



Monitoring  
Analytics

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

The Independent Market Monitor for PJM  
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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.<sup>1 2 3 4</sup> For historical delivery years (DYs) (2007/2008 through 2018/2019), 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 (2019/2020 through 2021/2022), generation capacity additions are defined as capacity that cleared in at least one RPM auction in the 2019/2020 through 2021/2022 delivery years.

## Summary

In summary, of the 36,859.2 MW of generation capacity additions from new resources, reactivations, and uprates to existing generation capacity resources for the 2007/2008 through 2018/2019 delivery years, 27,306.6 MW (74.1 percent) were based on market funding and 9,552.6 MW (25.9 percent) were based on nonmarket funding.

In summary, of the 5,776.9 MW of proposed generation capacity additions that have cleared in at least one RPM auction for the 2019/2020 through 2021/2022 delivery years, 2,749.6 MW are already in service and 3,027.3 MW are not yet in service. Applying historical completion rates to the MW not yet in service, 4,989.3 MW of generation capacity additions are expected to be in service through 2021/2022 (2,749.6 MW in service plus 2,239.7 MW of the 3,027.3 MW not yet in service). Of the 4,989.3 MW of expected capacity additions, 4,854.0 MW (97.3 percent) are based on market funding and 135.3 MW (2.7 percent) are based on nonmarket funding.

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<sup>1</sup> Delivery years are from June 1 through May 31.

<sup>2</sup> 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.

<sup>3</sup> This report includes all RPM auctions held prior to September 6, 2019.

<sup>4</sup> 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).

## Generation Capacity Changes

### ***Historical Generation Capacity Changes: 2007/2008 through 2018/2019***

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 2018/2019 delivery year. The average annual addition to generation capacity was 3,071.6 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 2018/2019**

	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
<b>Total</b>	<b>29,002.4</b>	<b>1,349.5</b>	<b>6,507.3</b>	<b>36,859.2</b>

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 2018/2019 delivery year. Of the 36,859.2 MW of generation capacity added, 29,600.2 MW (80.3 percent) were natural gas. Of the 29,002.4 MW of new generation capacity resources added, 25,018.9 MW (86.3 percent) were natural gas.

**Table 2 Internal PJM generation capacity additions by unit type: 2007/2008 through 2018/2019**

	ICAP (MW)			Total Additions
	New	Reactivations	Uprates	
Battery	0.0	0.0	0.0	0.0
CC	22,310.9	130.0	2,198.2	24,639.1
CT - Natural Gas	2,619.6	249.5	1,036.4	3,905.5
CT - Oil	108.0	0.0	96.7	204.7
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	1,294.2	1,294.2
RICE - Natural Gas	79.6	0.0	4.8	84.4
RICE - Oil	9.0	20.7	1.1	30.8
RICE - Other	191.2	4.0	37.2	232.4
Solar	619.2	0.0	75.7	694.9
Steam - Coal	1,356.3	0.0	741.3	2,097.6
Steam - Natural Gas	0.0	743.0	198.2	941.2
Steam - Oil	0.0	96.0	169.0	265.0
Steam - Other	154.0	96.0	28.9	278.9
Wind	1,230.9	0.0	219.9	1,450.8
<b>Total</b>	<b>29,002.4</b>	<b>1,349.5</b>	<b>6,507.3</b>	<b>36,859.2</b>

Table 3 shows a summary of internal PJM generation capacity additions by unit type for the last five years, the 2014/2015 delivery year through the 2018/2019 delivery year. Of the 25,445.8 MW of generation capacity added in the last five delivery years, 23,256.6 MW (91.4 percent) were natural gas. Of the 22,502.7 MW of new generation capacity resources added in the last five delivery years, 21,191.2 MW (94.2 percent) were natural gas.

**Table 3 Internal PJM generation capacity additions by unit type: 2014/2015 through 2018/2019**

	ICAP (MW)			Total Additions
	New	Reactivations	Uprates	
Battery	0.0	0.0	0.0	0.0
CC	20,277.9	5.0	1,090.4	21,373.3
CT - Natural Gas	833.7	90.0	242.3	1,166.0
CT - Oil	0.0	0.0	10.3	10.3
CT - Other	10.1	0.0	0.0	10.1
Fuel Cell	0.0	0.0	21.2	21.2
Hydro - Pumped Storage	0.0	0.0	76.0	76.0
Hydro - Run of River	284.4	4.0	28.2	316.6
Nuclear	0.0	0.0	367.6	367.6
RICE - Natural Gas	79.6	0.0	4.8	84.4
RICE - Oil	0.0	20.7	0.3	21.0
RICE - Other	42.6	0.0	24.7	67.3
Solar	540.6	0.0	69.8	610.4
Steam - Coal	0.0	0.0	125.6	125.6
Steam - Natural Gas	0.0	532.0	79.7	611.7
Steam - Oil	0.0	0.0	3.0	3.0
Steam - Other	129.0	0.0	12.3	141.3
Wind	304.8	0.0	135.2	440.0
<b>Total</b>	<b>22,502.7</b>	<b>651.7</b>	<b>2,291.4</b>	<b>25,445.8</b>

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 2018/2019 delivery year. The average annual loss in generation capacity was 3,286.1 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 2018/2019**

	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
<b>Total</b>	<b>36,104.0</b>	<b>3,328.6</b>	<b>39,432.6</b>

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 2018/2019 delivery year. Of the 39,432.6 MW decrease, 27,268.9 MW (69.2 percent) were coal steam units.

**Table 5 Internal PJM generation capacity decreases by unit type: 2007/2008 through 2018/2019**

	ICAP (MW)		
	Deactivations	Derates	Total Losses
Battery	0.0	0.0	0.0
CC	876.2	917.2	1,793.4
CT - Natural Gas	1,707.4	434.5	2,141.9
CT - Oil	1,960.5	210.5	2,171.0
CT - Other	7.2	2.0	9.2
Fuel Cell	0.0	3.6	3.6
Hydro - Pumped Storage	0.0	31.3	31.3
Hydro - Run of River	10.5	35.3	45.8
Nuclear	607.7	345.9	953.6
RICE - Natural Gas	0.0	0.0	0.0
RICE - Oil	77.6	6.1	83.7
RICE - Other	18.2	43.6	61.8
Solar	0.0	8.7	8.7
Steam - Coal	26,527.5	741.4	27,268.9
Steam - Natural Gas	2,338.3	64.9	2,403.2
Steam - Oil	1,724.0	110.9	1,834.9
Steam - Other	243.0	63.7	306.7
Wind	5.9	309.0	314.9
<b>Total</b>	<b>36,104.0</b>	<b>3,328.6</b>	<b>39,432.6</b>

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 2018/2019 delivery year. While new generation capacity was added, it was more than offset by deactivations and derates, for a net decrease of 2,573.4 MW over the 12 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, 2018, there were 10,798.1 unforced capacity (UCAP) MW of DR and EE Resources committed as RPM capacity.<sup>5</sup>

<sup>5</sup> The IMM reports DR and EE RPM commitments in the State of the Market Reports. For example, see Table 5-11 in the *2019 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 2018/2019**

	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
Total	36,859.2	39,432.6	(2,573.4)

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 2018/2019 delivery year.



**Table 7 Net changes in internal PJM generation capacity by unit type: 2007/2008 through 2018/2019**

	ICAP (MW)		Net Change
	Additions	Losses	
Battery	0.0	0.0	0.0
CC	24,639.1	1,793.4	22,845.7
CT - Natural Gas	3,905.5	2,141.9	1,763.6
CT - Oil	204.7	2,171.0	(1,966.3)
CT - Other	24.9	9.2	15.7
Fuel Cell	30.0	3.6	26.4
Hydro - Pumped Storage	272.0	31.3	240.7
Hydro - Run of River	412.8	45.8	367.0
Nuclear	1,294.2	953.6	340.6
RICE - Natural Gas	84.4	0.0	84.4
RICE - Oil	30.8	83.7	(52.9)
RICE - Other	232.4	61.8	170.6
Solar	694.9	8.7	686.2
Steam - Coal	2,097.6	27,268.9	(25,171.3)
Steam - Natural Gas	941.2	2,403.2	(1,462.0)
Steam - Oil	265.0	1,834.9	(1,569.9)
Steam - Other	278.9	306.7	(27.8)
Wind	1,450.8	314.9	1,135.9
<b>Total</b>	<b>36,859.2</b>	<b>39,432.6</b>	<b>(2,573.4)</b>

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 21,718.6 MW since the implementation of RPM in the 2007/2008 delivery year through the 2018/2019 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.<sup>6</sup>

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<sup>6</sup> 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 2018/2019<sup>7</sup>**

	ICAP (MW)					
	Additions	Losses	Integration	Net Change in Capacity Imports	Net Change in Capacity Exports	Net Change
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	95.0	(3,212.7)
2013/2014	629.2	3,075.2	2,746.0	934.3	17.9	1,216.4
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
<b>Total</b>	<b>36,859.2</b>	<b>39,432.6</b>	<b>21,802.5</b>	<b>183.0</b>	<b>(2,306.5)</b>	<b>21,718.6</b>

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 21,959.1 MW for combined cycles, and the maximum net decrease in generation capacity for a unit type was 6,988.8 MW for coal steam units.

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<sup>7</sup> The calculation of integration and capacity import MW values was revised from the *New Generation in the PJM Capacity Market: MW and Funding Sources for Delivery Years 2007/2008 through 2020/2021* report.

**Table 9 PJM generation capacity changes by unit type: 2007/2008 through 2018/2019**

	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	24,639.1	1,793.4	0.0	0.0	886.6	21,959.1
CT - Natural Gas	3,905.5	2,141.9	2,755.0	345.0	(117.0)	4,980.6
CT - Oil	204.7	2,171.0	472.0	0.0	(5.7)	(1,488.6)
CT - Other	24.9	9.2	0.0	0.0	0.0	15.7
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	45.8	136.0	503.0	95.0	911.0
Nuclear	1,294.2	953.6	2,134.0	100.0	454.7	2,119.9
RICE - Natural Gas	84.4	0.0	0.0	0.0	0.0	84.4
RICE - Oil	30.8	83.7	24.8	0.0	(3.9)	(24.2)
RICE - Other	232.4	61.8	22.8	0.0	0.0	193.4
Solar	694.9	8.7	0.0	0.0	0.0	686.2
Steam - Coal	2,097.6	27,268.9	15,932.9	(718.0)	(2,967.6)	(6,988.8)
Steam - Natural Gas	941.2	2,403.2	325.0	0.0	0.0	(1,137.0)
Steam - Oil	265.0	1,834.9	0.0	0.0	(220.0)	(1,349.9)
Steam - Other	278.9	306.7	0.0	(47.0)	0.0	(74.8)
Wind	1,450.8	314.9	0.0	0.0	6.4	1,129.5
<b>Total</b>	<b>36,859.2</b>	<b>39,432.6</b>	<b>21,802.5</b>	<b>183.0</b>	<b>(2,306.5)</b>	<b>21,718.6</b>

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.<sup>8</sup> 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.<sup>9</sup> The generation capacity additions reported by PJM are based on BRA over BRA changes and do not account for in service status.<sup>10</sup> 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.

<sup>8</sup> See Table 5-6 in the *2019 Quarterly State of the Market Report for PJM: January through March*, Section 5, “Capacity Market.”

<sup>9</sup> 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.

<sup>10</sup> 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 2018/2019. The IMM reported generation capacity additions are 2,509.5 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 2018/2019**

	IMM				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
Total	29,002.4	1,349.5	6,507.3	36,859.2	29,464.0	1,550.7	8,354.0	39,368.7	(461.6)	(201.2)	(1,846.7)	(2,509.5)

## 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 2019/2020 through 2021/2022 delivery years.

**Table 11 Proposed PJM generation capacity additions: 2019/2020 through 2021/2022**

	ICAP (MW)
2019/2020	4,709.7
2020/2021	807.4
2021/2022	259.8
Total	5,776.9

Table 12 shows proposed generation capacity additions (new resources, reactivations, and uprates) that cleared in at least one RPM auction for the 2019/2020 through 2021/2022 delivery years by unit type. Of the 5,776.9 MW of proposed generation capacity that cleared in at least one RPM auction for the 2019/2020 through 2021/2022 delivery years, 5,411.2 MW (93.7 percent) were natural gas and 5,301.4 MW (91.8 percent) were combined cycle units.

**Table 12 Proposed PJM generation capacity additions by unit type: 2019/2020 through 2021/2022<sup>11</sup>**

	ICAP (MW)
CC	5,301.4
CT	94.4
Solar	168.2
Wind	165.1
Other	47.8
Total	5,776.9

## 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).<sup>12</sup> 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.<sup>13</sup> 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 than 20

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<sup>11</sup> 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,” § 3.1 Market Data Postings, Rev. 14 (Oct. 25, 2018).

<sup>12</sup> 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.”

<sup>13</sup> “PJM Manual 14A: New Services Request Process,” § 5.4 Interconnection Service Agreement (ISA), Rev. 24 (July 26, 2018).

MW in order to be offered in a BRA.<sup>14</sup> 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 2019/2020 through 2021/2022 delivery years by current interconnection queue status.<sup>15</sup>

As shown in Table 13, of the 5,776.9 MW of proposed generation capacity additions that cleared in at least one RPM auction for the 2019/2020 through 2021/2022 delivery years, 2,749.6 MW are already in service.

**Table 13 Proposed PJM generation capacity additions by interconnection queue status: 2019/2020 through 2021/2022, as of September 3, 2019**

Status		2019/2020		2020/2021		2021/2022		Total	
		Cleared		Cleared		Cleared		Cleared	
		MW	Percent	MW	Percent	MW	Percent	MW	Percent
Not yet in service									
Completed SIS	New/Reactivations	0.0	0.0%	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%	0.0	0.0%
Completed FSA	New/Reactivations	0.0	0.0%	0.0	0.0%	8.7	3.3%	8.7	0.2%
	Uprates	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Executed CSA	New/Reactivations	1,992.8	42.3%	739.5	91.6%	112.1	43.1%	2,844.4	49.2%
	Uprates	57.9	1.2%	16.3	2.0%	100.0	38.5%	174.2	3.0%
Total not in service		2,050.7	43.5%	755.8	93.6%	220.8	85.0%	3,027.3	52.4%
In service									
	New/Reactivations	2,470.8	52.5%	6.2	0.8%	0.0	0.0%	2,477.0	42.9%
	Uprates	188.2	4.0%	45.4	5.6%	39.0	15.0%	272.6	4.7%
Total in service		2,659.0	56.5%	51.6	6.4%	39.0	15.0%	2,749.6	47.6%
Total Cleared		4,709.7	100.0%	807.4	100.0%	259.8	100.0%	5,776.9	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 proposed deactivations that have not yet occurred.<sup>16 17</sup>

<sup>14</sup> “PJM Manual 18: PJM Capacity Market,” § 4.2.3 Planned Generation Capacity Resources – Internal, Rev. 42 (July 25, 2019).

<sup>15</sup> The queue status is as of September 3, 2019.

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

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

There is significant uncertainty about whether the nuclear plants that have requested deactivation will ultimately retire. The two nuclear plants that have submitted retirement notices in effect on September 3, 2019, are: Beaver Valley and Three Mile Island. If proposed nuclear plant retirements are included, the expected net change in generation capacity through the 2021/2022 delivery year is a 1,108.9 MW decrease. If none of the nuclear plants retire, the expected net change in generation capacity through the 2021/2022 delivery year is a 1,505.0 MW increase instead.

**Table 14 Proposed PJM generation capacity changes: 2019/2020 through 2021/2022, as of September 3, 2019**

	2019/2020	2020/2021	2021/2022	Total
Generation Capacity Additions (already in service)	2,659.0	51.6	39.0	2,749.6
Generation Capacity Additions (not yet in service)	2,050.7	755.8	220.8	3,027.3
Total Generation Capacity Additions	4,709.7	807.4	259.8	5,776.9
Deactivations (non nuclear)	1,227.0	2,075.9	969.0	4,271.9
Deactivations (nuclear only)	802.8	909.7	901.4	2,613.9
Total Deactivations	2,029.8	2,985.6	1,870.4	6,885.8
Net (non nuclear)	3,482.7	(1,268.5)	(709.2)	1,505.0
Net (including nuclear)	2,679.9	(2,178.2)	(1,610.6)	(1,108.9)

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, 50.3 percent of MW for projects that completed a FSA went into service and 74.1 percent of MW that executed a Construction Service Agreement (CSA) went into service.

Table 15 shows that based on historical completion rates, 4.4 MW of the new/reactivation MW with a completed FSA (.503 \* 8.7), 2,106.3 MW new/reactivation MW with an executed CSA (.741 \* 2,844.4) and 129.0 MW of the uprate MW with an executed CSA (.741 \* 174.2) are expected to go into service. Thus, based on historical completion rates, of the 3,027.3 MW of proposed generation capacity additions not yet in service, 2,239.7 MW are expected to go into service.



**Table 15 Proposed PJM generation capacity additions for units not yet in service by interconnection queue status (Adjusted for historical completion rates): 2019/2020 through 2021/2022, as of September 3, 2019**

Status		2019/2020		2020/2021		2021/2022		Total	
		Cleared		Cleared		Cleared		Cleared	
		MW	Percent	MW	Percent	MW	Percent	MW	Percent
Not yet in service									
Completed SIS	New/Reactivations	0.0	0.0%	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%	0.0	0.0%
Completed FSA	New/Reactivations	0.0	0.0%	0.0	0.0%	4.4	2.7%	4.4	0.2%
	Uprates	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Executed CSA	New/Reactivations	1,475.7	97.2%	547.6	97.8%	83.0	51.4%	2,106.3	94.0%
	Uprates	42.9	2.8%	12.1	2.2%	74.1	45.9%	129.0	5.8%
Total not in service		1,518.6	100.0%	559.7	100.0%	161.4	100.0%	2,239.7	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 5,776.9 MW of proposed generation capacity additions that cleared in at least one RPM auction (Table 13), 4,989.3 MW (86.4 percent) are expected be in service through the 2021/2022 delivery year, based on the 2,749.6 MW already in service and the 2,239.7 MW expected to go into service as shown in Table 15. The expected net change in generation capacity through the 2021/2022 delivery year is a 1,896.5 MW decrease based on current information. There is significant uncertainty about whether the nuclear plants that have requested deactivation will ultimately retire. If none of those nuclear units retire, the expected net change in generation capacity through the 2021/2022 delivery year is a 717.4 MW increase instead.

**Table 16 Proposed PJM generation capacity changes (Adjusted for historical rate of completion): 2019/2020 through 2021/2022, as of September 3, 2019**

	2019/2020	2020/2021	2021/2022	Total
Generation Capacity Additions (already in service)	2,659.0	51.6	39.0	2,749.6
Generation Capacity Additions (not yet in service)	1,518.6	559.7	161.4	2,239.7
Total new generation and uprates	4,177.6	611.3	200.4	4,989.3
Deactivations (non nuclear)	1,227.0	2,075.9	969.0	4,271.9
Deactivations (nuclear only)	802.8	909.7	901.4	2,613.9
Total Deactivations	2,029.8	2,985.6	1,870.4	6,885.8
Net (non nuclear)	2,950.6	(1,464.6)	(768.6)	717.4
Net (including nuclear)	2,147.8	(2,374.3)	(1,670.0)	(1,896.5)

## 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 2018/2019***

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 2018/2019 delivery year. The supplier types are: merchant; municipal and cooperative utilities; and vertically integrated utilities.

For the 2007/2008 through 2018/2019 delivery years, of the 30,351.9 MW of generation capacity additions from new resources and reactivations (the first two columns of Table 1), 22,277.9 MW (73.4 percent) were based on market funding and 8,074.0 MW (26.6 percent) were based on nonmarket funding. Of the 30,351.9 MW of generation capacity additions from new resources and reactivations, a total of 1,850.1 MW (6.1 percent) were from solar and wind units, with 1,443.9 MW (78.0 percent of solar and wind) based on market funding and 406.2 MW (22.0 percent of solar and wind) based on nonmarket funding.<sup>18</sup>

For the 2007/2008 through the 2018/2019 delivery years, of the 6,507.3 MW of generation capacity additions from uprates to existing generation capacity resources (third column of Table 1), 5,028.7 MW (77.3 percent) were based on market funding and 1,478.6 MW (22.7 percent) were based on nonmarket funding. Of the 6,507.3 MW of generation capacity additions from uprates to existing generation capacity resources, a total of 295.6 MW (4.5 percent) were from solar and wind units, with 195.5 MW (66.2 percent of solar and wind) based on market funding and 100.1 MW (33.8 percent of solar and wind) based on nonmarket funding.

In summary, of the 36,859.2 MW of total generation capacity additions for the 2007/2008 through 2018/2019 delivery years (Table 1), 27,306.6 MW (74.1 percent) were based on market funding, and 9,552.6 MW (25.9 percent) were based on nonmarket funding.

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<sup>18</sup> 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 2018/2019<sup>19</sup>**

Funding and Supplier Type	ICAP (MW)					
	New and Reactivations	Percent	Upgrades	Percent	Total Additions	Total Percent
<b>Market</b>						
Merchant						
Solar and Wind	923.7	3.0%	112.0	1.7%	1,035.7	2.8%
Other	16,742.1	55.2%	2,291.7	35.2%	19,033.8	51.6%
<b>Total</b>	<b>17,665.8</b>	<b>58.2%</b>	<b>2,403.7</b>	<b>36.9%</b>	<b>20,069.5</b>	<b>54.4%</b>
Utility						
Solar and Wind	520.2	1.7%	83.5	1.3%	603.8	1.6%
Other	4,091.9	13.5%	2,541.5	39.1%	6,633.4	18.0%
<b>Total</b>	<b>4,612.1</b>	<b>15.2%</b>	<b>2,625.0</b>	<b>40.3%</b>	<b>7,237.2</b>	<b>19.6%</b>
<b>Market Total</b>	<b>22,277.9</b>	<b>73.4%</b>	<b>5,028.7</b>	<b>77.3%</b>	<b>27,306.6</b>	<b>74.1%</b>
<b>Nonmarket</b>						
Municipal/Coop						
Solar and Wind	82.3	0.3%	5.2	0.1%	87.6	0.2%
Other	1,738.2	5.7%	222.3	3.4%	1,960.5	5.3%
<b>Total</b>	<b>1,820.5</b>	<b>6.0%</b>	<b>227.5</b>	<b>3.5%</b>	<b>2,048.1</b>	<b>5.6%</b>
Utility						
Solar and Wind	323.9	1.1%	94.8	1.5%	418.7	1.1%
Other	5,929.6	19.5%	1,156.2	17.8%	7,085.8	19.2%
<b>Total</b>	<b>6,253.5</b>	<b>20.6%</b>	<b>1,251.0</b>	<b>19.2%</b>	<b>7,504.5</b>	<b>20.4%</b>
<b>Nonmarket Total</b>	<b>8,074.0</b>	<b>26.6%</b>	<b>1,478.6</b>	<b>22.7%</b>	<b>9,552.6</b>	<b>25.9%</b>
<b>Grand Total</b>	<b>30,351.9</b>	<b>100.0%</b>	<b>6,507.3</b>	<b>100.0%</b>	<b>36,859.2</b>	<b>100.0%</b>

## **Future Generation Capacity Changes**

Table 18 shows proposed generation capacity additions (new resources, reactivations, and upgrades) by interconnection queue status and funding type for the 2019/2020 through 2021/2022 delivery years.

Of the 3,027.3 MW of proposed generation capacity additions for the 2019/2020 through 2021/2022 delivery years that cleared at least one RPM auction and are not yet in service, 2,933.8 MW (96.9 percent) are based on market funding and 93.5 MW (3.1 percent) are based on nonmarket funding.<sup>20</sup>

Of the 2,749.6 MW of proposed generation capacity additions for the 2019/2020 through 2021/2022 delivery years that cleared at least one RPM auction and are already in service, 2,681.5 MW (97.5 percent) are based on market funding and 68.1 MW (2.5 percent) are based on nonmarket funding.

<sup>19</sup> 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,” § 3.1 Market Data Postings, Rev. 14 (Oct. 25, 2018).

<sup>20</sup> Solar and wind projects account for 199.6 MW of the 2,933.8 MW from market funding, and 57.5 MW of the 84.8 MW from nonmarket funding for proposed projects not yet in service.

Of the 5,776.9 MW of generation capacity additions that cleared in at least one RPM auction for the 2019/2020 through 2021/2022 delivery years (Table 11, Table 13 and Table 18), 5,615.3 MW (97.2 percent) are based on market funding, and 161.6 MW (2.8 percent) are based on nonmarket funding.

**Table 18 Proposed PJM generation capacity additions by interconnection queue status and funding type: 2019/2020 through 2021/2022<sup>21</sup>**

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	2,933.8	50.8%
	Nonmarket	93.5	1.6%
		Total Market	2,933.8 50.8%
		Total Nonmarket	93.5 1.6%
Total not in service		3,027.3	52.4%
In service			
		Market	2,681.5 46.4%
		Nonmarket	68.1 1.2%
Total in service		2,749.6	47.6%
Total Market		5,615.3	97.2%
Total Nonmarket		161.6	2.8%
Total Cleared		5,776.9	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 2019/2020 through 2021/2022 delivery years, with the historical completion rates applied to the capacity not yet in service.

Based on historical completion rates, 2,172.5 MW (74.1 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 2,681.5 MW of generation capacity additions based on market funding already in service, 4,854.0 MW (86.4 percent) of the proposed generation capacity additions based on market funding are expected to be in service.

Based on historical completion rates, 62.8 MW (67.2 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 68.1 MW of generation capacity additions based on

<sup>21</sup> 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,” § 3.1 Market Data Postings, Rev. 14 (Oct. 25, 2018).

nonmarket funding that are already in service, 130.9 MW (81.0 percent) of the proposed generation capacity additions based on nonmarket funding are expected to be in service.

Of the 5,776.9 MW of proposed generation capacity additions that cleared in at least one RPM auction for the 2019/2020 through 2021/2022 delivery years, 4,989.3 MW (86.4 percent), including capacity already in service, are expected to be in service. Of the 4,989.3 MW of generation capacity additions expected to be in service for the 2019/2020 through 2021/2022 delivery years, 4,854.02 MW (97.3 percent) are based on market funding and 135.3 MW (2.7 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): 2019/2020 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	2,172.5	43.5%
	Nonmarket	67.2	1.3%
Total Market		2,172.5	43.5%
Total Nonmarket		67.2	1.3%
Total not in service		2,239.7	44.9%
In service			
Total in service	Market	2,681.5	53.7%
	Nonmarket	68.1	1.4%
Total in service		2,749.6	55.1%
Total Market		4,854.0	97.3%
Total Nonmarket		135.3	2.7%
Total Cleared		4,989.3	100.0%

## Conclusions

For the period from the introduction of the RPM capacity market design in the 2007/2008 delivery year through the 2018/2019 delivery year, internal PJM generation capacity decreased by 2,573.4 MW (Table 6) after accounting for 36,859.2 MW of new resources, reactivations, and uprates (Table 1), and 39,432.6 MW of deactivations and derates (Table 4). PJM maintained a reserve margin in excess of the target reserve margin throughout this period.<sup>22</sup> Substantial demand side resources were also added to the capacity market during this time period.

For the 2019/2020 through 2021/2022 delivery years, of the 5,776.9 MW of proposed generation capacity additions that cleared in at least one RPM auction (Table 11), 2,749.6

<sup>22</sup> See Table 5-7 in the 2019 *Quarterly State of the Market Report for PJM: January through June*, Section 5, “Capacity Market.”

MW are already in service and 3,027.3 MW are not in service (Table 13). Of the 3,027.3 MW of proposed generation capacity additions not in service, 2,239.7 MW are expected to go into service based on historical completion rates (Table 15). If the 2,239.7 MW go into service, 4,989.3 MW of generation capacity would be added for the 2019/2020 through the 2021/2022 delivery years (Table 16).

There is significant uncertainty about whether the nuclear plants that have requested deactivation will ultimately retire. Based on the addition of 4,989.3 MW of generation capacity and after accounting for plant retirements, including nuclear plant retirements, announced as of September 3, 2019, there would be a net decrease in PJM generation capacity of 1,896.5 MW for the 2019/2020 through 2021/2022 delivery years (Table 16). If neither of the identified nuclear plants retire, there would be a net increase in capacity of 717.4 MW for the 2019/2020 through 2021/2022 delivery years (Table 16).

Of the 36,859.2 MW of generation capacity additions (new resources, reactivations, and uprates) for the 2007/2008 through 2018/2019 delivery years (Table 1), 27,306.6 MW (74.1 percent) were based on market funding and 9,552.6 MW (25.9 percent) were based on nonmarket funding (Table 17).

Of the 5,776.9 MW of generation capacity additions that cleared in at least one RPM auction for the 2019/2020 through 2021/2022 delivery years (Table 11), 5,615.3 MW (97.2 percent) are based on market funding, and 161.6 MW (2.8 percent) are based on nonmarket funding (Table 18).

Including both completed and upcoming delivery years, 32,921.9 MW (77.2 percent) of internal PJM generation capacity additions are based on market funding and 9,714.2 MW (22.8 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. PJM had excess reserves of more than 11,000 ICAP MW on June 1, 2019, and will have excess reserves of more than 15,000 ICAP MW on June 1, 2020, based on current positions. There are currently 125,757.4 MW in the PJM generator interconnection queues. Based on historical completion rates, 33,654.7 MW of new generation in the queue are expected to go into service.