



Monitoring
Analytics

2020 PJM Generation Capacity and Funding Sources: 2007/2008 through 2021/2022 Delivery Years

The Independent Market Monitor for PJM
September 15, 2020

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Introduction

This report, prepared by the Independent Market Monitor for PJM (IMM or MMU), presents an analysis of generation capacity under the Reliability Pricing Model (RPM) Capacity Market, from its inception in the 2007/2008 Delivery Year through the 2021/2022 Delivery Year.^{1 2 3 4} The data used in this report are through August 12, 2020. For historical delivery years (DYs) (2007/2008 through 2019/2020), generation capacity additions are defined as capacity that came into service in the specified DY, including new generation capacity resources, reactivations of previously deactivated generation capacity resources, and uprates to existing generation capacity resources. For the current and future DYs (2020/2021 through 2021/2022), generation capacity additions are defined as capacity that cleared in at least one RPM auction in the 2020/2021 through 2021/2022 Delivery Years.

Summary

In summary, of the 41,979.4 MW of generation capacity additions from new resources, reactivations, and uprates to existing generation capacity resources for the 2007/2008 through 2019/2020 Delivery Years, 32,333.9 MW (77.0 percent) were based on market funding and 9,645.5 MW (23.0 percent) were based on nonmarket funding.

In summary, of the 2,703.7 MW of proposed generation capacity additions that have cleared in at least one RPM auction for the 2020/2021 through 2021/2022 Delivery Years, 419.3 MW are already in service and 2,284.4 MW are not yet in service. Of the 2,703.7 MW of proposed generation capacity additions, 2,579.0 MW (95.4 percent) are based on market funding, and 124.7 MW (4.6 percent) are based on nonmarket funding. Applying historical completion rates to the MW not yet in service, 2,089.0 MW of generation capacity additions are expected to be in service through 2021/2022 (419.3 MW in service plus 1,669.7 MW of the 2,284.4 MW not yet in service). Of the 2,284.4 MW of expected capacity additions that cleared at least one RPM auction and are not yet in service,

¹ Delivery years are from June 1 through May 31.

² The capacity changes in this report are calculated based on June 1 through May 31. The capacity changes in the *New Generation in the PJM Capacity Market: MW and Funding Sources for Delivery Years 2007/2008 through 2020/2021* report were calculated based on June 2 through June 1.

³ This report includes all RPM auctions held prior to September 14, 2020.

⁴ FERC granted PJM's request for waiver of its Open Access Transmission Tariff to delay the 2022/2023 RPM Base Residual Auction from May 2019 to August 2019. See 164 FERC ¶ 61,153 (2018). FERC subsequently denied PJM's motion seeking clarification of the June 29, 2018, Order (163 FERC ¶ 61,236) and directed PJM not to run the 2022/2023 BRA in August 2019. See 168 FERC ¶ 61,051 (2019).

2,227.5 MW (97.5 percent) are based on market funding and 56.9 MW (2.5 percent) are based on nonmarket funding.

Generation Capacity Changes

Historical Generation Capacity Changes: 2007/2008 through 2019/2020

Table 1 shows a summary of internal PJM generation capacity additions (new resources, reactivations, and uprates) for each DY since the implementation of RPM in the 2007/2008 Delivery Year through the 2019/2020 Delivery Year. The average annual addition to generation capacity was 3,229.2 MW, the maximum addition to generation capacity for a DY was 8,462.4 MW in the 2018/2019 Delivery Year, and the minimum addition to generation capacity for a DY was 506.0 MW in the 2010/2011 Delivery Year.

Table 1 Internal PJM generation capacity additions: 2007/2008 through 2019/2020

	ICAP (MW)			Total Additions
	New	Reactivations	Uprates	
2007/2008	45.0	0.0	691.5	736.5
2008/2009	815.4	238.3	987.0	2,040.7
2009/2010	406.5	0.0	789.0	1,195.5
2010/2011	153.4	13.0	339.6	506.0
2011/2012	3,096.4	354.5	507.9	3,958.8
2012/2013	1,784.6	34.0	528.1	2,346.7
2013/2014	198.4	58.0	372.8	629.2
2014/2015	2,276.8	20.7	530.2	2,827.7
2015/2016	4,291.8	90.0	449.0	4,830.8
2016/2017	3,679.3	532.0	419.2	4,630.5
2017/2018	4,127.3	5.0	562.1	4,694.4
2018/2019	8,127.5	4.0	330.9	8,462.4
2019/2020	4,612.0	13.3	494.9	5,120.2
Total	33,614.4	1,362.8	7,002.2	41,979.4

Table 2 shows a summary of internal PJM generation capacity additions by unit type since the implementation of RPM in the 2007/2008 Delivery Year through the 2019/2020 Delivery Year. Of the 41,979.4 MW of generation capacity added, 34,335.1 MW (81.8 percent) were natural gas. Of the 33,614.4 MW of new generation capacity resources added, 29,397.0 MW (87.5 percent) were natural gas.

Table 2 Internal PJM generation capacity additions by unit type: 2007/2008 through 2019/2020

	ICAP (MW)			Total Additions
	New	Reactivations	Upgrades	
Battery	0.0	0.0	0.0	0.0
CC	26,649.2	130.0	2,443.6	29,222.8
CT - Natural Gas	2,619.6	249.5	1,128.3	3,997.4
CT - Oil	108.0	0.0	98.1	206.1
CT - Other	18.6	6.3	0.0	24.9
Fuel Cell	8.8	0.0	21.2	30.0
Hydro - Pumped Storage	0.0	0.0	272.0	272.0
Hydro - Run of River	296.3	4.0	112.5	412.8
Nuclear	0.0	0.0	1,394.2	1,394.2
RICE - Natural Gas	119.4	0.0	4.8	124.2
RICE - Oil	9.0	20.7	1.1	30.8
RICE - Other	201.2	4.0	37.2	242.4
Solar	738.1	0.0	77.6	815.7
Steam - Coal	1,356.3	0.0	768.6	2,124.9
Steam - Natural Gas	0.0	743.0	217.7	960.7
Steam - Oil	0.0	96.0	169.0	265.0
Steam - Other	154.0	96.0	28.9	278.9
Wind	1,335.9	13.3	227.4	1,576.6
Total	33,614.4	1,362.8	7,002.2	41,979.4

Table 3 shows a summary of internal PJM generation capacity additions by unit type for the last five years, the 2015/2016 Delivery Year through the 2019/2020 Delivery Year. Of the 27,738.3 MW of generation capacity added in the last five delivery years, 25,767.0 MW (92.9 percent) were natural gas. Of the 24,837.9 MW of new generation capacity resources added in the last five delivery years, 23,577.3 MW (94.9 percent) were natural gas.

Table 3 Internal PJM generation capacity additions by unit type: 2015/2016 through 2019/2020

	ICAP (MW)			Total Additions
	New	Reactivations	Upgrades	
Battery	0.0	0.0	0.0	0.0
CC	22,624.2	5.0	1,229.2	23,858.4
CT - Natural Gas	833.7	90.0	253.7	1,177.4
CT - Oil	0.0	0.0	9.9	9.9
CT - Other	3.7	0.0	0.0	3.7
Fuel Cell	0.0	0.0	0.0	0.0
Hydro - Pumped Storage	0.0	0.0	17.5	17.5
Hydro - Run of River	155.2	4.0	25.0	184.2
Nuclear	0.0	0.0	286.0	286.0
RICE - Natural Gas	119.4	0.0	4.8	124.2
RICE - Oil	0.0	0.0	0.3	0.3
RICE - Other	35.8	0.0	22.5	58.3
Solar	646.2	0.0	71.3	717.5
Steam - Coal	0.0	0.0	110.9	110.9
Steam - Natural Gas	0.0	532.0	75.0	607.0
Steam - Oil	0.0	0.0	0.0	0.0
Steam - Other	45.0	0.0	12.3	57.3
Wind	374.7	13.3	137.7	525.7
Total	24,837.9	644.3	2,256.1	27,738.3

Table 4 shows a summary of decreases in internal PJM generation capacity for each DY since the implementation of RPM in the 2007/2008 Delivery Year through the 2019/2020 delivery year. The average annual loss in generation capacity was 3,295.8 MW, the maximum loss in generation capacity for a DY was 8,554.0 MW in the 2015/2016 Delivery Year, and the minimum loss in generation capacity for a DY was 572.7 MW in the 2009/2010 Delivery Year.

Table 4 Internal PJM generation capacity decreases: 2007/2008 through 2019/2020

	ICAP (MW)		
	Deactivations	Derates	Total Losses
2007/2008	380.0	417.0	797.0
2008/2009	609.5	421.0	1,030.5
2009/2010	108.4	464.3	572.7
2010/2011	840.6	223.5	1,064.1
2011/2012	2,542.0	176.2	2,718.2
2012/2013	5,536.0	317.8	5,853.8
2013/2014	2,786.9	288.3	3,075.2
2014/2015	4,915.6	360.3	5,275.9
2015/2016	8,338.2	215.8	8,554.0
2016/2017	659.4	206.7	866.1
2017/2018	2,657.4	148.5	2,805.9
2018/2019	6,730.0	89.2	6,819.2
2019/2020	3,296.0	116.8	3,412.8
Total	39,400.0	3,445.4	42,845.4

Table 5 shows a summary of decreases in internal PJM generation capacity by unit type since the implementation of RPM in the 2007/2008 Delivery Year through the 2019/2020 Delivery Year. Of the 42,845.4 MW decrease, 29,188.3 MW (68.1 percent) were coal steam units.

Table 5 Internal PJM generation capacity decreases by unit type: 2007/2008 through 2019/2020

	ICAP (MW)		
	Deactivations	Derates	Total Losses
Battery	0.0	0.0	0.0
CC	876.2	933.1	1,809.3
CT - Natural Gas	2,064.1	442.0	2,506.1
CT - Oil	2,004.5	223.0	2,227.5
CT - Other	17.3	2.5	19.8
Fuel Cell	0.0	3.6	3.6
Hydro - Pumped Storage	0.0	31.3	31.3
Hydro - Run of River	10.5	47.0	57.5
Nuclear	1,410.5	358.4	1,768.9
RICE - Natural Gas	0.0	0.0	0.0
RICE - Oil	77.6	6.1	83.7
RICE - Other	25.5	49.8	75.3
Solar	0.0	24.7	24.7
Steam - Coal	28,446.9	741.4	29,188.3
Steam - Natural Gas	2,484.0	65.6	2,549.6
Steam - Oil	1,724.0	111.6	1,835.6
Steam - Other	253.0	70.4	323.4
Wind	5.9	334.9	340.8
Total	39,400.0	3,445.4	42,845.4

Table 6 shows a summary of the net changes in internal PJM generation capacity since the implementation of RPM in the 2007/2008 Delivery Year through the 2019/2020 Delivery Year. In each of the last four delivery years (2016/2017 through 2019/2020), there was a net increase in internal PJM generation capacity. But while new generation capacity was added, it was more than offset by deactivations and derates, for a net decrease of 866.0 MW over the entire 13 year period since the implementation of RPM. This net decrease in generation capacity was more than offset in the PJM Capacity Market by the addition of demand resources (DR) and energy efficiency (EE) resources. While DR and EE are not comparable to generation resources, PJM rules treated DR and EE as substitutes for generation capacity subject to limits in some delivery years. For example, on June 1, 2019, there were 11,042.8 unforced capacity (UCAP) MW of DR and EE Resources committed as RPM capacity.⁵

⁵ The IMM reports DR and EE RPM commitments in the State of the Market Reports. For example, see Table 5-11 in the *2020 Quarterly State of the Market Report for PJM: January through June*, Section 5: Capacity Market.

Table 6 Net changes in internal PJM generation capacity: 2007/2008 through 2019/2020

	ICAP (MW)		Net Change
	Additions	Losses	
2007/2008	736.5	797.0	(60.5)
2008/2009	2,040.7	1,030.5	1,010.2
2009/2010	1,195.5	572.7	622.8
2010/2011	506.0	1,064.1	(558.1)
2011/2012	3,958.8	2,718.2	1,240.6
2012/2013	2,346.7	5,853.8	(3,507.1)
2013/2014	629.2	3,075.2	(2,446.0)
2014/2015	2,827.7	5,275.9	(2,448.2)
2015/2016	4,830.8	8,554.0	(3,723.2)
2016/2017	4,630.5	866.1	3,764.4
2017/2018	4,694.4	2,805.9	1,888.5
2018/2019	8,462.4	6,819.2	1,643.2
2019/2020	5,120.2	3,412.8	1,707.4
Total	41,979.4	42,845.4	(866.0)

Table 7 shows a summary of the net changes in internal PJM capacity by unit type since the implementation of RPM in the 2007/2008 Delivery Year through the 2019/2020 Delivery Year.

Table 7 Net changes in internal PJM generation capacity by unit type: 2007/2008 through 2019/2020

	ICAP (MW)		Net Change
	Additions	Losses	
Battery	0.0	0.0	0.0
CC	29,222.8	1,809.3	27,413.5
CT - Natural Gas	3,997.4	2,506.1	1,491.3
CT - Oil	206.1	2,227.5	(2,021.4)
CT - Other	24.9	19.8	5.1
Fuel Cell	30.0	3.6	26.4
Hydro - Pumped Storage	272.0	31.3	240.7
Hydro - Run of River	412.8	57.5	355.3
Nuclear	1,394.2	1,768.9	(374.7)
RICE - Natural Gas	124.2	0.0	124.2
RICE - Oil	30.8	83.7	(52.9)
RICE - Other	242.4	75.3	167.1
Solar	815.7	24.7	791.0
Steam - Coal	2,124.9	29,188.3	(27,063.4)
Steam - Natural Gas	960.7	2,549.6	(1,588.9)
Steam - Oil	265.0	1,835.6	(1,570.6)
Steam - Other	278.9	323.4	(44.5)
Wind	1,576.6	340.8	1,235.8
Total	41,979.4	42,845.4	(866.0)

Table 8 shows changes in PJM generation capacity including capacity imports and exports and the integration of new zones into PJM. When imports and exports and the integration of new zones are included, PJM generation capacity increased by 21,993.1 MW since the implementation of RPM in the 2007/2008 Delivery Year through the 2019/2020 Delivery Year. A significant portion of the increase occurred in the 2011/2012 Delivery Year as a result of the ATSI Zone and DEOK Zone integrations into PJM.⁶

⁶ In June 2011, PJM integrated the American Transmission Systems, Inc. (ATSI) Control Zone. In January 2012, PJM integrated the Duke Energy Ohio/Kentucky (DEOK) Control Zone. In June 2013, PJM integrated the Eastern Kentucky Power Cooperative (EKPC). In December 2018, PJM integrated the Ohio Valley Electric Corporation (OVEC). By convention, control zones bear the name of a large utility service provider working within their boundaries. The nomenclature applies to the geographic area, not to any single company. For additional information on the integrations, their timing and their impact on the footprint of the PJM service territory prior to 2019, see *2018 State of the Market Report for PJM*, Volume 2, Appendix A: PJM Geography.

Table 8 PJM generation capacity changes: 2007/2008 through 2019/2020⁷

	ICAP (MW)						Net Change
	Additions	Losses	Integration	Net Change in Capacity Imports	Net Change in Capacity Exports		
2007/2008	736.5	797.0	0.0	70.0	15.3	(5.8)	
2008/2009	2,040.7	1,030.5	0.0	473.0	(9.9)	1,493.1	
2009/2010	1,195.5	572.7	0.0	229.0	(1,402.2)	2,254.0	
2010/2011	506.0	1,064.1	0.0	137.0	367.7	(788.8)	
2011/2012	3,958.8	2,718.2	16,889.5	(1,183.3)	(1,690.3)	18,637.1	
2012/2013	2,346.7	5,853.8	47.0	342.4	84.0	(3,201.7)	
2013/2014	629.2	3,075.2	2,746.0	934.3	28.9	1,205.4	
2014/2015	2,827.7	5,275.9	0.0	2,335.7	177.3	(289.8)	
2015/2016	4,830.8	8,554.0	0.0	511.4	(117.8)	(3,094.0)	
2016/2017	4,630.5	866.1	0.0	575.6	722.9	3,617.1	
2017/2018	4,694.4	2,805.9	0.0	(1,025.1)	(695.1)	1,558.5	
2018/2019	8,462.4	6,819.2	2,120.0	(3,217.0)	212.7	333.5	
2019/2020	5,120.2	3,412.8	165.0	(1,196.6)	401.3	274.5	
Total	41,979.4	42,845.4	21,967.5	(1,013.6)	(1,905.2)	21,993.1	

Table 9 shows changes in PJM generation capacity by unit type including capacity imports and exports and the integration of new zones into PJM. The maximum net increase in generation capacity for a unit type was 26,525.4 MW for combined cycles, and the maximum net decrease in generation capacity for a unit type was 10,477.3 MW for coal steam units.

⁷ The calculated export MW for 2012/2013 were revised from the *New Generation in the PJM Capacity Market: MW and Funding Sources for Delivery Years 2007/2008 through 2021/2022* report.

Table 9 PJM generation capacity changes by unit type: 2007/2008 through 2019/2020

	ICAP (MW)					
	Additions	Losses	Integration	Net Change in Capacity Imports	Net Change in Capacity Exports	Net Change
Battery	0.0	0.0	0.0	0.0	0.0	0.0
CC	29,222.8	1,809.3	0.0	0.0	888.1	26,525.4
CT - Natural Gas	3,997.4	2,506.1	2,920.0	345.0	(117.0)	4,873.3
CT - Oil	206.1	2,227.5	472.0	0.0	(5.7)	(1,543.7)
CT - Other	24.9	19.8	0.0	0.0	0.0	5.1
Fuel Cell	30.0	3.6	0.0	0.0	0.0	26.4
Hydro - Pumped Storage	272.0	31.3	0.0	0.0	(435.0)	675.7
Hydro - Run of River	412.8	57.5	136.0	503.0	95.0	899.3
Nuclear	1,394.2	1,768.9	2,134.0	100.0	454.7	1,404.6
RICE - Natural Gas	124.2	0.0	0.0	0.0	0.0	124.2
RICE - Oil	30.8	83.7	24.8	0.0	(3.9)	(24.2)
RICE - Other	242.4	75.3	22.8	0.0	0.0	189.9
Solar	815.7	24.7	0.0	0.0	0.0	791.0
Steam - Coal	2,124.9	29,188.3	15,932.9	(1,914.6)	(2,567.8)	(10,477.3)
Steam - Natural Gas	960.7	2,549.6	325.0	0.0	0.0	(1,263.9)
Steam - Oil	265.0	1,835.6	0.0	0.0	(220.0)	(1,350.6)
Steam - Other	278.9	323.4	0.0	(47.0)	0.0	(91.5)
Wind	1,576.6	340.8	0.0	0.0	6.4	1,229.4
Total	41,979.4	42,845.4	21,967.5	(1,013.6)	(1,905.2)	21,993.1

The changes in generation capacity reported here are based on capacity that is in service, including approved capacity modifications and uprates. The IMM also reports on changes to in service capacity in the State of the Market Reports.⁸ Additions to in service capacity do not include proposed generation capacity.

PJM reports generation capacity additions in its Base Residual Auction (BRA) reports based on a different metric.⁹ The generation capacity additions reported by PJM are based on BRA over BRA changes and do not account for in service status.¹⁰ Prior to the 2016/2017 BRA, the generation capacity additions reported by PJM included new capacity modifications regardless of whether the capacity was offered, and for the 2016/2017 and subsequent BRAs, the generation capacity additions reported by PJM include only new capacity modifications that were offered. PJM does not update the reported values to account for whether the capacity is in service.

⁸ See Table 5-6 in the *2020 Quarterly State of the Market Report for PJM: January through June*, Section 5: Capacity Market.

⁹ For example, see PJM’s “2021/2022 Base Residual Auction Report,” <<https://www.pjm.com/-/media/markets-ops/rpm/rpm-auction-info/2021-2022/2021-2022-base-residual-auction-report.ashx?la=en>> (May 23, 2018), pp. 21-25.

¹⁰ The IMM also reports on BRA over BRA changes in the IMM RPM Base Residual Auction reports.

Table 10 compares the PJM and IMM reported generation capacity additions through 2019/2020. The IMM reported generation capacity additions are 4,179.5 MW lower than the PJM reported total for the same time period. The difference is a result of the fact that the IMM reports in service capacity while PJM reports offered capacity.

Table 10 Comparison between IMM and PJM reported generation capacity additions: 2007/2008 through 2019/2020

	IMM				ICAP (MW) PJM				Difference			
	New	Reactivations	Uprates	Total	New	Reactivations	Uprates	Total	New	Reactivations	Uprates	Total
2007/2008	45.0	0.0	691.5	736.5	19.0	47.0	536.0	602.0	26.0	(47.0)	155.5	134.5
2008/2009	815.4	238.3	987.0	2,040.7	93.1	131.0	500.1	724.2	722.3	107.3	486.9	1,316.5
2009/2010	406.5	0.0	789.0	1,195.5	476.3	0.0	796.0	1,272.3	(69.8)	0.0	(7.0)	(76.8)
2010/2011	153.4	13.0	339.6	506.0	1,027.7	170.7	577.8	1,776.2	(874.3)	(157.7)	(238.2)	(1,270.2)
2011/2012	3,096.4	354.5	507.9	3,958.8	2,332.5	181.0	1,062.8	3,576.3	763.9	173.5	(554.9)	382.5
2012/2013	1,784.6	34.0	528.1	2,346.7	1,108.0	0.0	785.5	1,893.5	676.6	34.0	(257.4)	453.2
2013/2014	198.4	58.0	372.8	629.2	1,320.2	0.0	417.3	1,737.5	(1,121.8)	58.0	(44.5)	(1,108.3)
2014/2015	2,276.8	20.7	530.2	2,827.7	1,100.6	9.0	473.2	1,582.8	1,176.2	11.7	57.0	1,244.9
2015/2016	4,291.8	90.0	449.0	4,830.8	7,658.9	0.0	548.1	8,207.0	(3,367.1)	90.0	(99.1)	(3,376.2)
2016/2017	3,679.3	532.0	419.2	4,630.5	5,314.3	21.0	1,470.7	6,806.0	(1,635.0)	511.0	(1,051.5)	(2,175.5)
2017/2018	4,127.3	5.0	562.1	4,694.4	5,388.8	991.0	473.7	6,853.5	(1,261.5)	(986.0)	88.4	(2,159.1)
2018/2019	8,127.5	4.0	330.9	8,462.4	3,624.6	0.0	712.8	4,337.4	4,502.9	4.0	(381.9)	4,125.0
2019/2020	4,612.0	13.3	494.9	5,120.2	6,567.2	0.0	223.0	6,790.2	(1,955.2)	13.3	271.9	(1,670.0)
Total	33,614.4	1,362.8	7,002.2	41,979.4	36,031.2	1,550.7	8,577.0	46,158.9	(2,416.8)	(187.9)	(1,574.8)	(4,179.5)

Future Generation Capacity Changes

Table 11 shows proposed generation capacity additions (new resources, reactivations, and uprates) that cleared in at least one RPM auction for the 2020/2021 through 2021/2022 Delivery Years.

Table 11 Proposed PJM generation capacity additions: 2020/2021 through 2021/2022

	ICAP (MW)
2020/2021	615.9
2021/2022	2,087.8
Total	2,703.7

Table 12 shows proposed generation capacity additions (new resources, reactivations, and uprates) that cleared in at least one RPM auction for the 2020/2021 through 2021/2022 Delivery Years by unit type. Of the 2,703.7 MW of proposed generation capacity that cleared in at least one RPM auction for the 2020/2021 through 2021/2022 Delivery Years, 2,175.3 MW (80.5 percent) were natural gas, including 2,136.7 MW (79.0 percent) of combined cycle units, 388.1 MW (14.4 percent) were solar resources, and 91.8 MW (3.4 percent) were wind resources.

Table 12 Proposed PJM generation capacity additions by unit type: 2020/2021 through 2021/2022¹¹

	ICAP (MW)
CC	2,136.7
CT	58.1
Solar	388.1
Wind	91.8
Other	29.0
Total	2,703.7

Interconnection Queue Analysis

For every generation project in the interconnection queue, there are three required studies in the planning stage: the Feasibility Study is the first study; the System Impact Study (SIS) is the second study; and the Facilities Study Agreement (FSA) is the third study. Together, these studies determine the feasibility, impact, and cost of interconnecting generation projects. To proceed to the construction stage and move to a status of under construction, all three studies must be completed and a project developer must have signed an Interconnection Service Agreement (ISA) and, when necessary, a Construction Service Agreement (CSA).¹² The ISA defines developer obligations regarding cost responsibility for required transmission system upgrades. The ISA also confers the rights associated with capacity or energy generator resource status and specifies any operational restrictions or other limitations on which those rights depend. PJM may also include other schedule dates for milestone events such as permitting, regulatory certifications or third-party financial arrangements.¹³ The ISA is filed with the Commission. When transmission upgrades are required for completion of a generation project, a CSA is required. The terms and conditions of a CSA govern the construction of all transmission facilities for interconnection to the PJM transmission system. PJM and the developer execute a separate CSA with each impacted transmission owner. CSAs are also filed with the Commission.

Effective with the BRA for the 2019/2020 Delivery Year, PJM rules require that a Facilities Study Agreement (FSA) be executed for proposed generation resources greater

¹¹ The unit types have been combined in order to comply with PJM confidentiality rules. See “PJM Manual 33: Administrative Services for the PJM Interconnection Operating Agreement,” § 6.1 Market Data Postings, Rev. 16 (June 1, 2020).

¹² OATT Subpart G § 110.2 states “In some cases, where no network impacts are identified and there are no other projects in the vicinity of the small resource addition, the System Impact Study may not be required and the project will proceed directly to the Facilities Study.”

¹³ “PJM Manual 14A: New Services Request Process,” § 5.4 Interconnection Service Agreement (ISA), Rev. 26 (April 1, 2020).

than 20 MW in order to be offered in a BRA.¹⁴ Prior to the 2019/2020 Delivery Year, PJM rules only required that a System Impact Study (SIS) be executed in order to be offered in a BRA.

Table 13 shows proposed generation capacity additions (new resources, reactivations, and uprates) that cleared in at least one RPM auction for the 2020/2021 through 2021/2022 Delivery Years by current interconnection queue status.¹⁵

As shown in Table 13, of the 2,703.7 MW of proposed generation capacity additions that cleared in at least one RPM auction for the 2020/2021 through 2021/2022 Delivery Years, 419.3 MW are already in service.

Table 13 Proposed PJM generation capacity additions by interconnection queue status: 2020/2021 through 2021/2022, as of August 12, 2020

Status	2020/2021		2021/2022		Total		
	Cleared		Cleared		Cleared		
	MW (ICAP)	Percent	MW (ICAP)	Percent	MW (ICAP)	Percent	
Not yet in service							
Completed SIS	New/Reactivations	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Uprates	0.0	0.0%	0.0	0.0%	0.0	0.0%
Completed FSA	New/Reactivations	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Uprates	0.0	0.0%	0.0	0.0%	0.0	0.0%
Executed CSA	New/Reactivations	196.8	32.0%	1,921.4	92.0%	2,118.2	78.3%
	Uprates	71.3	11.6%	94.9	4.5%	166.2	6.1%
Total not in service		268.1	43.5%	2,016.3	96.6%	2,284.4	84.5%
In service							
	New/Reactivations	45.6	7.4%	19.5	0.9%	65.1	2.4%
	Uprates	302.2	49.1%	52.0	2.5%	354.2	13.1%
Total in service		347.8	56.5%	71.5	3.4%	419.3	15.5%
Total Cleared		615.9	100.0%	2,087.8	100.0%	2,703.7	100.0%

In addition to proposed generation capacity resources, reactivations, and uprates, planned deactivations will also affect the PJM generation capacity level through the 2021/2022 Delivery Year.

Table 14 shows the expected change in PJM generation capacity, accounting for proposed generation capacity additions that cleared in at least one RPM auction and

¹⁴ “PJM Manual 18: PJM Capacity Market,” § 4.2.3 Planned Generation Capacity Resources – Internal, Rev. 45 (May 28, 2020).

¹⁵ The queue status is as of August 12, 2020.

proposed deactivations that have not yet occurred.^{16 17 18} The expected net change in generation capacity through the 2021/2022 Delivery Year is a 499.0 MW increase.

Table 14 Proposed PJM generation capacity changes: 2020/2021 through 2021/2022, as of August 12, 2020

	2020/2021	2021/2022	Total
Generation Capacity Additions (already in service)	347.8	71.5	419.3
Generation Capacity Additions (not yet in service)	268.1	2,016.3	2,284.4
Total Generation Capacity Additions	615.9	2,087.8	2,703.7
Deactivations (non nuclear)	1,422.7	782.0	2,204.7
Deactivations (nuclear only)	0.0	0.0	0.0
Total Deactivations	1,422.7	782.0	2,204.7
Net (non nuclear)	(806.8)	1,305.8	499.0
Net (including nuclear)	(806.8)	1,305.8	499.0

Based on the history of projects in the queue, all the proposed generation capacity not yet in service in Table 14 will not go into service. Experience with units with comparable development status provides a guide to the proportion of projects that will go into service. The likelihood of completion increases significantly as projects proceed through the planning process. Analysis of historical interconnection queue data shows that 32.4 percent of MW for projects that completed a SIS went into service, 50.1 percent of MW for projects that completed a FSA went into service and 73.1 percent of MW that executed a Construction Service Agreement (CSA) went into service.

Table 15 shows that based on historical completion rates, 1,548.2 MW new/reactivation MW with an executed CSA ($.731 * 2,118.2$) and 121.5 MW of the uprate MW with an executed CSA ($.731 * 166.2$) are expected to go into service. Thus, based on historical completion rates, of the 2,284.4 MW of proposed generation capacity additions not yet in service, 1,669.7 MW are expected to go into service.

¹⁶ The list of completed and pending generating unit deactivations can be found at: <http://www.pjm.com/planning/services-requests/gen-deactivations.aspx>.

¹⁷ Deactivations for resources external to PJM that were previously pseudo tied are not included in these totals.

¹⁸ As of August 12, 2020, there were no proposed retirements of nuclear generation units.

Table 15 Proposed PJM generation capacity additions for units not yet in service by interconnection queue status (Adjusted for historical completion rates): 2020/2021 through 2021/2022, as of August 12, 2020

Status	2020/2021		2021/2022		Total		
	Cleared		Cleared		Cleared		
	MW (ICAP)	Percent	MW (ICAP)	Percent	MW (ICAP)	Percent	
Not yet in service							
Completed SIS	New/Reactivations	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Uprates	0.0	0.0%	0.0	0.0%	0.0	0.0%
Completed FSA	New/Reactivations	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Uprates	0.0	0.0%	0.0	0.0%	0.0	0.0%
Executed CSA	New/Reactivations	143.8	73.4%	1,404.4	95.3%	1,548.2	92.7%
	Uprates	52.1	26.6%	69.4	4.7%	121.5	7.3%
Total not in service		196.0	100.0%	1,473.7	100.0%	1,669.7	100.0%

Table 16 shows the expected net change in generation capacity based on the proposed generation capacity additions adjusted for the historical rate of completion, the proposed capacity additions already in service, and the planned deactivations. Of the 2,703.7 MW of proposed generation capacity additions that cleared in at least one RPM auction (Table 13), 2,089.0 MW (77.3 percent) are expected to be in service through the 2021/2022 Delivery Year, based on the 419.3 MW already in service and the 1,669.7 MW expected to go into service as shown in Table 15. Accounting for the 2,204.7 MW of planned deactivations, the expected net change in generation capacity through the 2021/2022 Delivery Year is a 115.7 MW decrease based on current information.

Table 16 Proposed PJM generation capacity changes (Adjusted for historical rate of completion): 2020/2021 through 2021/2022, as of August 12, 2020

	2020/2021	2021/2022	Total
Generation Capacity Additions (already in service)	347.8	71.5	419.3
Generation Capacity Additions (not yet in service)	196.0	1,473.7	1,669.7
Total new generation and uprates	543.8	1,545.2	2,089.0
Deactivations (non nuclear)	1,422.7	782.0	2,204.7
Deactivations (nuclear only)	0.0	0.0	0.0
Total Deactivations	1,422.7	782.0	2,204.7
Net (non nuclear)	(878.9)	763.2	(115.7)
Net (including nuclear)	(878.9)	763.2	(115.7)

Sources of Funding

Developers use a variety of sources to fund their projects, which can be categorized as one of two funding types: market and nonmarket. Market funding is from private investors bearing the investment risk without guarantees or support from any public sources, subsidies or guaranteed payment by ratepayers. Providers of market funding rely entirely on market revenues. Nonmarket funding, as defined in this report, is from

guaranteed revenues, including cost of service rates for a regulated utility, but does not include renewable energy credits (RECs) or federal tax policy.

Historical Generation Capacity Changes: 2007/2008 through 2019/2020

Table 17 shows generation capacity additions (new, reactivations, and uprates) by funding and supplier type, from the implementation of RPM in the 2007/2008 Delivery Year through the 2019/2020 Delivery Year. The supplier types are: merchant; municipal and cooperative utilities; and vertically integrated utilities.

For the 2007/2008 through 2019/2020 Delivery Years, of the 34,977.2 MW of generation capacity additions from new resources and reactivations (the first two columns of Table 1), 26,796.1 MW (76.6 percent) were based on market funding and 8,181.1 MW (23.4 percent) were based on nonmarket funding. Of the 34,977.2 MW of generation capacity additions from new resources and reactivations, a total of 2,087.3 MW (6.0 percent) were from solar and wind units, with 1,633.9 MW (78.3 percent of solar and wind) based on market funding and 453.4 MW (21.7 percent of solar and wind) based on nonmarket funding.¹⁹

For the 2007/2008 through the 2019/2020 Delivery Years, of the 7,002.2 MW of generation capacity additions from uprates to existing generation capacity resources (third column of Table 1), 5,537.8 MW (79.1 percent) were based on market funding and 1,464.4 MW (20.9 percent) were based on nonmarket funding. Of the 7,002.2 MW of generation capacity additions from uprates to existing generation capacity resources, a total of 305.0 MW (4.4 percent) were from solar and wind units, with 225.2 MW (73.8 percent of solar and wind) based on market funding and 79.8 MW (26.2 percent of solar and wind) based on nonmarket funding.

In summary, of the 41,979.4 MW of total generation capacity additions for the 2007/2008 through 2019/2020 Delivery Years (Table 1), 32,333.9 MW (77.0 percent) were based on market funding, and 9,645.5 MW (23.0 percent) were based on nonmarket funding.

¹⁹ The market and nonmarket categorization is based on the parent company. Solar and wind units built by market parent companies are categorized as market based funding, regardless of federal tax incentives and REC revenues.

Table 17 PJM generation capacity additions by funding and supplier type: 2007/2008 through 2019/2020²⁰

Funding and Supplier Type	New and Reactivations	Percent	ICAP (MW)		Total Additions	Total Percent
			Uprates	Percent		
Market						
Merchant						
Solar and Wind	1,224.6	3.5%	158.9	2.3%	1,383.4	3.3%
Other	21,168.2	60.5%	2,656.8	37.9%	23,824.9	56.8%
Total	22,392.7	64.0%	2,815.6	40.2%	25,208.4	60.0%
Utility						
Solar and Wind	409.3	1.2%	66.3	0.9%	475.6	1.1%
Other	3,994.1	11.4%	2,655.8	37.9%	6,649.9	15.8%
Total	4,403.4	12.6%	2,722.2	38.9%	7,125.5	17.0%
Market Total	26,796.1	76.6%	5,537.8	79.1%	32,333.9	77.0%
Nonmarket						
Municipal/Coop						
Solar and Wind	106.5	0.3%	5.2	0.1%	111.7	0.3%
Other	2,144.0	6.1%	240.8	3.4%	2,384.8	5.7%
Total	2,250.5	6.4%	246.1	3.5%	2,496.5	5.9%
Utility						
Solar and Wind	346.9	1.0%	74.6	1.1%	421.5	1.0%
Other	5,583.6	16.0%	1,143.8	16.3%	6,727.4	16.0%
Total	5,930.6	17.0%	1,218.4	17.4%	7,148.9	17.0%
Nonmarket Total	8,181.1	23.4%	1,464.4	20.9%	9,645.5	23.0%
Grand Total	34,977.2	100.0%	7,002.2	100.0%	41,979.4	100.0%

Future Generation Capacity Changes

Table 18 shows proposed generation capacity additions (new resources, reactivations, and uprates) by interconnection queue status and funding type for the 2020/2021 through 2021/2022 Delivery Years.

Of the 2,284.4 MW of proposed generation capacity additions for the 2020/2021 through 2021/2022 Delivery Years that cleared at least one RPM auction and are not yet in service, 2,227.5 MW (97.5 percent) are based on market funding and 56.9 MW (2.5 percent) are based on nonmarket funding.²¹

Of the 419.3 MW of proposed generation capacity additions for the 2020/2021 through 2021/2022 Delivery Years that cleared at least one RPM auction and are already in

²⁰ Funding and supplier types were not split into separate solar and wind/other categories in order to comply with PJM confidentiality rules. See “PJM Manual 33: Administrative Services for the PJM Interconnection Operating Agreement,” § 6.1 Market Data Postings, Rev. 16 (June 1, 2020).

²¹ Solar and wind projects account for 431.2 MW of the 2,579.0 MW from market funding, and 10.8 MW of the 124.7 MW from nonmarket funding for proposed projects not yet in service.

service, 351.5 MW (83.8 percent) are based on market funding and 67.8 MW (16.2 percent) are based on nonmarket funding.

Of the 2,703.7 MW of generation capacity additions that cleared in at least one RPM auction for the 2020/2021 through 2021/2022 Delivery Years (Table 11, Table 13 and Table 18), 2,579.0 MW (95.4 percent) are based on market funding, and 124.7 MW (4.6 percent) are based on nonmarket funding.

Table 18 Proposed PJM generation capacity additions by interconnection queue status and funding type: 2020/2021 through 2021/2022²²

Status	Funding Type	Cleared MW (ICAP)	Percent
Not yet in service			
Completed SIS	Market	0.0	0.0%
	Nonmarket	0.0	0.0%
Completed FSA or Executed CSA	Market	2,227.5	82.4%
	Nonmarket	56.9	2.1%
		Total Market	2,227.5 82.4%
		Total Nonmarket	56.9 2.1%
Total not in service		2,284.4	84.5%
In service			
		Market	351.5 13.0%
		Nonmarket	67.8 2.5%
Total in service		419.3	15.5%
Total Market		2,579.0	95.4%
Total Nonmarket		124.7	4.6%
Total Cleared		2,703.7	100.0%

The likelihood of completion increases significantly as projects proceed through the planning process. Table 19 shows proposed generation capacity additions (new resources, reactivations, and uprates) by interconnection queue status and funding type for the 2020/2021 through 2021/2022 Delivery Years, with the historical completion rates applied to the capacity not yet in service.

Based on historical completion rates, 1,628.1 MW (73.1 percent) of the proposed generation capacity additions based on market funding that are not yet in service are expected to go into service. Including the 351.5 MW of generation capacity additions based on market funding already in service, 1,979.6 MW (76.8 percent) of the proposed generation capacity additions based on market funding are expected to be in service.

²² The results for the completed FSAs and executed CSAs have been combined in order to comply with PJM confidentiality rules. See “PJM Manual 33: Administrative Services for the PJM Interconnection Operating Agreement,” § 6.1 Market Data Postings, Rev. 16 (June 1, 2020).

Based on historical completion rates, 41.6 MW (73.1 percent) of the proposed generation capacity additions based on nonmarket funding that are not yet in service are expected to go into service. Including the 67.8 MW of generation capacity additions based on nonmarket funding that are already in service, 109.4 MW (87.7 percent) of the proposed generation capacity additions based on nonmarket funding are expected to be in service.

Of the 2,703.7 MW of proposed generation capacity additions that cleared in at least one RPM auction for the 2020/2021 through 2021/2022 Delivery Years, 2,089.0 MW (77.3 percent), including capacity already in service, are expected to be in service. Of the 2,089.0 MW of generation capacity additions expected to be in service for the 2020/2021 through 2021/2022 Delivery Years, 1,979.6 MW (94.8 percent) are based on market funding and 109.4 MW (5.2 percent) are based on nonmarket funding.

Table 19 Proposed PJM generation capacity additions by interconnection queue status and funding type (Adjusted for historical rate of completion): 2020/2021 through 2021/2022

Status	Funding Type	Cleared MW (ICAP)	Percent
Not yet in service			
Completed SIS	Market	0.0	0.0%
	Nonmarket	0.0	0.0%
Completed FSA or Executed CSA	Market	1,628.1	77.9%
	Nonmarket	41.6	2.0%
Total Market		1,628.1	77.9%
Total Nonmarket		41.6	2.0%
Total not in service		1,669.7	79.9%
In service			
Total in service	Market	351.5	16.8%
	Nonmarket	67.8	3.2%
Total in service		419.3	20.1%
Total Market		1,979.6	94.8%
Total Nonmarket		109.4	5.2%
Total Cleared		2,089.0	100.0%

Conclusions

For the period from the introduction of the RPM capacity market design in the 2007/2008 Delivery Year through the 2019/2020 Delivery Year, internal PJM generation capacity decreased by 866.0 MW (Table 6) after accounting for 41,979.4 MW of new resources, reactivations, and uprates (Table 1), and 42,845.4 MW of deactivations and derates (Table 4), although in each of the last four delivery years (2016/2017 through 2019/2020), there was a net increase in internal PJM generation capacity. PJM maintained a reserve

margin in excess of the target reserve margin throughout this 13 year period.²³ Substantial demand side resources were also added to the capacity market during this time period.

For the 2020/2021 through 2021/2022 Delivery Years, of the 2,703.7 MW of proposed generation capacity additions that cleared in at least one RPM auction (Table 11), 419.3 MW are already in service and 2,284.4 MW are not in service (Table 13). Of the 2,284.4 MW of proposed generation capacity additions not in service, 1,669.7 MW are expected to go into service based on historical completion rates (Table 15). If the 1,669.7 MW go into service, 2,089.0 MW of generation capacity would be added for the 2020/2021 through the 2021/2022 Delivery Years (Table 16).

Based on the addition of 2,089.0 MW of generation capacity and after accounting for plant retirements announced of 2,204.7 as of August 12, 2010, there would be a net decrease in PJM generation capacity of 115.7 MW for the 2020/2021 through 2021/2022 Delivery Years (Table 16).

Of the 41,979.4 MW of generation capacity additions (new resources, reactivations, and uprates) for the 2007/2008 through 2019/2020 Delivery Years (Table 1), 32,333.9 MW (77.0 percent) were based on market funding and 9,645.5 MW (23.0 percent) were based on nonmarket funding (Table 17).

Of the 2,703.7 MW of generation capacity additions that cleared in at least one RPM auction for the 2020/2021 through 2021/2022 Delivery Years (Table 11), 2,579.0 MW (95.4 percent) are based on market funding, and 124.7 MW (4.6 percent) are based on nonmarket funding (Table 18).

Including both completed and upcoming delivery years, 34,912.9 MW (78.1 percent) of internal PJM generation capacity additions are based on market funding and 9,770.2 MW (21.9 percent) are based on nonmarket funding (Table 17 and Table 18).

The level of potential retirements of coal and nuclear units does not imply a reliability issue in PJM and does not imply a fuel security issue in PJM. A comparison of the total units at risk and the current excess capacity in PJM suggests that, ignoring local reliability issues, the current and expected excess capacity is of the same order of magnitude as the units at risk.²⁴ PJM had excess reserves of more than 11,000 ICAP MW on June 1, 2020, and will have excess reserves of more than 15,000 ICAP MW on June 1, 2021, based on current positions. There are currently 148,266.3 MW in the PJM generator interconnection queues with projected in service dates through 2029. Based on historical

²³ See Table 5-7 in the *2020 Quarterly State of the Market Report for PJM: January through June*, Section 5: Capacity Market.

²⁴ See the 2019 *State of the Market Report for PJM*, Volume 2, Section 7: Net Revenue, Units at Risk.

completion rates, 36,099.6 MW of new generation in the queue are expected to go into service.