be offered into the 2018/2019 Base Residual Auction, with 5,724.6 MW from external resources. As illustrated in Table 5, the amount of capacity exports in the 2018/2019 auction increased by 90.2 MW from that of the previous auction and FRR commitments increased by 16.9 MW from the 2017/2018 Delivery Year to 15,793 MW.

A total of 189,570.4 MW of capacity was offered into the Base Residual Auction. This is an increase of 2,096.7 MW from that which was eligible to be offered into the 2017/2018 BRA. A total of 19,454.8 MW was eligible, but not offered due to either (1) inclusion in an FRR Capacity Plan, (2) export of the resource, or (3) having been excused from offering into the auction. Resources were excused from the must offer requirement for the following reasons: approved retirement requests not yet reflected in eRPM, and excess capacity owned by an FRR entity.



2018/2019 RPM Base Residual Auction Results

Table 5 –RPM Base Residual Auction Generation, Demand, and Energy Efficiency Resource Information in the RTO

Auction Supply (all values in ICAP)	RTO ¹										
	2008/2009	2009/2010	2010/2011	2011/2012 ²	2012/2013	2013/2014 ³	2014/2015 ⁴	2015/2016 ⁵	2016/2017 ⁶	2017/2018	2018/2019
Internal PJM Capacity	166,037.9	167,026.3	168,457.3	169,241.6	179,791.2	195,633.4	199,375.5	207,559.1	208,098.0	202,477.4	203,300.6
Imports Offered	2,612.0	2,563.2	2,982.4	6,814.2	4,152.4	4,766.1	7,620.2	4,649.7	8,412.2	6,300.9	5,724.6
Total Eligible RPM Capacity	168,649.9	169,589.5	171,439.7	176,055.8	183,943.6	200,399.5	206,995.7	212,208.8	216,510.2	208,778.3	209,025.2
Exports / Delistings	4,205.8	2,240.9	3,378.2	3,389.2	2,783.9	2,624.5	1,230.1	1,218.8	1,218.8	1,223.2	1,313.4
FRR Commitments	24,953.5	25,316.2	26,305.7	25,921.2	26,302.1	25,793.1	33,612.7	15,997.9	15,576.6	15,776.1	15,793.0
Excused	722.0	1,121.9	1,290.7	1,580.0	1,732.2	1,825.7	3,255.2	8,712.9	8,524.0	4,305.3	2,348.4
Total Eligible RPM Capacity - Excused	29,881.3	28,679.0	30,974.6	30,890.4	30,818.2	30,243.3	38,098.0	25,929.6	25,319.4	21,304.6	19,454.8
Remaining Eligible RPM Capacity	138,768.6	140,910.5	140,465.1	145,165.4	153,125.4	170,156.2	168,897.7	186,279.2	191,190.8	187,473.7	189,570.4
Generation Offered	138,076.7	140,003.6	139,529.5	143,568.1	142,957.7	156,894.1	153,048.1	166,127.8	176,145.3	175,329.5	177,592.1
DR Offered	691.9	906.9	935.6	1,597.3	9,535.4	12,528.7	15,043.1	19,243.6	13,932.9	10,855.2	10,772.8
EE Offered	0.0	0.0	0.0	0.0	632.3	733.4	806.5	907.8	1,112.6	1,289.0	1,205.5
Total Eligible RPM Capacity Offered	138,768.6	140,910.5	140,465.1	145,165.4	153,125.4	170,156.2	168,897.7	186,279.2	191,190.8	187,473.7	189,570.4
Total Eligible RPM Capacity Unoffered	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

¹RTO numbers include all LDAs.

²All generation in the Duquesne zone is considered external to PJM for the 2011/2012 BRA.

³2013/2014 includes ATSI zone and generation

⁴2014/2015 includes Duke zone and generation

⁵2015/2016 includes a significant portion of AEP and DEOK zone load previously under the FRR Alternative

⁶2016/2017 includes EKPC zone



2018/2019 RPM Base Residual Auction Results

Table 6 shows the Generation, DR, and EE Resources Offered and Cleared in the RTO translated into Unforced Capacity (UCAP) MW amounts. Participants' sell offer EFORD values were used to translate the generation installed capacity values into unforced capacity (UCAP) values. DR sell offers and EE sell offers were converted into UCAP using the appropriate DR Factor and Forecast Pool Requirement (FPR) for the Delivery Year.

In UCAP terms, a total of 179,891.2 MW were offered into the 2018/2019 BRA, comprised of 166,909.6 MW of generation capacity, 11,675.5 MW of capacity from DR, and 1,306.1 MW of capacity from EE resources. Of those offered, a total of 166,836.9 MW of capacity was cleared in the BRA.

Of the 166,836.9 MW of capacity that cleared in the auction, 154,506 MW were from Generation Capacity Resources, 11,084.4 MW were from DR, and 1,246.5 MW were from EE resources. Capacity that was offered but not cleared in the BRA Auction will be eligible to offer into the First, Second and Third Incremental Auctions for the 2018/2019 Delivery Year.

Table 6 – Generation, Demand Resources, and Energy Efficiency Resources Offered and Cleared in UCAP MW

Auction Results (all values in UCAP**)	RTO*										
	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019
Generation Offered	131,164.8	132,614.2	132,124.8	136,067.9	134,873.0	147,188.6	144,108.8	157,691.1	168,716.0	166,204.8	166,909.6
DR Offered	715.8	936.8	967.9	1,652.4	9,847.6	12,952.7	15,545.6	19,956.3	14,507.2	11,293.7	11,675.5
EE Offered	-	-	-	-	652.7	756.8	831.9	940.3	1,156.8	1,340.0	1,306.1
Total Offered	131,880.6	133,551.0	133,092.7	137,720.3	145,373.3	160,898.1	160,486.3	178,587.7	184,380.0	178,838.5	179,891.2
Generation Cleared	129,061.4	131,338.9	131,251.5	130,856.6	128,527.4	142,782.0	135,034.2	148,805.9	155,634.3	154,690.0	154,506.0
DR Cleared	536.2	892.9	939.0	1,364.9	7,047.2	9,281.9	14,118.4	14,832.8	12,408.1	10,974.8	11,084.4
EE Cleared	0.0	0.0	0.0	0.0	568.9	679.4	822.1	922.5	1,117.3	1,338.9	1,246.5
Total Cleared	129,597.6	132,231.8	132,190.5	132,221.5	136,143.5	152,743.3	149,974.7	164,561.2	169,159.7	167,003.7	166,836.9
Uncleared	2,283.0	1,319.2	902.2	5,498.8	9,229.8	8,154.8	10,511.6	14,026.5	15,220.3	11,834.8	13,054.3

* RTO numbers include all LDAs

** UCAP calculated using sell offer EFORD for Generation Resources. DR and EE UCAP values include appropriate FPR and DR Factor.

Table 7 contains a summary of capacity additions and reductions from the 2007/2008 BRA to the 2018/2019 BRA. A total of 5,055.6 MW of incrementally new capacity in PJM was available for the 2018/2019 BRA. This incrementally new capacity includes new Generation Capacity Resources and capacity upgrades to existing Generation Capacity Resources. The increase is offset by generation



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capacity deratings on existing Generation Capacity Resources and a reduction in the quantity of offered DR and EE to yield a net increase of 1,268.9 MW of installed capacity.

Table 7 also illustrates the total amount of resource additions and reductions over eleven Delivery Years since the implementation of the RPM construct. Over the period covering the first twelve RPM BRAs, 40,206.7 MW of new generation capacity was added which was partially offset by 33,700.3 MW of capacity de-ratings or retirements over the same period. Additionally, 11,210.6 MW of new DR and 1,205.5 MW of new EE resources were offered over the course of the twelve Delivery Years since RPM's inception. The total net increase in installed capacity in PJM over the period of the last twelve RPM auctions was 18,922.5 MW.

Table 7 – Incremental Capacity Resource Additions and Reductions to Date

Capacity Changes (in ICAP)	RTO*												Total
	2007/2008	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015 ²	2015/2016	2016/2017 ³	2017/2018	2018/2019	
Increase in Generation Capacity	602.0	724.2	1,272.3	1,776.2	3,576.3	1,893.5	1,737.5	1,582.8	8,207.0	6,806.0	6,973.3	5,055.6	40,206.7
Decrease in Generation Capacity	-674.6	-375.4	-550.2	-301.8	-264.7	-3,253.9	-1,924.1	-1,550.1	-8,432.6	-4,992.0	-9,760.1	-3,620.8	-33,700.3
Net Increase in Demand Resource	555.0	574.7	215.0	28.7	661.7	7,938.1	2,993.3	2,514.4	4,200.5	-5,310.7	-3,077.7	-82.4	11,210.6
Net Increase in Energy Efficiency	0.0	0.0	0.0	0.0	0.0	632.3	101.1	73.1	101.3	204.8	176.4	-83.5	1,205.5
Net Increase in Installed Capacity	482.4	923.5	937.1	1503.1	3973.3	7,210.0	2,907.8	2,620.2	6,076.2	-3,291.9	-5,688.1	1,268.9	18,922.5

* RTO numbers include all LDAs

** Values are with respect to the quantity offered in the previous year's Base Residual Auction.

1) Does not include Existing Generation located in ATSI Zone

2) Does not include Existing Generation located in Duke Zone

3) Does not include Existing Generation located in EKPC Zone

Table 7A provides a further breakdown of the generation increases and decreases for the 2018/2019 Delivery Year on an LDA basis.

Table 7A – Generation Increases and Decreases by LDA Effective 2018/2019 Delivery Year

LDA Name	Increases	Decreases
EMAAC	1,172.9	(193.1)
MAAC	1,568.8	(248.8)
Total RTO	5,055.6	(3,620.8)

All Values in ICAP terms

*MAAC includes EMAAC

**RTO includes MAAC



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Table 8 provides a breakdown of the new capacity offered into the each BRA into the categories of new resources, reactivated units, and uprates to existing capacity, and then further down into resource type. As shown in this table, there was a significant quantity of generating capacity from new resources and uprates to existing resources offered into the 2018/2019 BRA. The capacity offered in the 2018/2019 BRA resulted from both new generating resources and uprates to existing resources including gas, diesel, coal, wind, and nuclear resources. The largest growth remains in gas turbines and combined cycle plants.

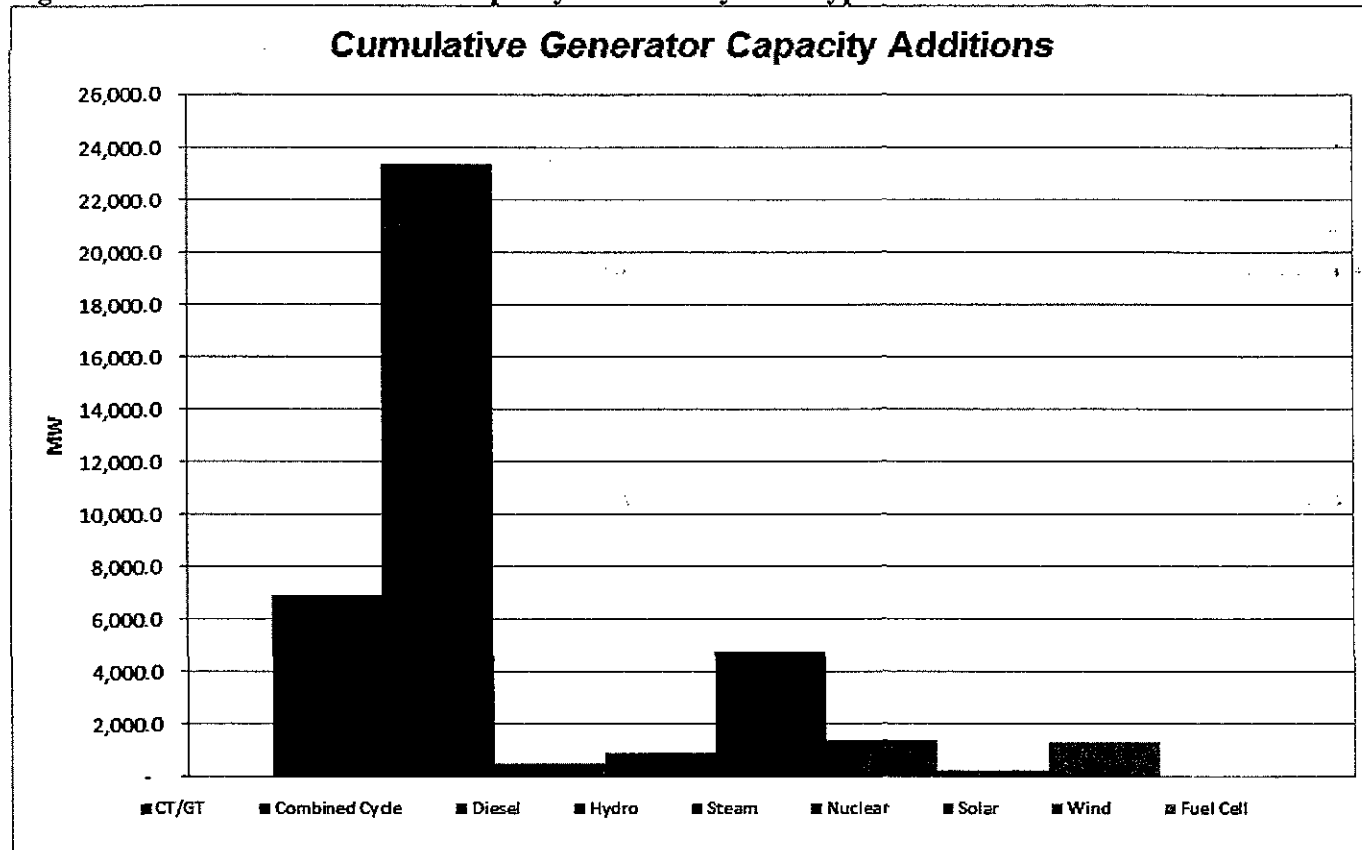


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Table 8 – Further Breakdown of Incremental Capacity Resource Additions from 2007/2008 to 2018/2019

	Delivery Year	CT/GT	Combined Cycle	Diesel	Hydro	Steam	Nuclear	Solar	Wind	Fuel Cell	Total
New Capacity Units (ICAP MW)	2007/2008			18.7	0.3						19.0
	2008/2009			27.0					66.1		93.1
	2009/2010	399.5		23.8		53.0					476.3
	2010/2011	283.3	580.0	23.0					141.4		1,027.7
	2011/2012	416.4	1,135.0			704.8		1.1	75.2		2,332.5
	2012/2013	403.8		7.8		621.3			75.1		1,108.0
	2013/2014	329.0	705.0	6.0		25.0		9.5	245.7		1,320.2
	2014/2015	108.0	650.0	35.1	132.9			28.0	146.6		1,100.6
	2015/2016	1,382.5	5,914.5	19.4	148.4	45.4		13.8	104.9	30.0	7,658.9
	2016/2017	171.1	4,994.5	38.3		24.0		32.1	54.3		5,314.3
	2017/2018	131.0	5,010.0	124.8	6.0	90.0		27.0			5,388.8
	2018/2019	1,032.5	2,352.3	29.9				82.8	127.1		3,624.6
Capacity from Reactivated Units (ICAP MW)	2007/2008					47.0					47.0
	2008/2009					131.0					131.0
	2009/2010										-
	2010/2011	160.0		10.7							170.7
	2011/2012	80.0				101.0					181.0
	2012/2013										-
	2013/2014										-
	2014/2015			9.0							9.0
	2015/2016										9.0
	2016/2017					21.0					21.0
	2017/2018					991.0					991.0
	2018/2019										-
Upgrades to Existing Capacity Resources (ICAP MW)	2007/2008	114.5		13.9	80.0	235.6	92.0				536.0
	2008/2009	108.2	34.0	18.0	105.5	196.0	38.4				500.1
	2009/2010	152.2	206.0		162.5	61.4	197.4		16.5		796.0
	2010/2011	117.3	163.0		48.0	89.2	160.3				577.8
	2011/2012	369.2	148.6	57.4		186.8	292.1		8.7		1,062.8
	2012/2013	231.2	164.3	14.2		193.0	126.0		56.8		785.5
	2013/2014	56.4	59.0	0.3		215.0	47.0		39.6		417.3
	2014/2015	104.9		0.5	41.5	138.6	107.0	7.1	73.6		473.2
	2015/2016	216.8	72.0	4.7	15.7	63.4	149.2	2.2	24.1		548.1
	2016/2017	436.6	420.0	3.3	7.4	484.3	102.6	1.7	14.8		1,470.7
	2017/2018	71.9	212.5	5.1	105.9	64.8	11.0	0.4	2.1		473.7
	2018/2019	33.4	548.0	2.4	22.9	11.9	79.3		14.9		712.8
Total		6,909.7	23,368.7	493.3	877.0	4,794.5	1,402.3	205.7	1,287.5	30.0	39,377.7

Figure 4: Cumulative Generation Capacity Increases by Fuel Type





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Table 9 shows the changes that have occurred regarding resource deactivation and retirement since the RPM was approved by FERC. The MW values shown in Table 9 represent the quantity of unforced capacity cleared in the 2018/2019 Base Residual Auction that came from resources that have either withdrawn their request to deactivate, postponed retirement, or been reactivated (i.e., came out of retirement or mothball state for the RPM auctions) since the inception of RPM. This total accounts for 4,938.4 MW of cleared UCAP in the 2018/2019 BRA which equates to 7,067.5 MW of ICAP Offered.

Table 9 – Changes to Generation Retirement Decisions since Commencement of RPM in 2007/2008

Generation Resource Decision Changes	RTO*	
	ICAP Offered	UCAP Cleared
Withdrawn Deactivation Requests	2,202.7	1,085.4
Postponed or Cancelled Retirement	3,571.7	3,138.5
Reactivation	1,293.1	714.5
Total	7,067.5	4,938.4

RPM Impact to Date

As illustrated in Table 5, for the 2018/2019 auction, the capacity exports were 1,313.4 MW and the offered capacity imports were 5,724.6 MW. The difference between the capacity imports and exports results is a net capacity import of 4,711.2 MW. In the planning year preceding the RPM auction implementation, 2006/2007, there was a net capacity export of 2,616.0 MW. In this auction, PJM is now a net importer of 4,711.2 MW. Therefore, RPM's impact on PJM capacity interchange is 7,027.2 MW.

The minimum net impact of the RPM implementation on the availability of Installed Capacity resources for the 2018/2019 planning year can be estimated by adding the net change in capacity imports and exports over the period, the forward demand and energy efficiency resources, the increase in Installed Capacity over the RPM implementation period from Table 8 and the net change in generation retirements from Table 9. Therefore, as illustrated in Table 10, the minimum estimated net impact of the RPM implementation on the availability of capacity in the 2018/2019 compared to what would have happened absent this implementation is 63,441.0 MW.



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Table 10 shows the details on RPM's impact to date in ICAP terms.

Table 10 – RPM's Impact to Date

Change in Capacity Availability	Installed Capacity MW
New Generation	29,464.0
Generation Upgrades (not including reactivations)	8,354.0
Generation Reactivation	1,559.7
Forward Demand and Energy Efficiency Resources	12,416.1
Cleared ICAP from Withdrawn or Cancelled Retirements	4,620.0
Net increase in Capacity Imports	7,027.2
Total Impact on Capacity Availability in 2018/2019 Delivery Year	63,441.0



2018/2019 RPM Base Residual Auction Results

Discussion of Factors Impacting the RPM Clearing Prices

The main factors impacting 2018/2019 RPM BRA clearing prices relative to 2017/2018 BRA clearing prices are provided below, separated out by significant changes to the market design and effects on the demand-side and supply-side of the market.

Significant Changes to RPM Design for the 2018/2019 Base Residual Auction

On June 9, 2015, in Docket No. ER15-623, FERC accepted a series of tariff reforms proposed in PJM's Capacity Performance (CP) filing of December 12, 2014, to establish Capacity Performance Resources to ensure PJM's capacity market provides adequate incentive for resource performance. CP Resources must be capable of sustained, predictable operation, and are expected to be available and capable of providing energy and reserves when needed throughout the entire Delivery Year, particularly during emergency conditions resulting in Performance Assessment Hours (PAH). Base Capacity Resources are not capable of sustained, predictable operation and/or are not expected to provide energy and reserves outside of the summer period. CP Resources are subject to a significant non-performance charge when they fail to perform under emergency conditions at any time during the Delivery Year; whereas, Base Capacity Resources are subject to a non-performance charge only when they fail to perform under emergency conditions during the summer period (at a charge rate that is lower than that for a CP Resource). The key CP filing provisions most directly related to the setup and clearing of the 2018/2019 BRA include:

- All Internal and External Generation Capacity Resources with the exception of Intermittent Resources and Capacity Storage Resources are required to offer as a CP Resource.
- Intermittent and Capacity Storage Resource are categorically exempt from the CP must-offer requirement, but may offer all or a portion of their capability as CP. For purposes of the exemption, Intermittent Resources include wind, solar, landfill gas, run of river hydroelectric power and other renewable resources.
- Exceptions to the CP Resource must-offer requirement are permitted if it is demonstrated that the Generation Capacity Resource is physically incapable of satisfying the requirements of a CP Resource.
- The default Market Seller Offer Cap (MSOC) for a CP Generation Capacity Resource is 85% of the Net CONE for the zone in which the resource resides. Generation Capacity Resource owners may qualify for a unit-specific MSOC above the default CP MSOC by submitting unit-specific Avoidable Cost Rate (ACR) data and information to support such offer cap.



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- Any resource that can qualify as a CP Resource **may** submit separate but coupled sell offers for CP and Base Capacity product types. When sell offer segments of both capacity product types are coupled with different offer prices, the auction clearing engine will clear only one of the products at most and will clear the product that results in the lowest cost solution for the system. Any Generation Capacity Resource with a unit-specific MSOC above the CP default MSOC **must** submit separate but coupled sell offers for CP and Base Capacity product types.
- A Base Capacity DR Constraint which places a maximum limit on the total quantity of Base Capacity DR and Base Capacity EE that can be procured in the auction is established for the entire RTO and each modeled LDA. A Base Capacity Resource Constraint which places a maximum limit on the total quantity of Base Capacity DR, Base Capacity EE and Base Capacity Generation Resources that can be procured in the auction is established for the entire RTO and each modeled LDA.
- The Short-Term Resource Procurement Target of 2.5% has been eliminated; therefore, 2.5% of the target reliability requirement is no longer held back from the target procurement quantity of the BRA.
- The UCAP MW value of DR and EE is no longer discounted by the DR Factor which has historically been about 95%. Therefore the UCAP MW value is about 5% greater for each ICAP MW of DR and EE cleared in the auction.

On November 28, 2014, in Docket No. ER14-2940, FERC approved revisions to the Variable Resource Requirement ("VRR") curve shape and Gross Cost of New Entry ("CONE") values as proposed in a PJM filing of September 25, 2014. This filing was made following last year's stakeholder review of the shape of the VRR curve and key inputs to that curve, where such review is required by PJM Tariff on a specified periodic basis. The new shape of the VRR Curve relative to the VRR curve shape used in the prior BRA for the 2017/2018 Delivery Year is best seen in Figure 2 on page 21 of PJM's September 25, 2014 filing (located at <http://www.pjm.com/media/documents/etariff/FercDockets/1304/20140925-er14-2940-000.pdf>). The new Gross CONE values used in the development of the VRR curve range depending on the LDA from 13% to 18.2% lower than values that would otherwise been used in the 2018/2019 BRA (see page 26 of PJM's September 25, 2014 filing).



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Changes that impacted the Demand Curve:

- The target reliability requirement for the 2018/2019 BRA is 160,607.4 MW, which is 275 MW (0.2%) lower than the target reliability requirement of the 2017/2018 BRA. The target reliability requirement for the 2017/2018 BRA was 160,882 MW which was based on an actual reliability requirement of 165,007 MW minus a short-term resource procurement target quantity of 4,125 MW.
- The Net CONE applicable to the RTO VRR curve is about 15% lower than the RTO Net CONE value used in the 2017/2018 BRA. Relative to the LDA Net CONE values used in the 2017/2018 BRA, the 2018/2019 LDA Net CONE values are lower for all LDAs ranging from a 14% decrease for the MAAC LDA to a 30% decrease for the DPL-South LDA. The reduction in Net CONE values are due to the lower Gross CONE values for the 2018/2019 BRA resulting from PJM's September 25, 2014 filing as described above, as well as, higher Net E&AS Offset values relative to those used last year due to an update of the 3-year period for which the reference resource E&AS revenues were determined (the 2018/2019 values are based on LMPs from calendar years 2012 through 2014 whereas the 2017/2018 values were based on LMPs from calendar years 2011 through 2013).
- The changes to the VRR Curve shape discussed in prior section shifted the VRR Curve to the right (increasing the demand for capacity all else equal).

Changes that impacted the Supply Curve:

- With the transition to the Capacity Performance product, the implied costs of committing to be a Capacity Resource increases due to the need to make improvements in generator performance during Performance Assessment Hours. These increased costs could be related weatherization, improved maintenance, and costs for fuel assurance. This shifts the supply curve for resources up and leads to higher capacity market prices overall.
- Low natural gas and therefore energy market prices have largely led to lower net energy market revenues across the PJM system especially for coal and oil steam units as well as nuclear units which leads to higher capacity market offers from these resources.



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Revision History

8/21/2015: Original version posted

8/28/2015: updated typos found in original version:

- MOPR-related data table of page 7: cleared quantities for RTO and MAAC were corrected; values were reversed in original version.
- Table 2A: Offered quantity of New Units in MAAC was corrected. Cleared quantities for New Units in EMAAC, MAAC and Total RTO were corrected.
- Titles of Table 3B and 3C changed to correctly describe data as “2018/2019” BRA



2019/2020 RPM Base Residual Auction Results

Executive Summary

The 2019/2020 Reliability Pricing Model (RPM) Base Residual Auction (BRA) cleared 167,305.9 MW of unforced capacity in the RTO. Accounting for load and resource commitments under the Fixed Resource Requirement (FRR), the reserve margin for the entire RTO for the 2019/2020 Delivery Year as procured in the BRA is 22.4%, or 5.9% higher than the target reserve margin of 16.5%. This reserve margin was achieved at Capacity Performance prices that are between approximately 33% to 60% of Net CONE, depending upon the zone comparison, while attracting just over 5,000 MW of new combined cycle gas resources.

The 2019/2020 RPM BRA was the second BRA to include the Capacity Performance ("CP") provisions approved by FERC prior to last year's 2018/2019 BRA. As part of the transition to 100% CP starting with next year's 2020/2021 BRA, PJM procured two capacity product types through the auction, Capacity Performance and Base Capacity. CP Resources must be capable of sustained, predictable operation, and are expected to be available and capable of providing energy and reserves when needed throughout the entire Delivery Year; whereas, Base Capacity Resources may not be capable of sustained, predictable operation and/or may not be expected to provide energy and reserves outside of the summer period. Base Capacity Resources include Base Capacity Demand Resources (DR), which are expected to be available only during the summer months, and Base Capacity Energy Efficiency (EE) Resources, which are expected to provide permanent continuous load reduction only during the summer months. Base Capacity Resources also include Base Capacity Generation Resources, which are expected to be available throughout the Delivery Year like all Capacity Performance Resources. But, unlike Capacity Performance Resources, Base Capacity Generation Resources will be subject to non-performance charges only when they fail to perform when needed during the summer months.

Base Capacity Resources do not provide the same level of availability or reliability as CP Resources, therefore constraints are imposed on the quantity of Base Capacity Resources that can be procured in each RPM auction. A Base Capacity DR Constraint which places a maximum limit on the total quantity of Base Capacity DR and Base Capacity EE that can be procured in the auction is established for the entire RTO and each modeled LDA. A Base Capacity Resource Constraint which places a maximum limit on the total quantity of Base Capacity DR, Base Capacity EE and Base Capacity Generation Resources that can be procured in the auction is established for the entire RTO and each modeled LDA. If these constraints are reached in the auction then these less-available resources will clear the auction at a lower clearing price than the clearing price associated with similarly located more-available resources.

2019/2020 BRA Resource Clearing Prices

Resource Clearing Prices (RCPs) for the 2019/2020 BRA are shown in Table 1 below. The RCP for CP Resources located in the rest of RTO is \$100.00/MW-day. The EMAAC LDA, ComEd LDA and BGE LDA were constrained LDAs in the 2019/2020 BRA with locational price adders of \$19.77/MW-day, \$102.77/MW-day and \$0.30/MW-day, respectively, for all resources located in those LDAs. The RCP for CP Resources in the EMAAC LDA is \$119.77/MW-day, the RCP for CP Resources in the COMED LDA is \$202.77 /MW-day, and the RCP for CP Resources located in the BGE LDA is \$100.30/MW-day. For comparison purposes, the RCP



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for CP Resources located in the rest of RTO in the 2018/2019 BRA was \$164.77/MW-day. The RCP for CP Resources in the EMAAC LDA was \$225.42/MW-day and the RCP for CP Resources in the COMED LDA was \$215.00 /MW-day in the 2018/2019 BRA. The BGE LDA cleared with the rest of RTO with a RCP for CP Resources of \$164.77/MW-day in the 2018/2019 BRA.

Capacity Type	2019/20 BRA Resource Clearing Prices (\$/MW-day)				
	Rest of RTO	EMAAC	PEPCO	COMED	BGE
Capacity Performance	\$100.00	\$119.77	\$100.00	\$202.77	\$100.30
Base Generation	\$80.00	\$99.77	\$80.00	\$182.77	\$80.30
Base DR/EE	\$80.00	\$99.77	\$0.01	\$182.77	\$80.30

The Base Capacity Resource Constraint is a binding constraint in the auction for the overall RTO resulting in a price decrement for Base Capacity Generation of \$20.00/MW-day relative to the RCP of similarly located CP resources. Additionally, the Base Capacity DR Constraint is a binding constraint in the PEPCO LDA resulting in price decrements for Base Capacity DR and EE located in the PEPCO LDA of \$79.99/MW-day. The price decrement for Base Capacity DR and EE is relative to the RCP of Base Capacity Generation Resources located in the PEPCO LDA.

The RCP for Base Capacity Resources located in the rest of RTO outside of the EMAAC, COMED and BGE LDAs is \$80.00/MW-day. The RCP for Base Capacity Resources located in the EMAAC LDA is \$99.77/MW-day, the RCP for Base Capacity Resources located in the ComEd LDA is \$182.77/MW-day, and the RCP for Base Capacity Resources located in the BGE LDA is \$80.30/MW-day. The RCP for Base Capacity DR & EE Resources located in the PEPCO LDA is \$0.01/MW-day. The Base DR/EE RCP in PEPCO is a function of the quantity of supply that effectively offered as price takers relative to the Base DR/EE constraint of 474.5 MW.

2019/2020 BRA Cleared Capacity Resources

As seen in the table below, the 2019/2020 BRA procured 5,373.6 MW of capacity from new generation and 155.6 MW from uprates to existing or planned generation. The quantity of capacity procured from external Generation Capacity Resources in the 2019/2020 BRA is 3,875.9 MW which is a decrease of 812 MW from that procured in last year's BRA. Of the 3,875.9 MW procured from external Generation Capacity Resources in the 2019/2020 BRA, 2,744.7 MW cleared as Capacity Performance product type and 1,131.2 MW cleared as Base product type. All external generation capacity that has cleared in the 2019/20 BRA has met the requirements for the Capacity Import Limit (CIL) exception. The total quantity of DR procured in the 2019/2020 BRA is 10,348 MW which is a decrease of 736.4 MW from that procured in last year's BRA; and, the total quantity of EE procured in the 2019/2020 BRA



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is 1,515.1 MW, which is an increase of 268.6 MW from that procured in last year's BRA. Of the 10,348 MW procured from DR Resources in the 2019/2020 BRA, 613.7 MW cleared as Capacity Performance product type and 9,734.3 MW cleared as Base product type. Of the 1,515.1 MW procured from EE Resources in the 2019/2020 BRA, 1,058.1 MW cleared as Capacity Performance product type and 457 MW cleared as Base product type.

Megawatts of Unforced Capacity Procured by Type from the 2014/2015 BRA to the 2019/2020 BRA

BRA Delivery Year	New Generation	Generation Upgrades	Imports	Demand Response	Energy Efficiency
2019/2020	5,373.6	155.6	3,875.9	10,348.0	1,515.1
2018/2019	2,954.3	587.6	4,687.9	11,084.4	1,246.5
2017/2018	5,927.4	339.9	4,525.5	10,974.8	1,338.9
2016/2017	4,281.6	1,181.3	7,482.7	12,408.1	1,117.3
2015/2016	4,898.9	447.4	3,935.3	14,832.8	922.5
2014/2015	415.5	341.1	3,016.5	14,118.4	822.1



2019/2020 RPM Base Residual Auction Results

Introduction

This document provides information for PJM stakeholders regarding the results of the 2019/2020 Reliability Pricing Model (RPM) Base Residual Auction (BRA). The 2019/2020 BRA opened on May 11, 2016, and the results were posted on May 24, 2016.

In each BRA, PJM seeks to procure a target capacity reserve level for the RTO in a least cost manner while recognizing the following reliability-based constraints on the location and type of capacity that can be committed:

- Internal PJM locational constraints are established by setting up Locational Deliverability Areas (LDAs) with each LDA having a separate target capacity reserve level and a maximum limit on the amount of capacity that it can import from resources located outside of the LDA.
- Constraints on the procurement of the more limited capacity product types are established for the RTO and each modeled LDA. The Base Capacity DR Constraint limits the quantity of Base Capacity DR and EE that can be procured in each LDA or in total across the entire RTO; and the Base Capacity Resource Constraint limits the quantity of the sum of Base Capacity DR and EE and Base Capacity Generation Resources that can be procured in each LDA or in total across the entire RTO.
- Capacity Import Limits (CILs) are established on the amount of external generation capacity that can be reliably committed to PJM. A separate CIL is established for each of five external source-zones and a single total CIL is established for the overall RTO. As described in more detail later in this report, external generation resources may seek exception to the CIL by meeting all three of the following conditions prior to the start of the auction: (1) they are committed to being pseudo-tied generation resources prior to the start of the Delivery Year; that is, they will be treated like internal generation, subject to redispatch and locational pricing; (2) they have long-term firm transmission service confirmed on the complete transmission path from such resource into PJM; and (3) they agree to be subject to the same capacity must-offer requirement as PJM's internal resources.

The auction clearing process commits capacity resources to procure a target capacity reserve level for the RTO in a least-cost manner while recognizing and enforcing these reliability-based constraints. The clearing solution may be required to commit capacity resource out-of-merit order but again in a least-cost manner to ensure that all of these constraints are respected. In those cases where one or more of the constraints results in out-of-merit commitment in the auction solution, resource clearing prices will be reflective of the price of resources selected out of merit order to meet the necessary requirements.

This document begins with a high-level summary of the BRA results followed by sections containing detailed descriptions of the 2019/2020 BRA results and a discussion of the results in the context of the ten previous BRAs.



2019/2020 RPM Base Residual Auction Results

Summary of Results

The 2019/2020 Reliability Pricing Model (RPM) Base Residual Auction (BRA) cleared 167,305.9 MW of unforced capacity in the RTO representing a 22.9% reserve margin. The reserve margin for the entire RTO is 22.4%, or 5.9% higher than the target reserve margin of 16.5%, when the Fixed Resource Requirement (FRR) load and resources are considered.

Resource Clearing Prices (RCPs) for the 2019/2020 BRA are shown in Table 4. The RCP for CP Resources located in the rest of RTO is \$100.00/MW-day. The EMAAC LDA, ComEd LDA and BGE LDA were constrained LDAs in the 2019/2020 BRA. The RCP for CP Resources in the EMAAC LDA is \$119.77/MW-day, the RCP for CP Resources in the COMED LDA is \$202.77 /MW-day, and the RCP for CP Resources located in the BGE LDA is \$100.30/MW-day. For comparison purposes, the RCP for CP Resources located in the rest of RTO in the 2018/2019 BRA was \$164.77/MW-day. The RCP for CP Resources in the EMAAC LDA was \$225.42/MW-day and the RCP for CP Resources in the COMED LDA was \$215.00 /MW-day in the 2018/2019 BRA. The BGE LDA cleared with the rest of RTO with a RCP for CP Resources of \$164.77/MW-day in the 2018/2019 BRA.

The Base Capacity Resource Constraint is a binding constraint in the auction for the overall RTO resulting in a price decrement for Base Capacity Generation of \$20.00/MW-day relative to the RCP of similarly located CP resources. Additionally, the Base Capacity DR Constraint is a binding constraint in the PEPCO LDA resulting in a price decrement for Base Capacity DR and EE of \$79.99/MW-day relative to RCP of Base Capacity Generation Resources located in the PEPCO LDA.

The RCP for Base Capacity Resources located in the rest of RTO is \$80.00/MW-day. The RCP for Base Capacity Resources located in the EMAAC LDA is \$99.77/MW-day, the RCP for Base Capacity Resources located in the ComEd LDA is \$182.77/MW-day, and the RCP for Base Capacity Resources located in the BGE LDA is \$80.30/MW-day. The RCP for Base Capacity DR & EE Resources located in the PEPCO LDA is \$0.01/MW-day.

The total quantity of new Generation Capacity Resources offered into the auction was 6,543.5 MW (UCAP) comprised of 6,330.1 MW of new generation units and 213.4 MW of uprates to existing generation units. The quantity of new Generation Capacity Resources cleared was 5,529.2 MW (UCAP) comprised of 5,373.6 MW (UCAP) from new generation units and 155.6 MW from uprates to existing generation units.

The quantity of capacity procured from external Generation Capacity Resources in the 2019/2020 BRA is 3,875.9 MW which is a decrease of 812 MW from that procured in last year's BRA. All external generation capacity that has cleared in the 2019/2020 BRA has met the requirements for CIL exception. These requirements help to ensure that external resources offering into the RPM auction



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have reasonable expectation of physically delivering on any RPM commitment and have high likelihood of being available for PJM when needed.

The total quantity of DR procured in the 2019/2020 BRA is 10,348 MW which is a decrease of 736.4 MW from that procured in last year's BRA; and, the total quantity of EE procured in the 2019/2020 BRA is 1,515.1 MW which is an increase of 268.6 MW from that procured in last year's BRA.

The RTO as a whole failed the Market Structure Test (i.e., the Three-Pivotal Supplier Test), resulting in the application of market power mitigation to all existing generation resources. Mitigation was applied to a supplier's existing generation resources resulting in utilizing the lesser of the supplier's approved Market Seller Offer Cap for such resource or the supplier's submitted offer price for such resource in the RPM Auction clearing.

All Generation Capacity Resources (including uprates to existing resources) of 20 MW or greater that are based on combustion turbine, combined cycle and integrated gasification combined cycle technologies that have not cleared an RPM Auction prior to February 1, 2013 are subject to the Minimum Offer Price Rule (MOPR). External Generation Capacity Resources meeting the above criteria and that have entered commercial operation on or after January 1, 2013 and that require sufficient transmission investment for delivery into PJM are also subject to MOPR. To avoid application of the MOPR, Capacity Market Sellers may request exemption through either a Competitive Entry Exemption request or a Self-Supply Exemption request. The table below shows the requested, granted and cleared aggregate quantity (in ICAP MW) of each exemption type received and processed by PJM. While there were nearly 13,000 MW of MOPR exemption requests, making a request does not obligate a resource to offer into the BRA.



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LDA	Exemption Type	Requested Quantity (ICAP MW)	Granted Quantity (ICAP MW)	Cleared Quantity (ICAP MW)
RTO*	Competitive Entry	5,401.0	5,401.0	1,933.0
RTO*	Self-Supply	1,827.2	1,827.2	1,779.5
MAAC	Competitive Entry	5,764.0	5,764.0	1,870.9
MAAC	Self-Supply	0.0	0.0	0.0
Total		12,992.2	12,992.2	5,583.4

*RTO values exclude MAAC

A further discussion of the 2019/2020 BRA results and additional information regarding the 2019/2020 RPM BRA are detailed in the body of this report. The discussion also provides a comparison of the 2019/2020 auction results to the results from the 2007/2008 through 2018/2019 RPM Auctions.



2019/2020 RPM Base Residual Auction Results

2019/2020 Base Residual Auction Results Discussion

Table 1 contains a summary of the RTO clearing prices, cleared unforced capacity, and implied cleared reserve margins resulting from the 2019/2020 RPM BRA in comparison to those from 2007/2008 through 2018/2019 RPM BRAs.

Table 1 –RPM Base Residual Auction Resource Clearing Price Results in the RTO

Auction Results	RTO												
	2007/2008	2008/2009	2009/2010	2010/2011	2011/2012 ¹	2012/2013	2013/2014 ²	2014/2015 ³	2015/2016 ⁴	2016/2017 ⁵	2017/2018	2018/2019	2019/2020
Resource Clearing Price	\$40.80	\$111.92	\$102.04	\$174.29	\$110.00	\$16.46	\$27.73	\$125.99	\$136.00	\$59.37	\$120.00	\$164.77	\$100.00
Cleared UCAP (MW)	129,409.2	129,597.6	132,231.8	132,190.4	132,221.5	136,143.5	152,743.3	149,974.7	164,561.2	169,159.7	167,003.7	166,836.9	167,305.9
Reserve Margin	19.1%	17.4%	17.6%	16.4%	17.9%	20.5%	19.7%	18.8%	19.3%	20.3%	19.7%	19.8%	22.4%

1) 2011/2012 BRA was conducted without Duquesne zone load.

2) 2013/2014 BRA includes ATSI zone

3) 2014/2015 BRA includes Duke zone

4) 2015/2016 BRA includes a significant portion of AEP and DEOK zone load previously under the FRR Alternative

5) 2016/2017 BRA includes EKPC zone

The Reserve Margin presented in Table 1 represents the percentage of installed capacity cleared in RPM and committed by FRR entities in excess of the RTO load (including load served under the Fixed Resource Requirement alternative). The 2019/2020 RPM BRA cleared 167,305.9 MW of unforced capacity in the RTO representing a 22.9% reserve margin. The reserve margin for the entire RTO is 22.4%, or 5.9% higher than the target reserve margin of 16.5%, when the Fixed Resource Requirement (FRR) load and resources are considered. Moreover, the cleared reserve margin is nearly 2 percent higher than the previous highs observed in the 2012/2013 and 2016/2017 BRAs.

New Generation Resource Participation

The 2019/2020 BRA results reflect a continuation of strong participation by new Generation Capacity Resources mostly in the form of new (or uprates to existing) gas-fired combustion turbine and combined cycle generation units. The total quantity of new Generation Capacity Resources offered into the auction was 6,543.5 MW (UCAP) comprised of 6,330.1 MW of new generation units and 213.4 MW of uprates to existing generation units. The quantity of new Generation Capacity Resources cleared was 5,529.2 MW (UCAP) comprised of 5,376.6 MW (UCAP) from new generation units, predominantly natural gas combined cycle and combustion turbines, and 155.6 MW from uprates to existing generation units.

Over the last several years, new generation cleared in RPM auctions has been very successful in meeting its committed in-service dates. For example, in the 2015/2016 Delivery Year, of the 4,575 MW of large, combined cycle units that cleared in RPM, all but 661



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MW are in-service, and the remainder is expected to be in service by mid-2017. For the upcoming 2016/2017 Delivery Year, all 4,091 MW of new, large, combined cycle generation that cleared in RPM is or will be fully in-service by June 1st. For the 2017/2018 Delivery Year, 3,132 MW of the 4,825 MW of new, large, combined cycle units are on schedule to be fully in service before the Delivery Year. In summary, over 80% of the new, large, combined cycle units that cleared in the RPM auctions for these three Delivery Years are either already in service or on schedule to be in service prior to the Delivery Year for which they initially committed.

Table 2A shows the breakdown, by major LDA, of capacity in UCAP terms of new units and uprates at existing units offered in the auction and capacity actually clearing in the auction. Eighty-four percent of the new generation capacity that offered into the 2019/2020BRA cleared the auction.

Table 2A – Offered and Cleared New Generation Capacity by LDA (in UCAP MW)

LDA	Offered			Cleared		
	Uprate	New Unit	Total	Uprate	New Unit	Total
EMAAC	54.8	35.6	90.4	13.5	35.6	49.1
MAAC	63.8	2,274.5	2,338.3	22.5	1,843.3	1,865.8
Total RTO	213.4	6,330.1	6,543.5	155.6	5,373.6	5,529.2

*All MW Values are in UCAP Terms

*MAAC includes EMAAC

**RTO includes MAAC



2019/2020 RPM Base Residual Auction Results

Capacity Import Participation

The quantity of capacity imports cleared in the 2019/2020 BRA were 3,875.9 MW (UCAP) which represents a decrease of 812 MW from the imports that cleared in the 2018/2019 BRA. Of the 3,875.9 MW procured from external Generation Capacity Resources in the 2019/2020 BRA, 2,744.7 MW cleared as Capacity Performance product type and 1,131.2 MW cleared as Base product type. The majority of the imports are from resources located in regions west of the PJM RTO. All external generation capacity that has cleared in the 2019/20 BRA has met the requirements for the CIL exception.

Table 2B – Offered and Cleared Capacity Imports (in UCAP MW)

	External Source Zones					Total
	NORTH	WEST 1	WEST 2	SOUTH 1	SOUTH 2	
Offered MW (UCAP)	252.0	2,199.2	1,105.6	371.0	415.6	4,343.4
Cleared MW (UCAP)	252.0	2,132.9	866.9	371.0	253.1	3,875.9
Resource Clearing Price (\$/MW-day)	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	

Note: Cleared MW quantities include resources that received CIL Exception and those associated with pre-OATT grandfathered transmission

Demand Resource Participation

The total quantity of DR offered into the 2019/2020 BRA was 11,818 MW (UCAP), representing an increase of 1.2% over the DR that offered into the 2018/2019 BRA. Of the 11,818 MW of total DR that offered in this auction, 10,348 MW cleared. The cleared DR is 736.4 MW less than that which cleared in the 2018/2019 BRA. Of the 10,348 MW procured from DR Resources in the 2019/2020 BRA, 613.7 MW cleared as Capacity Performance product type and 9,734.3 MW cleared as Base product type. Table 3A contains a comparison of the DR Offered and Cleared in 2018/2019 BRA & 2019/2020 BRA represented in UCAP.

Energy Efficiency Resource Participation

An EE resource is a project that involves the installation of more efficient devices/equipment or the implementation of more efficient processes/systems exceeding then-current building codes, appliance standards, or other relevant standards at the time of installation as known at the time of commitment. The EE resource must achieve a permanent, continuous reduction in electric energy consumption (during the defined EE performance hours) that is not reflected in the peak load forecast used for the BRA for the Delivery Year for which the EE resource is proposed. The EE resource must be fully implemented at all times during the Delivery Year, without any



2019/2020 RPM Base Residual Auction Results

requirement of notice, dispatch, or operator intervention. Of the 1,650.3 MW of energy efficiency that offered into the 2019/2020 BRA, 1,515.1 MW of EE resources cleared in the auction. Of the 1,515.1 MW procured from EE Resources in the 2019/2020 BRA, 1,058.1 MW cleared as Capacity Performance product type and 457 MW cleared as Base product type.

Table 3B contains a summary of the DR and EE resources that offered and cleared by zone in the 2019/2020 BRA. Approximately 87.6% of the demand resources and 91.8% of the energy efficiency resources that were offered into the BRA cleared. The uncleared resources were offered at a price above the applicable clearing price for the LDA in which the resource was offered.

Figure 1 illustrates the demand side participation in the PJM Capacity Market from 2005/2006 Delivery Year to the 2019/2020 Delivery Year. Demand side participation includes active load management (ALM) prior to 2007/2008 Delivery Year, Interruptible Load for Reliability (ILR) and DR offered into each BRA and nominated in FRR Plans, and EE resources starting with the 2012/2013 Delivery Year. The demand side participation in the capacity market has increased dramatically since the inception of RPM in the 2007/2008 Delivery Year through the 2015/2016 BRA, but as shown in Figure 1, total demand side participation and cleared resources for the 2019/2020 BRA have fallen below the levels seen in the 2014/2015 BRA.



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Table 3A – Comparison of Demand Resources Offered and Cleared in 2018/2019 BRA & 2019/2020 BRA represented in UCAP

LDA	Zone	Offered MW (UCAP)			Cleared MW (UCAP)		
		2018/2019	2019/2020	Increase in Offered MW	2018/2019	2019/2020	Increase in Cleared MW
EVAAC	AECO	165.1	153.8	(11.3)	162.1	145.7	(16.4)
EVAAC/DPL-S	DPL	422.7	397.9	(24.8)	418.2	371.6	(46.6)
EVAAC	JCPL	206.4	231.2	24.8	200.1	200.8	0.7
EVAAC	PECO	513.0	565.1	52.1	504.5	527.4	22.9
PSEG/PS-N	PSEG	386.6	427.8	41.2	382.2	380.7	(1.5)
EVAAC	RECO	7.6	10.3	2.7	7.5	10.3	2.8
EVAAC Sub Total		1,701.4	1,786.1	84.7	1,674.6	1,636.5	(38.1)
PEPCO	PEPCO	667.1	570.4	(96.7)	523.1	483.3	(39.8)
BGE	BGE	813.9	729.3	(84.6)	660.0	256.4	(403.6)
MAAC	METED	334.9	379.8	44.9	327.4	321.7	(5.7)
MAAC	PENELEC	392.6	392.0	(0.6)	384.7	339.4	(45.3)
PPL	PPL	873.6	815.6	(58.0)	716.2	739.8	23.6
MAAC** Sub Total		4,783.5	4,673.2	(110.3)	4,286.0	3,777.1	(508.9)
RTO	AEP	1,441.5	1,603.1	161.6	1,417.6	1,416.1	(1.5)
RTO	APS	990.7	1,039.4	48.7	976.8	926.0	(50.8)
ATSI/ATSI-C	ATSI	891.9	978.0	86.1	877.0	897.6	20.6
COMED	COMED	1,901.2	1,792.0	(109.2)	1,876.7	1,757.4	(119.3)
RTO	DAY	234.9	237.6	2.7	231.6	219.8	(11.8)
RTO	DEOK	205.7	248.8	43.1	203.8	236.7	32.9
RTO	DOM	827.8	816.8	(11.0)	817.3	729.7	(87.6)
RTO	DUQ	263.0	286.8	23.8	262.3	247.2	(15.1)
RTO	EKPC	135.3	142.3	7.0	135.3	140.4	5.1
Grand Total		11,675.5	11,818.0	142.5	11,084.4	10,348.0	(736.4)

**MAAC sub-total includes all MAAC Zones



2019/2020 RPM Base Residual Auction Results

Table 3B – Comparison of Demand Resources and Energy Efficiency Resources Offered versus Cleared in the 2018/2019 BRA

LDA	Zone	Offered MW (UCAP)			Cleared MW (UCAP)		
		DR	EE	Total	DR	EE	Total
EMAAC	AECO	153.8	18.6	172.4	145.7	14.1	159.8
EMAAC/DPL-S	DPL	397.9	25.7	423.6	371.6	22.4	394.0
EMAAC	JOPL	231.2	26.1	257.3	200.8	21.2	222.0
EMAAC	PECO	565.1	50.2	615.3	527.4	41.1	568.5
PSEG/PS-N	PSEG	427.8	59.6	487.4	380.7	49.3	430.0
EMAAC	RECO	10.3	25.3	35.6	10.3	12.7	23.0
EMAAC Sub Total		1,786.1	205.5	1,991.6	1,636.5	160.8	1,797.3
PEPCO	PEPCO	570.4	85.2	655.6	483.3	79.0	562.3
BGE	BGE	729.3	100.7	830.0	256.4	100.7	357.1
MAAC	METED	379.8	20.7	400.5	321.7	18.2	339.9
MAAC	PENELEC	392.0	26.1	418.1	339.4	17.3	356.7
PPL	PPL	815.6	56.8	872.4	739.8	50.9	790.7
MAAC** Sub Total		4,673.2	495.0	5,168.2	3,777.1	426.9	4,204.0
RTO	AEP	1,603.1	76.6	1,679.7	1,416.1	72.0	1,488.1
RTO	APS	1,039.4	29.0	1,068.4	926.0	26.8	952.8
ATSI/ATSI-C	ATSI	978.0	52.8	1,030.8	897.6	41.0	938.6
COMED	COMED	1,792.0	725.1	2,517.1	1,757.4	724.8	2,482.2
RTO	DAY	237.6	25.9	263.5	219.8	24.5	244.3
RTO	DEOK	248.8	31.2	280.0	236.7	24.4	261.1
RTO	DOM	816.8	190.2	1,007.0	729.7	152.0	881.7
RTO	DUQ	286.8	15.2	302.0	247.2	14.1	261.3
RTO	EKPC	142.3	9.3	151.6	140.4	8.6	149.0
Grand Total		11,818.0	1,650.3	13,468.3	10,348.0	1,515.1	11,863.1

**MAAC sub-total includes all MAAC Zones

Any resource that can qualify as a CP Resource may submit separate but coupled sell offers for CP and Base Capacity product types. When sell offer segments of both capacity product types are coupled with different offer prices, the auction clearing engine will clear only one of the products at most and will clear the product that results in the lowest cost solution for the system. Any Generation Capacity Resource with a unit-specific MSOC above the CP default MSOC must submit separate but coupled sell offers for CP and Base Capacity product types. Table 3C shows a breakdown of offered and cleared capacity for each resource type grouped by



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coupling scenario. As shown on Table 3C, 138,635.5 MW or 89.2% of the total cleared generation capacity cleared as CP; 613.7 MW or 5.9% of the total cleared DR capacity cleared as CP; and, 1,058.1 MW or 69.8% of total cleared EE capacity cleared as CP.

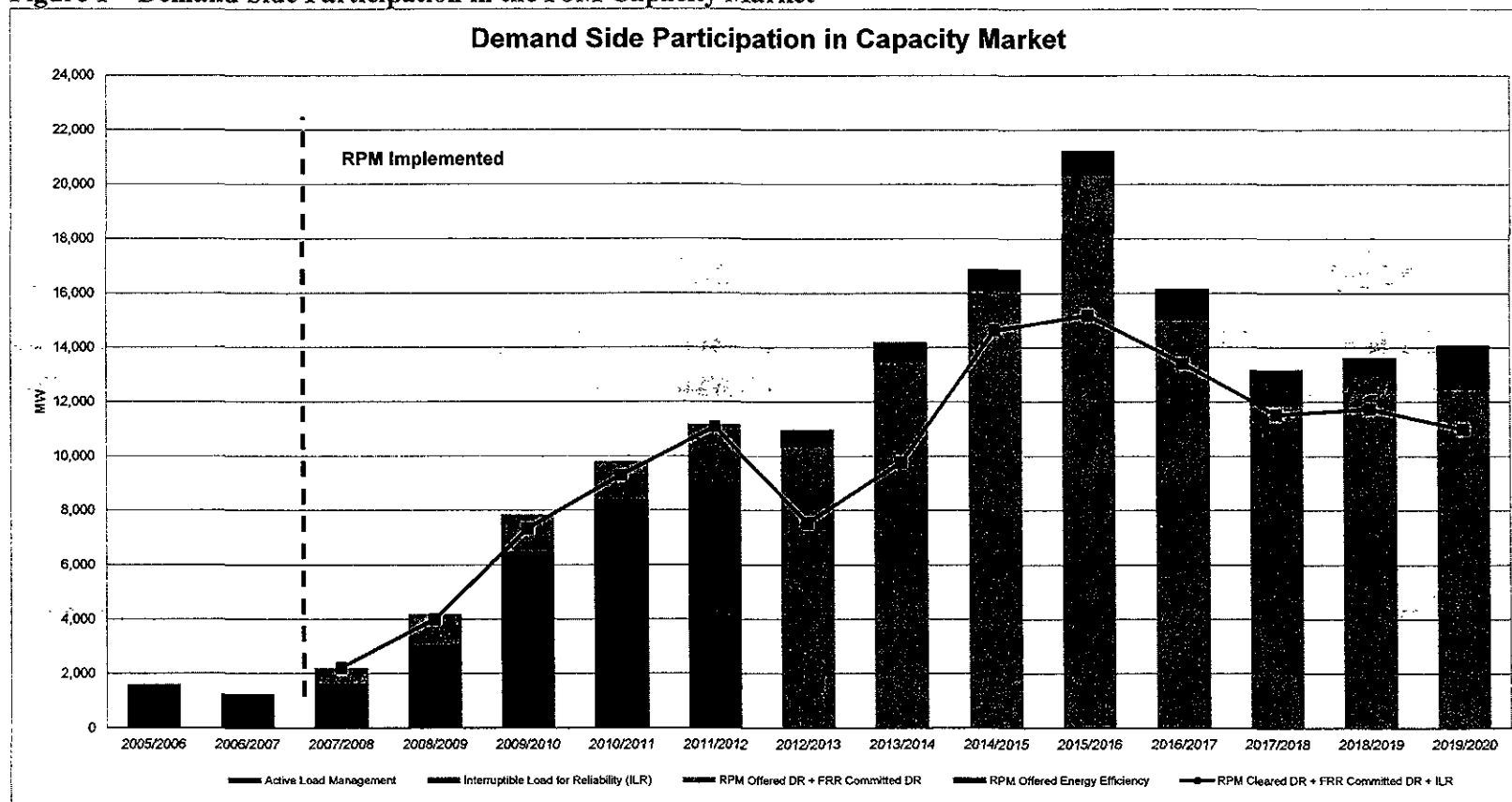
Table 3C – Breakdown of Capacity Resources Offered versus Cleared by Product Type in the 2018/19 BRA in UCAP

Resource Type Product Coupling Scenario		Offered MW (UCAP)		Cleared MW (UCAP)	
		Base Product Type	Capacity Performance Product Type	Base Product Type	Capacity Performance Product Type
GEN	Capacity Performance and Base	26,221.3	26,821.4	11,831.2	12,236.2
GEN	Capacity Performance Only	-	140,219.9	-	126,399.3
GEN	Base Only	5,023.0	-	4,976.1	-
GEN Sub Total		31,244.3	167,041.3	16,807.3	138,635.5
DR	Capacity Performance and Base	4,659.4	4,317.6	3,961.9	266.7
DR	Capacity Performance Only	-	404.0	-	347.0
DR	Base Only	6,656.9	-	5,772.4	-
DR Sub Total		11,316.3	4,721.6	9,734.3	613.7
EE	Capacity Performance and Base	582.3	582.4	45.2	517.0
EE	Capacity Performance Only	-	541.1	-	541.1
EE	Base Only	526.1	-	411.8	-
EE Sub Total		1,108.4	1,123.5	457.0	1,058.1
Grand Total		43,669.0	172,886.4	26,998.6	140,307.3



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Figure 1 – Demand Side Participation in the PJM Capacity Market





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Renewable Resource Participation

969 MW of wind resources were offered into and cleared the 2019/2020 BRA as compared to 857.2 MW of wind resources that offered into and cleared the 2018/2019 BRA. The capacity factor applied to wind resources is 13%, meaning that for every 100 MW of wind energy, 13 MW are eligible to meet capacity requirements. The 969 MW of cleared wind capacity translates to 7,453.8 MW of wind energy nameplate capability that is expected to be available in the 2019/2020 Delivery Year. Of the 969 MW procured from wind resources in the 2019/2020 BRA, 89.4 MW cleared as Capacity Performance product type and 879.6 MW cleared as Base product type.

335 MW of solar resources were offered into and cleared the 2019/2020 BRA as compared to 183.7 MW of solar resources that offered into and cleared the 2018/2019 BRA. The capacity factor applied to solar resources is 38%, meaning that for every 100 MW of solar energy, 38 MW are eligible to meet capacity requirements. The 335 MW of cleared solar capacity translates to 881.6 MW of nameplate solar energy capability that is expected to be available in the 2019/2020 Delivery Year. Of the 335 MW procured from solar resources in the 2019/2020 BRA, 0.4 MW cleared as Capacity Performance product type and 334.6 MW cleared as Base product type.

LDA Results

An LDA was modeled in the BRA and had a separate VRR Curve if (1) the LDA has a CETO/CETL margin that is less than 115%; or (2) the LDA had a locational price adder in any of the three immediately preceding BRAs; or (3) the LDA is EMAAC, SWMAAC, and MAAC. An LDA not otherwise qualifying under the above three tests may also be modeled if PJM finds that the LDA is determined to be likely to have a Locational Price Adder based on historic offer price levels or if such LDA is required to achieve an acceptable level of reliability consistent with the Reliability Principles and Standards.

As a result of the above criteria, MAAC, EMAAC, SWMAAC, PSEG, PS-NORTH, DPL-SOUTH, PEPCO, ATSI, ATSI-Cleveland, COMED, BGE and PL were modeled as LDAs in the 2019/2020 RPM Base Residual Auction. The EMAAC LDA, ComEd LDA and BGE LDAs were binding constraints in the auction resulting in a Locational Price Adder for these LDAs. A Locational Price Adder represents the difference in Resource Clearing Prices for the Capacity Performance product between a resource in a constrained LDA and the immediate higher level LDA.



2019/2020 RPM Base Residual Auction Results

Table 4 contains a summary of the clearing results in the LDAs from the 2019/2020 RPM Base Residual Auction.

Table 4 –RPM Base Residual Auction Clearing Results in the LDAs

Auction Results	RTO	MAAC	SWMAAC	PEPCO	BGE	EMAAC	DPL-SOUTH	PSEG	PS-NORTH	ATSI	ATSI-CLEVELAND	PPL	COMED
Offered MW (UCAP)	185,539.5	74,633.0	13,299.9	6,786.6	4,100.7	33,228.2	1,721.4	6,634.0	3,726.5	11,847.7	2,486.7	12,106.3	26,588.7
Cleared MW (UCAP)	167,305.9	64,915.0	11,394.6	6,248.4	2,739.5	30,769.3	1,598.5	5,455.0	3,205.3	10,291.1	2,089.0	9,649.6	22,971.4
System Marginal Price	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00
Locational Price Adder*	-	-	-	-	\$0.30	\$19.77	\$19.77	\$19.77	\$19.77	-	-	-	\$102.77
Base Capacity Resource Price Decrement**	(\$20.00)	(\$20.00)	(\$20.00)	(\$20.00)	(\$20.00)	(\$20.00)	(\$20.00)	(\$20.00)	(\$20.00)	(\$20.00)	(\$20.00)	(\$20.00)	(\$20.00)
Base DR/EE Capacity Price Decrement	-	-	-	(\$79.99)	-	-	-	-	-	-	-	-	-
RCP for Base DR/EE Resources	\$80.00	\$80.00	\$80.00	\$0.01	\$80.30	\$99.77	\$99.77	\$99.77	\$99.77	\$80.00	\$80.00	\$80.00	\$182.77
RCP for Base Generation Resources	\$80.00	\$80.00	\$80.00	\$80.00	\$80.30	\$99.77	\$99.77	\$99.77	\$99.77	\$80.00	\$80.00	\$80.00	\$182.77
RCP for Capacity Performance Resources	\$100.00	\$100.00	\$100.00	\$100.00	\$100.30	\$119.77	\$119.77	\$119.77	\$119.77	\$100.00	\$100.00	\$100.00	\$202.77

*Locational Price Adder is with respect to the immediate parent LDA

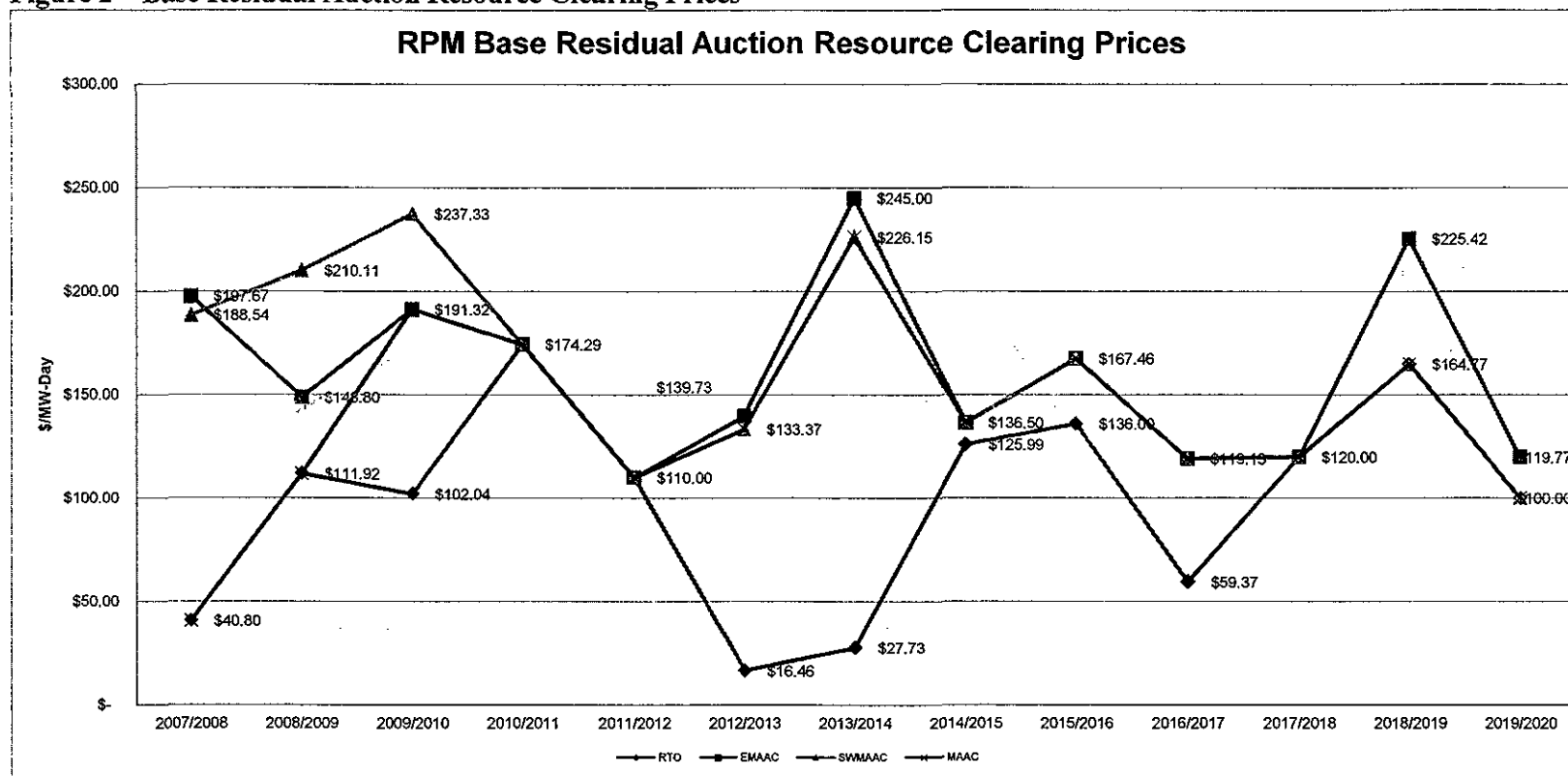
**Base Generation and Base DR/EE receive the Base Capacity Resource Price Decrement

Since the EMAAC LDA, ComEd LDA and BGE LDAs were constrained LDAs, Capacity Transfer Rights (CTRs) will be allocated to loads in these constrained LDA for the 2019/2020 Delivery Year. CTRs are allocated by load ratio share to all Load Serving Entities (LSEs) in a constrained LDA that has a higher clearing price than the unconstrained region. CTRs serve as a credit back to the LSEs in the constrained LDA for use of the transmission system to import less expensive capacity into that constrained LDA and are valued at the difference in the clearing prices of the constrained and unconstrained regions.



2019/2020 RPM Base Residual Auction Results

Figure 2 – Base Residual Auction Resource Clearing Prices



*2014/2015 through 2019/2020 Prices reflect the Annual Resource Clearing Prices.



2019/2020 RPM Base Residual Auction Results

Table 5 contains a summary of the RTO resources for each cleared BRA from 2008/2009 through the 2019/2020 Delivery Years. The summary includes all resources located in the RTO (including FRR Capacity Plans).

A total of 212,401 MW of installed capacity was eligible to be offered into the 2019/2020 Base Residual Auction, with 4,821.4 MW from external resources. As illustrated in Table 5, the amount of capacity exports in the 2019/2020 auction increased by 4.8 MW from that of the previous auction and FRR commitments decreased by 407.7 MW from the 2018/2019 Delivery Year to 15,385.3 MW.

A total of 194,243 MW of capacity was offered into the Base Residual Auction. This is an increase of 4,672.6 MW from that which was offered into the 2018/2019 BRA. A total of 18,158 MW was eligible, but not offered due to either (1) inclusion in an FRR Capacity Plan; (2) export of the resource, or (3) having been excused from offering into the auction. Resources were excused from the must offer requirement for the following reasons: approved retirement requests not yet reflected in eRPM, and excess capacity owned by an FRR entity.



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Table 5 –RPM Base Residual Auction Generation, Demand, and Energy Efficiency Resource Information in the RTO

Auction Supply (all values in ICAP)	RTO ¹											
	2008/2009	2009/2010	2010/2011	2011/2012 ²	2012/2013	2013/2014 ³	2014/2015 ⁴	2015/2016 ⁵	2016/2017 ⁶	2017/2018	2018/2019	2019/2020
Internal PJM Capacity	166,037.9	167,026.3	168,457.3	169,241.6	179,791.2	195,633.4	199,375.5	207,559.1	208,098.0	202,477.4	203,300.6	207,579.6
Imports Offered	2,612.0	2,563.2	2,982.4	6,814.2	4,152.4	4,766.1	7,620.2	4,649.7	8,412.2	6,300.9	5,724.6	4,821.4
Total Eligible RPM Capacity	168,649.9	169,589.5	171,439.7	176,055.8	183,943.6	200,399.5	206,995.7	212,208.8	216,510.2	208,778.3	209,025.2	212,401.0
Exports / Delistings	4,205.8	2,240.9	3,378.2	3,389.2	2,783.9	2,624.5	1,230.1	1,218.8	1,218.8	1,223.2	1,313.4	1,318.2
FRR Commitments	24,953.5	25,316.2	26,305.7	25,921.2	26,302.1	25,793.1	33,612.7	15,997.9	15,576.6	15,776.1	15,793.0	15,385.3
Excused	722.0	1,121.9	1,290.7	1,580.0	1,732.2	1,825.7	3,255.2	8,712.9	8,524.0	4,305.3	2,348.4	1,454.5
Total Eligible RPM Capacity - Excused	29,881.3	28,679.0	30,974.6	30,890.4	30,818.2	30,243.3	38,098.0	25,929.6	25,319.4	21,304.6	19,454.8	18,158.0
Remaining Eligible RPM Capacity	138,768.6	140,910.5	140,465.1	145,165.4	153,125.4	170,156.2	168,897.7	186,279.2	191,190.8	187,473.7	189,570.4	194,243.0
Generation Offered	138,076.7	140,003.6	139,529.5	143,538.1	142,957.7	156,894.1	153,048.1	166,127.8	176,145.3	175,329.5	177,592.1	181,866.4
DR Offered	691.9	906.9	935.6	1,597.3	9,535.4	12,528.7	15,043.1	19,243.6	13,932.9	10,855.2	10,772.8	10,859.2
EE Offered	0.0	0.0	0.0	0.0	632.3	733.4	806.5	907.8	1,112.6	1,289.0	1,205.5	1,517.4
Total Eligible RPM Capacity Offered	138,768.6	140,910.5	140,465.1	145,165.4	153,125.4	170,156.2	168,897.7	186,279.2	191,190.8	187,473.7	189,570.4	194,243.0
Total Eligible RPM Capacity Unoffered	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

¹RTO numbers include all LDAs.

²All generation in the Duquesne zone is considered external to PJM for the 2011/2012 BRA.

³2013/2014 includes ATSI zone and generation

⁴2014/2015 includes Duke zone and generation

⁵2015/2016 includes a significant portion of AEP and DEOK zone load previously under the FRR Alternative

⁶2016/2017 includes EKPC zone



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Table 6 shows the Generation, DR, and EE Resources Offered and Cleared in the RTO translated into Unforced Capacity (UCAP) MW amounts. Participants' sell offer EFORD values were used to translate the generation installed capacity values into unforced capacity (UCAP) values. DR sell offers and EE sell offers were converted into UCAP using the appropriate DR Factor and Forecast Pool Requirement (FPR) for the Delivery Year.

In UCAP terms, a total of 185,539.5 MW were offered into the 2019/2020 BRA, comprised of 172,071.2 MW of generation capacity, 11,818 MW of capacity from DR, and 1,650.3 MW of capacity from EE resources. Of those offered, a total of 167,305.9 MW of capacity was cleared in the BRA.

Of the 167,305.9 MW of capacity that cleared in the auction, 155,442.8 MW were from Generation Capacity Resources, 10,348 MW were from DR, and 1,515.1 MW were from EE resources. Capacity that was offered but not cleared in the BRA Auction will be eligible to offer into the First, Second and Third Incremental Auctions for the 2019/2020 Delivery Year.

Table 6 – Generation, Demand Resources, and Energy Efficiency Resources Offered and Cleared in UCAP MW

Auction Results (all values in UCAP**)	RTO*											
	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020
Generation Offered	131,164.8	132,614.2	132,124.8	136,067.9	134,873.0	147,188.6	144,108.8	157,691.1	168,716.0	166,204.8	166,909.6	172,071.2
DR Offered	715.8	936.8	967.9	1,652.4	9,847.6	12,952.7	15,545.6	19,956.3	14,507.2	11,293.7	11,675.5	11,818.0
EE Offered	-	-	-	-	652.7	756.8	831.9	940.3	1,156.8	1,340.0	1,306.1	1,650.3
Total Offered	131,880.6	133,551.0	133,092.7	137,720.3	145,373.3	160,898.1	160,486.3	178,587.7	184,380.0	178,838.5	179,891.2	185,539.5
Generation Cleared	129,061.4	131,338.9	131,251.5	130,856.6	128,527.4	142,782.0	135,034.2	148,805.9	155,634.3	154,690.0	154,506.0	155,442.8
DR Cleared	536.2	892.9	939.0	1,364.9	7,047.2	9,281.9	14,118.4	14,832.8	12,408.1	10,974.8	11,084.4	10,348.0
EE Cleared	0.0	0.0	0.0	0.0	568.9	679.4	822.1	922.5	1,117.3	1,338.9	1,246.5	1,515.1
Total Cleared	129,597.6	132,231.8	132,190.5	132,221.5	136,143.5	152,743.3	149,974.7	164,561.2	169,159.7	167,003.7	166,836.9	167,305.9
Uncleared	2,283.0	1,319.2	902.2	5,498.8	9,229.8	8,154.8	10,511.6	14,026.5	15,220.3	11,834.8	13,054.3	18,233.6

* RTO numbers include all LDAs

** UCAP calculated using sell offer EFORD for Generation Resources. DR and EE UCAP values include appropriate FPR and DR Factor.

Table 7 contains a summary of capacity additions and reductions from the 2007/2008 BRA to the 2019/2020 BRA. A total of 6,327.8 MW of incrementally new capacity in PJM was available for the 2019/2020 BRA. This incrementally new capacity includes new Generation Capacity Resources and capacity upgrades to existing Generation Capacity Resources. The increase is offset by generation



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capacity deratings on existing Generation Capacity Resources and an increase in the quantity of offered DR and EE to yield a net increase of 3,803.0 MW of installed capacity.

Table 7 also illustrates the total amount of resource additions and reductions over twelve Delivery Years since the implementation of the RPM construct. Over the period covering the first thirteen RPM BRAs, 46,534.5 MW of new generation capacity was added, which was partially offset by 36,623.4 MW of capacity de-ratings or retirements over the same period. Additionally, 11,297 MW of new DR and 1,517.4 MW of new EE resources were offered over the course of the thirteen Delivery Years since RPM's inception. The total net increase in installed capacity in PJM over the period of the last thirteen RPM auctions was 22,725.5 MW.

Table 7 – Incremental Capacity Resource Additions and Reductions to Date

Capacity Changes (in ICAP)	RTO*													Total
	2007/2008	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014 ¹	2014/2015 ²	2015/2016	2016/2017 ³	2017/2018	2018/2019	2019/2020	
Increase in Generation Capacity	602.0	724.2	1,272.3	1,776.2	3,576.3	1,893.5	1,737.5	1,582.8	8,207.0	6,806.0	6,973.3	5,055.6	6,327.8	46,534.5
Decrease in Generation Capacity	-674.6	-375.4	-550.2	-301.8	-264.7	-3,253.9	-1,924.1	-1,550.1	-6,432.6	-4,992.0	-9,760.1	-3,620.8	-2,923.1	-36,623.4
Net Increase in Demand Resource	555.0	574.7	215.0	28.7	661.7	7,938.1	2,993.3	2,514.4	4,200.5	-5,310.7	-3,077.7	-82.4	86.4	11,297.0
Net Increase in Energy Efficiency	0.0	0.0	0.0	0.0	0.0	632.3	101.1	73.1	101.3	204.8	176.4	-83.5	311.9	1,517.4
Net Increase in Installed Capacity	482.4	923.5	937.1	1503.1	3973.3	7,210.0	2,907.8	2,620.2	6,076.2	-3,291.9	-5,688.1	1,268.9	3,803.0	22,725.5

* RTO numbers include all LDAs

** Values are with respect to the quantity offered in the previous year's Base Residual Auction.

1) Does not include Existing Generation located in ATSI Zone

2) Does not include Existing Generation located in Duke Zone

3) Does not include Existing Generation located in EKPC Zone

Table 7A provides a further breakdown of the generation increases and decreases for the 2019/2020 Delivery Year on an LDA basis.

Table 7A – Generation Increases and Decreases by LDA Effective 2019/2020 Delivery Year

LDA Name	Increases	Decreases
EMAAC	93.0	(1,275.4)
MAAC	2,508.9	(1,736.7)
Total RTO	6,327.8	(2,923.1)

All Values in ICAP terms

*MAAC includes EMAAC

**RTO includes MAAC



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Table 8 provides a breakdown of the new capacity offered into the each BRA into the categories of new resources, reactivated units, and uprates to existing capacity, and then further down into resource type. As shown in this table, there was a significant quantity of generating capacity from new resources and uprates to existing resources offered into the 2019/2020 BRA. The capacity offered in the 2019/2020 BRA resulted from both new generating resources and uprates to existing resources including gas, diesel, coal, wind, and nuclear resources. The largest growth remains in gas turbines and combined cycle plants.



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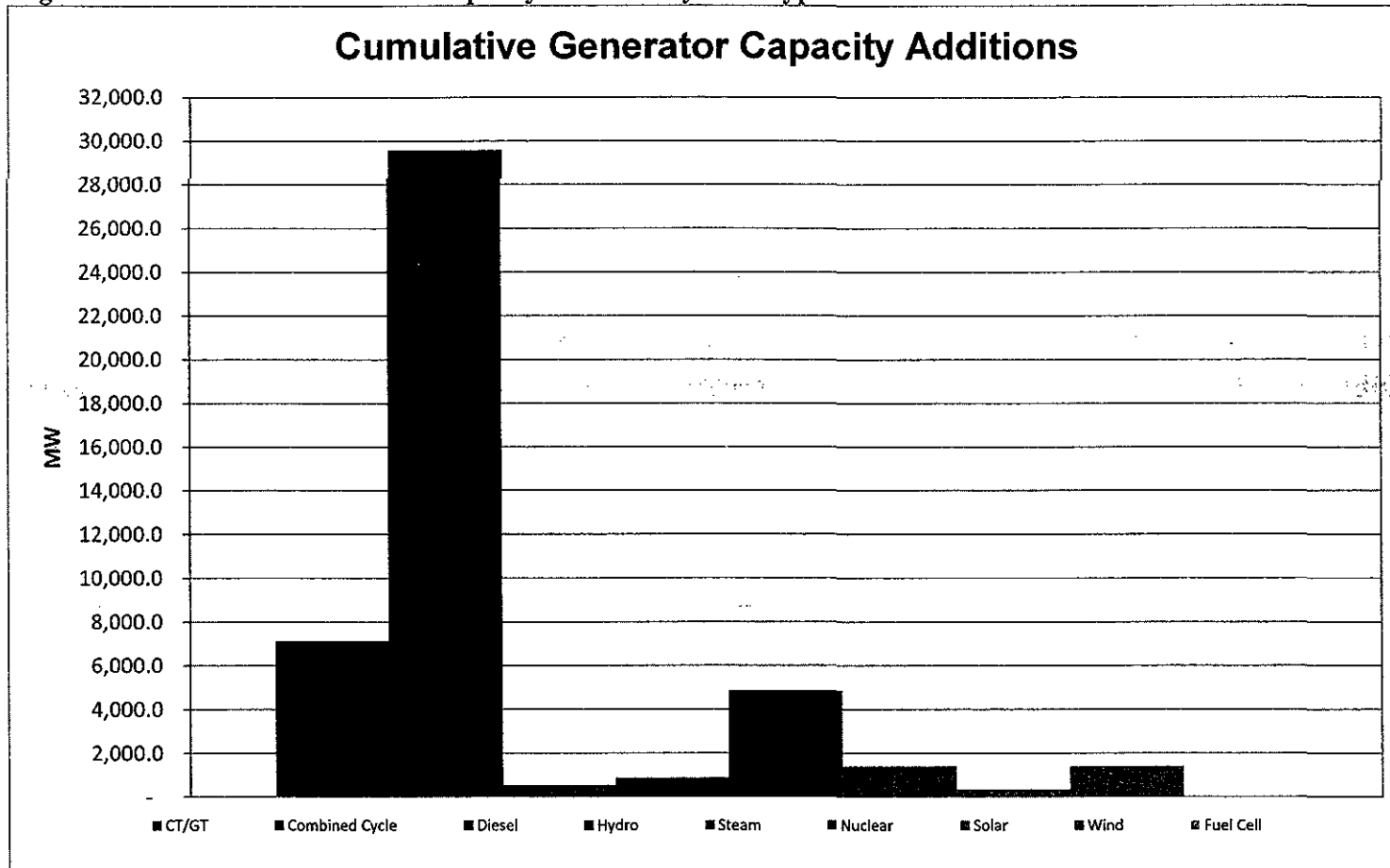
Table 8 – Further Breakdown of Incremental Capacity Resource Additions from 2007/2008 to 2019/2020

	Delivery Year	CT/GT	Combined Cycle	Diesel	Hydro	Steam	Nuclear	Solar	Wind	Fuel Cell	Total
New Capacity Units (ICAP MW)	2007/2008			18.7	0.3						19.0
	2008/2009			27.0					66.1		93.1
	2009/2010	399.5		23.8		53.0					476.3
	2010/2011	283.3	580.0	23.0					141.4		1,027.7
	2011/2012	416.4	1,135.0			704.8		1.1	75.2		2,332.5
	2012/2013	403.8		7.8		621.3			75.1		1,108.0
	2013/2014	329.0	705.0	6.0		25.0		9.5	245.7		1,320.2
	2014/2015	108.0	650.0	35.1	132.9			28.0	146.6		1,100.6
	2015/2016	1,382.5	5,914.5	19.4	148.4	45.4		13.8	104.9	30.0	7,658.9
	2016/2017	171.1	4,994.5	38.3		24.0		32.1	54.3		5,314.3
	2017/2018	131.0	5,010.0	124.8	6.0	90.0		27.0			5,388.8
	2018/2019	1,032.5	2,352.3	29.9				82.8	127.1		3,624.6
	2019/2020	167.0	6,145.0	29.9				152.3	73.0		6,567.2
Capacity from Reactivated Units (ICAP MW)	2007/2008					47.0					47.0
	2008/2009					131.0					131.0
	2009/2010										-
	2010/2011	160.0		10.7							170.7
	2011/2012	80.0				101.0					181.0
	2012/2013										-
	2013/2014										-
	2014/2015			9.0							9.0
	2015/2016										-
	2016/2017					21.0					21.0
	2017/2018					991.0					991.0
	2018/2019										-
	2019/2020										-
Upgrades to Existing Capacity Resources (ICAP MW)	2007/2008	114.5		13.9	80.0	235.6	92.0				536.0
	2008/2009	108.2	34.0	18.0	105.5	196.0	38.4				500.1
	2009/2010	152.2	206.0		162.5	61.4	197.4		16.5		796.0
	2010/2011	117.3	163.0		48.0	89.2	160.3				577.8
	2011/2012	369.2	148.6	57.4		186.8	292.1		8.7		1,062.8
	2012/2013	231.2	164.3	14.2		193.0	126.0		56.8		785.5
	2013/2014	56.4	59.0	0.3		215.0	47.0		39.6		417.3
	2014/2015	104.9		0.5	41.5	138.6	107.0	7.1	73.6		473.2
	2015/2016	216.8	72.0	4.7	15.7	63.4	149.2	2.2	24.1		548.1
	2016/2017	436.6	420.0	3.3	7.4	484.3	102.6	1.7	14.8		1,470.7
	2017/2018	71.9	212.5	5.1	105.9	64.8	11.0	0.4	2.1		473.7
	2018/2019	33.4	548.0	2.4	22.9	11.9	79.3	-	14.9	-	712.8
	2019/2020	29.3	72.5	3.9	5.2	65.3			46.8		223.0
Total		7,106.0	29,586.2	527.1	882.2	4,859.8	1,402.3	358.0	1,407.3	30.0	46,158.9



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Figure 4: Cumulative Generation Capacity Increases by Fuel Type





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Table 9 shows the changes that have occurred regarding resource deactivation and retirement since the RPM was approved by FERC. The MW values shown in Table 9 represent the quantity of unforced capacity cleared in the 2019/2020 Base Residual Auction that came from resources that have either withdrawn their request to deactivate, postponed retirement, or been reactivated (i.e., came out of retirement or mothball state for the RPM auctions) since the inception of RPM. This total accounts for 4,938.4 MW of cleared UCAP in the 2019/2020 BRA which equates to 7,067.5 MW of ICAP Offered.

Table 9 – Changes to Generation Retirement Decisions since Commencement of RPM in 2007/2008

Generation Resource Decision Changes	RTO*	
	ICAP Offered	UCAP Cleared
Withdrawn Deactivation Requests	2,202.7	1,085.4
Postponed or Cancelled Retirement	3,571.7	3,138.5
Reactivation	1,293.1	714.5
Total	7,067.5	4,938.4

RPM Impact to Date

As illustrated in Table 5, for the 2019/2020 auction, the capacity exports were 1,318.2 MW and the offered capacity imports were 4,821.4 MW. The difference between the capacity imports and exports results is a net capacity import of 3,503.2 MW. In the planning year preceding the RPM auction implementation, 2006/2007, there was a net capacity export of 2,616.0 MW. In this auction, PJM is now a net importer of 3,503.2 MW. Therefore, RPM's impact on PJM capacity interchange is 6,119.2 MW.

The minimum net impact of the RPM implementation on the availability of Installed Capacity resources for the 2019/2020 planning year can be estimated by adding the net change in capacity imports and exports over the period, the forward demand and energy efficiency resources, the increase in Installed Capacity over the RPM implementation period from Table 8 and the net change in generation retirements from Table 9. Therefore, as illustrated in Table 10, the minimum estimated net impact of the RPM implementation on the availability of capacity in the 2019/2020 compared to what would have happened absent this implementation is 65,092.5 MW.



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Table 10 shows the details on RPM's impact to date in ICAP terms.

Table 10 – RPM's Impact to Date

Change in Capacity Availability	Installed Capacity MW
New Generation	36,031.2
Generation Upgrades (not including reactivations)	8,577.0
Generation Reactivation	1,550.7
Forward Demand and Energy Efficiency Resources	12,814.4
Cleared ICAP from Withdrawal or Cancelled Retirements	-
Net increase in Capacity Imports	6,119.2
Total Impact on Capacity Availability in 2019/2020 Delivery Year	65,092.5



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Discussion of Factors Impacting the RPM Clearing Prices

The main factors impacting 2019/2020 RPM BRA clearing prices relative to 2018/2019 BRA clearing prices are provided below, separated out by changes to the demand-side and supply-side of the market.

Changes that impacted the Demand Curve:

- The target reliability requirement for the 2019/2020 BRA is 158,984 MW, which is 1,624 MW (1.0%) lower than the target reliability requirement of the 2018/2019 BRA of 160,607 MW.

Changes that impacted the Supply Curve:

- Unlike previous BRAs, there are no major environmental rules that are imminent in implementation for the 2019/2020 Delivery year, though there are permit renewal issues and state specific implementation of environmental rules to consider on items such as coal ash, cooling water intake structures, and updated NAAQS standards that are on the horizon for many existing resources. The now stayed EPA Clean Power Plan would not take effect until 2022, at the earliest, if upheld, which would only have its first effect for the 2021/2022 BRA to be held in 2018.
- In theory, with the transition to the Capacity Performance product, the implied costs of committing to be a Capacity Resource increases due to the need to make improvements in generator performance during Performance Assessment Hours. These increased costs could be related weatherization, improved maintenance, and costs for fuel assurance. One should then expect an upward and leftward shift in the resource supply curve leading to higher capacity market prices overall, all else equal. However, observed offer behavior and discussions with some generation owners since Capacity Performance has been implemented indicate that such costs are lower than expected. In particular, the use of third party marketers to help firm up gas supplies has provided options for ensuring performance that may not have been contemplated prior to Capacity Performance.
- Intuitively one would expect low natural gas prices and low overall energy demand, which have led to lower energy market prices, have also led to lower net energy market revenues across the PJM system, especially for coal and oil steam units as well as nuclear units. Such conditions should be expected to lead to higher capacity market offers from these resources to at least cover going forward costs.



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- Relative to last year, there were more new resources offered in the BRA and cleared than the previous year and overall there was more than 4,500 MW of additional resources offered in the 2019/2020 BRA than in the previous year. This has the effect of shifting the supply curve down and to the right which would lower prices, all else equal.