Generation and Transmission Planning

Overview

Planned Generation and Retirements

- **Planned Generation.** As of June 30, 2016, 83,390.2 MW of capacity were in generation request queues for construction through 2024, compared to an average installed capacity of 191,697.2 MW as of June 30, 2016. Of the capacity in queues, 6,217.8 MW, or 7.4 percent, are uprates and the rest are new generation. Wind projects account for 15,154.0 MW of nameplate capacity or 18.2 percent of the capacity in the queues. Combined cycle projects account for 52,993.4 MW of capacity or 69.0 percent of the capacity in the queues.
- **Generation Retirements.** As shown in Table 12-6, 28.396.0 MW have been, or are planned to be, retired between 2011 and 2020. Of that, 4,238.3 MW are planned to retire after 2016. In the first six months of 2016, 381 MW were retired. Of the 4,238.3 MW pending retirement, 1,109 MW are coal units. The coal unit retirements were a result of low gas prices, and the EPA's Mercury and Air Toxics Standards (MATS) for some units.
- **Generation Mix.** A significant shift in the distribution of unit types within the PJM footprint continues as natural gas fired units enter the queue and steam units retire. There are 2,007.0 MW of coal fired steam capacity and 57,552.1 MW of gas fired capacity are in the queue. The replacement of coal steam units by units burning natural gas will significantly affect future congestion, the role of firm and interruptible gas supply, and natural gas supply infrastructure.

Generation and Transmission Interconnection Planning Process

- Any entity that requests interconnection of a new generating facility, including increases to the capacity of an existing generating unit, or that requests interconnection of a merchant transmission facility, must follow the process defined in the PJM tariff to obtain interconnection service.[1] The process is complex and time consuming at least in part as a result of the required analyses. The cost, time and uncertainty associated with interconnecting to the grid may create barriers to entry for potential entrants.
- The queue contains a substantial number of projects that are not likely to be built. Excluding currently active projects and projects currently under construction, 2,417 projects, representing 345,621.0 MW, have entered the queue process since its inception. Of those, 646 projects, 45,391.0 MW, went into service. Of the projects that entered the queue process, 86.9 percent of the MW withdrew prior to completion. Such projects may create barriers to entry for projects that would otherwise be completed by taking up queue positions, increasing interconnection costs and creating uncertainty.
- Feasibility, impact and facilities studies may be delayed for reasons including disputes with developers, circuit and network issues and retooling as a result of projects being withdrawn. The Earlier Queue Submittal Task Force (EQSTF) was established in August 2015 to address delays.[2]
- As defined in the tariff, a transmission owner (TO) is an "entity that owns, leases or otherwise has a possessory interest in facilities used for the transmission of electric energy in interstate commerce under the tariff."[3] Where the transmission owner is a vertically integrated company that also owns generation, there is a potential conflict of interest when the transmission owner evaluates the interconnection requirements of new generation which is a competitor to the generation of the parent company and when the transmission owner evaluates the interconnection requirements of new generation which is part of the same company as the transmission owner. There is also a potential conflict of interest when the transmission owner evaluates the interconnection requirements of a merchant transmission developer which is a competitor of the transmission owner.

1 See PJM, OATT Parts IV & VI.
2 See Earlier Queue Submittal Task Force at <http://www.pjm.com/committees-and-groups/task-forces/eqstf.aspx>.
3 See PJM, OATT, Part I, § 1 "Definitions"

Regional Transmission Expansion Plan (RTEP)

- Artificial Island is an area in southern New Jersey that includes nuclear units at Salem and at Hope Creek in the PSEG Zone. On April 29, 2013, PJM issued a request for proposal (RFP), seeking technical solutions to improve stability issues and operational performance under a range of anticipated system conditions, and the elimination of potential planning criteria violations in this area. On July 30, 2015, the PJM Board of Managers accepted PJM's recommendation to assign the project to LS Power, a merchant developer, PSEG, and PHI with a total cost estimate between $263M and $283M.[4] [5]
- On October 25, 2012, Schedule 12 of the tariff and Schedule 6 of the OA were changed to address FERC Order No. 1000 reforms to the cost allocation requirements for local and regional transmission planning projects that were formerly defined in Order No. 890. The new approach was applied for the first time to the 2013 RTEP.

Backbone Facilities

- PJM baseline transmission projects are implemented to resolve reliability criteria violations. PJM backbone transmission projects are a subset of significant baseline projects, which are intended to resolve multiple reliability criteria violations and congestion issues and which may have substantial impacts on energy and capacity markets. There is currently only one backbone project under development, Surry Skiffes Creek 500kV.

Transmission Facility Outages

- PJM maintains a list of reportable transmission facilities. When the reportable transmission facilities need to be taken out of service, PJM transmission owners are required to report planned transmission facility outages as early as possible. PJM processes the transmission facility outage requests according to rules in PJM's Manual 3 to decide if the outage is on time, late, or past its deadline and whether or not they will allow the outage.[6]
- There were 10,262 transmission outage requests submitted for the first six months of 2016. Of the requested outages, 80.9 percent were planned for five days or shorter and 3.9 percent were planned for longer than 30 days. Of the requested outages, 49.9 percent were late according to the rules in PJM's Manual 3.

Recommendations

The MMU recommends improvements to the planning process.

- The MMU recommends that PJM continue to incorporate the principle that the goal of transmission planning should be the incorporation of transmission investment decisions into market driven processes as much as possible. (Priority: Low. First reported 2001. Status: Not adopted.)
- The MMU recommends the creation of a mechanism to permit a direct comparison, or competition, between transmission and generation alternatives, including which alternative is less costly and who bears the risks associated with each alternative. (Priority: Low. First reported 2013. Status: Not adopted.)
- The MMU recommends that rules be implemented to permit competition to provide financing for transmission projects. This competition could reduce the cost of capital for transmission projects and significantly reduce total costs to customers. (Priority: Low. First reported 2013. Status: Not adopted.)
- The MMU recommends that rules be implemented to require that project cost caps on new transmission projects be part of the evaluation of competing projects. (Priority: Low. First reported 2015. Status: Not adopted.)
- The MMU recommends that barriers to entry be addressed in a timely manner in order to help ensure that the capacity market will result in the entry of new capacity to meet the needs of PJM market participants and reflect the uncertainty and resultant risks in the cost of new entry used to

4 See "Artificial Island Recommendations," presented at the TEAC meeting on April 28, 2015 at <http://www.pjm.com/~/media/committees-groups/committees/teac/20150428-ai/20150428-artificial-island-recommendations.ashx>.

5 See letter from Terry Boston concerning the Artificial Island Project at <http://www.pjm.com/~/media/documents/reports/board-statement-on-artificial-island-project.ashx>

6 PJM. "Manual 03: Transmission Operations," Revision 49 (June 1, 2016), Section 4.

establish the capacity market demand curve in RPM. (Priority: Low. First reported 2012. Status: Not adopted.)

- The MMU recommends that the question of whether Capacity Injection Rights (CIRs) should persist after the retirement of a unit be addressed. Even if the treatment of CIRs remains unchanged, the rules need to ensure that incumbents cannot exploit control of CIRs to block or postpone entry of competitors.[7] (Priority: Low. First reported 2013. Status: Not adopted.)
- The MMU recommends outsourcing interconnection studies to an independent party to avoid potential conflicts of interest. Currently, these studies are performed by incumbent transmission owners under PJM's direction. This creates potential conflicts of interest, particularly when transmission owners are vertically integrated and the owner of transmission also owns generation. (Priority: Low. First reported 2013. Status: Not adopted.)
- The MMU recommends improvements in queue management including that PJM establish a review process to ensure that projects are removed from the queue if they are not viable, as well as a process to allow commercially viable projects to advance in the queue ahead of projects which have failed to make progress, subject to rules to prevent gaming. (Priority: Medium. First reported 2013. Status: Partially adopted.)
- The MMU recommends an analysis of the study phase of PJM's transmission planning to reduce the need for postponements of study results, to decrease study completion times, and to improve the likelihood that a project at a given phase in the study process will successfully go into service. (Priority: Medium. First reported 2014. Status: Partially adopted.)
- The MMU recommends that PJM establish fair terms of access to rights of way and property, such as at substations, in order to remove any barriers to entry and permit competition between incumbent transmission providers and merchant transmission providers in the RTEP. (Priority: Medium. First reported 2014. Status: Not adopted.)
- The MMU recommends that PJM enhance the transparency and queue management process for merchant transmission investment. Issues related to data access and complete explanations of cost impacts should be addressed. The goal should be to remove barriers to competition from merchant transmission. (Priority: Medium. First reported 2015. Status: Not adopted.)
- The MMU recommends consideration of changing the minimum distribution factor in the allocation from .01 to .00 and adding a threshold minimum usage impact on the line. (Priority: Medium. First reported 2015. Status: Not adopted.)
- The MMU recommends that PJM reevaluate all transmission outage tickets as on time or late as if they were new requests when an outage is rescheduled and apply the standard rules for late submissions to any such outages. (Priority: Low. First reported 2014. Status: Not adopted.)
- The MMU recommends that PJM draft a clear definition of the congestion analysis required for transmission outage requests to include in Manual 3 after appropriate review. (Priority: Low. First reported 2015. Status: Not adopted.)
- The MMU recommends that PJM modify the rules to reduce or eliminate the approval of late outage requests submitted or rescheduled after the FTR auction bidding opening date. (Priority: Low. First reported 2015. Status: Not adopted.)
- The MMU recommends that PJM not permit transmission owners to divide long duration outages into smaller segments to avoid complying with the requirements for long duration outages. (Priority: Low. First reported 2015. Status: Not adopted.)

Conclusion

The goal of PJM market design should be to enhance competition and to ensure that competition is the driver for all the key elements of PJM markets. But transmission investments have not been fully incorporated into competitive markets. The construction of new transmission facilities has significant impacts on the energy and capacity markets. But when generating units retire

7 See "Comments of the Independent Market Monitor for PJM," Docket No. ER12-1177-000, <http://www.monitoringanalytics.com/reports/Reports/2012/IMM_Comments_ER12-1177-000_20120312.pdf>.

or load increases, there is no market mechanism in place that would require direct competition between transmission and generation to meet loads in the affected area. In addition, despite FERC Order No. 1000, there is not yet a transparent, robust and clearly defined mechanism to permit competition to build transmission projects, to ensure that competitors provide a total project cost cap, or to obtain least cost financing through the capital markets.

The addition of a planned transmission project changes the parameters of the capacity auction for the area, changes the amount of capacity needed in the area, changes the capacity market supply and demand fundamentals in the area and may effectively forestall the ability of generation to compete. But there is no mechanism to permit a direct comparison, let alone competition, between transmission and generation alternatives. There is no mechanism to evaluate whether the generation or transmission alternative is less costly, whether there is more risk associated with the generation or transmission alternatives, or who bears the risks associated with each alternative. Creating such a mechanism should be an explicit goal of PJM market design.

The PJM queue evaluation process should be improved to ensure that barriers to competition for new generation investments are not created. Issues that need to be addressed include the ownership rights to CIRs, whether transmission owners should perform interconnection studies, and improvements in queue management.

The PJM rules for competitive transmission development through the RTEP should build upon FERC Order No. 1000 to create real competition between incumbent transmission providers and merchant transmission providers. PJM should enhance the transparency and queue management process for merchant transmission investment. Issues related to data access and complete explanations of cost impacts should be addressed. The goal should be to remove barriers to competition from merchant transmission. Another element of opening competition would be to consider transmission owners' ownership of property and rights of way at or around transmission substations. In many cases, the land acquired included property intended to support future expansion of the grid. Incumbents have included the costs of the property in their rate base. Because PJM now has the responsibility for planning the development of the grid under its RTEP process, property bought to facilitate future expansion should be a part of the RTEP process and be made available to all providers on equal terms.

There are currently no market incentives for transmission owners to submit and complete transmission outages in a timely and efficient manner. Requiring transmission owners to pay does not create an effective incentive when those payments are passed through to transmission customers. The process for the submission of planned transmission outages needs to be carefully reviewed and redesigned to limit the ability of transmission owners to submit transmission outages that are late for FTR Auction bid submission dates and are late for the Day-Ahead Energy Market. The submission of late transmission outages can inappropriately affect market outcomes when market participants do not have the ability to modify market bids and offers.

Planned Generation and Retirements

Planned Generation Additions

Expected net revenues provide incentives to build new generation to serve PJM markets. The amount of planned new generation in PJM reflects investors' perception of the incentives provided by the combination of revenues from the PJM energy, capacity and ancillary service markets. On June 30, 2016, 83,390.2 MW of capacity were in generation request queues for construction through 2024, compared to an average installed capacity of 191,580.5 MW as of June 30, 2016. Although it is clear that not all generation in the queues will be built, PJM has added capacity annually since 2000 (Table 12-1). In the first six months of 2016, 4,299.2 MW of nameplate capacity went into service in PJM.

Table 12-1 Year-to-year capacity additions from PJM generation queue: Calendar years 2000 through June 30, 2016

Year	MW
2000	505.0
2001	872.0
2002	3,841.0
2003	3,524.0
2004	1,935.0
2005	819.0
2006	471.0
2007	1,265.0
2008	2,776.7
2009	2,515.9
2010	2,097.4
2011	5,007.8
2012	2,669.4
2013	1,126.8
2014	2,659.0
2015	3,808.4
2016	4,299.2

PJM Generation Queues

Generation request queues are groups of proposed projects, including new units, reratings of existing units, capacity resources and energy only resources. Each queue is open for a fixed amount of time. Studies commence on all projects in a given queue when that queue closes. The duration of the queue period has varied. Queues A and B were open for a year. Queues C-T were open for six months. Starting in February 2008, Queues U-Y1 were open for three months. Starting in May 2012, the duration of the queue period was reset to six months, starting with Queue Y2. Queue AC1 is currently open.

All projects that have been entered in a queue have a status assigned. Projects listed as active are undergoing one of the studies (feasibility, system impact, facility) required to proceed. Other status options are under construction, suspended, and in service. Withdrawn projects are removed from the queue and listed separately. A project cannot be suspended until it has reached the status of under construction. Any project that entered the queue before February 1, 2011, can be suspended for up to three years. Projects that entered the queue after February 1, 2011, face an additional restriction in that the suspension period is reduced to one year if they affect any project later in the queue.[8] When a project is suspended, PJM extends the scheduled milestones by the duration of the suspension. If, at any time, a milestone is not met, PJM will initiate the termination of the Interconnection Service Agreement (ISA) and the corresponding cancellation costs must be paid by the customer.[9]

Table 12-2 shows MW in queues by expected completion date and MW changes in the queues between December 31, 2015 and June 30, 2016, for ongoing projects, i.e. projects with the status active, under construction or suspended.[10] Projects that are already in service are not included here. The total MW in queues decreased by 1,932.9 MW, or 2.3 percent, from 85,323.1 MW at the end of 2015.

Table 12-2 Queue comparison by expected completion year (MW): December 31, 2015 vs. June 30, 2016[11]

			Change	
Year	As of 12/31/2015	As of 6/30/2016	MW	Percent
2015	9,641.9	0.0	NA	NA
2016	15,085.7	13,080.5	(2,005.2)	(15.3%)
2017	12,442.3	15,201.6	2,759.3	18.2%
2018	13,403.6	19,738.5	6,334.9	32.1%
2019	21,461.3	17,742.9	(3,718.4)	(21.0%)
2020	11,444.3	12,682.8	1,238.5	9.8%
2021	0.0	4,079.9	4,079.9	NA
2022	250.0	250.0	0.0	0.0%
2023	0.0	614.0	614.0	100.0%
2024	1,594.0	0.0	(1,594.0)	0.0%
Total	85,323.1	83,390.2	(1,932.9)	(2.3%)

Table 12-3 shows the yearly project status changes in more detail and how scheduled queue capacity has changed between December 31, 2015, and June 30, 2016. For example, 12,973.3 MW entered the queue in the first six months of 2016, 11,279.7 MW of which are currently active and 1,693.6 MW of which

8 See PJM. Manual 14C. "Generation and Transmission Interconnection Process," Revision 8 (December 20, 2012), Section 3.7, <http://www.pjm.com/~/media/documents/manuals/m14c.ashx>.
9 PJM does not track the duration of suspensions or PJM termination of projects.
10 Expected completion dates are entered when the project enters the queue. Actual completion dates are generally different than expected completion dates.
11 Wind and solar capacity in Table 12-2 through Table 12-5 have not been adjusted to reflect derating.

were withdrawn before the quarter ended. Of the total 52,350.1 MW marked as active at the beginning of the first six months of 2016, 6,005.4 MW were withdrawn, 29.9 MW were suspended, 979.5 MW started construction, and 1.1 MW went into service by the end of the quarter. The Under Construction column shows that 714.6 MW came out of suspension and 979.5 MW began construction in the first six months of 2016, in addition to the 22,694.2 MW of capacity that maintained the status under construction from the previous quarter.

Table 12-3 Change in project status (MW): December 31, 2015 vs. June 30, 2016

		Status at 6/30/2016				
Status at 12/31/2015	Total at 12/31/2015	Active	Suspended	Under Construction	In Service	Withdrawn
Entered in Q1-Q2 2016		11,279.7	0.0	0.0	0.0	1,693.6
Active	52,350.1	42,150.3	29.9	979.5	1.1	6,005.4
Suspended	4,698.9	0.0	4,460.6	714.6	0.0	368.6
Under Construction	28,274.1	0.0	1,081.8	22,694.2	1,592.1	1,827.6
In Service	41,021.9	0.0	0.0	0.0	43,797.8	0.0
Withdrawn	286,258.0	0.0	0.0	0.0	0.0	290,334.8
Total at 6/30/2016		53,430.0	5,572.3	24,388.3	45,391.0	300,229.9

Table 12-4 shows the amount of capacity active, in service, under construction, suspended, or withdrawn for each queue since the beginning of the RTEP process and the total amount of capacity that had been included in each queue. All items in queues A-M are either in service or have been withdrawn. As of June 30, 2016, there are 83,390.6 MW of capacity in queues that are not yet in service, of which 6.7 percent are suspended, 29.2 percent are under construction and 64.1 percent have not begun construction.

Table 12-4 Capacity in PJM queues (MW): At March 31, 2016[12]

Queue	Active	In-Service	Under Construction	Suspended	Withdrawn	Total
A Expired 31-Jan-98	0.0	8,103.0	0.0	0.0	17,252.0	25,355.0
B Expired 31-Jan-99	0.0	4,645.5	0.0	0.0	15,656.7	20,302.2
C Expired 31-Jul-99	0.0	531.0	0.0	0.0	3,474.8	4,005.8
D Expired 31-Jan-00	0.0	850.6	0.0	0.0	7,369.0	8,219.6
E Expired 31-Jul-00	0.0	795.2	0.0	0.0	8,033.8	8,829.0
F Expired 31-Jan-01	0.0	52.0	0.0	0.0	3,092.5	3,144.5
G Expired 31-Jul-01	0.0	1,189.6	0.0	0.0	17,980.8	19,170.4
H Expired 31-Jan-02	0.0	702.5	0.0	0.0	8,421.9	9,124.4
I Expired 31-Jul-02	0.0	103.0	0.0	0.0	3,738.3	3,841.3
J Expired 31-Jan-03	0.0	40.0	0.0	0.0	846.0	886.0
K Expired 31-Jul-03	0.0	98.9	0.0	0.0	485.3	584.2
L Expired 31-Jan-04	0.0	256.5	0.0	0.0	4,033.7	4,290.2
M Expired 31-Jul-04	0.0	504.8	0.0	0.0	3,705.6	4,210.4
N Expired 31-Jan-05	0.0	2,398.8	38.0	0.0	8,090.3	10,527.0
O Expired 31-Jul-05	0.0	1,668.2	437.0	0.0	5,466.8	7,572.0
P Expired 31-Jan-06	0.0	3,064.7	253.0	210.0	5,110.5	8,638.2
Q Expired 31-Jul-06	0.0	3,147.9	0.0	0.0	11,385.7	14,533.6
R Expired 31-Jan-07	0.0	1,886.4	648.3	800.0	19,420.6	22,755.3
S Expired 31-Jul-07	0.0	3,770.5	295.0	70.0	12,396.5	16,532.0
T Expired 31-Jan-08	200.0	2,814.0	1,408.0	300.0	22,813.3	27,535.3
U Expired 31-Jan-09	400.0	837.3	349.9	920.0	30,829.6	33,336.8
V Expired 31-Jan-10	969.2	1,940.6	780.1	555.0	12,568.4	16,813.3
W Expired 31-Jan-11	1,295.0	1,991.5	1,133.5	1,158.7	18,501.6	24,080.3
X Expired 31-Jan-12	1,749.0	2,869.9	7,075.7	354.8	18,295.0	30,344.5
Y Expired 30-Apr-13	1,276.5	661.8	4,519.6	855.5	18,465.3	25,778.5
Z Expired 30-Apr-14	2,050.0	411.6	5,125.2	62.2	6,684.7	14,333.7
AA1 Expired 31-Oct-14	6,933.9	54.2	2,214.1	256.3	2,543.9	12,002.4
AA2 Expired 30-Apr-15	8,952.3	1.1	48.5	20.0	7,054.4	16,076.3
AB1 Expired 31-Oct-15	14,342.3	0.0	62.5	9.9	6,058.9	20,473.6
AB2 Through 31-Mar-16	15,017.6	0.0	0.0	0.0	454.1	15,471.7
AC1 Through 30-Jun-16	244.2	0.0	0.0	0.0	0.0	244.2
Total	53,430.0	45,391.0	24,388.3	5,572.3	300,230.0	429,011.6

12 Projects listed as partially in service are counted as in service for the purposes of this analysis.

Distribution of Units in the Queues

Table 12-5 shows the projects under construction, suspended, or active, by unit type, and control zone.[13] As of June 30, 2016, 83,374.6 MW of capacity were in generation request queues for construction through 2024, compared to 85,323.1 MW at December 31, 2015.[14] Table 12-5 also shows the planned retirements for each zone.

Table 12-5 Queue capacity by LDA, control zone and fuel (MW): At June 30, 2016[15]

LDA	Zone	BioMass	CC	CT	Diesel	Fuel Cell	Hydro	Nuclear	Solar	Steam	Storage	Wind	Total Queue Capacity	Planned Retirements
EMAAC	AECO	0.0	1,706.0	469.0	0.0	1.7	0.0	0.0	71.0	0.0	20.0	175.0	2,442.7	0.0
	DPL	0.0	742.0	0.0	2.0	0.0	0.0	0.0	1,489.5	0.0	24.0	599.6	2,857.1	34.0
	JCPL	0.0	2,467.2	0.0	0.0	0.4	0.0	0.0	344.6	0.0	146.1	0.0	2,958.3	616.0
	PECO	0.0	1,221.0	0.0	6.6	0.0	0.0	94.0	0.0	0.0	40.0	0.0	1,361.6	50.8
	PSEG	0.0	2,659.5	1,009.0	5.6	0.4	0.0	0.0	96.6	24.0	2.0	0.0	3,797.1	611.0
	RECO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	EMAAC Total	0.0	8,795.7	1,478.0	14.2	2.6	0.0	94.0	2,001.7	24.0	232.1	774.6	13,416.9	1,311.8
SWMAAC	BGE	0.0	0.0	0.0	5.3	0.0	0.4	19.2	42.1	0.0	20.1	0.0	87.1	135.0
	Pepco	0.0	2,609.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2,609.6	0.0
	SWMAAC Total	0.0	2,609.6	0.0	5.3	0.0	0.4	19.2	42.1	0.0	20.1	0.0	2,696.7	135.0
WMAAC	Met-Ed	0.0	485.0	34.1	0.0	0.0	0.0	0.0	103.0	0.0	0.0	0.0	622.1	0.0
	PENELEC	0.0	1,340.5	1,150.9	140.9	0.0	40.0	0.0	13.5	0.0	40.0	358.3	3,084.1	0.0
	PPL	16.0	6,610.0	19.9	5.0	0.0	0.0	0.0	16.0	0.0	30.0	466.5	7,163.4	0.0
	WMAAC Total	16.0	8,435.5	1,204.9	145.9	0.0	40.0	0.0	132.5	0.0	70.0	824.8	10,869.6	0.0
Non-MAAC	AEP	0.0	10,671.0	398.0	9.4	0.0	146.5	102.0	529.2	211.0	114.0	6,526.2	18,707.3	0.0
	AP	0.0	4,480.4	0.0	126.8	0.0	0.0	0.0	427.7	1,726.5	71.0	1,123.8	7,956.2	0.0
	ATSI	0.0	5,148.0	25.0	24.7	0.0	0.0	0.0	150.0	0.0	12.5	518.0	5,878.2	0.0
	ComEd	0.0	5,014.3	940.0	53.9	0.0	22.7	80.0	0.0	0.0	109.0	3,742.5	9,962.4	2,329.0
	DAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.4	12.0	20.0	300.0	355.4	0.0
	DEOK	0.0	0.0	0.0	4.8	0.0	0.0	0.0	125.0	50.0	29.8	0.0	209.6	0.0
	DLCO	0.0	205.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	225.0	0.0
	Dominion	62.5	5,869.9	167.4	12.0	0.0	0.0	0.0	3,843.5	0.0	34.0	1,344.1	11,333.4	412.0
	EKPC	0.0	1,764.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,764.0	0.0
	Non-MAAC Total	62.5	33,152.6	1,530.4	231.6	0.0	169.2	182.0	5,098.8	1,999.5	410.3	13,554.6	56,391.5	2,741.0
Total		78.5	52,993.4	4,213.3	397.0	2.6	209.6	295.2	7,275.1	2,023.5	732.5	15,154.0	83,374.6	4,187.8

A significant shift in the distribution of unit types within the PJM footprint continues to develop as natural gas fired units enter the queue and steam units retire. While 57,552.1 MW of gas fired capacity are in the queue, there are only 2,007.0 MW of coal fired steam capacity in the queue. The only new coal project currently in the queue is the new Hatfield unit, with 1,710 MW of capacity. This project, which entered the queue in October 2014 and is already under construction, is intended to replace three coal units retired in October 2013 at the same location. With respect to retirements, 1,109.0 MW of coal fired steam capacity and 208.8 MW of natural gas capacity are slated for deactivation between now and 2020. The replacement of coal steam units by units burning natural gas could significantly affect future congestion, the role of firm and interruptible gas supply, and natural gas supply infrastructure.

Planned Retirements

As shown in Table 12-6, 28,396 MW have been, or are planned to be, retired between 2011 and 2020.[16] Of that, 4,238.3 MW are planned to retire after 2016. In the first six months of 2016, 381.0 MW were retired. Of the 4,238.3 MW pending retirement, 1,109.0 MW are coal units. The coal unit retirements were a result of low gas prices and the EPA's Mercury and Air Toxics Standards (MATS) for some units.

13 Unit types designated as reciprocating engines are classified as diesel.

14 Since wind resources cannot be dispatched on demand, PJM rules previously required that the unforced capacity of wind resources be derated to 20 percent of nameplate capacity until actual generation data are available. Beginning with Queue U, PJM derates wind resources to 13 percent of nameplate capacity until there is operational data to support a different conclusion. PJM derates solar resources to 38 percent of nameplate capacity. Based on the derating of 15,154.0 MW of wind resources and 5,098.8 MW of solar resources, the 83,374.6 MW currently active in the queue would be reduced to 67,029.4 MW.

15 This data includes only projects with a status of active, under-construction, or suspended.

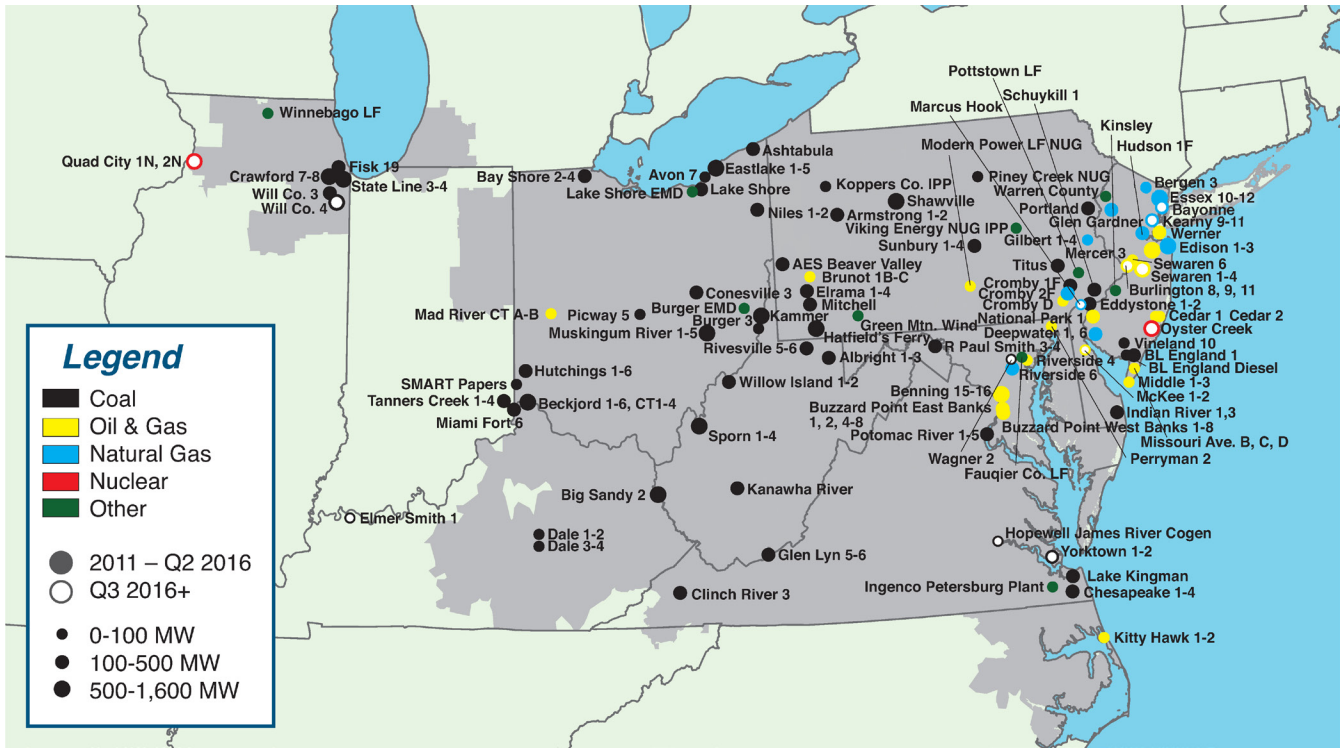
16 See PJM "Generator Deactivation Summary Sheets," at <http://www.pjm.com/planning/generation-deactivation/gd-summaries.aspx> (June 2, 2016).

Table 12-6 Summary of PJM unit retirements by fuel (MW): 2011 through 2020

	Coal	Diesel	Heavy Oil	Kerosene	Landfill Gas	Light Oil	Natural Gas	Nuclear	Wind	Wood Waste	Total
Retirements 2011	543.0	0.0	0.0	0.0	0.0	63.7	522.5	0.0	0.0	0.0	1,129.2
Retirements 2012	5,907.9	0.0	0.0	0.0	0.0	788.0	250.0	0.0	0.0	16.0	6,961.9
Retirements 2013	2,589.9	2.9	166.0	0.0	3.8	85.0	0.0	0.0	0.0	8.0	2,855.6
Retirements 2014	2,427.0	50.0	0.0	184.0	15.3	0.0	294.0	0.0	0.0	0.0	2,970.3
Retirements 2015	7,661.8	10.3	0.0	644.2	2.0	212.0	1,319.0	0.0	10.4	0.0	9,859.7
Retirements 2016	243.0	59.0	74.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	381.0
Planned Retirements 2016	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Planned Retirements Post-2016	1,109.0	0.0	34.0	0.0	0.0	0.0	661.8	2,433.5	0.0	0.0	4,238.3
Total	20,481.6	122.2	274.0	828.2	26.1	1,148.7	3,047.3	2,433.5	10.4	24.0	28,396.0

A map of the retirements between 2011 and 2020 is shown in Figure 12-1.

Figure 12-1 Map of PJM unit retirements: 2011 through 2020



The list of pending retirements is shown in Table 12-7.

Table 12-7 Planned retirement of PJM units: as of June 30, 2016

Unit	Zone	ICAP (MW)	Fuel	Unit Type	Projected Deactivation Date
Yorktown 1-2	Dominion	323.0	Coal	Steam	15-Apr-17
McKee 1-2	DPL	34.0	Heavy Oil	Combustion Turbine	31-May-17
Hopewell James River Cogen	Dominion	89.0	Coal	Steam	31-May-17
Will County 4	ComEd	510.0	Coal	Steam	31-May-18
Sewaren 1-4	PSEG	453.0	Kerosene	Combustion Turbine	01-Jun-18
Quad Cities 1-2	ComEd	1,819.0	Nuclear	Nuclear	01-Jun-18
Bayonne Cogen Plant (CC)	PSEG	158.0	Natural gas	Steam	01-Nov-18
MH50 Marcus Hook Co-gen	PECO	50.8	Natural gas	Steam	13-May-19
Elmer Smith U1	External	52.0	Coal	Steam	01-Jun-19
Oyster Creek	JCPL	614.5	Nuclear	Nuclear	31-Dec-19
Wagner 2	BGE	135.0	Coal	Steam	01-Jun-20
Total		4,238.3			

Table 12-8 shows the capacity, average size, and average age of units retiring in PJM, from 2011 through 2020, while Table 12-9 shows these retirements by state. The majority, 72.1 percent, of all MW retiring during this period are coal steam units. These units have an average age of 55.8 years and an average size of 162.6 MW. Over half of them, 52.3 percent, are located in either Ohio or Pennsylvania. Retirements have generally consisted of smaller subcritical coal steam units and those without adequate environmental controls to remain viable beyond 2016.

Table 12-8 Retirements by fuel type: 2011 through 2020

	Number of Units	Avg. Size (MW)	Avg. Age at Retirement (Years)	Total MW	Percent
Coal	126	162.6	55.8	20,481.6	72.1%
Diesel	7	17.5	42.7	122.2	0.4%
Heavy Oil	4	68.5	57.5	274.0	1.0%
Kerosene	20	41.4	45.5	828.2	2.9%
Landfill Gas	8	3.3	14.4	26.1	0.1%
Light Oil	15	76.6	43.8	1,148.7	4.0%
Natural Gas	51	59.8	46.4	3,047.3	10.7%
Nuclear	3	811.2	47.7	2,433.5	8.6%
Wind	1	10.4	15.0	10.4	0.0%
Wood Waste	2	12.0	23.5	24.0	0.1%
Total	237	119.8	49.8	28,396.0	100.0%

Table 12-9 Retirements (MW) by fuel type and state: 2011 through 2020

State	Coal	Diesel	Heavy Oil	Kerosene	Landfill Gas	Light Oil	Natural Gas	Nuclear	Wind	Wood Waste	Total
DC	0.0	0.0	0.0	0.0	0.0	788.0	0.0	0.0	0.0	0.0	788.0
DE	254.0	0.0	34.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	288.0
IL	2,134.0	0.0	0.0	0.0	6.4	0.0	0.0	1,819.0	0.0	0.0	3,959.4
IN	982.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	982.0
KY	1,047.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,047.0
MD	250.0	51.0	74.0	0.0	0.0	0.0	115.0	0.0	0.0	0.0	490.0
NC	0.0	0.0	0.0	0.0	0.0	31.0	0.0	0.0	0.0	0.0	31.0
NJ	136.0	8.0	0.0	828.2	7.7	212.0	2,680.5	614.5	0.0	0.0	4,486.9
OH	5,752.6	60.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5,812.9
PA	5,145.0	0.0	166.0	0.0	10.0	117.7	251.8	0.0	10.4	24.0	5,724.9
VA	2,140.0	2.9	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	2,144.9
WV	2,641.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2,641.0
Total	20,481.6	122.2	274.0	828.2	26.1	1,148.7	3,047.3	2,433.5	10.4	24.0	28,396.0

Actual Generation Deactivations in 2016

Table 12-10 shows the units that were deactivated in 2016.

Table 12-10 Unit deactivations in 2016

Company	Unit Name	ICAP (MW)	Primary Fuel	Zone Name	Average Age (Years)	Retirement Date
Exelon Corporation	Fauquier County Landfill	2.0	Diesel	Dominion	12	31-Jan-16
Exelon Corporation	Perryman 2	51.0	Diesel	BGE	44	01-Feb-16
NRG Energy Inc.	Avon Lake 7	94.0	Coal	ATSI	67	16-Apr-16
Eastern Kentucky Power Cooperative, Inc.	Dale 3	74.0	Coal	EKPC	59	16-Apr-16
Eastern Kentucky Power Cooperative, Inc.	Dale 4	75.0	Coal	EKPC	56	16-Apr-16
Rockland Capital Energy Investments, LLC	BL England Diesel Units 1-4	8.0	Diesel	AECO	55	31-May-16
Exelon Corporation	Riverside 4	74.0	Heavy Oil	BGE	65	01-Jun-16
South Jersey Industries, Inc.	Warren County Landfill Generator	3.0	LFG	JCPL	10	02-Jun-16
Total		381.0				

Generation Mix

As of June 30, 2016, PJM had an installed capacity of 191,697.2 MW (Table 12-11). This measure differs from capacity market installed capacity because it includes energy-only units, excludes all external units, and uses nameplate values for solar and wind resources.

Table 12-11 Existing PJM capacity: At June 30, 2016 (By zone and unit type (MW))[17]

Zone	CC	CT	Diesel	Fuel Cell	Hydroelectric	Nuclear	Solar	Steam	Storage	Wind	Total
AECO	901.9	570.7	22.6	0.0	0.0	0.0	41.7	815.9	0.0	7.5	2,360.3
AEP	6,100.0	3,682.2	77.1	0.0	1,071.9	2,071.0	2.5	18,897.8	4.0	2,103.2	34,009.7
APS	1,129.0	1,226.9	47.9	0.0	129.2	0.0	36.1	5,409.0	47.4	1,088.5	9,114.0
ATSI	685.0	1,617.4	67.7	0.0	0.0	2,134.0	0.0	5,719.0	0.0	0.0	10,223.1
BGE	0.0	789.0	18.4	0.0	0.0	1,716.0	0.0	2,995.5	0.0	0.0	5,518.9
ComEd	3,146.1	7,244.0	93.8	0.0	0.0	10,473.5	9.0	5,166.1	107.5	2,606.9	28,846.9
DAY	0.0	1,368.5	47.5	0.0	0.0	0.0	1.1	2,908.0	40.0	0.0	4,365.1
DEOK	47.2	654.0	0.0	0.0	112.0	0.0	0.0	3,567.0	10.0	0.0	4,390.2
DLCO	244.0	15.0	0.0	0.0	6.3	1,777.0	0.0	660.0	0.0	0.0	2,702.3
Dominion	6,851.6	3,761.7	151.8	0.0	3,589.3	3,581.3	157.8	7,775.0	0.0	0.0	25,868.5
DPL	1,498.5	1,820.4	96.1	30.0	0.0	0.0	10.0	1,620.0	0.0	0.0	5,075.0
EKPC	0.0	774.0	0.0	0.0	70.0	0.0	0.0	1,687.0	0.0	0.0	2,531.0
JCPL	2,682.5	763.1	19.9	0.0	400.0	614.5	151.2	10.0	0.0	0.0	4,641.2
Met-Ed	2,111.0	406.5	41.4	0.0	19.0	805.0	0.0	200.0	0.0	0.0	3,582.9
PECO	3,209.0	834.0	2.9	0.0	1,642.0	4,546.8	3.0	979.1	1.0	0.0	11,217.8
PENELEC	850.0	407.5	110.2	0.0	512.8	0.0	0.0	6,793.5	10.4	930.9	9,615.3
Pepco	230.0	1,091.7	9.9	0.0	0.0	0.0	0.0	3,649.1	0.0	0.0	4,980.7
PPL	2,657.9	616.2	55.5	0.0	706.6	2,520.0	15.0	5,169.9	20.0	219.7	11,980.8
PSEG	3,846.3	1,132.0	11.1	0.0	5.0	3,493.0	134.0	2,050.1	2.0	0.0	10,673.5
RECO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	36,190.0	28,774.8	873.8	30.0	8,264.1	33,732.1	561.4	76,072.0	242.3	6,956.7	191,697.2

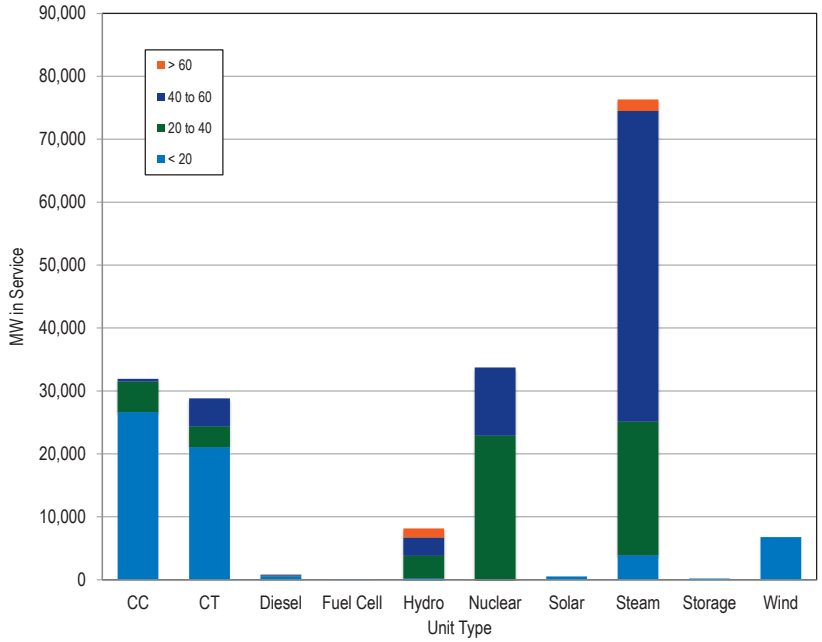
Figure 12-2 and Table 12-12 show the age of PJM generators by unit type. Units older than 40 years comprise 71,186.4 MW, or 37.1 percent, of the total capacity of 191,697.2 MW.

Table 12-12 PJM capacity (MW) by age (years): At June 30, 2016

Age (years)	CC	CT	Diesel	Fuel Cell	Hydroelectric	Nuclear	Solar	Steam	Storage	Wind	Total
Less than 20	30,893.5	21,015.3	609.4	30.0	344.8	0.0	561.4	3,905.5	242.3	6,956.7	64,558.9
20 to 40	4,854.5	3,315.5	98.8	0.0	3,557.2	22,893.9	0.0	21,232.0	0.0	0.0	55,951.9
40 to 60	442.0	4,444.0	163.6	0.0	2,915.0	10,838.2	0.0	49,188.5	0.0	0.0	67,991.3
More than 60	0.0	0.0	2.0	0.0	1,447.1	0.0	0.0	1,746.0	0.0	0.0	3,195.1
Total	36,190.0	28,774.8	873.8	30.0	8,264.1	33,732.1	561.4	76,072.0	242.3	6,956.7	191,697.2

17 The capacity described in this section refers to all capacity in PJM at nameplate ratings, regardless of whether the capacity entered the RPM auction. This table previously included external units.

Figure 12-2 PJM capacity (MW) by age (years): At June 30, 2016



Generation and Transmission Interconnection Planning Process

PJM made changes to the queue process in May 2012.[18] These changes included reducing the length of the queues, creating an alternate queue for some small projects, and adjustments to the rules regarding suspension rights and Capacity Interconnection Rights (CIR). PJM staff reported on June 11, 2015, that due to these and other process improvements, the study backlog has been significantly reduced.[19] The Earlier Queue Submittal Task Force (EQSTF) was established in August 2015, to further address the issue.[20]

18 See letter from PJM to Secretary Kimberly Bose, Docket No. ER12-1177-000, <http://www.pjm.com/~/media/documents/ferc/2012-filings/20120229-er12-1177-000.ashx>.

19 See presentation by Dave Egan to the PJM Planning Committee, at <http://www.pjm.com/~/media/committees-groups/committees/pc/20150611/20150611-item-09-queue-status-update.ashx>.

20 See Earlier Queue Submittal Task Force at <http://www.pjm.com/committees-and-groups/task-forces/eqstf.aspx>.

Interconnection Study Phase

In the study phase of the interconnection planning process, a series of studies are performed to determine the feasibility, impact, and cost of projects in the queue. Table 12-13 is an overview of PJM's study process. System impact and facilities studies are often redone when a project is withdrawn in order to determine the impact on the projects remaining in the queue.

Table 12-13 PJM generation planning process

Process Step	Start on	Financial Obligation	Days for PJM to Complete	Days for Applicant to Decide Whether to Continue
Feasibility Study	Close of current queue	Cost of study (partially refundable deposit)	90	30
System Impact Study	Upon acceptance of the System Impact Study Agreement	Cost of study (partially refundable deposit)	120	30
Facilities Study	Upon acceptance of the Facilities Study Agreement	Cost of study (refundable deposit)	Varies	60
Schedule of Work	Upon acceptance of Interconnection Service Agreement (ISA)	Letter of credit for upgrade costs	Varies	37
Construction (only for new generation)	Upon acceptance of Interconnection Construction Service Agreement (ICSA)	None	Varies	NA

Manual 14B requires PJM to apply a commercial probability factor at the feasibility study stage to improve the accuracy of capacity and cost estimates. The commercial probability factor is based on the historical incidence of projects dropping out of the queue at the impact study stage.[21] The impact and facilities studies are performed using the full amount of planned generation in the queues. The actual withdrawal rates are shown in Table 12-14 and Table 12-15.

Table 12-14 shows the milestone status when projects were withdrawn, for all withdrawn projects. Of the projects withdrawn, 47.8 percent were withdrawn before the system impact study was completed. Once an Interconnection Service Agreement (ISA) or a Wholesale Market Participation Agreement (WMPA) is executed, the financial obligation for any necessary transmission

21 See PJM Manual 14B. "PJM Region Transmission Planning Process," Revision 33 (May 5, 2016), p.70.

upgrades cannot be retracted.[22] [23] Withdrawing at or beyond this point is uncommon; only 221 projects, or 12.5 percent, of all projects withdrawn were withdrawn after reaching this milestone.

Table 12-14 Last milestone at time of withdrawal: January 1, 1997 through June 30, 2016

Milestone Completed	Projects Withdrawn	Percent
Never Started	93	5.3%
Feasibility Study	788	44.5%
System Impact Study	427	24.1%
Facilities Study	242	13.7%
Construction Service Agreement (CSA) or beyond	221	12.5%
Total	1,771	100.0%

Table 12-15 and Table 12-16 show the time spent at various stages in the queue process and the completion time for the studies performed. For completed projects, there is an average time of 960 days, or 2.6 years, between entering a queue and going into service. For withdrawn projects, there is an average time of 701 days between entering a queue and withdrawing.

Table 12-15 Average project queue times (days): At June 30, 2016

Status	Average (Days)	Standard Deviation	Minimum	Maximum
Active	933	646	34	3,745
In-Service	945	691	1	4,024
Suspended	2,200	881	634	4,260
Under Construction	1,703	998	205	6,380
Withdrawn	676	688	5	4,249

Table 12-16 presents information on the time in the stages of the queue for those projects not yet in service. Of the 651 projects in the queue as of June 30, 2016, 116 had a completed feasibility study and 223 were under construction.

22 "Generators planning to connect to the local distribution systems at locations that are not under FERC jurisdiction and wish to participate in PJM's market need to execute a PJM Wholesale Market Participation Agreement (WMPA)..." instead of an ISA. See PJM Manual 14C. "Generation and Transmission Interconnection Facility Construction," Revision 08 (December 20, 2012), p.8.

23 See PJM. "Manual 14C: Generation and Transmission Interconnection Facility Construction," Revision 08 (December 20, 2012), p.22.

Table 12-16 PJM generation planning summary: At June 30, 2016

Milestone Reached	Number of Projects	Percent of Total Projects	Average Days	Maximum Days
Never Started	155	22.3%	731	2,540
Feasibility Study	116	16.7%	792	1,828
System Impact Study	97	14.0%	971	3,651
Facilities Study	103	14.8%	1,731	4,260
Construction Service Agreement (CSA) or beyond	223	32.1%	1,846	4,621
Total	694	100.0%		

The time it takes to complete a study depends on the backlog and the number of projects in the queue, but not on the size of the project. Table 12-17 shows the number of projects that entered the queue by year. The last two full years show an increase in queue entries, primarily by renewable projects (solar, hydro, storage, biomass, wind). Of the 496 projects entered in 2014 and 2015, 314, 63.3 percent, were renewable. Of the 136 projects entered in the first six months of 2016, 137, 80.6 percent, were renewable.

Table 12-17 Number of projects entered in the queue as of June 30, 2016

	Fuel Group			
Year Entered	Nuclear	Renewable	Traditional	Grand Total
1997	2	0	11	13
1998	0	0	18	18
1999	1	5	85	91
2000	2	3	79	84
2001	4	6	83	93
2002	3	14	33	50
2003	1	35	17	53
2004	4	17	32	53
2005	3	78	51	132
2006	9	78	70	157
2007	9	68	142	219
2008	3	114	99	216
2009	10	113	50	173
2010	5	381	55	441
2011	6	265	78	349
2012	2	73	80	155
2013	1	78	73	152
2014	0	122	68	190
2015	0	192	114	306
2016	2	136	32	170
Total	67	1,778	1,270	3,115

Even though renewable projects comprise the majority of projects entered in the queue, as well as what is currently active in the queue, renewable projects only account for 28.1 percent of the nameplate MW currently active in the queue (Table 12-18).

Table 12-18 Queue details by fuel group: At June 30, 2016

Fuel Group	Number of Projects	Percent of Projects	MW	Percent MW
Nuclear	11	1.6%	295.2	0.4%
Renewable	458	65.6%	23,454.1	28.1%
Traditional	229	32.8%	59,663.7	71.5%
Total	698	100.0%	83,413.0	100.0%

Table 12-19 shows the current status of all generation queue projects by fuel type and project classification from January 1, 1997, through June 30, 2016. For example, between January 1, 1997 and June 30, 2016, 133 upgrades at natural gas fired facilities have completed the queue process and are in service.

Table 12-19 Status of all generation queue projects: January 1, 1997 through June 30, 2016

		Number of Projects												
Project Status	Project Classification	Natural Gas	Wind	Coal	Solar	Nuclear	Hydro	Oil	Biomass	Storage	Other	LFG	Diesel	TOTAL
In Service	New Generation	85	59	9	89	1	9	4	8	13	3	69	6	355
	Upgrade	133	15	45	5	37	17	14	4	3	4	12	2	291
Under Construction	New Generation	35	25	2	58	-	4	-	1	30	-	10	-	165
	Upgrade	24	-	5	11	1	-	-	2	3	-	3	-	49
Suspended	New Generation	12	17	-	25	-	-	-	-	2	-	1	-	57
	Upgrade	2	2	-	-	-	-	-	-	-	-	-	-	4
Withdrawn	New Generation	397	352	53	597	9	40	9	32	51	10	72	12	1,634
	Upgrade	65	13	12	8	9	2	13	1	3	2	7	2	137
Active	New Generation	73	43	-	182	-	1	-	-	29	-	5	-	333
	Upgrade	53	6	3	6	10	2	-	-	9	-	-	1	90
Total Projects	New Generation	602	496	64	951	10	54	13	41	125	13	157	18	2,544
	Upgrade	277	36	65	30	57	21	27	7	18	6	22	5	571

Since 1997, there have been a total of 3,115 projects in PJM generation queues. A total of 2,544 projects have been classified as new generation and 571 projects have been classified as upgrades. Wind, solar and natural gas projects have accounted for 2,392 projects, or 76.7 percent, of all 3,115 generation queue projects. A total of 183 new projects from either project classification entered the generation queue in the first six months of 2016.

Table 12-22 shows the MW in Table 12-19 by share by classification as new generation or upgrade. Within a fuel type the shares of upgrades add to 100 percent and the shares of new generation add to 100 percent. For example, 81.0 percent of all hydro projects classified as upgrades are currently in service in PJM, 9.5 percent of hydro upgrades were withdrawn and 9.5 percent are active. From January 1, 1997, through June 30, 2016, solar projects have had the lowest completion rate across all technology types for projects classified as new generation and solar and storage projects have had the lowest completion rate across all technology types for projects classified as upgrades. Landfill gas projects have had the highest completion rate across all technology types for projects classified as new generation and hydro projects have had the highest completion rate across all technology types for projects classified as upgrades.

Table 12-20 Status of all generation queue projects as percent of total projects by classification: January 1, 1997 through June 30, 2016

		Percent of Total Project MW by Classification											
Project Status	Project Classification	Natural Gas	Wind	Coal	Solar	Nuclear	Hydro	Oil	Biomass	Storage	Other	LFG	Diesel
In Service	New Generation	14.1%	11.9%	14.1%	9.4%	10.0%	16.7%	30.8%	19.5%	10.4%	23.1%	43.9%	33.3%
	Upgrade	48.0%	41.7%	69.2%	16.7%	64.9%	81.0%	51.9%	57.1%	16.7%	66.7%	54.5%	40.0%
Under Construction	New Generation	5.8%	5.0%	3.1%	6.1%	0.0%	7.4%	0.0%	2.4%	24.0%	0.0%	6.4%	0.0%
	Upgrade	8.7%	0.0%	7.7%	36.7%	1.8%	0.0%	0.0%	28.6%	16.7%	0.0%	13.6%	0.0%
Suspended	New Generation	2.0%	3.4%	0.0%	2.6%	0.0%	0.0%	0.0%	0.0%	1.6%	0.0%	0.6%	0.0%
	Upgrade	0.7%	5.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Withdrawn	New Generation	65.9%	71.0%	82.8%	62.8%	90.0%	74.1%	69.2%	78.0%	40.8%	76.9%	45.9%	66.7%
	Upgrade	23.5%	36.1%	18.5%	26.7%	15.8%	9.5%	48.1%	14.3%	16.7%	33.3%	31.8%	40.0%
Active	New Generation	12.1%	8.7%	0.0%	19.1%	0.0%	1.9%	0.0%	0.0%	23.2%	0.0%	3.2%	0.0%
	Upgrade	19.1%	16.7%	4.6%	20.0%	17.5%	9.5%	0.0%	0.0%	50.0%	0.0%	0.0%	20.0%

Table 12-23 shows the nameplate generating capacity of projects in the PJM generation queue by technology type and project classification. For example, the 365 new generation wind projects that have been withdrawn from the queue as of June 30, 2016 listed in Table 12-19, constitute 55,486.1MW of nameplate capacity. The 462 new generation and upgrade natural gas projects that have been withdrawn in the same time period constitute 187,765.1 MW of nameplate capacity.

Table 12-21 Status of all generation capacity (MW) in the PJM generation queue: January 1, 1997 through June 30, 2016

		Project MW												
Project Status	Project Classification	Natural Gas	Wind	Coal	Solar	Nuclear	Hydro	Oil	Biomass	Storage	Other	LFG	Diesel	TOTAL
In Service	New Generation	21,759.8	6,881.3	1,378.0	649.2	9.0	465.6	607.0	255.7	139.0	50.0	366.6	69.5	32,630.6
	Upgrade	6,166.9	33.7	755.5	8.9	3,730.8	1,260.6	125.8	28.8	36.4	547.5	40.3	25.3	12,760.4
Under Construction	New Generation	16,630.2	3,669.3	1,790.0	656.0	0.0	123.1	0.0	16.0	81.1	0.0	62.0	0.0	23,027.7
	Upgrade	986.1	0.0	120.0	5.0	102.0	0.0	0.0	62.5	72.0	0.0	13.0	0.0	1,360.6
Suspended	New Generation	1,550.2	3,290.0	0.0	414.7	0.0	0.0	0.0	0.0	40.0	0.0	0.9	0.0	5,295.7
	Upgrade	201.6	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	276.6
Withdrawn	New Generation	179,173.7	55,197.1	31,721.6	7,917.6	8,161.0	1,988.0	1,721.0	1,027.7	568.1	843.8	405.7	63.9	288,789.3
	Upgrade	8,591.4	289.0	815.0	47.8	916.0	56.0	589.0	12.1	32.0	24.0	39.4	29.0	11,440.7
Active	New Generation	34,521.0	7,909.7	0.0	5,999.2	0.0	12.5	0.0	0.0	406.8	0.0	22.6	0.0	48,871.8
	Upgrade	3,663.1	210.0	97.0	204.6	193.2	74.0	0.0	0.0	132.6	0.0	0.0	6.1	4,580.6
Total Projects	New Generation	253,634.8	76,947.4	34,889.6	15,636.7	8,170.0	2,589.2	2,328.0	1,299.4	1,235.0	893.8	857.7	133.4	398,615.1
	Upgrade	19,609.1	607.7	1,787.5	266.3	4,942.0	1,390.6	714.8	103.4	273.0	571.5	92.7	60.4	30,418.9

Table 12-22 shows the MW in Table 12-21 by share by classification as new generation or upgrade. Within a fuel type the shares of upgrades add to 100 percent and the shares of new generation add to 100 percent. For example, 42.3 percent of all coal projects classified as upgrades are currently in service in PJM, 6.7 percent are under construction, 45.6 percent were withdrawn and 5.4 percent are active.

Table 12-22 Status of all generation queue projects as percent of total MW in project classification: January 1, 1997 through June 30, 2016

		Percent of Total Project MW by Classification											
Project Status	Project Classification	Natural Gas	Wind	Coal	Solar	Nuclear	Hydro	Oil	Biomass	Storage	Other	LFG	Diesel
In Service	New Generation	8.6%	8.9%	3.9%	4.2%	0.1%	18.0%	26.1%	19.7%	11.3%	5.6%	42.7%	52.1%
	Upgrade	31.4%	5.5%	42.3%	3.3%	75.5%	90.7%	17.6%	27.9%	13.3%	95.8%	43.5%	41.9%
Under Construction	New Generation	6.6%	4.8%	5.1%	4.2%	0.0%	4.8%	0.0%	1.2%	6.6%	0.0%	7.2%	0.0%
	Upgrade	5.0%	0.0%	6.7%	1.9%	2.1%	0.0%	0.0%	60.4%	26.4%	0.0%	14.0%	0.0%
Suspended	New Generation	0.6%	4.3%	0.0%	2.7%	0.0%	0.0%	0.0%	0.0%	3.2%	0.0%	0.1%	0.0%
	Upgrade	1.0%	12.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Withdrawn	New Generation	70.6%	71.7%	90.9%	50.6%	99.9%	76.8%	73.9%	79.1%	46.0%	94.4%	47.3%	47.9%
	Upgrade	43.8%	47.6%	45.6%	18.0%	18.5%	4.0%	82.4%	11.7%	11.7%	4.2%	42.5%	48.0%
Active	New Generation	13.6%	10.3%	0.0%	38.4%	0.0%	0.5%	0.0%	0.0%	32.9%	0.0%	2.6%	0.0%
	Upgrade	18.7%	34.6%	5.4%	76.8%	3.9%	5.3%	0.0%	0.0%	48.6%	0.0%	0.0%	10.1%

Table 12-23 shows the status of all natural gas projects by number of projects that entered PJM generation queues from January 1, 1997 through June 30, 2016, by zone. Of the 126 natural gas projects classified either as new generation or upgrade currently active in the PJM generation queue, 53 projects, 42.1 percent, are located within AEP, ComEd and PENELEC.

Table 12-23 Status of all natural gas generation queue projects: January 1, 1997 through June 30, 2016

		Number of Projects																				
Project Status	Project Classification	AECO	AEP	AP	ATSI	BGE	ComEd	DAY	DEOK	Dominion	DPL	DLCO	EKPC	JCPL	Met-Ed	PECO	PENELEC	Pepco	PPL	PSEG	RECO	TOTAL
In Service	New Generation	7	2	7	0	6	2	0	1	4	7	0	0	8	3	7	6	6	8	11	0	85
	Upgrade	7	9	6	1	3	9	6	0	27	13	0	0	5	1	8	5	3	6	24	0	133
Under Construction	New Generation	3	5	2	1	1	0	0	0	3	0	1	0	1	0	2	4	4	6	2	0	35
	Upgrade	1	4	2	1	0	6	0	0	4	0	0	0	0	0	2	0	2	1	1	0	24
Suspended	New Generation	2	1	5	0	0	0	0	0	0	1	0	0	0	0	0	3	0	0	0	0	12
	Upgrade	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	2
Withdrawn	New Generation	23	11	37	12	11	8	0	1	17	18	2	2	22	25	41	46	32	34	53	2	397
	Upgrade	5	1	4	3	0	1	0	1	7	4	0	0	5	7	2	4	3	4	14	0	65
Active	New Generation	4	11	7	5	0	10	0	0	3	1	0	2	4	1	1	11	0	4	9	0	73
	Upgrade	2	9	6	2	0	7	0	0	5	0	0	0	1	2	3	2	1	6	7	0	53
Total Projects	New Generation	39	30	58	18	18	20	0	2	27	27	3	4	35	29	51	70	42	52	75	2	602
	Upgrade	15	23	18	7	3	23	6	1	43	17	0	0	12	10	15	12	9	17	46	0	277

Table 12-24 shows the status of all gas projects by MW that entered PJM generation queues from January 1, 1997 through June 30, 2016, by zone.

Table 12-24 Status of all natural gas generation capacity (MW) in the PJM generation queue: January 1, 1997 through June 30, 2016

		Project MW																				
Project Status	Project Classification	AECO	AEP	AP	ATSI	BGE	ComEd	DAY	DEOK	Dominion	DPL	DLCO	EKPC	JCPL	Met-Ed	PECO	PENELEC	Pepco	PPL	PSEG	RECO	TOTAL
In Service	New Generation	1,016.2	1,615.0	1,701.0	0.0	390.0	629.0	0.0	20.0	3,211.0	1,122.2	0.0	0.0	2,070.3	1,397.0	2,464.3	1,227.3	115.0	2,726.6	2,054.9	0.0	21,759.8
	Upgrade	265.7	244.0	796.7	40.0	6.5	849.5	60.0	0.0	1,383.7	189.0	0.0	0.0	224.0	10.0	715.0	45.5	45.1	327.3	964.9	0.0	6,166.9
Under Construction	New Generation	453.5	3,314.0	946.5	800.0	1.3	0.0	0.0	0.0	3,315.1	0.0	205.0	0.0	440.0	0.0	760.5	88.7	2,374.0	3,924.0	7.6	0.0	16,630.2
	Upgrade	7.0	41.0	16.0	161.0	0.0	112.6	0.0	0.0	232.0	0.0	0.0	0.0	0.0	0.0	132.0	0.0	124.5	0.0	160.0	0.0	986.1
Suspended	New Generation	606.0	525.0	70.1	0.0	0.0	0.0	0.0	0.0	0.0	291.0	0.0	0.0	0.0	0.0	0.0	58.1	0.0	0.0	0.0	0.0	1,550.2
	Upgrade	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	200.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	201.6
Withdrawn	New Generation	6,932.0	5,535.0	15,915.1	5,400.8	4,792.1	3,948.0	0.0	134.5	11,066.0	5,651.4	665.0	377.8	10,726.0	12,486.5	23,270.0	16,537.1	19,769.2	13,576.7	22,383.7	6.9	179,173.7
	Upgrade	122.8	610.0	567.0	86.0	0.0	10.0	0.0	36.0	305.3	668.0	0.0	0.0	253.0	1,730.0	205.0	1,040.6	85.0	480.0	2,392.7	0.0	8,591.4
Active	New Generation	963.2	6,933.0	3,355.9	4,066.9	0.0	4,869.3	0.0	0.0	2,051.9	451.0	0.0	1,764.0	1,827.6	450.0	220.0	2,403.4	0.0	1,878.9	3,285.8	0.0	34,521.0
	Upgrade	147.0	256.0	220.0	165.0	0.0	1,001.0	0.0	0.0	438.3	0.0	0.0	0.0	0.0	69.1	109.0	98.5	111.1	827.0	221.1	0.0	3,663.1
Total Projects	New Generation	9,970.9	17,922.0	21,988.6	10,267.7	5,183.4	9,446.3	0.0	154.5	19,644.0	7,515.6	870.0	2,141.8	15,063.9	14,333.5	26,714.8	20,314.6	22,258.2	22,106.2	27,732.0	6.9	253,634.8
	Upgrade	542.5	1,151.0	1,599.7	452.0	6.5	1,973.1	60.0	36.0	2,359.3	857.0	0.0	0.0	677.0	1,809.1	1,161.0	1,186.2	365.7	1,634.3	3,738.7	0.0	19,609.1

Table 12-25 shows the status of all wind generation projects that entered PJM generation queues from January 1, 1997 through June 30, 2016, by zone. Of the 74 wind projects to achieve in service status, 55 projects, 74.3 percent are located within ComEd, AP and PENELEC. Of the 49 wind projects currently active in the PJM generation queue, 37 projects, 75.5 percent are located within AEP, ComEd and AP.

Table 12-25 Status of all wind generation queue projects: January 1, 1997 through June 30, 2016

		Number of Projects																				
Project Status	Project Classification	AECO	AEP	AP	ATSI	BGE	ComEd	DAY	DEOK	Dominion	DPL	DLCO	EKPC	JCPL	Met-Ed	PECO	PENELEC	Pepco	PPL	PSEG	RECO	TOTAL
In Service	New Generation	1	8	11	0	0	16	0	0	0	0	0	0	1	1	0	17	0	4	0	0	59
	Upgrade	0	0	3	0	0	2	0	0	0	0	0	0	0	0	0	6	0	4	0	0	15
Under Construction	New Generation	1	9	4	1	0	4	0	0	4	1	0	0	0	0	0	1	0	0	0	0	25
	Upgrade	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Suspended	New Generation	1	7	1	0	0	2	2	0	1	0	0	0	0	0	0	2	0	1	0	0	17
	Upgrade	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Withdrawn	New Generation	15	74	39	6	0	88	13	0	11	8	0	1	1	0	0	58	0	37	1	0	352
	Upgrade	1	0	7	0	0	1	0	0	0	0	0	0	0	0	0	2	0	2	0	0	13
Active	New Generation	0	16	5	1	0	11	0	0	3	2	0	0	0	0	0	2	0	3	0	0	43
	Upgrade	0	0	3	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	6
Total Projects	New Generation	18	114	60	8	0	121	15	0	19	11	0	1	2	1	0	80	0	45	1	0	496
	Upgrade	2	0	14	0	0	5	0	0	0	0	0	0	0	0	0	9	0	6	0	0	36

Table 12-26 shows the wind project capacity in MW of all wind generation projects that have entered the PJM generation queue from January 1, 1997 through June 30, 2016, by zone. Wind projects in ComEd, AEP and PENELEC accounted for 55,867.6 MW, or 72.0 percent of all nameplate wind generation capacity in the PJM generation queue. Of the 6,915 MW of wind generation capacity to complete the generation queue process and achieve in service status, 6,580.4 MW, or 95.2 percent of nameplate capacity is located within ComEd, AEP, AP and PENELEC. Of the 8,119.7 MW of wind generation capacity currently active in the PJM generation queue, 6,707.4 MW of generation capacity or 82.6 percent is located within AEP, ComEd and AP.

Table 12-26 Status of all wind generation capacity (MW) in the PJM generation queue: January 1, 1997 through June 30, 2016

		Project MW																				
Project Status	Project Classification	AECO	AEP	AP	ATSI	BGE	ComEd	DAY	DEOK	Dominion	DPL	DLCO	EKPC	JCPL	Met-Ed	PECO	PENELEC	Pepco	PPL	PSEG	RECO	TOTAL
In Service	New Generation	7.5	2,052.0	1,031.4	0.0	0.0	2,634.5	0.0	0.0	0.0	0.0	0.0	0.0	30.6	70.0	0.0	856.1	0.0	199.2	0.0	0.0	6,881.3
	Upgrade	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4	0.0	27.3	0.0	0.0	33.7
Under Construction	New Generation	150.0	966.6	426.0	500.0	0.0	802.5	0.0	0.0	685.9	100.0	0.0	0.0	0.0	0.0	0.0	38.3	0.0	0.0	0.0	0.0	3,669.3
	Upgrade	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Suspended	New Generation	20.0	1,650.0	60.0	0.0	0.0	710.0	300.0	0.0	300.0	0.0	0.0	0.0	0.0	0.0	0.0	150.0	0.0	100.0	0.0	0.0	3,290.0
	Upgrade	5.0	0.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.0
Withdrawn	New Generation	3,626.4	13,904.2	2,828.5	645.6	0.0	20,855.8	1,828.0	0.0	1,782.9	2,210.0	0.0	150.3	60.0	0.0	0.0	4,847.6	0.0	2,437.8	20.0	0.0	55,197.1
	Upgrade	0.0	0.0	199.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0	0.0	6.0	0.0	0.0	289.0
Active	New Generation	0.0	3,909.6	547.8	18.0	0.0	2,060.0	0.0	0.0	358.2	499.6	0.0	0.0	0.0	0.0	0.0	150.0	0.0	366.5	0.0	0.0	7,909.7
	Upgrade	0.0	0.0	20.0	0.0	0.0	170.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0	0.0	0.0	210.0
Total Projects	New Generation	3,803.9	22,482.4	4,893.7	1,163.6	0.0	27,062.8	2,128.0	0.0	3,127.0	2,809.6	0.0	150.3	90.6	70.0	0.0	6,042.0	0.0	3,103.5	20.0	0.0	76,947.4
	Upgrade	5.0	0.0	289.0	0.0	0.0	174.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	106.4	0.0	33.3	0.0	0.0	607.7

Table 12-27 shows the status of all solar generation projects that have entered the PJM generation queue from January 1, 1997 through June 30, 2016, by zone. Solar projects have been highly concentrated in several zones as of June 30, 2016. Out of a total of 981 solar projects in the PJM generation queue, 488 projects or 49.7 percent have been located in JCPL, AECO and PSEG, all zones in New Jersey. Of these three zones, AECO has the lowest completion rates for new generation and upgrade solar projects. Excluding currently active projects, only 5.8 percent of solar projects classified as new generation or upgrades in AECO are either in service or under construction. Of these three zones, PSEG has the highest completion rates. Excluding currently active projects, 43.0 percent of solar projects classified as either new generation or upgrades in PSEG are either in service or under construction.

The number of currently active new generation solar projects is also highly concentrated in several zones. Out of 188 active new generation projects, 80 projects, or 42.5 percent of all currently active new generation solar projects are located in Dominion.

Table 12-27 Status of all solar generation queue projects: January 1, 1997 through June 30, 2016

		Number of Projects																				
Project Status	Project Classification	AECO	AEP	AP	ATSI	BGE	ComEd	DAY	DEOK	Dominion	DPL	DLCO	EKPC	JCPL	Met-Ed	PECO	PENELEC	Pepco	PPL	PSEG	RECO	TOTAL
In Service	New Generation	5	1	2	0	1	1	1	0	6	4	0	0	31	0	1	0	0	2	34	0	89
	Upgrade	0	0	0	0	0	0	0	0	2	0	0	0	3	0	0	0	0	0	0	0	5
Under Construction	New Generation	3	4	3	0	2	0	2	0	4	12	0	0	16	0	0	0	0	3	9	0	58
	Upgrade	0	0	0	0	0	0	0	0	1	9	0	0	1	0	0	0	0	0	0	0	11
Suspended	New Generation	0	4	5	0	0	0	0	0	3	0	0	0	9	1	0	1	0	0	2	0	25
	Upgrade	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Withdrawn	New Generation	147	16	36	6	4	7	4	4	40	77	0	0	145	11	5	10	6	24	55	0	597
	Upgrade	1	1	0	0	0	0	0	0	1	0	0	0	5	0	0	0	0	0	0	0	8
Active	New Generation	8	11	24	1	5	0	0	1	76	43	0	0	8	1	0	0	0	0	4	0	182
	Upgrade	0	0	0	0	0	0	0	0	4	0	0	0	1	0	0	0	0	0	1	0	6
Total Projects	New Generation	163	36	70	7	12	8	7	5	129	136	0	0	209	13	6	11	6	29	104	0	951
	Upgrade	1	1	0	0	0	0	0	0	8	9	0	0	10	0	0	0	0	0	1	0	30

Table 12-28 shows the MW for solar projects in the generation queue. Solar project MW have been highly concentrated in several zones as of June 30, 2016. Out of a total of 15,288.6 MW of solar nameplate capacity in the PJM generation queue since 1997, 4,173.2 MW or 26.2 percent have been located in JCPL, AECO and PSEG, all zones in New Jersey. Solar projects in Dominion have accounted for 5,521.8 MW or 34.7 percent of all solar project nameplate capacity in the PJM queue from January 1, 1997 through June 30, 2016. Solar projects in DPL have accounted for 2,636.4 MW or 16.6 percent of all solar project nameplate capacity in the PJM queue from January 1, 1997 through June 30, 2016.

Table 12-28 Current status of all solar generation capacity (MW) in the PJM generation queue: January 1, 1997 through June 30, 2016

		Project MW																				
Project Status	Project Classification	AECO	AEP	AP	ATSI	BGE	ComEd	DAY	DEOK	Dominion	DPL	DLCO	EKPC	JCPL	Met-Ed	PECO	PENELEC	Pepco	PPL	PSEG	RECO	TOTAL
In Service	New Generation	38.5	2.5	34.0	0.0	1.1	9.0	2.5	0.0	157.0	28.4	0.0	0.0	198.3	0.0	3.3	0.0	0.0	15.0	159.6	0.0	649.2
	Upgrade	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.0	0.0	0.0	5.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.9
Under Construction	New Generation	20.8	32.2	32.5	0.0	22.0	0.0	23.4	0.0	118.4	159.5	0.0	0.0	175.0	0.0	0.0	0.0	0.0	16.0	56.2	0.0	656.0
	Upgrade	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
Suspended	New Generation	0.0	51.7	38.9	0.0	0.0	0.0	0.0	0.0	205.0	0.0	0.0	0.0	92.9	3.0	0.0	13.5	0.0	0.0	9.7	0.0	414.7
	Upgrade	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Withdrawn	New Generation	1,628.8	330.5	692.2	60.1	9.2	84.8	51.5	63.0	1,510.2	1,118.5	0.0	0.0	1,201.1	367.0	50.1	34.3	58.1	267.7	390.6	0.0	7,917.6
	Upgrade	10.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	23.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	47.8
Active	New Generation	50.2	445.3	356.3	150.0	20.1	0.0	0.0	125.0	3,321.7	1,330.0	0.0	0.0	71.2	100.0	0.0	0.0	0.0	0.0	29.4	0.0	5,999.2
	Upgrade	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	193.9	0.0	0.0	0.0	9.4	0.0	0.0	0.0	0.0	0.0	1.3	0.0	204.6
Total Projects	New Generation	1,738.3	862.2	1,153.9	210.1	52.4	93.8	77.4	188.0	5,312.3	2,636.4	0.0	0.0	1,738.5	470.0	53.4	47.8	58.1	298.7	645.6	0.0	15,636.7
	Upgrade	10.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	209.5	0.0	0.0	0.0	39.5	0.0	0.0	0.0	0.0	0.0	1.3	0.0	266.3

Transmission Facility Outages

Scheduling Transmission Facility Outage Requests

A transmission facility is designated as reportable by PJM if a change in its status can affect a transmission constraint on any Monitored Transmission Facility or could impede free flowing ties within the PJM RTO and/or adjacent areas.[24] When one of the reportable transmission facilities needs to be taken out of service, the TO is required to submit an outage request as early as possible.[25]

Transmission outages have significant impacts on PJM markets. There are impacts on FTR auctions, on congestion, and on expected market outcomes in the day-ahead and real-time markets. It is important for the efficient functioning of the markets that there be clear, enforceable rules governing transmission outages.

Transmission outages are categorized by duration: greater than 30 calendar days; less than or equal to 30 calendar days and greater than five calendar days; or less than or equal to five calendar days.[26] Table 12-29 shows that 80.9 percent of the requested outages were planned for less than or equal to five days and 3.9 percent of requested outages were planned for greater than 30 days in the first six months of 2016. All of the outage data in this section except in the analysis for the FTR market are for outages scheduled to occur in the first six months of 2015 and 2016, regardless of when they were initially submitted.[27] The outage

24 If a transmission facility is not modeled in the PJM EMS or the facility is not expected to significantly impact PJM system security or congestion management, it is not reportable. See PJM. "Manual 3A: Energy Management System (EMS) Model Updates and Quality Assurance (QA), Revision 10 (June 25, 2015).

25 See PJM. "Manual 3: Transmission Operations," Revision 48 (December 1, 2015), p.57.

26 See PJM. "Manual 3: Transmission Operations," Revision 48 (December 1, 2015), p.58.

27 The hotline tickets, EMS tripping tickets or test outage tickets were excluded. We only included all the transmission outage tickets submitted by PJM internal companies which are currently active.

data in the analysis for the FTR market are for outages scheduled to occur in the planning periods 2014 to 2015 and 2015 to 2016.

Table 12-29 Transmission facility outage request summary by planned duration: January through June, 2015 and 2016

	2015 (Jan - Jun)		2016 (Jan - Jun)	
Planned Duration (Days)	Outage Requests	Percent	Outage Requests	Percent
<=5	8,237	78.4%	8,305	80.9%
>5 & <=30	1,699	16.2%	1,554	15.1%
>30	573	5.5%	403	3.9%
Total	10,509	100.0%	10,262	100.0%

After receiving a transmission facility outage request from a TO, PJM assigns a received status to the request based on its submission date, outage planned starting and ending date, and outage planned duration. The received status can be on time, late or past deadline, as defined in Table 12-30.[28]

The purpose of the rules defined in Table 12-30 is to require the TOs to submit transmission facility outages prior to the Financial Transmission Right (FTR) auctions so that market participants have complete information about market conditions on which to base their FTR bids and so that PJM can accurately model market conditions.[29]

Table 12-30 PJM transmission facility outage request received status definition

Planned Duration (Days)	Ticket Submission Date	Received Status
<=5	Before the 1st of the month one month prior to the starting month of the outage	On Time
	After or on the 1st of the month one month prior to the starting month of the outage	Late
	After 8:00AM three days prior to the outage	Past Deadline
> 5 & <=30	Before the 1st of the month six months prior to the starting month of the outage	On Time
	After or on the 1st of the month six months prior to the starting month of the outage	Late
	After 8:00AM three days prior to the outage	Past Deadline
>30	The earlier of 1) February 1st, 2) the 1st of the month six months prior to the starting month of the outage	On Time
	After or on the earlier of 1) February 1st, 2) the 1st of the month six months prior to the starting month of the outage	Late
	After 8:00AM three days prior to the outage	Past Deadline

Table 12-31 shows a summary of requests by received status. In the first six months of 2016, 49.9 percent of outage requests received were late.

Table 12-31 Transmission facility outage request summary by received status: January through June, 2015 and 2016

	2015 (Jan - Jun)				2016 (Jan - Jun)			
Planned Duration (Days)	On Time	Late	Total	Percent Late	On Time	Late	Total	Percent Late
<=5	4,514	3,723	8,237	45.2%	4,278	4,027	8,305	48.5%
>5 & <=30	843	856	1,699	50.4%	724	830	1,554	53.4%
>30	186	387	573	67.5%	142	261	403	64.8%
Total	5,543	4,966	10,509	47.3%	5,144	5,118	10,262	49.9%

Once received, PJM processes outage requests in priority order: emergency transmission outage request; transmission outage requests submitted on time; and transmission outage request submitted late. PJM retains the right to deny all transmission outage requests that are submitted past the relevant deadline unless the request is an emergency.[30]

28 See PJM. "Manual 3: Transmission Operations," Revision 48 (December 1, 2015), p.58 and p. 59.
29 See "Report of PJM Interconnection, L.L.C. on Transmission Oversight Procedures," Docket No. EL01-122-000 (November 2, 2001).
30 PJM. "Manual 3: Transmission Operations," Revision 48 (December 1, 2015), p. 69.

Outages with emergency status will be approved even if submitted past the relevant deadline after PJM determines that the outage does not result in Emergency Procedures. PJM cancels or withholds approval of any outage that results in Emergency Procedures.[31] Table 12-32 is a summary of outage requests by emergency status. Of all outage requests scheduled to occur in the first six months of 2016, 12.9 percent were for emergency outages. Of all outage requests scheduled to occur in the first six months of 2015, 13.0 percent were for emergency outages.

Table 12-32 Transmission facility outage request summary by emergency: January through June, 2015 and 2016

	2015 (Jan - Jun)				2016 (Jan - Jun)			
Planned Duration (Days)	Emergency	Non Emergency	Total	Percent Emergency	Emergency	Non Emergency	Total	Percent Emergency
<=5	1,069	7,168	8,237	13.0%	1,104	7,201	8,305	13.3%
>5 & <=30	235	1,464	1,699	13.8%	192	1,362	1,554	12.4%
>30	64	509	573	11.2%	32	371	403	7.9%
Total	1,368	9,141	10,509	13.0%	1,328	8,934	10,262	12.9%

PJM will approve all transmission outage requests that are submitted on time and do not jeopardize the reliability of the PJM system. PJM will approve all transmission outage requests that are submitted late and do not cause congestion on the PJM system and do not jeopardize the reliability of the PJM system.

After PJM determines that a late request may cause congestion, PJM informs the Transmission Owner of solutions available to eliminate the congestion. For example, if a generator planned or maintenance outage request is contributing to the congestion, PJM can request that the Generation Owner defer the outage. If no solutions are available, PJM may require the Transmission Owner to reschedule or cancel the outage. Table 12-33 is a summary of outage requests by congestion status. Of all outage requests submitted to occur in the first six months of 2016, 8.3 percent were expected to cause congestion. Of all the outage requests that were expected to cause congestion, 3.4 percent (29 out of 855) were denied by PJM in the first six months of 2016 (Table 12-35).

31 PJM. "Manual 3: Transmission Operations," Revision 48 (December 1, 2015), p. 67 and p.68.

Table 12-33 Transmission facility outage request summary by congestion: January through June, of 2015 and 2016

	2015 (Jan - Jun)				2016 (Jan - Jun)			
Planned Duration (Days)	Congestion Expected	No Congestion Expected	Total	Percent Congestion Expected	Congestion Expected	No Congestion Expected	Total	Percent Congestion Expected
<=5	756	7,481	8,237	9.2%	635	7,670	8,305	7.6%
>5 & <=30	185	1,514	1,699	10.9%	183	1,371	1,554	11.8%
>30	57	516	573	9.9%	37	366	403	9.2%
Total	998	9,511	10,509	9.5%	855	9,407	10,262	8.3%

Table 12-34 shows the outage requests summary by received status, congestion status and emergency status. In the first six months of 2016, 37.0 percent of requests were submitted late and were nonemergency while 1.6 (164 out of 10,262) percent of requests were late, nonemergency, and expected to cause congestion.

Table 12-34 Transmission facility outage requests that by received status, congestion and emergency: January through June, 2015 and 2016

		2015 (Jan - Jun)				2016 (Jan - Jun)			
Submission Status		Congestion Expected	No Congestion Expected	Total	Percent	Congestion Expected	No Congestion Expected	Total	Percent
Late	Emergency	55	1,307	1,362	13.0%	33	1,287	1,320	12.9%
	Non Emergency	170	3,434	3,604	34.3%	164	3,634	3,798	37.0%
On Time	Emergency	0	6	6	0.1%	0	8	8	0.1%
	Non Emergency	773	4,764	5,537	52.7%	658	4,478	5,136	50.0%
Total		998	9,511	10,509	100.0%	855	9,407	10,262	100.0%

Once PJM processes an outage request, the outage request is labelled as Submitted, Received, Denied, Approved, Cancelled by Company, Revised, Active or Complete according to the processed stage of a request.[32] Table 12-35 shows the detailed process status for outage requests only for the outage requests that are expected to cause congestion. All process status categories except Cancelled, Complete or Denied are in the In Process category in Table 12-35. Table 12-35 shows that 13.3 (114 out of 855) percent outage requests which were expected to cause congestion were nonemergency, late,

32 See PJM. "Outage Information," <http://www.pjm.com/markets-and-operations/etools/oasis/system-information/outage-info.aspx> (November 1, 2015).

but approved and completed and 2.1 percent (18 out of 855) of the outage requests which were expected to cause congestion were nonemergency, late and denied in the first six months of 2016.

requests were approved by PJM and then rescheduled by the TOs, and 9.1 percent of the transmission outages were approved by PJM and subsequently cancelled by the TOs.

Table 12-35 Transmission facility outage requests that might cause congestion status summary: January through June, 2015 and 2016

		2015 (Jan - Jun)						2016 (Jan - Jun)					
Submission Status		Cancelled	Complete	In Process	Denied	Congestion Expected	Percent Complete	Cancelled	Complete	In Process	Denied	Congestion Expected	Percent Complete
Late	Emergency	7	47	0	1	55	4.7%	0	33	0	0	33	3.9%
	Non Emergency	36	109	2	23	170	10.9%	30	114	2	18	164	13.3%
On Time	Emergency	0	0	0	0	0	0.0%	0	0	0	0	0	0.0%
	Non Emergency	216	517	2	38	773	66.9%	169	478	0	11	658	72.6%
Total		259	673	4	62	998	67.4%	199	625	2	29	855	73.1%

There are clear rules defined for assigning on time or late status for submitted outage requests in both the PJM Tariff and PJM Manuals.[33] However, the on time or late status only affects the priority that PJM assigns for processing the outage request. Many (69.5 percent or 114 out of 164) nonemergency, expected to cause congestion, late transmission outages were approved and completed. The expected impact on congestion is the basis for PJM's treatment of late outage requests. But there is no rule or clear definition of this congestion analysis in the PJM Manuals. The MMU recommends that PJM draft a clear definition of the congestion analysis required for transmission outage requests to include in Manual 3 after appropriate review.

Rescheduling Transmission Facility Outage Requests

A TO can reschedule or cancel an outage after initial submission. Table 12-36 is a summary of all the outage requests planned for the first six months of 2015 and 2016 which were approved and then cancelled or rescheduled by TOs at least once. If an outage request was submitted, approved and subsequently rescheduled at least once, the outage request will be counted as Approved and Rescheduled. If an outage request was submitted, approved and subsequently cancelled at least once, the outage request will be counted as Approved and Cancelled. In the first six months of 2016, 15.8 percent of transmission outage

33 OATT Attachment K Appendix § 1.9.2 (Outage Scheduling).

Table 12-36 Rescheduled and cancelled transmission outage request summary: January through June, 2015 and 2016

	2015 (Jan - Jun)					2016 (Jan - Jun)				
Days	Outage Requests	Approved and Rescheduled	Percent Approved and Rescheduled	Approved and Cancelled	Percent Approved and Cancelled	Outage Requests	Approved and Rescheduled	Percent Approved and Rescheduled	Approved and Cancelled	Percent Approved and Cancelled
<=5	8,237	774	9.4%	1,085	13.2%	8,305	787	9.5%	842	10.1%
>5 & <=30	1,699	669	39.4%	110	6.5%	1,554	641	41.2%	76	4.9%
>30	573	272	47.5%	46	8.0%	403	190	47.1%	16	4.0%
Total	10,509	1,715	16.3%	1,241	11.8%	10,262	1,618	15.8%	934	9.1%

If a requested outage is determined to be late and TO reschedules the outage, the outage will be revaluated by PJM again as on time or late.

A transmission outage ticket with a duration of five days or less with an on time status can retain its on time status if the outage is rescheduled within the original scheduled month.[34] This rule allows a TO to reschedule within the same month with very little notice.

A transmission outage ticket with a duration exceeding five days with an on time status can retain its on time status if the outage is rescheduled to a future month, and the revision is submitted by the first of the month prior to the revised month in which the outage will occur.[35] This rescheduling rule is much less strict than the rule that applies to the first submission of outage requests with similar duration. When first submitted, the outage request with a duration exceeding five days needs to be submitted before the first of the month six months prior to the month in which the outage was expected to occur.

The MMU recommends that PJM reevaluate all transmission outage tickets as on time or late as if they were new requests when an outage is rescheduled and apply the standard rules for late submissions to any such outages.

Long Duration Transmission Facility Outage Requests

PJM rules (Table 12-30) define a transmission outage request as on time or late based on the planned outage duration and the time of submission. The rule has stricter submission requirements for transmission outage requests planned for longer than 30 days. In order to avoid the stricter submission requirement, some transmission owners divided the duration of outage requests longer than 30 days into shorter segments for the same equipment and submitted one request for each segment. The MMU recommends that PJM not permit transmission owners to divide long duration outages into smaller segments to avoid complying with the requirements for long duration outages. Table 12-37 shows that there were 7,333 transmission equipment planned outages in the first six months of 2016, of which 438 were planned outages longer than 30 days, and of which 69 or 0.9 percent were scheduled longer than 30 days if the duration of the outages were combined for the same equipment. The duration of those outages could potentially be longer than 30 days, however were divided into shorter periods by transmission owners.

Table 12-37 Transmission outage summary: January through June, 2015 and 2016

		2015 (Jan - Jun)		2016 (Jan - Jun)	
Duration	Divided into Shorter Periods	Number of Outages	Percent	Number of Outages	Percent
> 30 Days	No	522	7.4%	369	5.0%
	Yes	81	1.1%	69	0.9%
<= 30 Days		6,497	91.5%	6,895	94.0%
Total		7,100	100.0%	7,333	100.0%

34 PJM. "Manual 3: Transmission Operations," Revision 48 (December 1, 2015), p. 63.
35 PJM. "Manual 3: Transmission Operations," Revision 48 (December 1, 2015), p. 64.

Table 12-38 shows the details of potentially long duration (> 30 days) outages when combining the duration of the outages for the same equipment. The actual duration of scheduled outages would be longer than 30 days if the duration of the outages were combined for the same equipment within a period of days. In the first six months of 2016, there would have been three outages with a combined duration longer than 30 days that were instead scheduled to occur as shorter outages within a period of less than or equal to 31 days. In the first six months of 2016, there would have been 18 outages with a combined duration longer than 30 days that were instead scheduled to occur as shorter outages within a period of more than 31 days and less than 62 days.

Table 12-38 Summary of potentially long duration (> 30 days) outages: January through June, 2015 and 2016

	2015 (Jan - Jun)		2016 (Jan - Jun)	
Days	Number of Outages	Percent	Number of Outages	Percent
<=31	7	8.6%	3	4.3%
>31 & <=62	17	21.0%	18	26.1%
>62 and <=93	24	29.6%	9	13.0%
>93	33	40.7%	39	56.5%
Total	81	100.0%	69	100.0%

Transmission Facility Outage Analysis for the FTR Market

Transmission facility outages affect the price and quantity outcomes of FTR auctions. The purpose of the rules is to ensure that outages are known with enough lead time prior to FTR auctions both so that market participants can understand market conditions and so that PJM can accurately model market conditions. Outage requests must be submitted according to rules based on planned outage duration (Table 12-30). The rules defining when an outage is late are based on the timing of FTR auctions. When an outage request is submitted late, the outage will be marked as late and may be denied if it is expected to cause congestion. Table 12-42 shows that 874 outage requests with a duration of two weeks or longer but shorter than two months were late, and only four of them were denied by PJM. Table 12-42 also shows that 198 outage requests with a duration of two months or longer were late and none of them were denied by PJM in the 2015 to 2016 planning year.

There are Long Term, Annual and Monthly Balance of Planning Period auctions in the FTR market. When modeling transmission outages in the annual ARR allocation and FTR auction, PJM does not consider outages with planned durations shorter than two weeks, does consider some outages with planned duration longer than two weeks but shorter than two months, and does consider all outages with planned duration longer than or equal to two months. PJM posts an FTR outage list to the FTR web page usually at least one week before the auction bidding opening day.[36]

Table 12-39 shows that 89.8 percent of the outage requests for outages expected to occur during the planning period 2015 to 2016 had a planned duration of less than two weeks and that 50.4 (9,789 out of 19,441) percent of all outage requests for the planning period were submitted late according to outage submission rules.

Table 12-39 Transmission facility outage requests by received status: Planning periods 2014 to 2015 and 2015 to 2016

	2014/2015				2015/2016			
Planned Duration	On Time	Late	Total	Percent	On Time	Late	Total	Percent
<2 weeks	9,306	8,382	17,688	88.7%	8,749	8,717	17,466	89.8%
>=2 weeks & <2 months	844	896	1,740	8.7%	769	874	1,643	8.5%
>=2 months	201	317	518	2.6%	134	198	332	1.7%
Total	10,351	9,595	19,946	100.0%	9,652	9,789	19,441	100.0%

Table 12-40 shows outage requests summary by emergency status. Of all outage requests for outages expected to occur in the 2015 to 2016 planning year and submitted late, 74.0 percent were for nonemergency outages.

36 PJM Financial Transmission Rights, "Annual ARR Allocation and FTR Auction Transmission outage Modeling," <http://www.pjm.com/~/media/markets-ops/ftr/annual-ftr-auction/2015-2016/2015-2016-annual-outage-modeling.ashx> (April 1, 2015).

Table 12-40 Transmission facility outage requests by received status and emergency: Planning periods 2014 to 2015 and 2015 to 2016

		2014/2015				2015/2016			
	Planned Duration	Emergency	Non Emergency	Total	Percent Non Emergency	Emergency	Non Emergency	Total	Percent Non Emergency
On Time	<2 weeks	13	9,293	9,306	99.9%	16	8,733	8,749	99.8%
	>=2 weeks & <2 months	0	844	844	100.0%	2	767	769	99.7%
	>=2 months	0	201	201	100.0%	0	134	134	100.0%
	Total	13	10,338	10,351	99.9%	18	9,634	9,652	99.8%
Late	<2 weeks	2,370	6,012	8,382	71.7%	2,372	6,345	8,717	72.8%
	>=2 weeks & <2 months	169	727	896	81.1%	144	730	874	83.5%
	>=2 months	63	254	317	80.1%	32	166	198	83.8%
	Total	2,602	6,993	9,595	72.9%	2,548	7,241	9,789	74.0%

PJM analyzes expected congestion for both on time and late outage requests. A late outage request may be denied or cancelled if it is expected to cause congestion. Table 12-41 shows a summary of requests by expected congestion and received status. Overall, 4.3 percent of all outage requests for outages expected to occur in the 2015 to 2016 planning year and submitted late were requests that were expected to cause congestion.

Table 12-41 Transmission facility outage requests by submission status and congestion: Planning periods 2014 to 2015 and 2015 to 2016

		2014/2015				2015/2016			
	Planned Duration	Congestion Expected	No Congestion Expected	Total	Percent Congestion Expected	Congestion Expected	No Congestion Expected	Total	Percent Congestion Expected
On Time	<2 weeks	1,339	7,967	9,306	14.4%	1,131	7,618	8,749	12.9%
	>=2 weeks & <2 months	168	676	844	19.9%	158	611	769	20.5%
	>=2 months	38	163	201	18.9%	32	102	134	23.9%
	Total	1,545	8,806	10,351	14.9%	1,321	8,331	9,652	13.7%
Late	<2 weeks	447	7,935	8,382	5.3%	366	8,351	8,717	4.2%
	>=2 weeks & <2 months	45	851	896	5.0%	44	830	874	5.0%
	>=2 months	9	308	317	2.8%	10	188	198	5.1%
	Total	501	9,094	9,595	5.2%	420	9,369	9,789	4.3%

Table 12-42 shows that 89.0 percent of late outage requests with a duration of two weeks or longer but shorter than two months were completed, 0.5 percent were denied by PJM and 9.3 percent of late outage requests with a duration of two weeks or longer but shorter than two months were cancelled by company in the 2015 to 2016 planning year. The table also shows that 90.4 percent of late outage requests with duration of two months or longer were completed, none of them were denied, and 7.6 percent were cancelled by company in the 2015 to 2016 planning year.

Table 12-42 Transmission facility outage requests by received status and processed status: Planning periods 2014 to 2015 and 2015 to 2016

		2014/2015				2015/2016			
Planned Duration	Processed Status	On Time	Percent	Late	Percent	On Time	Percent	Late	Percent
<2 weeks	In Progress	21	0.2%	146	1.7%	16	0.2%	141	1.6%
	Denied	106	1.1%	100	1.2%	70	0.8%	54	0.6%
	Cancelled by Company	2,761	29.7%	1,205	14.4%	2,383	27.2%	1,042	12.0%
	Active	0	0.0%	0	0.0%	0	0.0%	1	0.0%
	Completed	6,418	69.0%	6,931	82.7%	6,280	71.8%	7,479	85.8%
Total Submission		9,306	100.0%	8,382	100.0%	8,749	100.0%	8,717	100.0%
>=2 weeks & <2 months	In Progress	1	0.1%	9	1.0%	0	0.0%	11	1.3%
	Denied	0	0.0%	4	0.4%	1	0.1%	4	0.5%
	Cancelled by Company	199	23.6%	106	11.8%	216	28.1%	81	9.3%
	Active	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	Completed	644	76.3%	777	86.7%	552	71.8%	778	89.0%
Total Submission		844	100.0%	896	100.0%	769	100.0%	874	100.0%
>=2 months	In Progress	0	0.0%	7	2.2%	0	0.0%	4	2.0%
	Denied	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	Cancelled by Company	42	20.9%	31	9.8%	30	22.4%	15	7.6%
	Active	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	Completed	159	79.1%	279	88.0%	104	77.6%	179	90.4%
Total Submission		201	100.0%	317	100.0%	134	100.0%	198	100.0%

Table 12-43 shows that there were 874 outage requests with a duration of two weeks or longer but shorter than two months submitted late, of which 41 were nonemergency and expected to cause congestion in the 2015 to 2016 planning year. Of the 41 such requests, four were cancelled by company, and 37 were complete. For the outages planned for two months or longer, there were 332 total outages, of which 198 requests were late. Of the late requests, nine outages were nonemergency and expected to cause congestion and were all approved.

Table 12-43 Transmission facility outage requests by received status, processed status, emergency and congestion: Planning periods 2014 to 2015 and 2015 to 2016

		2014/2015						2015/2016					
		On Time			Late			On Time			Late		
Planned Duration	Processed Status	Non Emergency and Congestion Expected	Total	Percent	Non Emergency and Congestion Expected	Total	Percent	Non Emergency and Congestion Expected	Total	Percent	Non Emergency and Congestion Expected	Total	Percent
<2 weeks	In Progress	2	21	9.5%	3	146	2.1%	0	16	0.0%	1	141	0.7%
	Denied	70	106	66.0%	39	100	39.0%	32	70	45.7%	18	54	33.3%
	Cancelled by Company	362	2,761	13.1%	75	1,205	6.2%	300	2,383	12.6%	58	1,042	5.6%
	Active	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	1	0.0%
	Completed	904	6,418	14.1%	224	6,931	3.2%	796	6,280	12.7%	204	7,479	2.7%
Total Submission	Total	1,338	9,306	14.4%	341	8,382	4.1%	1,128	8,749	12.9%	281	8,717	3.2%
>=2 weeks & <2 months	In Progress	1	1	100.0%	0	9	0.0%	0	0	0.0%	0	11	0.0%
	Denied	0	0	0.0%	2	4	50.0%	1	1	100.0%	0	4	0.0%
	Cancelled by Company	31	199	15.6%	6	106	5.7%	29	216	13.4%	4	81	4.9%
	Active	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
	Completed	136	644	21.1%	33	777	4.2%	128	552	23.2%	37	778	4.8%
Total Submission	Total	168	844	19.9%	41	896	4.6%	158	769	20.5%	41	874	4.7%
>=2 months	In Progress	0	0	0.0%	0	7	0.0%	0	0	0.0%	0	4	0.0%
	Denied	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
	Cancelled by Company	3	42	7.1%	1	31	3.2%	2	30	6.7%	0	15	0.0%
	Active	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
	Completed	35	159	22.0%	8	279	2.9%	30	104	28.8%	9	179	5.0%
Total Submission	Total	38	201	18.9%	9	317	2.8%	32	134	23.9%	9	198	4.5%

If an outage request were submitted after the Annual FTR Auction bidding opening date, the outage would not be considered in the FTR model. If an outage were submitted on time according to the transmission outage rules, it may not be modeled in the FTR model if it is submitted after the Annual FTR Auction bidding opening date. Table 12-44 shows that 91.1 percent of outage requests labelled on time according to rules were submitted or rescheduled after the annual FTR bidding opening date in the 2015 to 2016 planning year.

Table 12-44 Transmission facility outage requests by received status and bidding opening date: Planning periods 2014 to 2015 and 2015 to 2016

	2014/2015						2015/2016					
	On Time			Late			On Time			Late		
Planned Duration	Before Bidding Opening Date	After Bidding Opening Date	Percent After	Before Bidding Opening Date	After Bidding Opening Date	Percent After	Before Bidding Opening Date	After Bidding Opening Date	Percent After	Before Bidding Opening Date	After Bidding Opening Date	Percent After
<2 weeks	567	8,739	93.9%	30	8,352	99.6%	641	8,108	92.7%	36	8,681	99.6%
>=2 weeks & <2 months	173	671	79.5%	15	881	98.3%	191	578	75.2%	12	862	98.6%
>=2 months	45	156	77.6%	2	315	99.4%	31	103	76.9%	6	192	97.0%
Total	785	9,566	92.4%	47	9,548	99.5%	863	8,789	91.1%	54	9,735	99.4%

Table 12-45 shows that 86.3 percent of late outage requests which were submitted or rescheduled after the Annual FTR Auction bidding opening date were approved and complete in the 2015 to 2016 planning.

Table 12-45 Late transmission facility outage requests that are submitted after annual bidding opening date: Planning periods 2014 to 2015 and 2015 to 2016

	2014/2015			2015/2016		
Planned Duration	Completed Outages	Total	Percent	Completed Outages	Total	Percent
<2 weeks	6,911	8,352	82.7%	7,449	8,681	85.8%
>=2 weeks & <2 months	771	881	87.5%	771	862	89.4%
>=2 months	278	315	88.3%	178	192	92.7%
Total	7,960	9,548	83.4%	8,398	9,735	86.3%

Thus, although the definition of late outages was developed in order to prevent outages for the planning period being submitted after the Annual FTR Auction bidding opening date, the rules have not worked to prevent this since the rule has no direct connection to the annual FTR auction opening date. By requiring all long-duration transmission outages to be submitted before February 1, PJM outage submission rules only prevent long-duration transmission outages from being submitted late. The rule does not address the situation in which long-duration transmission outages are submitted on-time, but are rescheduled so that they are late. The Annual FTR Auction model may consider transmission outages planned for longer than two weeks but less than two months. Those outages not only include long-duration but also include outages shorter than 30 days. In those cases, PJM outage submission rules failed to prevent long-duration transmission outages submitted late. The MMU recommends that PJM modify the rules to reduce or eliminate the approval of late outage requests submitted or rescheduled after the FTR Auction bidding opening date.

Transmission Facility Outage Analysis in the Day-Ahead Market

Transmission facility outages also affect the energy market. Just as with the FTR Market, it is critical that outages that affect the operating day are known prior to the submission of offers in the Day-Ahead Energy Market both, so that market participants can understand market conditions and so that PJM can accurately model market conditions.

PJM maintains the history of outage requests including all the processed status changes and all the starting or ending date changes. Any such status change is defined as an instance. For example, if an outage request were submitted, received, approved and completed, the four occurrences, termed instances, of the outage request will be stored in the database. If an outage request is revised, that is an instance. There may be more than one instance for each outage request due to the change of the processed status. In the day-ahead market transmission outage analysis, all instances of the outages when either the status of the request is changed planned to occur in the first six months of 2015 and 2016 are included. In the day-ahead market transmission analysis, prior to April 1, 2016, all submissions or changes of outage requests at or after 12:00 pm on the day before the planned starting date until the hour beginning 23:00 pm on the planned starting date or changes of outage requests at or after 12:00 pm on the day before the planned ending date until the hour beginning 23:00 pm on the planned ending date were defined as late for day-ahead market. Beginning April 1, 2016, all submissions or changes of outage requests at or after 10:30 am on the day before the planned starting date until the hour beginning 23:00 pm on the planned starting date, or changes of outage requests at or after 10:30 am on the day before the planned ending date until the hour beginning 23:00 pm on the planned ending date, will be defined as late for the day-ahead market based on timeline changes in the day-ahead market implement on April 1, 2016.

Table 12-46 shows that in the first six months of 2016 38.7 percent (29,784 of 76,877) of outage request instances were nonemergency and late for the day-

ahead market, and 2.0 percent (1,542 out of 76,877) of nonemergency outage request instances were submitted late for the day-ahead market, nonemergency and PJM expected them to cause congestion.

Table 12-46 Transmission facility outage request instance summary by congestion and emergency: January through June, of 2015 and 2016

		2015 (Jan - Jun)				2016 (Jan - Jun)			
For Day-ahead Market	Submission Status	Congestion Expected	No Congestion Expected	Total	Percent	Congestion Expected	No Congestion Expected	Total	Percent
Late	Emergency	220	6,077	6,297	8.2%	126	4,484	4,610	6.0%
	Non Emergency	2,156	16,818	18,974	24.6%	1,542	28,242	29,784	38.7%
On Time	Emergency	271	1,777	2,048	2.7%	151	1,363	1,514	2.0%
	Non Emergency	7,556	42,198	49,754	64.6%	4,969	36,000	40,969	53.3%
	Total	10,203	66,870	77,073	100.0%	6,788	70,089	76,877	100.0%

Table 12-47 shows that there were 34,394 late outage request instances submitted in the first six months of 2016, of which 16,395 (47.7 percent) had the status of Submitted, Cancelled by Company or Revised and of which 27 had the status Denied. Among all the late outage request instances, 223 (0.6 percent) nonemergency instances had the status Submitted, Cancelled by Company or Revised, were nonemergency and were expected to cause congestion. If an outage request instance had the status of Submitted, Cancelled by Company, Revised or Denied, and was late for the day-ahead market, that instance may have negative impact to the market.

Table 12-47 Late transmission facility outage request instance status summary by congestion and emergency: January through June, of 2015 and 2016

	2015 (Jan - Jun)			2016 (Jan - Jun)		
Processed Status	Non Emergency and Congestion Expected	Total	Percent	Non Emergency and Congestion Expected	Total	Percent
Submitted	44	1,543	6.1%	18	1,487	4.3%
Denied	34	94	0.4%	5	27	0.1%
Cancelled by Company	82	986	3.9%	59	721	2.1%
Revised	188	4,481	17.7%	140	14,187	41.2%
Active	653	7,766	30.7%	604	8,337	24.2%
Approved	308	1,709	6.8%	92	951	2.8%
Received	271	1,616	6.4%	76	958	2.8%
Completed	576	7,076	28.0%	548	7,726	22.5%
Total	2,156	25,271	100.0%	1,542	34,394	100.0%

Table 48 shows that the top five transmission owners accounted for 79.4 percent of all outages that were submitted, cancelled or revised late for the day-ahead market in the first six months of 2016. These transmission owners were: AEP, ComEd, Dominion, Pepco and GPU.

Table 48 Transmission facility outage request instances submitted, cancelled or revised late for the Day-ahead Market summary by transmission owner: January through June, of 2015 and 2016

	2015 (Jan - Jun)			2016 (Jan - Jun)		
Transmission Owner	Late for Day Ahead Market	On Time for Day Ahead Market	Percent of Total Late	Late for Day Ahead Market	On Time for Day Ahead Market	Percent of Total Late
AECO	213	1,397	3.0%	240	1,098	1.5%
AEP	1,206	2,497	17.2%	5,675	1,889	34.6%
AP	335	1,191	4.8%	610	838	3.7%
ATSI	883	2,998	12.6%	678	2,140	4.1%
BGE	205	901	2.9%	194	762	1.2%
CPP	15	24	0.2%	33	66	0.2%
ComEd	455	2,108	6.5%	2,215	1,923	13.5%
DAY	44	103	0.6%	43	133	0.3%
DEOK	65	252	0.9%	85	266	0.5%
DLCO	358	994	5.1%	104	613	0.6%
DPL	234	1,198	3.3%	290	944	1.8%
Dominion	419	2,583	6.0%	2,147	2,269	13.1%
EKPC	59	233	0.8%	73	211	0.4%
GPU	599	1,798	8.5%	1,008	1,707	6.1%
Hudson	8	4	0.1%	2	8	0.0%
Linden	18	1	0.3%	5	1	0.0%
Neptune	0	5	0.0%	8	9	0.0%
PECO	269	976	3.8%	186	714	1.1%
PPL	210	688	3.0%	129	492	0.8%
PSEG	1,267	1,659	18.1%	669	1,349	4.1%
Pepco	114	408	1.6%	1,977	429	12.1%
RECO	12	41	0.2%	12	22	0.1%
UGI	22	82	0.3%	12	58	0.1%
Total	7,010	22,141	100.0%	16,395	17,941	100.0%