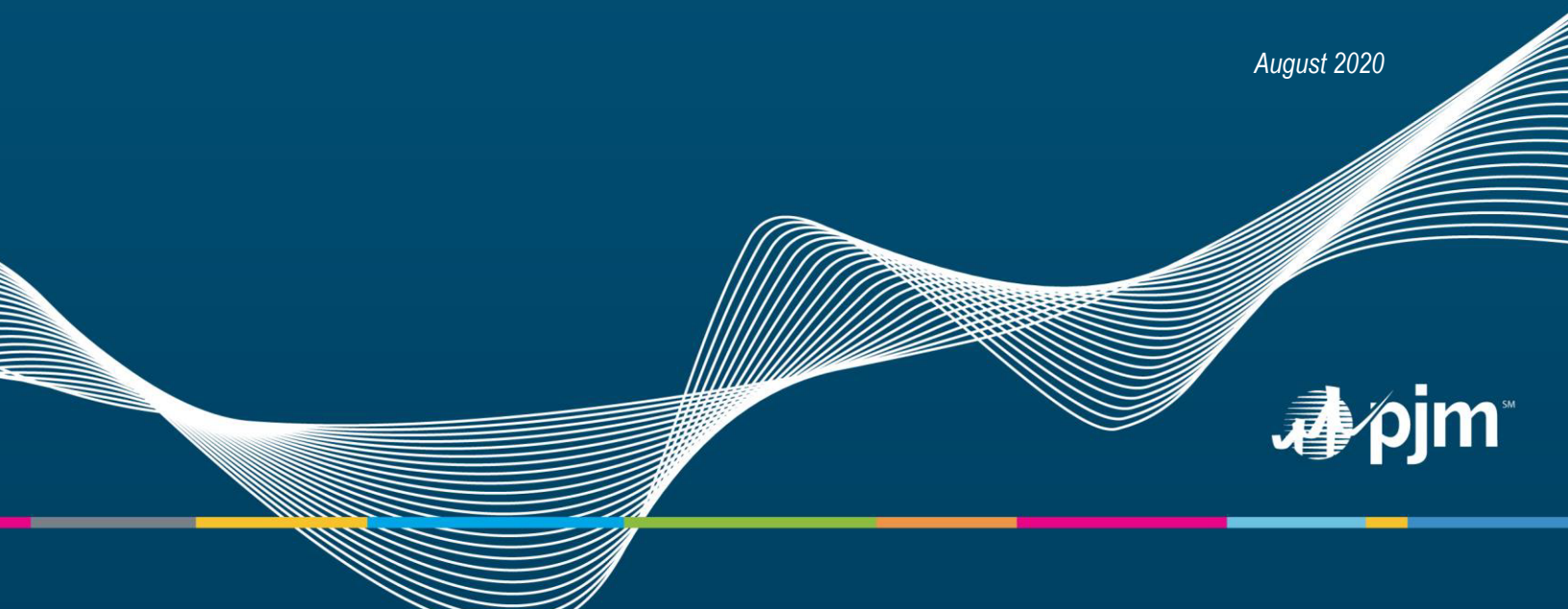


Load Management Performance Report 2019/2020

August 2020



PJM has made all efforts possible to accurately document all information in this report. However, PJM cannot warrant or guarantee that the information is complete or error free. The information seen here does not supersede the PJM Operating Agreement or the PJM Tariff both of which can be found by accessing: <http://www.pjm.com/documents/agreements/pjm-agreements.aspx>

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>Event Overview</i>	9
<i>Test Requirement Overview</i>	12
<i>Test Performance</i>	12

Executive Summary

Load Management Demand Resources (Emergency and Pre-emergency 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 two DR products available during the 2019/2020 Delivery Year – Base DR and Capacity Performance DR.

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 10 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. The last mandatory Load Management event was on 10/2/2019. Test performance was 150% for 19/20 Delivery Year. 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
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%
2017/18	No Events	163%
2018/19	No Events	146%
2019/20	78%	150%

Overview

PJM Interconnection, L.L.C. procures capacity for its system reliability through the Reliability Pricing Model (RPM). Members may also meet their reliability requirement through a Fixed Resource Requirement (“FRR”) plan. 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 two Load Management Products available during the 2019/20 Delivery Year¹: Base DR and Capacity Performance DR. The availability period for each of the products is included 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.

Table 2: DR product availability window.

DR Product	Max. interruptions	Max. event duration (hrs)	Availability period	Availability Hours (EPT)
Capacity Performance	Unlimited	12	June – October, May	10AM – 10PM
Base	Unlimited	10	November - April	6AM – 9PM
			June – September	10AM – 10PM

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. The customer must be able to reduce load to or below the pre-determined level which must be lower than the amount of capacity reserved 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.

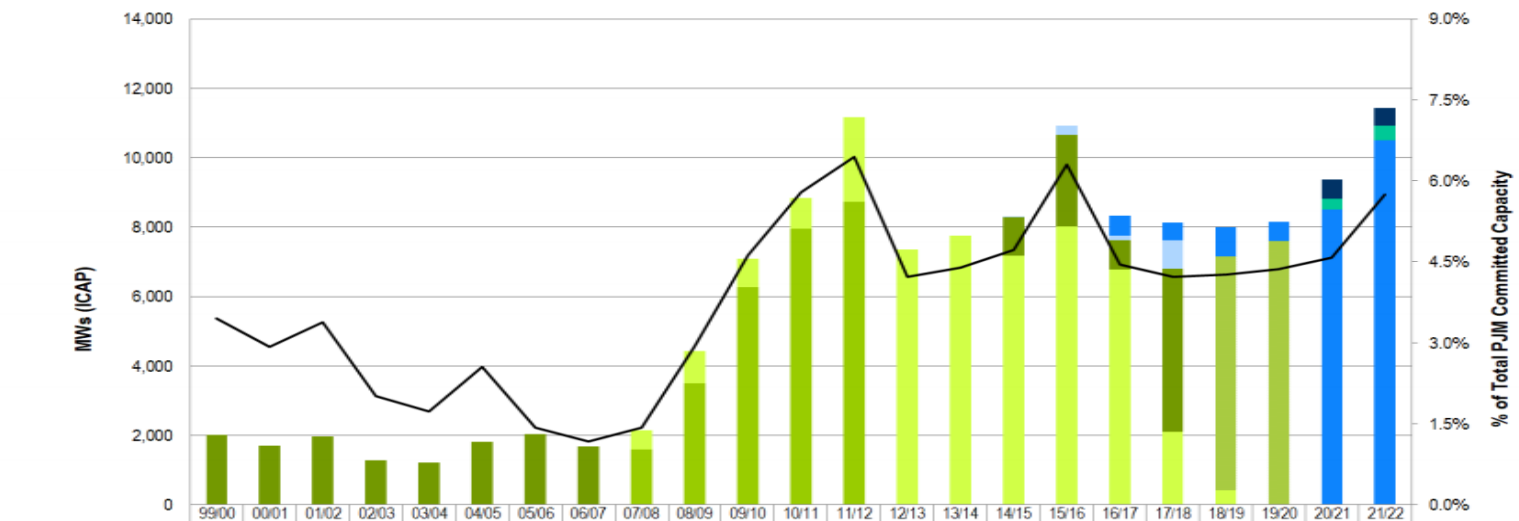
¹ The Delivery Year for the capacity construct corresponds to PJM’s Planning Year which runs each year from June 1 until May 31 of the following year.

Participation Summary

The capacity values 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 of the RPM commitment. PJM determines the UCAP value of different types of Resources based on methods described in the PJM manuals.

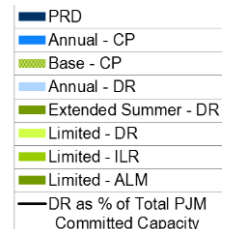
Figure 1 shows Load Management Commitments by Delivery Year from 1999/2000 through 2021/22 based on what cleared in the RPM auctions (BRA, IAs, and CP Transition Auctions) or as part of a LSEs FRR plan. Load Management participation in the PJM capacity market substantially increased from the 2007/08 Delivery Year through the 2011/12 Delivery Year, then declined, and has varied since. The final commitment values for the next two Delivery Years are uncertain since the values can still be adjusted in the Incremental Auctions and via replacement Capacity transactions. For the 2019/20 Delivery Year, Load Management capacity commitments represented 8,159MW of ICAP while total registered Load Management represented 9,615MW. Registered Load Management 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.

Figure 1: PJM Demand Response Committed MWs by Delivery Year



Notes:

- 1) Data represents net commitment value (for each product specified) on 12/2/2019.
- 2) RPM was implemented DY 07/08.
- 3) DY 20/21 MWs include results from Base, First, and Second Incremental Auction.
- 4) DY 21/22 MWs include results from Base and First Incremental Auction.
- 5) ALM MWs are seasonal averages for Delivery Years before 07/08.



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.

Table 3 shows the committed ICAP by Product Type for each PJM zone for the 2019/20 Delivery Year. Forty eight 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 2019/20 Delivery Year.

Zone	Base DR	Capacity Performance	Total
AECO	102.1	0	102.1
AEP	1,399.2	23.4	1422.6
APS	584.1	36.4	620.5
ATSI	622.3	206	828.3
BGE	181.3	6.1	187.4
COMED	1,491.6	1.3	1492.9
DAY	136.6	1.7	138.3
DEOK	121.0	21.1	142.1
DOM	660.8	0	660.8
DPL	327.2	14.9	342.1
DUQ	92.9	3.1	96
EKPC	0	122.8	122.8
JCPL	123.9	4.6	128.5
METED	176.5	0	176.5
PECO	296.7	3.1	299.8
PENELEC	233.5	12.9	246.4
PEPCO	388.7	51.7	440.4
PPL	456.8	32.2	489
PSEG	205.5	15	220.5
RECO	2.2	0	2.2
Total	7,602.9	556.3	8159.2

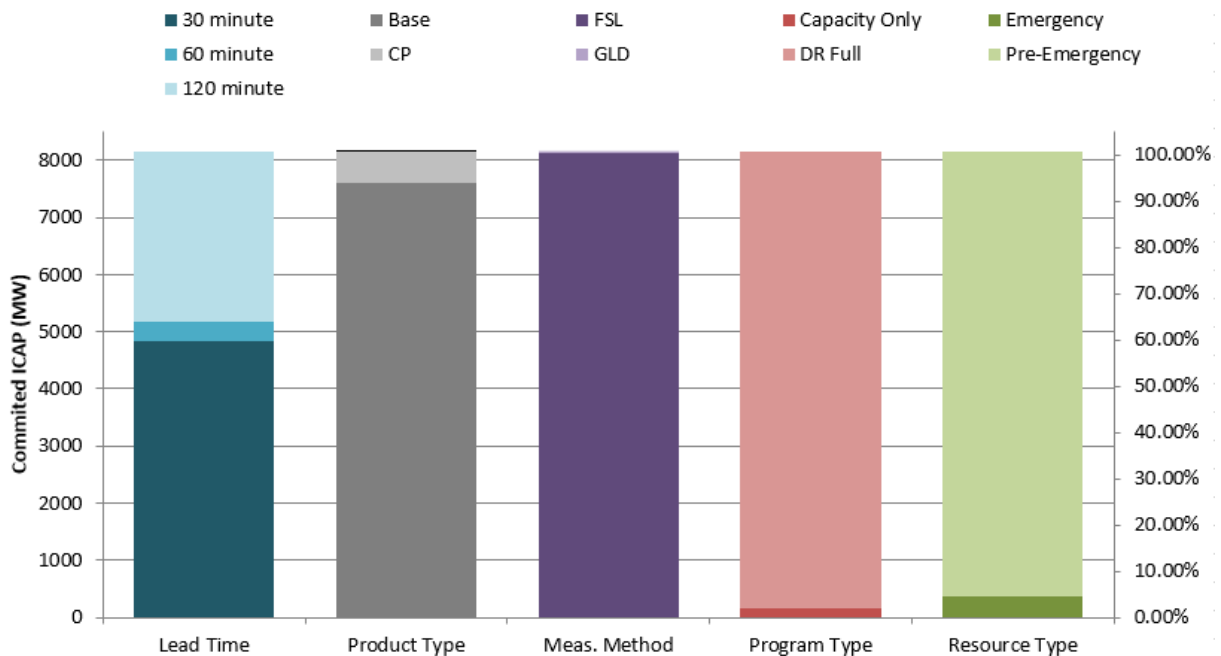
Load Management resources are registered by Lead Time, Product Type, Measurement Method, Program Type, and Resource Type. Figure 2 shows the breakdown of Committed ICAP for each item. 58% of resources were able to respond in 30 minutes, while 39% qualified for a 120 minute exception, and the remaining 3% qualified for a 60 minute exception.

The Product Type commitment level is determined by what is cleared in the RPM auctions or included in an FRR plan. 95% of committed ICAP is Base, and the remaining 5% is Capacity Performance (see Figure 2). The compliance measurement method is 99.7% Firm Service Level (FSL), and only 0.3% 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 are eligible to receive both capacity revenue and emergency energy revenue when there is Load Management event. Capacity Only receives capacity revenue but is not eligible for emergency energy payments during Load Management events. Capacity Only registrations are typically only used for 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 95% of committed ICAP fell into this category. The Emergency classification is for registrations that use behind the meter generation with environmental restrictions that only allow them to run during PJM emergency conditions. 5% of resources met this condition.

Figure 2: Committed ICAP for DR by Resource Type, Lead Time, Program Type, and Measurement Method for the 2019/20 Delivery Year.



Event Overview

Table 4 below summarizes capacity performance compliance and expected energy load reductions reported by CSPs prior to the event compared to actual energy load reduction that were settled. PJM dispatched Capacity Performance DR Long Lead resources October 2nd, 2019 during their mandatory compliance period and Base DR resources during their voluntary period. Resources in Dominion, PEPCO and BGE zones were dispatched from 14:00 through 15:45 and resources in AEP zone were dispatched from 14:00 through 16:00. Overall event performance during the mandatory compliance period was 78%. Capacity compliance is measured based on FSL and GLD approaches which can be significantly different from real time energy load reductions. Further, CSPs expected 728 MWs of real time energy load reductions but only 395 MWs (54%) were actually realized. PJM uses the expected energy reductions reported by CSPs as part of the dispatch decision making process when DR resources are required to maintain system reliability.

Table 4. Load Management Event Summary

Product	Capacity Committed (MW)**	Capacity Reduction (MW)	Capacity Performance	Expected Energy Reduction (MW)	Settled Energy Reduction (MW)***
Capacity Performance	25.4	19.9	78%	24.2	22
Base*	n/a	n/a	n/a	703.8	373
Total	25.4	19.9	78%	728	395

* Base DR was a voluntary event since resources were only required to reduce load through September. Base capacity load reductions are used to offset CP shortfall and any residual Base reductions are eligible for bonus payments.

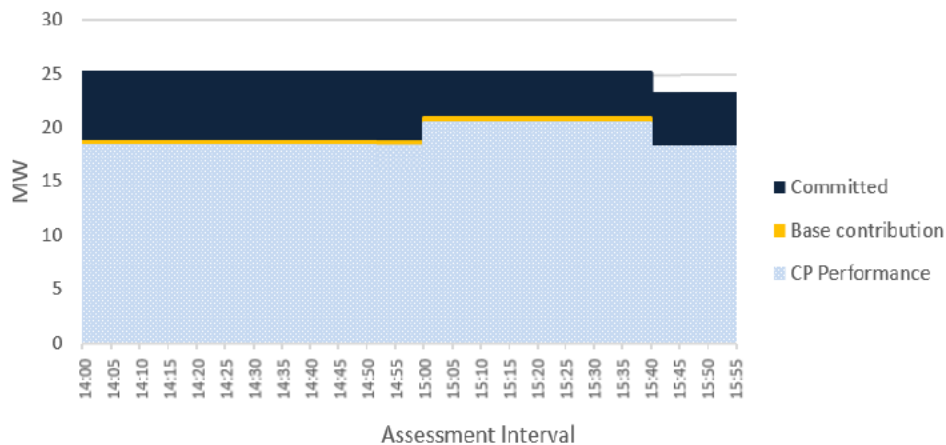
**Long lead time and Pre-Emergency resources only in the Event zones

***MW reduction in HE 15 (highest reduction hour)

Past event performance and information can be found in the Historical Load Management Events report

<https://pjm.com/-/media/planning/res-adeq/load-forecast/alm-history.ashx?la=en>

Figure 3. Load Management interval performance during the event



There were 4 zones involved in the intervals starting 14:00 through 15:45 (AEP, BGE, PEPCO, DOM) and 1 zone from 14.45 through 16.00 (AEP), therefore the commitment is lower in the latter time interval.

Table 5. Load Management Event Summary by zone

Zone	Capacity Committed (MW)	Capacity Reduction (MW)	Base to fulfill shortfall**	Compliance reduction	Capacity Performance	Expected Avg Energy Reduction (MW)	Settled Energy Reduction (MW)
AEP	23.3	17.4	0	17.4	75%	23.1	20
BGE	0.2	0.4	0	0.4	250%	0.2	0.4
DOM*	0	n/a	n/a	n/a	n/a	n/a	n/a
PEPCO	1.9	1.7	0.4	2.1	106%	0.9	1.5
Total	25.4	19.5	0.4	19.9	78%	24.2	21.9

* DOM had only Base available

**Base to fulfill shortfall represents average interval MW from Base resource for a given CSP to fulfill CP shortfall for the same CSP in each PAI hour.

BONUS AND PENALTIES PAYMENTS

Voluntary Base DR, Economic Energy Reductions and cleared Ancillary Services offers during the event intervals are eligible for Bonus payments. Total Bonus amount allocated to DR was \$447,666. Average performance was a 6MW shortfall which resulted into \$40,049 non-performance penalties.

Table 6. Event bonus and penalties

Product	Event penalties	Avg Shortfall (MW/Interval)*	Avg Penalty Rate (\$/MW)	Event bonus	Avg Bonus (MW/Interval)*	Weighted Avg bonus rate (\$/MW)
CP	\$40,049	5.9	\$284	\$344	0.5	\$36.5
Base	n/a	n/a	n/a	\$441,283	558.5	\$34.7
Economic Energy/Ancillary Services	n/a	n/a	n/a	\$6,039	1.1	\$36
Total	\$40,049	5.9	\$284	\$447,666	560	\$34.73

*Performance is assessed based on each 5 minute interval.

EMERGENCY ENERGY SETTLEMENTS

For Emergency DR events, Load Management DR Full type registrations are eligible to submit settlements for the energy reductions provided. The compensation is based on each registration's strike price, shutdown cost and the LMPs during the event. Table 7 shows the settlement values for Emergency DR (Load Management) Event by zone.

Table 7.

Zone	Reductions (MWh)	Credits	\$/MWh
AEP	732.6	\$806,039	\$1100
BGE	57.8	\$63,626	\$1100
DOM	164.4	\$180,866	\$1100
PEPCO	11.2	\$12,300	\$1100
Grand Total	966	\$1,062,830	\$1100

Test Requirement Overview

If a Load Management Registration is not dispatched 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 dispatched a mandatory event for those Registrations. If a PJM-initiated Load Management Event is dispatched 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 the Load Management events.

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 Base Product must be tested on a non-holiday weekday from June – September between 12PM and 8PM of that Delivery Year. The Capacity Performance Product must be tested on a non-holiday weekday in June – October or May of the DY from 10AM – 10PM. 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 no 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

Most DR resources committed for the Delivery Year were required to perform tests to assess their performance capability. Of the overall DR Load Management Resource commitment of 8,159 MW (ICAP) 186MW received a FERC waiver from testing due to COVID 19 and 25 MW demonstrated their level of compliance when called on for the October 2 PAI event . This reduced test committed MWs by 211 MW to 7,948 MW. The testing result was 3,977 MW of over-compliance or a performance level of 150% across all zones. Table 7 shows the results, to date, by product type. The zonal level results for Base DR are in Table 8. The net result for each zone is over-compliance. However, there were some individual CSPs whose tests resulted in under compliance.

Table 7. Load Management commitments, compliance, and test performance (ICAP) by product, DY2019/20

Product	Test commitment (MW)*	Reduction (MW)	Over/under performance (MW)	Performance	Re-test
Base	7,602.6	11,445	3,842	151%	0.8%
Capacity Performance	344.7	479.8	135	139%	0
Total	7,947.3	11,925	3,977	150%	0.77%

Table 8. Load Management commitments, compliance, and test performance (ICAP by Zone, DY2019/20)

Zone	Committed ICAP (MW)	Test commitment (MW)*	Reduction (MW)	Over/under performance (MW)	Performance	Re-test
AECO	102.1	102.1	152.2	50.1	149%	0.00%
AEP	1422.6	1399.3	1752.6	353.3	125%	1.80%
APS	620.5	620.5	680.7	60.2	110%	1.51%
ATSI	828.3	642.2	733.8	91.6	114%	0.68%
BGE	187.4	187.2	1341.6	1154.4	717%	0.00%
COMED	1492.9	1492.9	1688.8	195.9	113%	0.10%
DAY	138.3	138.3	183.7	45.4	133%	0.00%
DEOK	142.1	142.1	264.6	122.5	186%	1.70%
DOM	660.8	660.8	857.2	196.4	130%	0.00%
DPL	342.1	342.1	987.7	645.6	289%	0.48%
DUQ	96.0	96.0	127.9	31.9	133%	0.00%
EKPC	122.8	122.8	135.9	13.1	111%	0.00%
JCPL	128.5	128.5	151.8	23.4	118%	2.51%
METED	176.5	176.5	203.4	26.9	115%	0.00%
PECO	299.8	299.8	325.0	25.2	108%	2.67%
PENELEC	246.4	246.4	272.5	26.1	111%	0.76%
PEPCO	440.4	438.5	1280.5	842.0	292%	0.00%
PPL	489.0	489.0	521.8	32.8	107%	0.47%
PSEG	220.5	220.1	260.5	40.0	118%	1.58%
RECO	2.2	2.2	2.4	0.2	109%	0.00%
Total	8159.2	7947.3	11924.7	3977.2	150%	0.77%

* Test commitment = Commitment ICAP – Daily Deficiency MW – exempt MW – PAI MW

Test Failure Charges for the 2019/20 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 the 2019/20 Delivery Year is \$155/MW-day. The annual penalties for under-compliance total about \$1.7M which will be allocated to RPM LSEs pro-rata based on their Daily Load Obligation Ratio. Therefore, the under-compliance penalties at the time of this report are about 0.45% of the total expected annual RPM Load Management credits (\$376M) this year. Table 6 below shows Penalties by Product for the 2019/2020 Delivery Year thus far.

Table 9. Load Management Test Penalties by Product, DY2019/20

Product	Penalties \$	Shortfall (MW)	Average Weighted Penalty Rate (\$/MW-day)	Penalties as % of Total LM Credits (\$376M)
Base	\$ 1,712,155	27.7	\$155	0.45%
Capacity Performance	0	0	0	0
Total	\$ 1,712,155	27.7	\$155	0.45%

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 make replacement transactions for future deficiencies which would change these values. For 19/20 Delivery Year there were two deficiencies totaling \$22.6K.

Table 10. Load Management Deficiency Charges by Product, DY2019/20

Product	Average Weighted Deficiency Charge (\$/MW-day)	Total charges through 1/30 (\$)
Base	\$198	\$22,639
Capacity Performance	0	0
Grand Total	\$198	\$22,639