

Load Management Performance Report 2016/2017

August 2017



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For additional detailed information on any of the topics discussed, please refer to the appropriate PJM manual which can be found by accessing: <http://www.pjm.com/documents/manuals.aspx>

Contents

<i>Executive Summary</i>	4
<i>Overview</i>	5
<i>Participation Summary</i>	6
<i>Test Requirement Overview</i>	10
<i>Test Performance</i>	10

Executive Summary

Load Management Demand Resources (DR) has the ability to participate as a capacity resource in the PJM capacity market (Reliability Pricing Model or RPM) or to support a Load Serving Entity's Fixed Resource Requirement (FRR) plan. There were four DR products available during the 2016/2017 Delivery Year: Limited DR, Summer Extended DR, Annual DR, and Capacity Performance. This is the third Delivery Year that the Summer Extended and Annual products were available and the first year that the Capacity Performance product was available.

A Curtailment Service Provider (CSP) is the PJM member that nominates the end use customer location(s) as a capacity resource and is fully responsible for the performance of the resource. Load Management products are required to respond to PJM Pre-Emergency or Emergency Load Management events, based on the availability period for each product (see Table 2: DR product availability), or receive a penalty. PJM may declare Emergency Load Management events outside the required availability window but does not measure capacity compliance in such cases (resources are eligible for emergency energy revenue if they reduce load). Load Management that is not dispatched during its availability period must perform a mandatory test to demonstrate it can meet its capacity commitment or receive a penalty.

Table 1 shows both the mandatory event and test performance values for the past 8 delivery years. In the years where there was more than one event, the event performance is the event MW weighted average of all of the events. PJM Load Management events outside the mandatory compliance period are excluded from the results. There were no Load Management events in the 2016/17 delivery year. All DR capacity resources were required to test since there were no events and therefore the test results are available (performance = 153%). Historically, test performance has been substantially higher than event performance which is largely a function of the difference in the test requirements compared to what a resource must do when dispatched during Load Management Event.

Table 1: Annual performance summary. Only events with mandatory compliance are included.

Delivery year	Event performance	Test performance
2009/10	No Events	118%
2010/11	100%	111%
2011/12	91%	107%
2012/13	104%	116%
2013/14	94%	129%
2014/15	No Events	144%
2015/16	No Events	134%
2016/17	No Events	153%

Overview

PJM Interconnection, L.L.C. procures capacity for its system reliability through the Reliability Pricing Model (RPM). The sources for meeting system reliability are divided into four groups:

- 1) Generation Capacity
- 2) Transmission Upgrades
- 3) Load Management (Pre-Emergency and Emergency Demand Resources)
- 4) Energy Efficiency

There were four Load Management Products available during the 2016/17 Delivery Year¹: Limited DR, Extended Summer DR, Annual DR, and Capacity Performance DR. The availability period for each of the products is in Table 2. By default, the interruptions must be implemented within thirty minutes of notification by PJM. Those resources that cannot be fully implemented within thirty minutes of notification and qualify for an exception may respond within either 60 or 120 minutes depending on their capabilities and the exception they qualify for.

Table 2: DR product availability window.

DR Product	Max. interruptions	Max. event duration (hrs)	Availability period	Availability Hours (EPT)
Limited	10	6	June – September Non-NERC Hol. Wkdys.	12PM – 8PM
Extended Summer	Unlimited	10	June – October, May	10AM – 10PM
Annual	Unlimited	12 15	June – October, May November - April	10AM – 10PM 6AM – 9PM
Capacity Performance	Unlimited	12 15	June – October, May November - April	10AM – 10PM 6AM – 9PM

DR compliance can be more complex to measure than compliance for generation resources meeting their capacity obligations. In order to ensure the reliability service for which a resource is paid has actually been provided, PJM utilizes two different types of measurement and verification methodologies. DR Resources can choose the most appropriate of the following measurement methodologies:

- Firm Service Level (FSL) – Load Management achieved by a customer reducing its load to a pre-determined level upon the notification from the CSP’s market operations center. The customer must be able to reduce load below the pre-determined level which must be lower than the amount of capacity reserve for the customer as represented by the peak load contribution (PLC).
- Guaranteed Load Drop (GLD) – Load Management achieved by a customer reducing its load below the PLC when compared to what the load would have been absent the PJM event or test.

¹ The Delivery Year for the capacity construct corresponds to PJM’s Planning Year which runs each year from June 1 until May 31 of the following year.

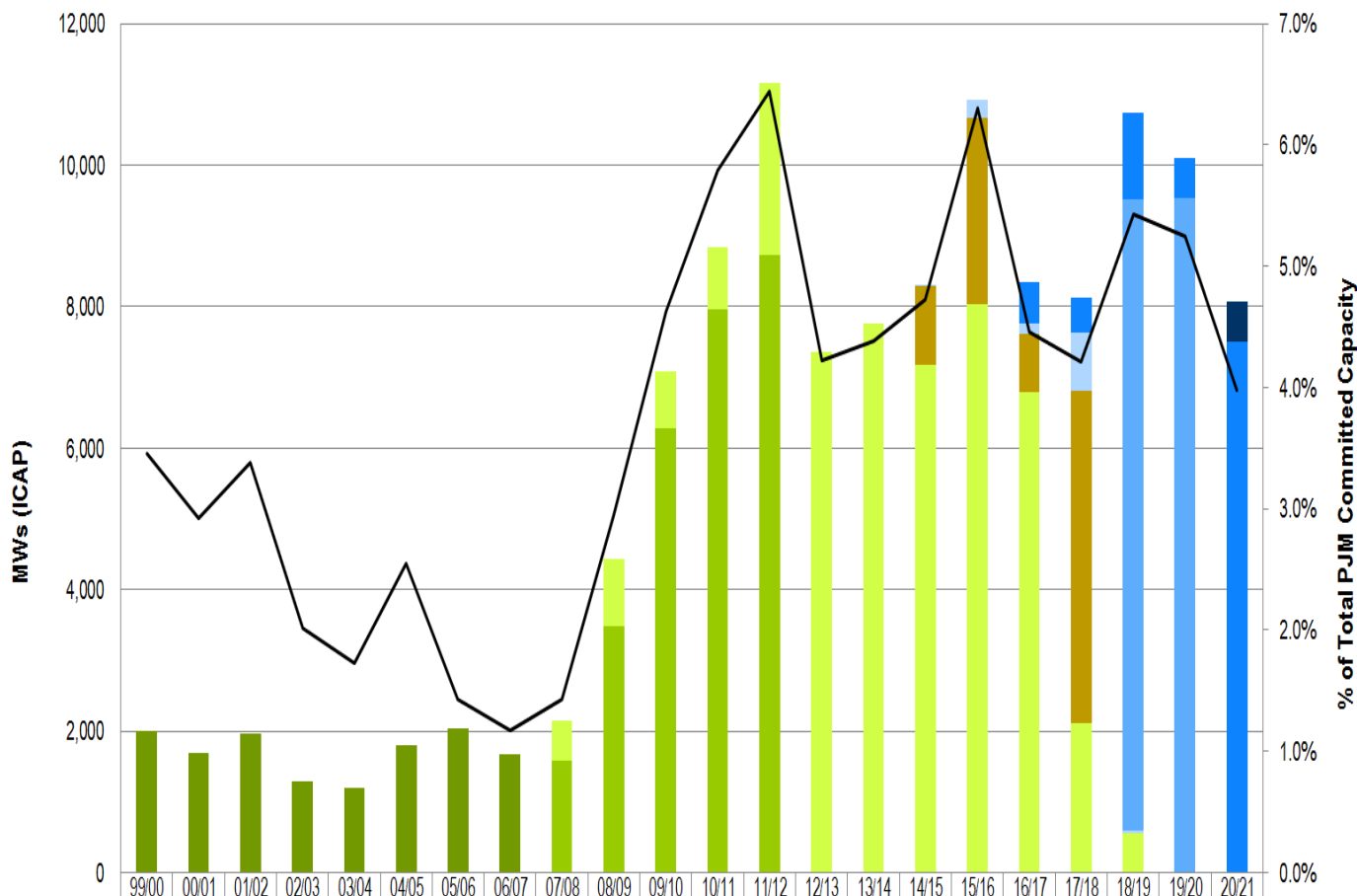
Participation Summary

The capacity numbers in this report are in terms of either Installed Capacity (ICAP) or Unforced Capacity (UCAP) depending upon which is most relevant. PJM calculates the Resource amounts required to meet the reliability standard in terms of UCAP which is also utilized to measure compliance with a RPM commitment. PJM determines the UCAP value of different types of Resources based on methods described in the PJM manuals.

Figure 1 shows Load Management Commitments by Delivery Year from 2007/08 through 2019/20 based on what cleared in the RPM auctions (BRA, IAs, and CP Transition Auctions) or as part of a LSEs FRR plan. Load Management participation in the PJM capacity market substantially increased from the 2007/08 Delivery Year through the 2011/12 Delivery Year, then declined, and has varied since 2012/13. The final commitment values for the next three Delivery Years are uncertain since the values can still be adjusted in the Incremental Auctions and via Replacement Capacity Transactions and Transition Mechanisms. For the 2016/17 Delivery Year, Load Management capacity commitments represented 8,349MW of ICAP while total registered Load Management represented 9,343 MW. Registered Emergency DR may be in excess of the commitment if the CSP has indicated they have the potential to deliver an amount that is higher than their actual commitment².

² For example, a CSP may clear 10 MW of resources in an RPM auction but register 11 MW load reduction capability by end use customers to fulfill such commitment.

Figure 1: PJM Demand Response Committed MWs by Delivery Year



PRD																0	0	0	0	558		
Annual - CP																574	493	1,224	564	7,508		
Base - CP																0	0	8,907	9,537	0		
Annual - DR														22	266	144	822	44	0	0		
Extended Summer - DR														1,126	2,635	836	4,694	1	0	0		
Limited - DR							555	940	815	869	2,425	7,361	7,753	7,166	8,027	6,783	2,113	555	0	0		
Limited - ILR							1,585	3,489	6,274	7,961	8,731					0	0	0	0	0		
Limited - ALM	2,005	1,693	1,962	1,292	1,207	1,806	2,042	1,677							0	0	0	0	0	0		
DR as % of Total PJM Committed Capacity	3.5%	2.9%	3.4%	2.0%	1.7%	2.5%	1.4%	1.2%	1.4%	2.9%	4.6%	5.8%	6.4%	4.2%	4.4%	4.7%	6.3%	4.5%	4.2%	5.4%	5.3%	4.0%

Notes:

- 1) Data as of 8/3/2017.
- 2) RPM was implemented DY 07/08.
- 3) DY 18/19 MWs include results from Base, First, and Second Incremental Auction.
- 4) DY 19/20 MWs include results from Base Residual Auction.
- 5) DY 20/21 MWs include results from Base Residual Auction.
- 6) ALM MWs are seasonal averages for Delivery Years before 07/08.

Table 3 shows the committed ICAP by Product Type (Limited, Extended Summer, Annual, Capacity Performance) for each of the 20 PJM zones for the 2016/17 Delivery Year. Sixty-one PJM members or affiliates operate as a Curtailment Service Provider and over 2 million end use customers across almost every segment (residential, commercial, industrial, government, education, agricultural, etc.) participate as Load Management resources.

Table 3: Committed ICAP (MW) by Product Type and Zone for the 2016/17 Delivery Year.

Zone	Annual DR	Extended Summer DR	Limited DR	Capacity Performance	Total
Atlantic City Electric (AECO)	8	53	50	1	111
American Electric Power (AEP)		5	1,315	104	1,425
Allegheny Power (APS)	1	5	584	84	674
American Transmissions Systems Inc. (ATSI)	56	89	340	2	487
Baltimore Gas and Electric (BGE)	3	0	651	1	655
Commonwealth Edison (COMED)		52	985	124	1,162
Dayton Power & Light (DAY)		1	166	6	172
Duke Energy Ohio & Kentucky (DEOK)		16	154	93	263
Dominion Virginia Power (DOM)	-	64	455	31	550
Delmarva Power & Light (DPL)	1	194	132		326
Duquesne Light (DUQ)		2	130	1	134
East Kentucky Power Cooperative (EKPC)			27	114	141
Jersey Central Power & Light (JCPL)	11	0	109		120
Metropolitan Edison (METED)	4		207		211
PECO (PECO)	18	6	273	1	298
Pennsylvania Electric Company (PENELEC)	4	1	229	12	246
Pepco (PEPCO)	2	346	164		511
Pennsylvania Power & Light (PPL)	17	0	529	1	547
Public Service Enterprise Group (PSEG)	18	1	295		314
Rockland Electric Company (RECO)	0		3		4
Total	142	836	6,796	575	8,349

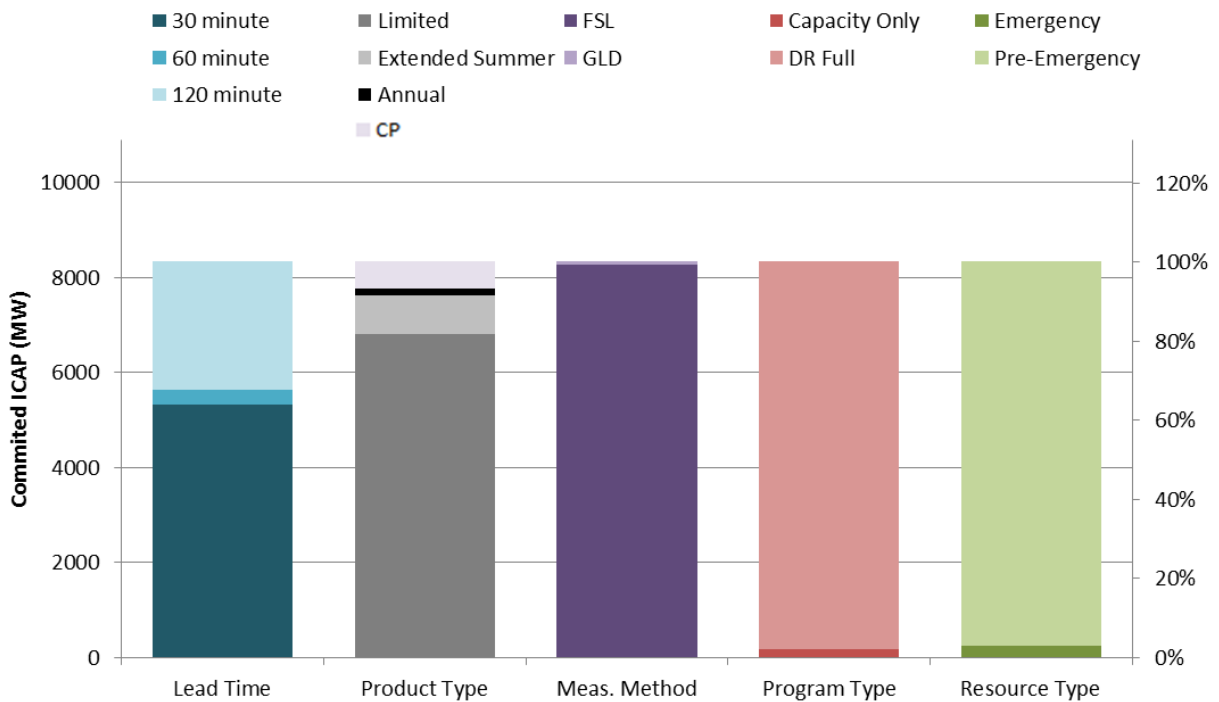
Load Management resources are registered by Lead Time, Product Type, Measurement Method, Program Type, and Resource Type. Figure 2 shows the breakdown of Committed ICAP for each item. 64% of resources were able to respond in 30 minutes, while 32% qualified for a 120 minute exception, and the remaining 4% qualified for a 60 minute exception.

The Product Type commitment level is determined by what is cleared in the RPM auctions. 81% of committed ICAP was Limited, 2% is Annual, 10% is Extended Summer, and the remaining 7% is Capacity Performance (see Figure 2). The compliance measurement method is 99% Firm Service Level (FSL), and only 1% Guaranteed Load Drop.

Figure 2 shows that 98% of committed ICAP is registered as Load Management DR Full. The remaining 2% is registered as Capacity Only. Load Management Full resources receive both a capacity revenue stream as well as an emergency energy revenue when there is Load Management event. Capacity Only means that resource receives capacity payments but is not eligible for emergency energy payments during Load Management events and is typically only used for some legacy EDC related tariff requirements or for registrations that participate with two different CSPs.

Load Management resource designations are split into Pre-Emergency and Emergency. The default designation is Pre-Emergency; Figure 2 shows that 97% of committed ICAP fell into this category. The Emergency classification is for those resources that use behind the meter generation and have environmental restrictions that permit them to run only during PJM emergency conditions. 3% of resources met this condition.

Figure 2: Committed ICAP for DR by Resource Type, Lead Time, Program Type, and Measurement Method for the 2016/17 Delivery Year.



Test Requirement Overview

If a Load Management Registration is not called in a mandatory Load Management event, the CSP must test the Registration. The Load Management Test is initiated by a Curtailment Service Provider (CSP) that has a capacity commitment. The CSP must simultaneously test all Registrations of the same product type in a Zone if PJM has not called a mandatory event for those Registrations. If a PJM-initiated Load Management Event is called for those Registrations during the product availability period, there is no test requirement and no Test Failure Charges would be assessed to a CSP for those registrations. Rather, their performance will be based on Load Management event.

The timing of a Load Management Test is intended to represent the conditions when a PJM-initiated Load Management event might occur in order to assess performance during a similar period. The Limited Product must be tested on a non-holiday weekday from June – September between 12PM and 8PM of that Delivery Year. The Extended, Annual, and Capacity Performance Products must be tested on a non-holiday weekday in June – October or May from 10AM – 10PM. All of a CSP's committed DR Registrations in the same Zone and Product that have not been called in a PJM initiated event are required to test at the same time for a one hour period. The requirement to test all resources in a zone simultaneously is necessary to ensure that test conditions are as close to realistic as possible. It is requested that the CSP notify PJM of intent to test 48 hours in advance to allow coordination with PJM dispatch.

There is not a limit on the number of tests a CSP can perform. However, a CSP may only submit data for one test to be used by PJM to measure compliance. If the CSP's Zonal Resources collectively achieve a reduction greater than 75% of the CSP's committed MW volume during the test, the CSP may choose to retest the Resources in that Zone that failed to meet their individual nominated value.

Load Management Resources are assessed a Test Failure Charge if their test data demonstrates that they did not meet their commitment level. The Test Failure Charge is calculated based on the CSP's Weighted Daily Revenue Rate which is the amount the CSP is paid for their RPM commitments in each Zone. The Weighted Daily Revenue Rate takes into consideration the different prices DR can be paid in the same Zone. For example, a CSP can clear DR in the Base Residual and/or Incremental Auctions in the same Zone, all of which are paid different rates. The penalty rate for under-compliance is the greater of 1.2 times the CSP's Weighted Daily Revenue Rate or \$20 plus the Weighted Daily Revenue Rate. If a CSP didn't clear in a RPM auction in a Zone, the CSP-specific Revenue Rate will be replaced by the PJM Weighted Daily Revenue Rate for such Zone.

Test Performance

Since there were no Load Management events during the 2016/2017 Delivery Year, all DR resources that are committed for the Delivery Year were required to perform tests to assess their performance capability. 8,342MW (ICAP) were committed as Limited Load Management Resources. The net result of the testing was 4,382 MW of over-compliance or a performance level of 153% across all zones. Table 4 shows the results by product. The zonal level results for all products combined are in Table 5. The net result for each zone is over-compliance, except for performance in RECO. There were some individual CSPs whose tests resulted in under compliance.

Table 4: Load Management commitments, compliance, and test performance (ICAP) by product, DY2016/17

Product	Committed net deficiency ICAP (MW)	Reduction (MW)	Over/under performance (MW)	Performance	Re-test
Limited	6,792	9,947	3,155	146%	1.3%
Extended Summer	836	1,904	1,069	228%	0%
Annual	142	172	30	121%	0.3%
Capacity Performance	574	701	127	122%	0%
Total	8,342	12,723	4,380	153%	1.1%

Table 5: Load Management commitments, compliance, and test performance for DR resources (ICAP by Zone, DY2016/17)

Zone	Committed ICAP (MW)	Committed net deficiency (MW)	Reduction (MW)	Over/under performance (MW)	Performance	Re-test
AECO	110.7	110.6	160.2	49.6	145%	0.5%
AEP	1,424.6	1,424.4	1,625.7	201.3	114%	0%
APS	673.7	673.6	759.6	86.0	113%	4.7%
ATSI	487.4	486.9	883.6	396.7	181%	0%
BGE	655.0	655.0	2,261.6	1,606.7	345%	0.2%
COMED	1,161.5	1,159.8	1,397.9	238.1	121%	0.1%
DAY	172.2	172.2	215.6	43.4	125%	0%
DEOK	262.7	262.6	372.0	109.4	142%	0%
DOM	550.0	548.8	640.5	91.7	117%	3.3%
DPL	326.3	326.2	922.8	596.5	283%	0.8%
DUQ	133.7	133.5	167.2	33.7	125%	2.0%
EKPC	140.8	140.8	209.4	68.6	149%	0%
JCPL	120.4	120.4	145.1	24.7	120%	0.5%
METED	210.8	210.7	239.9	29.1	114%	0%
PECO	297.9	297.9	325.9	28.0	109%	2.3%
PENELEC	245.9	245.9	315.7	69.9	128%	0%
PEPCO	511.1	511.1	1,009.1	498.0	197%	1.2%
PPL	547.4	545.4	611.7	66.2	112%	0%
PSEG	313.7	313.3	456.8	143.5	146%	5.9%
RECO	3.6	3.6	3.2	-0.4	89%	0%
Total	8,349	8,342	12,723	4,380	153%	1.1%

Test Failure Charges for the 2016/17 Delivery Year are applied on an individual CSP/Zone basis for settlement purposes. The Test Failure Charges are reported on an aggregate basis here to preserve confidentiality. The weighted average Penalty Rate for Limited resources for the 2016/17 Delivery Year is \$161/MW-day (\$166 last year).

The annual penalties for under-compliance total about \$3.7M (\$6.3M last year) which will be allocated to RPM LSEs pro-rata based on their Daily Load Obligation Ratio. Therefore, the under-compliance penalties are about 0.79% of the total Load Management credits (\$466M) in RPM this year compared to 0.69% (\$900M of credits) last year. Table 6 below shows Penalties by Product for the 2016/2017 Delivery Year.

Table 6: Load Management Test Penalties by Product, DY2016/17

Product	Penalties \$	Shortfall (MW)	Average Weighted Penalty Rate (\$/MW-day)	Penalties as % of Total LM Credits (\$466M)
Limited	\$2,967,170	49	\$166	0.64%
Extended Summer	\$370,300	7.3	\$139	0.08%
Annual	\$241,412	4.8	\$137	0.05%
Capacity Performance	\$124,309	2.1	\$162	0.03%
Total	\$3,703,191	63	\$161	0.79%

Resources that are short on Committed MWs face the deficiency charges. Deficiency charges are applied based on the amount of days in the year the resource is deficient of Committed MWs. Participants can still make replacement transactions for future deficiencies which would change these values. Thus, data in the table below may change based on ongoing replacement transactions.

Table 7: Load Management Deficiency Charges by Product, DY2016/17

Zone	Average Weighted Deficiency Charge (\$/MW-day)	Total charge	Deficiency Charges as % of Total LM Credits (\$466M)
Annual	\$100	\$139,568	0.030%
Capacity Performance	\$161	\$23,091	0.005%
Extended Summer	\$91	\$13,658	0.003%
Limited	\$113	\$374,568	0.080%
Grand Total	\$122	\$550,885	0.118%