# Generation and Transmission Planning[1]

## Overview

### Planned Generation and Retirements

- **Planned Generation.** As of June 30, 2017, 94,755.8 MW of capacity were in generation request queues for construction through 2024, compared to an average installed capacity of 199,987.9 MW as of June 30, 2017. Of the capacity in queues, 9,204.2 MW, or 9.7 percent, are uprates and the rest are new generation. Wind projects account for 15,419.6 MW of nameplate capacity or 16.3 percent of the capacity in the queues. Natural gas fired projects account for 59,981.5 MW of capacity or 63.3 percent of the capacity in the queues.
- **Generation Retirements.** As shown in Table 12-5, 32,620.7 MW have been, or are planned to be, retired between 2011 and 2020. Of that, 7,475.1 MW are planned to retire after the first six months of 2017. In the first six months of 2017, 1,495 MW were retired. Of the 7,475.1 MW pending retirement, 5,212.0 MW are coal units. The coal unit retirements were a result of low gas prices, low capacity prices and the investments required for compliance with 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 coal fired steam units retire. There are 279.0 MW of coal fired steam capacity and 59,981.5 MW of gas fired capacity in the queue. The replacement of coal fired 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.[2] PJM's process is designed to ensure that new generation is added in a reliable and systematic manner. 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. The queue process results in a substantial number of projects that drop out. Excluding currently active projects and projects currently under construction, 3,538 projects, representing 461,602.7 MW, have entered the queue process since its inception. Of those, 727 projects, representing 49,472.4 MW, went into service. Of the projects that entered the queue process, 68.8 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 associated with the submittal of large numbers of requests at the end of the queue window, which resulted in revisions to the PJM Open Access Transmission Tariff, effective October 31, 2016.[3] [4] On December 15, 2016, the Commission issued a notice of proposed rulemaking proposing additional queue reforms intended to improve certainty, promote more informed interconnection, and enhance interconnection processes.[5]
- 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."[6] Where the transmission owner is a vertically integrated company that also owns generation,

1 Totals presented in this section include corrections to historical data and may not match totals presented in previous reports.

2 See OATT Parts IV & VI.
3 See Earlier Queue Submittal Task Force at <http://www.pjm.com/committees-and-groups/closed-groups/eqstf.aspx>
4 See Letter Order, ER16-2518-000 (Oct. 7, 2016).
5 157 FERC ¶ 61,212 (2016).
6 See OATT § 1 (Transmission Owner).

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.

## 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.[7] [8] On August 5, 2016, PJM announced that the Artificial Island project was to be suspended immediately due to unanticipated project complexities and significant cost overruns. On March 3, 2017, PJM held a special Transmission Expansion Advisory Committee (TEAC) meeting to discuss their updated analysis of the Artificial Island project. PJM staff presented updated assumptions that went into the new project analysis. In consultation with project developers and stakeholders, PJM made several major revisions to the project. These included switching the interconnection point from the Salem Substation to the Hope Creek Substation, removal of the New Freedom switched vertical circuit (SVC) from the project scope, and removal of the optical ground wire (OPGW) from the project scope. These revisions led to a revised total project cost estimate of $280 million, $240 million less than the previous $420 million project cost estimate released in February 2016. On April 6, 2017, the PJM Board lifted a suspension of the project. It is expected to be in service by June 2020.

- 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. The allocation process has been upheld by the FERC despite repeated challenges.[9]

## 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 are currently three backbone projects under development, Surry Skiffes Creek 500kV, the Northern New Jersey 345 kV Upgrades, and Byron Wayne 345 kV.[10]

## 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 or late and whether or not they will allow the outage.[11]

- There were 8,988 transmission outage requests submitted in the first six months of 2017. Of the requested outages, 76.3 percent were planned for five days or shorter and 7.9 percent were planned for longer than 30 days.

7 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>.

8 See letter from Terry Boston concerning the Artificial Island Project at <http://www.pjm.com/-/media/library/reports-notices/special-reports/board-statement-on-artificial-island-project.ashx?la=en>.

9 See 155 FERC ¶ 61,090 (2016); 155 FERC ¶ 61,089 (2016); 155 FERC ¶ 61,088 (2016); see also Order No. 1000, FERC Stats. & Regs. ¶ 31,323 (2011), *order on reh'g*, Order No. 1000-A, 139 FERC ¶ 61,132, *order on reh'g and clarification*, Order No. 1000-B, 141 FERC ¶ 61,044 (2012), *aff'd sub nom.* 762 F.3d 41, 412 (D.C. Cir. 2014); 142 FERC ¶ 61,074 (2013) (accepting the proposed PJM cost allocation method, effective February 1, 2013, subject to the outcome of PJM's Order No. 1000 regional compliance filing proceeding); 142 FERC ¶ 61,214 (2013), *order on reh'g and compliance*, 147 FERC ¶ 61,128 (2014), *order on reh'g and compliance*, 150 FERC ¶ 61,038 (2015), *order on reh'g and compliance*, 151 FERC ¶ 61,250 (2015).

10 See "2016 RTEP Process Scope and Input Assumptions White Paper," P 23. <http://www.pjm.com/~/media/documents/reports/2016-rtep-process-scope-and-input-assumptions.ashx> Accessed July 17, 2017.

11 PJM. "Manual 03: Transmission Operations," Revision 51 (June 1, 2017), Section 4.

Of the requested outages, 48.9 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 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.[12] (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 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 0.01 to 0.00 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.)

12 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>.

- 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.)
- 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.)

## 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 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, 2017, 94,755.8 MW of capacity were in generation request queues for construction through 2024, compared to an average installed capacity of 199,987.9 MW as of June 30, 2017. Although it is clear that not all generation in the queues will be built, PJM has added capacity.[13] In the first six months of 2017, 3,036.4 MW of nameplate capacity went into service in PJM.

## 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 AC2 closed on March 31, 2017. Queue AD1 began on April 1, 2017.

13 See Monitoring Analytics, "New Generation in the PJM Capacity Market: MW and Funding Sources for Delivery Years 2007/2008 through 2018/2019," <http://www.monitoringanalytics.com/reports/Reports/2016/New_Generation_in_the_PJM_Capacity_Market_20160504.pdf>.

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.[14] 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.[15]

Table 12-1 shows MW in queues by expected completion date and MW changes in the queues between December 31, 2016, and June 30, 2017, for ongoing projects, i.e. projects with the status active, under construction or suspended.[16] Projects that are already in service are not included here. The total MW in queues increased by 12,819.5 MW, or 15.6 percent, from 81,936.3 MW at the end of 2016 to 94,755.8 MW on June 30, 2017.

### Table 12-1 Queue comparison by expected completion year (MW): December 31, 2016 to June 30, 2017[17]

| | | | Six Month Change | |
|---|---|---|---|---|
| Year | As of 12/31/2016 | As of 6/30/2017 | MW | Percent |
| 2016 | 21,064.0 | 0.0 | (21,064.0) | 0.0% |
| 2017 | 12,957.0 | 15,554.2 | 2,597.2 | 16.7% |
| 2018 | 14,859.6 | 22,418.2 | 7,558.6 | 33.7% |
| 2019 | 18,416.5 | 25,275.2 | 6,858.7 | 27.1% |
| 2020 | 10,869.3 | 19,271.0 | 8,401.7 | 43.6% |
| 2021 | 1,925.9 | 11,036.3 | 9,110.4 | 82.5% |
| 2022 | 250.0 | 1,200.9 | 950.9 | 79.2% |
| 2023 | 0.0 | 0.0 | 0.0 | 0.0% |
| 2024 | 1,594.0 | 0.0 | (1,594.0) | 0.0% |
| Total | 81,936.3 | 94,755.8 | 12,819.5 | 15.6% |

14 See PJM. Manual 14C "Generation and Transmission Interconnection Process," Revision 12 (June 22, 2017) Section 3.7 <http://www.pjm.com/~/media/documents/manuals/m14c.ashx>.
15 PJM does not track the duration of suspensions or PJM termination of projects.
16 Expected completion dates are entered when the project enters the queue. Actual completion dates are generally different than expected completion dates.
17 Wind and solar capacity in Table 12-1 through Table 12-4 have not been adjusted to reflect derating.

Table 12-2 shows the yearly project status changes in more detail and how scheduled queue capacity has changed between December 31, 2016, and June 30, 2017. For example, 8,209.0 MW entered the queue in the first three months of 2017 and 6,619.3 of these MW have been withdrawn in the first six months of 2017. Of the total 71,567.0 MW marked as active at the beginning of 2017, 3,002.1 MW were withdrawn, 588.0 MW were suspended, 35.0 MW started construction, and 159.1 MW went into service by June 30, 2017. The Under Construction column shows that 15.0 MW came out of suspension and 35.0 MW began construction in the first six months of 2017, in addition to the 19,060.0 MW of capacity that maintained the status under construction from December 31, 2016 through June 30, 2017.

### Table 12-2 Change in project status (MW): December 31, 2016 to June 30, 2017

| | | Status at 6/30/2017 | | | | |
|---|---|---|---|---|---|---|
| Status at 12/31/2016 | Total at 12/31/2016 | Active | Suspended | Under Construction | In Service | Withdrawn |
| (Entered in 2017) | | 1,589.8 | 0.0 | 0.0 | 0.0 | 6,619.3 |
| Active | 71,567.0 | 65,997.9 | 588.0 | 35.0 | 159.1 | 3,002.1 |
| Suspended | 5,790.0 | 0.0 | 6,858.6 | 15.0 | 0.0 | 547.0 |
| Under Construction | 24,045.3 | 0.0 | 611.5 | 19,060.0 | 1,824.5 | 317.8 |
| In Service | 46,436.0 | 0.0 | 0.0 | 0.0 | 47,488.8 | 0.0 |
| Withdrawn | 305,900.6 | 0.0 | 0.0 | 0.0 | 0.0 | 306,888.4 |
| Total at 12/31/2016 | | 67,587.7 | 8,058.1 | 19,110.0 | 49,472.4 | 317,374.5 |

Table 12-3 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, 2017, there are 94,755.8 MW of capacity in queues that are not yet in service, of which 8.5 percent are suspended, 20.2 percent are under construction and 71.3 percent have not begun construction.

### Table 12-3 Capacity in PJM queues (MW): At June 30, 2017[18]

| 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 | 4,621.5 | 0.0 | 0.0 | 15,656.7 | 20,278.2 |
| 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 | 8,090.2 | 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 | 3,037.3 | 253.0 | 0.0 | 5,320.5 | 8,610.8 |
| 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 | 1,986.4 | 60.0 | 1,288.3 | 19,420.6 | 22,755.3 |
| S Expired 31-Jul-07 | 0.0 | 3,549.5 | 120.0 | 70.0 | 12,396.5 | 16,136.0 |
| T Expired 31-Jan-08 | 0.0 | 2,814.0 | 1,408.0 | 300.0 | 23,013.3 | 27,535.3 |
| U Expired 31-Jan-09 | 200.0 | 837.3 | 649.9 | 820.0 | 30,829.6 | 33,336.8 |
| V Expired 31-Jan-10 | 590.0 | 2,748.6 | 36.1 | 561.0 | 12,877.6 | 16,813.3 |
| W Expired 31-Jan-11 | 292.0 | 2,129.5 | 866.9 | 989.8 | 19,759.2 | 24,037.3 |
| X Expired 31-Jan-12 | 1,689.0 | 4,598.2 | 3,268.9 | 2,369.5 | 18,418.8 | 30,344.5 |
| Y Expired 30-Apr-13 | 827.5 | 1,614.1 | 3,842.6 | 267.2 | 19,188.2 | 25,739.5 |
| Z Expired 30-Apr-14 | 1,021.0 | 641.4 | 5,616.4 | 135.1 | 6,886.8 | 14,300.7 |
| AA1 Expired 31-Oct-14 | 4,586.5 | 156.7 | 1,333.1 | 326.8 | 5,597.2 | 12,000.3 |
| AA2 Expired 30-Apr-15 | 7,271.5 | 220.9 | 326.5 | 756.0 | 7,491.4 | 16,066.3 |
| AB1 Expired 31-Oct-15 | 12,018.9 | 64.0 | 715.9 | 101.5 | 7,546.1 | 20,446.4 |
| AB2 Expired 31-Mar-16 | 11,169.8 | 10.0 | 137.7 | 39.8 | 3,908.2 | 15,265.5 |
| AC1 Through 30-Sep-16 | 17,474.2 | 1.1 | 0.0 | 33.1 | 3,069.6 | 20,578.1 |
| AC2 Through 30-Apr-17 | 9,817.4 | 0.0 | 0.0 | 0.0 | 2,617.6 | 12,435.0 |
| AD1 Through 30-Jun-17 | 629.9 | 0.0 | 0.0 | 0.0 | 0.2 | 630.1 |
| Total | 67,587.7 | 49,472.4 | 19,110.0 | 8,058.1 | 317,374.5 | 461,602.7 |

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

## Distribution of Units in the Queues

Table 12-4 shows the projects under construction, suspended, or active, by unit type, and control zone.[19] As of June 30, 2017, 94,755.8 MW of capacity were in generation request queues for construction through 2024, compared to 99,249.3 MW at December 31, 2016.[20] Table 12-4 also shows the planned retirements for each zone.

### Table 12-4 Queue capacity by LDA, control zone and fuel (MW): At June 30, 2017[21]

| Zone | Biomass | CC | CT | Diesel | Fuel Cell | Hydro | Nuclear | Solar | Steam | Storage | Wind | Total Queue Capacity | Planned Retirements |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AECO | 0.0 | 1,674.6 | 462.0 | 0.0 | 1.9 | 0.0 | 0.0 | 93.5 | 0.0 | 20.0 | 25.0 | 2,277.0 | 303.0 |
| DPL | 10.0 | 802.0 | 57.0 | 32.8 | 0.0 | 0.0 | 0.0 | 1,497.6 | 0.0 | 25.0 | 649.6 | 3,074.0 | 0.0 |
| JCPL | 0.0 | 1,927.2 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 205.7 | 0.0 | 85.5 | 0.0 | 2,218.7 | 614.5 |
| PECO | 0.0 | 1,256.0 | 0.0 | 6.6 | 0.0 | 0.0 | 94.0 | 20.0 | 0.0 | 0.0 | 0.0 | 1,376.6 | 50.8 |
| PSEG | 0.0 | 2,636.5 | 677.0 | 5.0 | 3.4 | 0.0 | 0.0 | 79.6 | 24.0 | 0.5 | 0.0 | 3,426.0 | 611.0 |
| RECO | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 |
| EMAAC Total | 10.0 | 8,296.3 | 1,196.0 | 44.4 | 5.9 | 0.0 | 94.0 | 1,896.4 | 24.0 | 131.0 | 674.6 | 12,372.5 | 1,579.3 |
| BGE | 0.0 | 0.0 | 0.0 | 1.3 | 0.0 | 0.4 | 30.3 | 44.1 | 0.0 | 0.1 | 0.0 | 76.2 | 135.0 |
| Pepco | 0.0 | 1,857.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 62.5 | 0.0 | 0.0 | 0.0 | 1,920.1 | 0.8 |
| SWMAAC Total | 0.0 | 1,857.6 | 0.0 | 1.3 | 0.0 | 0.4 | 30.3 | 106.6 | 0.0 | 0.1 | 0.0 | 1,996.3 | 135.8 |
| Met-Ed | 0.0 | 485.0 | 34.1 | 0.0 | 0.0 | 0.0 | 0.0 | 158.0 | 30.0 | 0.0 | 0.0 | 707.1 | 805.0 |
| PENELEC | 0.0 | 1,333.0 | 521.1 | 121.1 | 0.0 | 17.0 | 0.0 | 63.5 | 590.0 | 0.0 | 458.8 | 3,104.5 | 0.0 |
| PPL | 16.0 | 5,758.0 | 19.9 | 19.9 | 0.0 | 0.0 | 0.0 | 30.0 | 0.0 | 30.0 | 266.2 | 6,140.0 | 0.0 |
| WMAAC Total | 16.0 | 7,576.0 | 575.1 | 141.0 | 0.0 | 17.0 | 0.0 | 251.5 | 620.0 | 30.0 | 725.0 | 9,951.6 | 805.0 |
| AEP | 0.0 | 8,266.0 | 394.0 | 15.2 | 0.0 | 46.5 | 28.0 | 4,456.1 | 229.0 | 91.0 | 7,382.1 | 20,907.8 | 0.0 |
| AP | 0.0 | 7,005.1 | 30.0 | 99.6 | 0.0 | 15.0 | 0.0 | 614.6 | 10.0 | 37.8 | 1,030.7 | 8,842.8 | 0.0 |
| ATSI | 0.0 | 5,153.0 | 0.0 | 3.9 | 0.0 | 0.0 | 0.0 | 482.0 | 0.0 | 0.0 | 815.7 | 6,454.5 | 776.0 |
| ComEd | 0.0 | 8,145.2 | 1,117.0 | 18.8 | 0.0 | 22.7 | 0.0 | 387.0 | 64.0 | 85.5 | 3,446.5 | 13,286.7 | 510.0 |
| DAY | 0.0 | 1,150.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 741.9 | 12.0 | 39.9 | 300.0 | 2,243.8 | 2,941.0 |
| DEOK | 0.0 | 513.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 290.0 | 20.0 | 19.8 | 0.0 | 842.8 | 0.0 |
| DLCO | 0.0 | 205.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 11.7 | 0.0 | 20.0 | 0.0 | 236.7 | 0.0 |
| Dominion | 62.5 | 7,355.3 | 155.0 | 8.0 | 0.0 | 0.0 | 0.0 | 8,696.6 | 14.0 | 34.0 | 1,045.1 | 17,370.5 | 728.0 |
| EKPC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 209.9 | 0.0 | 0.0 | 0.0 | 209.9 | 0.0 |
| RMU | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 40.0 | 0.0 | 0.0 | 0.0 | 40.0 | 0.0 |
| Non-MAAC Total | 62.5 | 37,792.6 | 1,696.0 | 145.4 | 0.0 | 84.2 | 28.0 | 15,929.7 | 349.0 | 328.0 | 14,020.0 | 70,435.4 | 4,955.0 |
| Total | 88.5 | 55,522.5 | 3,467.1 | 332.1 | 5.9 | 101.6 | 152.3 | 18,184.2 | 993.0 | 489.1 | 15,419.6 | 94,755.8 | 7,475.1 |

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 coal fired steam units retire. As of June 30, 2017, there were 14,502.5 MW of gas fired capacity under construction in PJM. As of June 30, 2017, there were only 108.0 MW of coal fired steam capacity under construction in PJM. With respect to retirements, 5,212.0 MW of coal fired steam capacity and 661.8 MW of natural gas capacity are slated for deactivation between June 30, 2017, and December 31, 2020. The replacement of coal fired steam units by natural gas units could significantly affect future congestion, the role of firm and interruptible gas supply, and natural gas supply infrastructure.

## Planned Retirements

As shown in Table 12-5, 32,620.7 MW have been, or are planned to be, retired between 2011 and 2020.[22] Of that, 7,475.1 MW are planned to retire after the first six months of 2017. In the first six months of 2017, 1,495 MW were retired. Of the 7,475.1 MW pending retirement, 5,212.0 MW are coal units. The coal unit retirements were a result of low gas prices, low capacity prices and the investments required for compliance with the EPA's Mercury and Air Toxics Standards (MATS) for some units.

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

20 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 namplate 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 15,419.6 MW of wind resources and 18,184.2 MW of solar resources, the 94,755.8 MW currently active in the queue would be reduced to 70,066.6 MW.

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

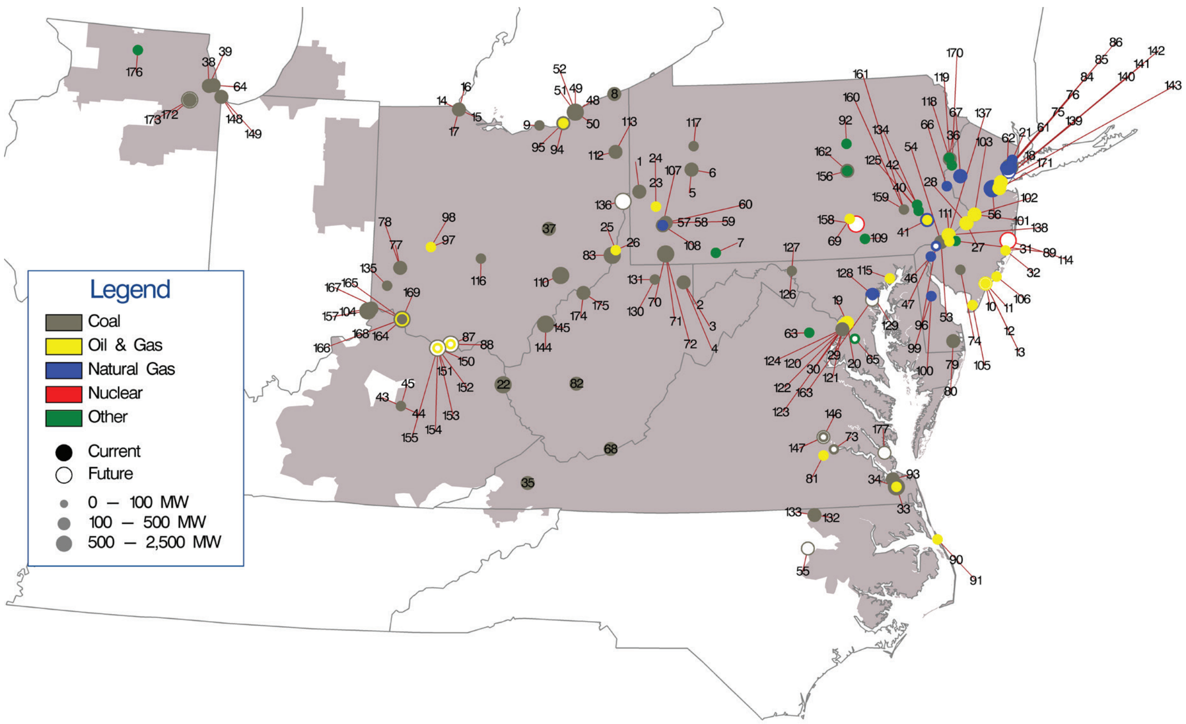
22 See PJM "Generator Deactivation Summary Sheets," at <http://www.pjm.com/planning/generation-deactivation/gd-summaries.aspx> (June 1, 2017).

## Table 12-5 Summary of PJM unit retirements by fuel (MW): 2011 through 2020

| | Coal | Diesel | Heavy Oil | Hydro | Kerosene | Landfill Gas | Light Oil | Natural Gas | Nuclear | Waste Coal | Wind | Wood Waste | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Retirements 2011 | 543.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 131.0 | 522.5 | 0.0 | 0.0 | 0.0 | 0.0 | 1,196.5 |
| Retirements 2012 | 5,907.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 788.0 | 250.0 | 0.0 | 0.0 | 0.0 | 16.0 | 6,961.9 |
| Retirements 2013 | 2,558.9 | 2.9 | 166.0 | 0.0 | 0.0 | 7.0 | 3.0 | 82.0 | 0.0 | 31.0 | 0.0 | 8.0 | 2,858.8 |
| Retirements 2014 | 2,239.0 | 50.0 | 0.0 | 0.0 | 184.0 | 15.3 | 188.0 | 294.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2,970.3 |
| Retirements 2015 | 7,064.8 | 0.0 | 0.0 | 0.0 | 644.2 | 2.0 | 222.3 | 1,319.0 | 0.0 | 0.0 | 10.4 | 0.0 | 9,262.7 |
| Retirements 2016 | 243.0 | 51.0 | 0.0 | 0.5 | 0.0 | 9.9 | 22.0 | 74.0 | 0.0 | 0.0 | 0.0 | 0.0 | 400.4 |
| Retirements 2017 (Jan-Jun) | 1,461.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 34.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1,495.0 |
| Planned Retirements (Jul 2017 and later) | 5,212.0 | 2.4 | 148.0 | 0.0 | 0.0 | 0.8 | 30.6 | 661.8 | 1,419.5 | 0.0 | 0.0 | 0.0 | 7,475.1 |
| Total | 25,229.6 | 106.3 | 314.0 | 0.5 | 828.2 | 35.0 | 1,384.9 | 3,237.3 | 1,419.5 | 31.0 | 10.4 | 24.0 | 32,620.7 |

A map of the retirements between 2011 and 2020 is shown in Figure 12-1 with a mapping to unit names identified in Table 12-6.

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



## Table 12-6 Unit identification for map of PJM unit retirements: 2011 through 2020

| ID | Unit | ID | Unit | ID | Unit | ID | Unit | ID | Unit | ID | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | AES Beaver Valley | 31 | Cedar 1 | 61 | Essex 10-11 | 91 | Kitty Hawk GT 2 | 121 | Potomac River 2 | 151 | Stuart 2 |
| 2 | Albright 1 | 32 | Cedar 2 | 62 | Essex 12 | 92 | Koppers Co. IPP | 122 | Potomac River 3 | 152 | Stuart 3 |
| 3 | Albright 2 | 33 | Chesapeake 1-4 | 63 | Fauquier County Landfill | 93 | Lake Kingman | 123 | Potomac River 4 | 153 | Stuart 4 |
| 4 | Albright 3 | 34 | Chesapeake 7-10 | 64 | Fisk Street 19 | 94 | Lake Shore 18 | 124 | Potomac River 5 | 154 | Stuart Diesels 1-4 |
| 5 | Armstrong 1 | 35 | Clinch River 3 | 65 | GUDE Landfill | 95 | Lake Shore EMD | 125 | Pottstown LF (Moser) | 155 | Stuart Diesels 1-4 |
| 6 | Armstrong 2 | 36 | Columbia Dam Hydro | 66 | Gilbert 1-4 | 96 | MH50 Markus Hook Co-gen | 126 | R Paul Smith 3 | 156 | Sunbury 1-4 |
| 7 | Arnold (Green Mtn. Wind Farm | 37 | Conesville 3 | 67 | Glen Gardner 1-8 | 97 | Mad River CTs A | 127 | R Paul Smith 4 | 157 | Tanners Creek 1-4 |
| 8 | Ashtabula 5 | 38 | Crawford 7 | 68 | Glen Lyn 5-6 | 98 | Mad River CTs B | 128 | Riverside 4 | 158 | Three Mile Island Unit 1 |
| 9 | Avon Lake 7 | 39 | Crawford 8 | 69 | Harrisburg 4 CT | 99 | McKee 1 | 129 | Riverside 6 | 159 | Titus 1 |
| 10 | BL England 1 | 40 | Cromby 1 | 70 | Hatfield's Ferry 1 | 100 | McKee 2 | 130 | Riversville 5 | 160 | Titus 2 |
| 11 | BL England 2 | 41 | Cromby 2 | 71 | Hatfield's Ferry 2 | 101 | Mercer 1 | 131 | Riversville 6 | 161 | Titus 3 |
| 12 | BL England 3 | 42 | Cromby D | 72 | Hatfield's Ferry 3 | 102 | Mercer 2 | 132 | Roanoke Valley 1 | 162 | Viking Energy NUG |
| 13 | BL England Diesel Units 1-4 | 43 | Dale 1-2 | 73 | Hopewell James River Cogeneration | 103 | Mercer 3 | 133 | Roanoke Valley 2 | 163 | Wagner 2 |
| 14 | Bay Shore 1 | 44 | Dale 3 | 74 | Howard Down 10 | 104 | Miami Fort 6 | 134 | Rolling Hills Landfill Generator | 164 | Walter C Beckjord 1 |
| 15 | Bay Shore 2 | 45 | Dale 4 | 75 | Hudson 1 | 105 | Middle 1-3 | 135 | SMART Paper | 165 | Walter C Beckjord 2 |
| 16 | Bay Shore 3 | 46 | Deepwater 1 | 76 | Hudson 2 | 106 | Missouri Ave B,C,D | 136 | Sammis 1-4 | 166 | Walter C Beckjord 3 |
| 17 | Bay Shore 4 | 47 | Deepwater 6 | 77 | Hutchings 1-3, 5-6 | 107 | Mitchell 2 | 137 | Schuylkill 1 | 167 | Walter C Beckjord 4 |
| 18 | Bayonne Cogen Plant (CC) | 48 | Eastlake 1 | 78 | Hutchings 4 | 108 | Mitchell 3 | 138 | Schuylkill Diesel | 168 | Walter C Beckjord 5-6 |
| 19 | Benning 15 | 49 | Eastlake 2 | 79 | Indian River 1 | 109 | Modern Power Landfill NUG | 139 | Sewaren 1 | 169 | Walter C Beckjord GT 1-4 |
| 20 | Benning 16 | 50 | Eastlake 3 | 80 | Indian River 3 | 110 | Muskingum River 1-5 | 140 | Sewaren 2 | 170 | Warren County Landfill |
| 21 | Bergen 3 | 51 | Eastlake 4 | 81 | Ingenco Petersburg | 111 | National Park 1 | 141 | Sewaren 3 | 171 | Werner 1-4 |
| 22 | Big Sandy 2 | 52 | Eastlake 5 | 82 | Kanawha River 1-2 | 112 | Niles 1 | 142 | Sewaren 4 | 172 | Will County 3 |
| 23 | Brunot Island 1B | 53 | Eddystone 1 | 83 | Kanmer 1-3 | 113 | Niles 2 | 143 | Sewaren 6 | 173 | Will County 4 |
| 24 | Brunot Island 1C | 54 | Eddystone 2 | 84 | Kearny 10 | 114 | Oyster Creek | 144 | Sporn 1-4 | 174 | Willow Island 1 |
| 25 | Burger 3 | 55 | Edgecomb NUG (Rocky 1-2) | 85 | Kearny 11 | 115 | Perryman 2 | 145 | Sporn 5 | 175 | Willow Island 2 |
| 26 | Burger EMD | 56 | Edison 1-3 | 86 | Kearny 9 | 116 | Picway 5 | 146 | Spruance NUG1 (Rich 1-2) | 176 | Winnebago Landfill |
| 27 | Burlington 8,11 | 57 | Elrama 1 | 87 | Killen 2 | 117 | Piney Creek NUG | 147 | Spruance NUG2 (Rich 3-4) | 177 | Yorktown 1-2 |
| 28 | Burlington 9 | 58 | Elrama 2 | 88 | Killen CT | 118 | Portland 1 | 148 | State Line 3 | | |
| 29 | Buzzard Point East Banks 1,2,4-8 | 59 | Elrama 3 | 89 | Kinsley Landfill | 119 | Portland 2 | 149 | State Line 4 | | |
| 30 | Buzzard Point West Banks 1-9 | 60 | Elrama 4 | 90 | Kitty Hawk GT 1 | 120 | Potomac River 1 | 150 | Stuart 1 | | |

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

## Table 12-7 Planned retirement of PJM units: as of June 30, 2017[23]

| Unit | Zone | ICAP (MW) | Fuel | Unit Type | Projected Deactivation Date |
|---|---|---|---|---|---|
| GUDE Landfill | Pepco | 0.8 | Landfill Gas | DIESEL | 24-Aug-17 |
| Yorktown 1-2 | Dominion | 323.0 | Coal | STEAM | 14-Sep-17 |
| Hopewell James River Cogeneration | Dominion | 89.0 | Coal | STEAM | 31-May-18 |
| Killen 2 | DAY | 600.0 | Coal | STEAM | 01-Jun-18 |
| Stuart 1 | DAY | 577.0 | Coal | STEAM | 01-Jun-18 |
| Stuart 2 | DAY | 577.0 | Coal | STEAM | 01-Jun-18 |
| Stuart 3 | DAY | 577.0 | Coal | STEAM | 01-Jun-18 |
| Stuart 4 | DAY | 577.0 | Coal | STEAM | 01-Jun-18 |
| Stuart Diesels 1-4 | DAY | 2.4 | Diesel | DIESEL | 01-Jun-18 |
| Killen CT | DAY | 24.0 | Light Oil | CT | 01-Jun-18 |
| Stuart Diesels 1-4 | DAY | 6.6 | Light Oil | DIESEL | 01-Jun-18 |
| Sewaren 1 | PSEG | 104.0 | Natural Gas | STEAM | 01-Jun-18 |
| Sewaren 2 | PSEG | 118.0 | Natural Gas | STEAM | 01-Jun-18 |
| Sewaren 3 | PSEG | 107.0 | Natural Gas | STEAM | 01-Jun-18 |
| Sewaren 4 | PSEG | 124.0 | Natural Gas | STEAM | 01-Jun-18 |
| Bayonne Cogen Plant (CC) | PSEG | 158.0 | Natural Gas | STEAM | 01-Nov-18 |
| Spruance NUG1 (aka Spruance 1 Rich 1-2) | Dominion | 115.5 | Coal | STEAM | 12-Jan-19 |
| Spruance NUG2 (aka Spruance 2 Rich 3-4) | Dominion | 85.0 | Coal | STEAM | 12-Jan-19 |
| BL England 2 | AECO | 155.0 | Coal | STEAM | 30-Apr-19 |
| BL England 3 | AECO | 148.0 | Heavy Oil | STEAM | 30-Apr-19 |
| MH50 Markus Hook Co-gen | PECO | 50.8 | Natural Gas | STEAM | 13-May-19 |
| Three Mile Island Unit 1 Nuclear Generating Station | Met-Ed | 805.0 | Nuclear | NUCLEAR | 30-Sep-19 |
| Oyster Creek Nuclear Generating Station | JCPL | 614.5 | Nuclear | NUCLEAR | 31-Dec-19 |
| Sammis 1-4 | ATSI | 640.0 | Coal | STEAM | 31-May-20 |
| Will County 4 | ComEd | 510.0 | Coal | STEAM | 31-May-20 |
| Wagner 2 | BGE | 135.0 | Coal | STEAM | 01-Jun-20 |
| Bay Shore 1 | ATSI | 136.0 | Coal | STEAM | 01-Oct-20 |
| Edgecomb NUG (aka Edgecomb Rocky 1-2) | Dominion | 115.5 | Coal | STEAM | 31-Oct-20 |
| Total | | 7,475.1 | | | |

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, 77.3 percent, of all MW retiring during this period are coal fired steam units. These coal fired steam units have an average age of 54.4 years and an average size of 175.2 MW. Over half of the retiring coal fired steam units, 54.6 percent, are located in either Ohio or Pennsylvania.

Retirements have generally consisted of smaller subcritical coal fired steam units and those without adequate environmental controls to remain viable beyond 2017.

23 Units designated as external installed capacity have been removed

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

| Fuel | Number of Units | Avg. Size (MW) | Avg. Age at Retirement (Years) | Total MW | Percent |
|---|---|---|---|---|---|
| Coal | 144 | 175.2 | 54.4 | 25,229.6 | 77.3% |
| Diesel | 5 | 21.3 | 39.8 | 106.3 | 0.3% |
| Heavy Oil | 2 | 157.0 | 49.5 | 314.0 | 1.0% |
| Hydro | 1 | 0.5 | 113.8 | 0.5 | 0.0% |
| Kerosene | 20 | 41.4 | 45.5 | 828.2 | 2.5% |
| Landfill Gas | 9 | 3.9 | 14.0 | 35.0 | 0.1% |
| Light Oil | 30 | 46.2 | 43.2 | 1,384.9 | 4.2% |
| Natural Gas | 55 | 58.9 | 47.3 | 3,237.3 | 9.9% |
| Nuclear | 2 | 709.8 | 47.8 | 1,419.5 | 4.4% |
| Waste Coal | 1 | 31.0 | 20.3 | 31.0 | 0.1% |
| Wind | 1 | 10.4 | 15.6 | 10.4 | 0.0% |
| Wood Waste | 2 | 12.0 | 23.2 | 24.0 | 0.1% |
| Total | 272 | 119.9 | 49.1 | 32,620.7 | 100.0% |

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

| State | Coal | Diesel | Heavy Oil | Hydro | Kerosene | Landfill Gas | Light Oil | Natural Gas | Nuclear | Waste Coal | Wind | Wood Waste | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 788.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 788.0 |
| DE | 254.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 34.0 | 0.0 | 0.0 | 0.0 | 0.0 | 288.0 |
| IL | 2,134.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2,140.4 |
| IN | 982.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 982.0 |
| KY | 995.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 995.0 |
| MD | 250.0 | 51.0 | 0.0 | 0.0 | 0.0 | 0.8 | 0.0 | 189.0 | 0.0 | 0.0 | 0.0 | 0.0 | 490.8 |
| NC | 324.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 31.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 355.5 |
| NJ | 1,543.0 | 0.0 | 148.0 | 0.5 | 828.2 | 9.8 | 220.0 | 2,680.5 | 614.5 | 0.0 | 0.0 | 0.0 | 6,044.5 |
| OH | 9,248.6 | 52.4 | 0.0 | 0.0 | 0.0 | 0.0 | 228.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9,529.9 |
| PA | 4,517.0 | 0.0 | 166.0 | 0.0 | 0.0 | 16.0 | 49.7 | 333.8 | 805.0 | 31.0 | 10.4 | 24.0 | 5,952.9 |
| VA | 2,340.5 | 2.9 | 0.0 | 0.0 | 0.0 | 2.0 | 67.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2,412.7 |
| WV | 2,641.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2,641.0 |
| Total | 25,229.6 | 106.3 | 314.0 | 0.5 | 828.2 | 35.0 | 1,384.9 | 3,237.3 | 1,419.5 | 31.0 | 10.4 | 24.0 | 32,620.7 |

## Generation Deactivations in 2017

Table 12-10 shows the units that were deactivated in the first six months of 2017.

### Table 12-10 Unit deactivations in January 1 through June 30, 2017

| Company | Unit Name | ICAP (MW) | Primary Fuel | Zone Name | Average Age (Years) | Retirement Date |
|---|---|---|---|---|---|---|
| Dominion Resources, Inc. | Roanoke Valley 1 | 165.0 | Coal | Dominion | 22.8 | 01-Mar-17 |
| Dominion Resources, Inc. | Roanoke Valley 2 | 44.0 | Coal | Dominion | 21.8 | 01-Mar-17 |
| City of Dover | McKee 1 | 17.0 | Natural Gas | DPL | 55.4 | 31-May-17 |
| City of Dover | McKee 2 | 17.0 | Natural Gas | DPL | 55.3 | 31-May-17 |
| Public Service Enterprise Group Incorporated | Hudson 2 | 620.0 | Coal | PSEG | 48.5 | 01-Jun-17 |
| Public Service Enterprise Group Incorporated | Mercer 1 | 316.0 | Coal | PSEG | 56.5 | 01-Jun-17 |
| Public Service Enterprise Group Incorporated | Mercer 2 | 316.0 | Coal | PSEG | 56.0 | 01-Jun-17 |
| Total | | 1,495.0 | | | | |

## Existing Generation Mix

As of June 30, 2017, PJM had an installed capacity of 199,987.9 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, 2017 (By zone and unit type (MW))[24]

| ZONE | CC | CT | Diesel | Fuel Cell | Hydro | Nuclear | Solar | Steam | Storage | Wind | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AECO | 901.9 | 570.7 | 14.6 | 0.0 | 0.0 | 0.0 | 59.4 | 815.9 | 0.0 | 7.5 | 2,370.0 |
| AEP | 6,100.0 | 3,682.2 | 80.3 | 0.0 | 1,071.9 | 2,071.0 | 14.7 | 18,897.8 | 6.0 | 2,254.0 | 34,177.9 |
| APS | 1,749.0 | 1,560.9 | 47.9 | 0.0 | 129.2 | 0.0 | 36.1 | 5,409.0 | 78.9 | 1,191.5 | 10,202.5 |
| ATSI | 1,570.5 | 1,618.3 | 63.7 | 0.0 | 0.0 | 2,134.0 | 0.0 | 5,719.0 | 0.0 | 0.0 | 11,105.5 |
| BGE | 0.0 | 936.6 | 22.4 | 0.0 | 0.4 | 1,716.0 | 1.1 | 2,921.5 | 0.0 | 0.0 | 5,598.0 |
| ComEd | 3,146.1 | 7,244.0 | 109.1 | 0.0 | 0.0 | 10,473.5 | 9.0 | 5,166.1 | 127.6 | 3,081.9 | 29,357.3 |
| 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 | 4.8 | 0.0 | 112.0 | 0.0 | 0.0 | 3,981.0 | 20.0 | 0.0 | 4,819.0 |
| 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 | 8,371.6 | 4,092.7 | 171.8 | 0.0 | 3,589.3 | 3,581.3 | 217.8 | 7,566.0 | 0.0 | 208.0 | 27,798.5 |
| DPL | 2,498.5 | 1,820.4 | 162.1 | 30.0 | 0.0 | 0.0 | 118.4 | 1,586.0 | 0.0 | 0.0 | 6,215.4 |
| 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 | 16.1 | 0.0 | 400.0 | 614.5 | 220.0 | 15.0 | 0.0 | 0.0 | 4,711.2 |
| Met-Ed | 2,630.8 | 401.7 | 33.4 | 0.0 | 19.5 | 805.0 | 0.0 | 200.0 | 0.0 | 0.0 | 4,090.4 |
| PECO | 3,209.0 | 834.0 | 2.9 | 0.0 | 3,284.0 | 4,546.8 | 3.0 | 979.1 | 1.0 | 0.0 | 12,859.8 |
| PENELEC | 850.0 | 407.5 | 150.0 | 0.0 | 512.8 | 0.0 | 0.0 | 6,799.5 | 28.4 | 958.8 | 9,707.0 |
| Pepco | 1,072.0 | 1,204.7 | 11.9 | 0.0 | 0.0 | 0.0 | 0.0 | 3,649.1 | 0.0 | 0.0 | 5,937.7 |
| PPL | 2,657.9 | 602.5 | 55.5 | 0.0 | 706.6 | 2,520.0 | 15.0 | 5,169.9 | 20.0 | 219.7 | 11,967.1 |
| PSEG | 3,846.3 | 1,132.0 | 11.1 | 0.0 | 5.0 | 3,493.0 | 182.7 | 798.1 | 4.0 | 0.0 | 9,472.2 |
| RECO | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 41,577.3 | 29,682.8 | 1,005.1 | 30.0 | 9,907.0 | 33,732.1 | 878.3 | 74,928.0 | 325.9 | 7,921.4 | 199,987.9 |

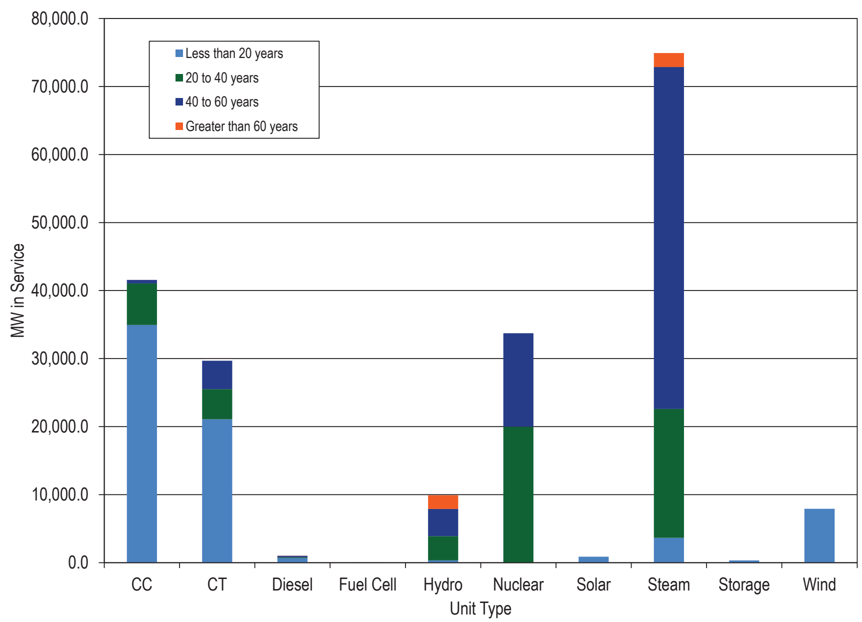
24 The capacity described in this section refers to all capacity in PJM at the summer installed capacity rating, regardless of whether the capacity entered the RPM auction. This table previously included external units.

Figure 12-2 and Table 12-12 show the age of PJM generators by unit type. Units older than 40 years comprise 77,015.0 MW, or 38.5 percent, of the total capacity of 199,987.9 MW.

### Table 12-12 PJM capacity (MW) by age (years): At June 30, 2017

| Age (years) | CC | CT | Diesel | Fuel Cell | Hydro | Nuclear | Solar | Steam | Storage | Wind | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Less than 20 | 34,946.8 | 21,076.8 | 667.6 | 30.0 | 339.7 | 0.0 | 878.3 | 3,650.4 | 325.9 | 7,921.4 | 69,836.8 |
| 20 to 40 | 6,098.5 | 4,435.4 | 117.9 | 0.0 | 3,563.2 | 19,977.9 | 0.0 | 18,943.1 | 0.0 | 0.0 | 53,136.0 |
| 40 to 60 | 532.0 | 4,170.6 | 215.6 | 0.0 | 3,985.0 | 13,754.2 | 0.0 | 50,263.5 | 0.0 | 0.0 | 72,920.9 |
| Greater than 60 | 0.0 | 0.0 | 4.0 | 0.0 | 2,019.1 | 0.0 | 0.0 | 2,071.0 | 0.0 | 0.0 | 4,094.1 |
| Total | 41,577.3 | 29,682.8 | 1,005.1 | 30.0 | 9,907.0 | 33,732.1 | 878.3 | 74,928.0 | 325.9 | 7,921.4 | 199,987.9 |

### Figure 12-2 PJM capacity (MW) by age (years): At June 30, 2017




## Generation and Transmission Interconnection Planning Process

PJM made changes to the queue process in May 2012.[25] 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.[26] The Earlier Queue Submittal Task Force (EQSTF) was established in August 2015, to further address the issue.[27]

### The Earlier Queue Submittal Task Force

In 2015 and 2016, participants of the Earlier Queue Submittal Task Force (EQSTF) drafted rule changes to the Interconnection Queue process meant to address high levels of deficient project applications being submitted to PJM for review.

To discourage incomplete interconnection project requests, the EQSTF proposed to only assign queue positions for project applications that had submitted all required project elements including site control. In addition, all project applications would be required to remedy any deficiencies by the end of the queue window in order to be considered in feasibility studies or

25 See PJM Interconnection, L.L.C., Docket No. ER12-1177 (Feb. 29, 2012).
26 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>.
27 See Earlier Queue Submittal Task Force at <http://www.pjm.com/committees-and-groups/closed-groups/eqstf.aspx>.

be terminated and withdrawn. Queue positions had historically been assigned to project developers that paid the study deposit and submitted a project application by the appropriate submission deadline. Project applications with missing information were assigned queue numbers so long as these two criteria were met.

The EQSTF also proposed rule changes to interconnection study fee structures that would discourage the submission of speculative or incomplete queue projects. Under the old rules, deposits provided by developers for interconnection studies could not be charged until after a queue position was accepted. Under the new rules, these deposits would be available for charging before a queue position is assigned.

In addition, rather than socializing the study costs for deficient applications from project developers, the EQSTF proposed that these project costs be assigned directly to the developer that submitted the project. This would significantly increase the cost burden that developers would experience if a project is found to be deficient in the review process.

The EQSTF proposed to change the timing of queue windows and Feasibility Study dates to enable more generation projects to participate in the PJM Base Residual Auction. The EQSTF proposed shifting start dates for the queue windows back a month from May 1 to April 1 and Nov 1 to October 1. The EQSTF also proposed shifting feasibility study dates from Dec 1 to Nov 1 and June 1 to May 1.

Revisions to the OATT developed by the EQSTF were approved by the FERC effective October 31, 2016.[28]

On December 15, 2016, the Commission issued a notice of proposed rulemaking proposing additional queue reforms intended to improve certainty, promote more informed interconnection, and enhance interconnection processes.

28 See Letter Order, ER16-2518-000 (Oct. 7, 2016).

## Interconnection Queue Analysis

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.[29] 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.

## Withdrawn Projects

Table 12-14 shows the milestone status when projects were withdrawn, for all withdrawn projects. Of the projects withdrawn, 52.0 percent were withdrawn before the system impact study was completed. Once an Interconnection Service Agreement (ISA) or a Wholesale Market Participation Agreement

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

(WMPA) is executed, the financial obligation for any necessary transmission upgrades cannot be retracted.[30] [31] Withdrawing at or beyond this point is uncommon; only 249 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, 2017

| Milestone Completed | Projects Withdrawn | Percent | Average Days | Maximum Days |
|---|---|---|---|---|
| Never Started | 213 | 10.7% | 162 | 1,235 |
| Feasibility Study | 825 | 41.3% | 341 | 3,238 |
| System Impact Study | 450 | 22.5% | 608 | 3,174 |
| Facilities Study | 259 | 13.0% | 1,341 | 4,210 |
| Construction Service Agreement (CSA) or beyond | 249 | 12.5% | 1,497 | 4,249 |
| Total | 1,996 | 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 995 days, or 2.7 years, between entering a queue and going into service. For withdrawn projects, there is an average time of 656 days, or 1.8 years, between entering a queue and withdrawing.

### Table 12-15 Average project queue times (days): At June 30, 2017

| Status | Average (Days) | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|
| Active | 903 | 535 | 106 | 3,745 |
| In-Service | 995 | 714 | 1 | 4,024 |
| Suspended | 2,087 | 1,215 | 624 | 5,185 |
| Under Construction | 1,772 | 1,030 | 441 | 4,672 |
| Withdrawn | 656 | 684 | 1 | 4,249 |

## Average Time in Queue

Table 12-16 presents information on the time in the stages of the queue for those projects not yet in service. Of the 814 projects in the queue as of June 30, 2017, 70 had a completed feasibility study and 145 were under construction.

### Table 12-16 PJM generation planning summary: At June 30, 2017

| Milestone Reached | Number of Projects | Percent of Total Projects | Average Days | Maximum Days |
|---|---|---|---|---|
| Under Review | 424 | 52.1% | 772 | 2,039 |
| Feasibility Study | 70 | 8.6% | 1,012 | 1,828 |
| System Impact Study | 98 | 12.0% | 1,087 | 3,651 |
| Facilities Study | 77 | 9.5% | 2,010 | 4,260 |
| Construction Service Agreement (CSA) or beyond | 145 | 17.8% | 2,199 | 5,185 |
| Total | 814 | 100.0% | | |

## Queue Analysis by Fuel Group

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 number of queue entries has increased during the past three years, primarily by renewable projects (solar, hydro, storage, biomass, wind). Of the 895 projects entered in 2014, 2015, and 2016, 626, 69.9 percent, were renewable. Of the 197 projects entered in the first 6 months of 2017, 153, 77.7 percent, were renewable.

30 "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 12 (June 22, 2017).

31 See PJM. "Manual 14C: Generation and Transmission Interconnection Facility Construction," Revision 12 (June 22, 2017).

Table 12-17 Number of projects entered in the queue as of June 30, 2017

| | 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 | 382 | 54 | 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 | 312 | 85 | 399 |
| 2017 | 2 | 153 | 42 | 197 |
| Total | 69 | 2,108 | 1,364 | 3,541 |

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 36.2 percent of the nameplate MW currently active in the queue (Table 12-18).

Table 12-18 Queue details by fuel group: June 30, 2017

| Fuel Group | Number of Projects | Percent of Projects | MW | Percent MW |
|---|---|---|---|---|
| Nuclear | 8 | 1.0% | 152.3 | 0.2% |
| Renewable | 571 | 69.9% | 34,343.0 | 36.2% |
| Traditional | 238 | 29.1% | 60,320.6 | 63.6% |
| Total | 817 | 100.0% | 94,816.0 | 100.0% |

## Queue Analysis by Fuel Type and Project Classification

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, 2017. For example, between January 1, 1997 and June 30, 2017, 152 nameplate capacity upgrades at natural gas fired facilities have completed the queue process and are in service.

Since 1997, there have been a total of 3,538 projects in PJM generation queues. A total of 2,891 projects have been classified as new generation and 647 projects have been classified as upgrades. Wind, solar and natural gas projects have accounted for 2,777 projects, or 78.5 percent, of all 3,538 generation queue projects. A total of 197 new projects from either project classification entered the generation queue in the first six months of 2017.

## Table 12-19 Status of all generation queue projects: January 1, 1997 through June 30, 2017

| | | 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 | 93 | 61 | 9 | 109 | 1 | 10 | 4 | 7 | 18 | 3 | 75 | 6 | 396 |
| | Upgrade | 152 | 15 | 46 | 16 | 42 | 16 | 14 | 6 | 3 | 4 | 16 | 2 | 332 |
| Under Construction | New Generation | 28 | 22 | 0 | 47 | 0 | 4 | 0 | 0 | 23 | 0 | 2 | 0 | 126 |
| | Upgrade | 24 | 0 | 4 | 2 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 34 |
| Suspended | New Generation | 15 | 20 | 1 | 33 | 0 | 0 | 0 | 1 | 6 | 0 | 1 | 0 | 77 |
| | Upgrade | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 11 |
| Withdrawn | New Generation | 426 | 373 | 54 | 714 | 9 | 40 | 9 | 37 | 75 | 10 | 74 | 12 | 1,833 |
| | Upgrade | 78 | 15 | 13 | 11 | 9 | 2 | 13 | 2 | 7 | 2 | 10 | 1 | 163 |
| Active | New Generation | 80 | 42 | 0 | 310 | 1 | 1 | 0 | 1 | 18 | 0 | 6 | 0 | 459 |
| | Upgrade | 62 | 7 | 5 | 14 | 7 | 1 | 0 | 1 | 5 | 0 | 2 | 3 | 107 |
| Total Projects | New Generation | 642 | 518 | 64 | 1,213 | 11 | 55 | 13 | 46 | 140 | 13 | 158 | 18 | 2,891 |
| | Upgrade | 321 | 40 | 68 | 43 | 58 | 20 | 27 | 10 | 20 | 6 | 28 | 6 | 647 |

## Table 12-20 Status of all generation queue projects as a percent of total projects by classification: January 1, 1997 through June 30, 2017

| | | Percent of Total Projects by Classification | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Status | Project Classification | Natural Gas | Wind | Coal | Solar | Nuclear | Hydro | Oil | Biomass | Storage | Other | LFG | Diesel |
| In Service | New Generation | 14.5% | 11.8% | 14.1% | 9.0% | 9.1% | 18.2% | 30.8% | 15.2% | 12.9% | 23.1% | 47.5% | 33.3% |
| | Upgrade | 47.4% | 37.5% | 67.6% | 37.2% | 72.4% | 80.0% | 51.9% | 60.0% | 15.0% | 66.7% | 57.1% | 33.3% |
| Under Construction | New Generation | 4.4% | 4.2% | 0.0% | 3.9% | 0.0% | 7.3% | 0.0% | 0.0% | 16.4% | 0.0% | 1.3% | 0.0% |
| | Upgrade | 7.5% | 0.0% | 5.9% | 4.7% | 0.0% | 5.0% | 0.0% | 10.0% | 10.0% | 0.0% | 0.0% | 0.0% |
| Suspended | New Generation | 2.3% | 3.9% | 1.6% | 2.7% | 0.0% | 0.0% | 0.0% | 2.2% | 4.3% | 0.0% | 0.6% | 0.0% |
| | Upgrade | 1.6% | 7.5% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 15.0% | 0.0% | 0.0% | 0.0% |
| Withdrawn | New Generation | 66.4% | 72.0% | 84.4% | 58.9% | 81.8% | 72.7% | 69.2% | 80.4% | 53.6% | 76.9% | 46.8% | 66.7% |
| | Upgrade | 24.3% | 37.5% | 19.1% | 25.6% | 15.5% | 10.0% | 48.1% | 20.0% | 35.0% | 33.3% | 35.7% | 16.7% |
| Active | New Generation | 12.5% | 8.1% | 0.0% | 25.6% | 9.1% | 1.8% | 0.0% | 2.2% | 12.9% | 0.0% | 3.8% | 0.0% |
| | Upgrade | 19.3% | 17.5% | 7.4% | 32.6% | 12.1% | 5.0% | 0.0% | 10.0% | 25.0% | 0.0% | 7.1% | 50.0% |

Table 12-20 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, 80.0 percent of all hydro projects classified as upgrades are currently in service in PJM, 10.0 percent of hydro upgrades were withdrawn, 5.0 percent of hydro upgrades are under construction, and 5.0 percent of hydro upgrades are active in the queue. From January 1, 1997, through June 30, 2017, solar projects have had the lowest completion rate across all technology types for projects classified as new generation 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 12-21 shows the nameplate generating capacity of projects in the PJM generation queue by technology type and project classification. For example, the 373 new generation wind projects that have been withdrawn from the queue as of June 30, 2017, listed in Table 12-19 constitute 58,711.1 MW of nameplate capacity. The 504 new generation and upgrade natural gas projects that have been withdrawn in the same time period constitute 195,564.6 MW of nameplate capacity.

## Table 12-21 Status of all generation capacity (MW) in the PJM generation queue: January 1, 1997 through June 30, 2017

| | | Project MW | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Status | Project Classification | Natural Gas | Wind | Coal | Solar | Nuclear | Hydro | Oil | Biomass | Storage | Other | LFG | Diesel | TOTAL |
| In Service | New Generation | 25,645.1 | 6,647.2 | 1,378.0 | 851.4 | 9.0 | 565.6 | 607.0 | 225.7 | 161.4 | 50.0 | 406.9 | 69.5 | 36,616.7 |
| | Upgrade | 6,668.4 | 33.7 | 767.5 | 19.4 | 3,912.8 | 605.6 | 125.8 | 58.8 | 36.4 | 547.5 | 54.5 | 25.3 | 12,855.6 |
| Under Construction | New Generation | 12,949.2 | 3,427.9 | 0.0 | 858.9 | 0.0 | 35.6 | 0.0 | 0.0 | 41.1 | 0.0 | 11.2 | 0.0 | 17,323.9 |
| | Upgrade | 1,542.1 | 0.0 | 108.0 | 4.5 | 0.0 | 17.0 | 0.0 | 62.5 | 52.0 | 0.0 | 0.0 | 0.0 | 1,786.1 |
| Suspended | New Generation | 3,497.7 | 3,429.4 | 80.0 | 387.6 | 0.0 | 0.0 | 0.0 | 16.0 | 75.8 | 0.0 | 0.9 | 0.0 | 7,487.4 |
| | Upgrade | 365.7 | 175.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 | 0.0 | 0.0 | 0.0 | 570.7 |
| Withdrawn | New Generation | 186,746.0 | 58,711.0 | 33,431.6 | 11,498.3 | 8,161.0 | 1,988.0 | 1,721.0 | 1,055.5 | 789.2 | 843.8 | 421.2 | 63.9 | 305,430.7 |
| | Upgrade | 8,818.6 | 380.6 | 865.0 | 112.8 | 916.0 | 56.0 | 589.0 | 37.1 | 92.1 | 24.0 | 48.7 | 4.0 | 11,943.9 |
| Active | New Generation | 36,313.6 | 8,126.5 | 0.0 | 16,017.9 | 28.0 | 15.0 | 0.0 | 6.0 | 191.4 | 0.0 | 42.0 | 0.0 | 60,740.4 |
| | Upgrade | 5,313.2 | 260.8 | 91.0 | 915.2 | 124.3 | 34.0 | 0.0 | 4.0 | 98.8 | 0.0 | 0.0 | 6.1 | 6,847.4 |
| Total Projects | New Generation | 265,151.6 | 80,342.1 | 34,889.6 | 29,614.1 | 8,198.0 | 2,604.2 | 2,328.0 | 1,303.2 | 1,258.9 | 893.8 | 882.1 | 133.4 | 427,599.0 |
| | Upgrade | 22,708.0 | 850.0 | 1,831.5 | 1,051.9 | 4,953.1 | 712.6 | 714.8 | 162.4 | 309.3 | 571.5 | 103.2 | 35.4 | 34,003.7 |

Figure 12-3 shows the project MW that have entered the PJM generation queue by fuel type and year of entry. In 2015 and 2016, natural gas, wind, and solar projects accounted for the majority of all new projects entering the generation queue. The increase in solar projects entering the queue in 2016 from 2015 was primarily a result of new projects in Dominion. The increase in solar projects entering the queue in the first six months of 2017 was primarily a result of new projects in AEP.

## Figure 12-3 Queue project MW by fuel type and queue entry year: January 1, 1997 through June 30, 2017

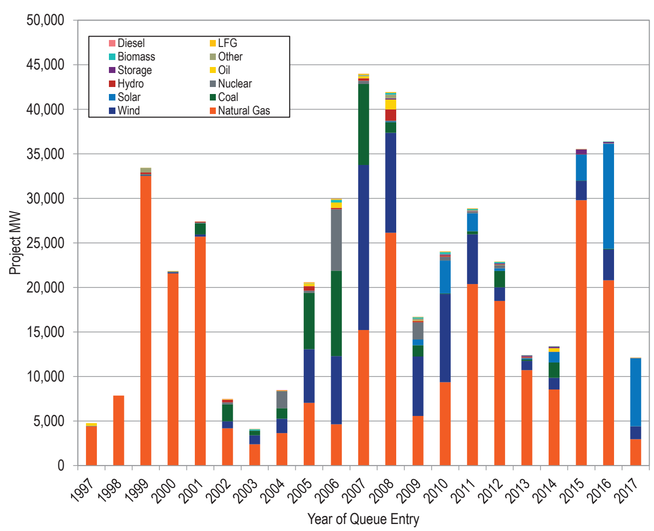


Table 12-22 shows the MW in Table 12-21 by share by classification as new generation or upgrade. Within a fuel type the shares of upgrades add to 100 percent and the shares of new generation add to 100 percent. For example, 73.1 percent of wind projects classified as new generation have been withdrawn from the queue between January 1, 1997, and June 30, 2017.

### Table 12-22 Status of all generation queue projects as percent of total MW in project classification: January 1, 1997 through June 30, 2017

| | | 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 | 9.7% | 8.3% | 3.9% | 2.9% | 0.1% | 21.7% | 26.1% | 17.3% | 12.8% | 5.6% | 46.1% | 52.1% |
| | Upgrade | 29.4% | 4.0% | 41.9% | 1.8% | 79.0% | 85.0% | 17.6% | 36.2% | 11.8% | 95.8% | 52.8% | 71.5% |
| Under Construction | New Generation | 4.9% | 4.3% | 0.0% | 2.9% | 0.0% | 1.4% | 0.0% | 0.0% | 3.3% | 0.0% | 1.3% | 0.0% |
| | Upgrade | 6.8% | 0.0% | 5.9% | 0.4% | 0.0% | 2.4% | 0.0% | 38.5% | 16.8% | 0.0% | 0.0% | 0.0% |
| Suspended | New Generation | 1.3% | 4.3% | 0.2% | 1.3% | 0.0% | 0.0% | 0.0% | 1.2% | 6.0% | 0.0% | 0.1% | 0.0% |
| | Upgrade | 1.6% | 20.6% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 9.7% | 0.0% | 0.0% | 0.0% |
| Withdrawn | New Generation | 70.4% | 73.1% | 95.8% | 38.8% | 99.5% | 76.3% | 73.9% | 81.0% | 62.7% | 94.4% | 47.7% | 47.9% |
| | Upgrade | 38.8% | 44.8% | 47.2% | 10.7% | 18.5% | 7.9% | 82.4% | 22.8% | 29.8% | 4.2% | 47.2% | 11.3% |
| Active | New Generation | 13.7% | 10.1% | 0.0% | 54.1% | 0.3% | 0.6% | 0.0% | 0.5% | 15.2% | 0.0% | 4.8% | 0.0% |
| | Upgrade | 23.4% | 30.7% | 5.0% | 87.0% | 2.5% | 4.8% | 0.0% | 2.5% | 31.9% | 0.0% | 0.0% | 17.2% |

## Natural Gas Project Analysis

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, 2017, by zone. Of the 142 natural gas projects classified either as new generation or upgrade currently active in the PJM generation queue, 60 projects, 42.3 percent, are located within AEP, ComEd and AP.

### Table 12-23 Status of all natural gas generation queue projects: January 1, 1997 through June 30, 2017

| | | 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 | 2 | 6 | 2 | 0 | 1 | 5 | 7 | 0 | 0 | 8 | 4 | 6 | 8 | 7 | 9 | 12 | 0 | 93 |
| | Upgrade | 7 | 14 | 9 | 1 | 1 | 12 | 6 | 0 | 30 | 16 | 0 | 0 | 5 | 1 | 9 | 5 | 5 | 6 | 25 | 0 | 152 |
| Under Construction | New Generation | 3 | 2 | 3 | 1 | 1 | 0 | 0 | 1 | 3 | 0 | 1 | 0 | 1 | 0 | 2 | 1 | 2 | 5 | 2 | 0 | 28 |
| | Upgrade | 1 | 1 | 1 | 1 | 0 | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 0 | 5 | 0 | 1 | 4 | 4 | 0 | 24 |
| Suspended | New Generation | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 6 | 1 | 0 | 0 | 0 | 15 |
| | Upgrade | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 5 |
| Withdrawn | New Generation | 26 | 17 | 38 | 13 | 8 | 10 | 0 | 1 | 17 | 16 | 2 | 3 | 24 | 25 | 42 | 49 | 33 | 39 | 61 | 2 | 426 |
| | Upgrade | 6 | 7 | 5 | 4 | 0 | 2 | 0 | 1 | 7 | 4 | 0 | 0 | 5 | 8 | 2 | 4 | 3 | 4 | 16 | 0 | 78 |
| Active | New Generation | 4 | 10 | 8 | 4 | 0 | 11 | 1 | 0 | 3 | 2 | 0 | 0 | 2 | 1 | 1 | 7 | 0 | 5 | 20 | 1 | 80 |
| | Upgrade | 3 | 9 | 6 | 3 | 0 | 16 | 0 | 0 | 11 | 1 | 0 | 0 | 1 | 3 | 1 | 2 | 0 | 4 | 2 | 0 | 62 |
| Total Projects | New Generation | 42 | 32 | 59 | 20 | 15 | 23 | 1 | 3 | 28 | 26 | 3 | 3 | 36 | 30 | 51 | 71 | 43 | 58 | 95 | 3 | 642 |
| | Upgrade | 17 | 31 | 22 | 9 | 1 | 32 | 6 | 1 | 51 | 21 | 0 | 0 | 13 | 12 | 17 | 12 | 11 | 18 | 47 | 0 | 321 |

Table 12-24 shows the status of all gas projects by MW that entered PJM generation queues from January 1, 1997 through June 30, 2017, by zone. Of the 41,626.8 MW of natural gas projects classified either as new generation or upgrade currently active in the PJM generation queue, 21,605.7 MW, 51.9 percent, are located within AEP, ComEd and Dominion.

### Table 12-24 Status of all natural gas generation capacity (MW) in the PJM generation queue: January 1, 1997 through June 30, 2017

| | Project | Project MW | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Status | 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 | 815.5 | 390.0 | 629.0 | 0.0 | 20.0 | 4,011.0 | 1,122.2 | 0.0 | 0.0 | 2,070.3 | 2,052.0 | 2,464.0 | 1,267.1 | 840.0 | 2,826.9 | 2,804.9 | 0.0 | 25,645.1 |
| | Upgrade | 265.7 | 394.0 | 857.7 | 40.0 | 2.5 | 864.0 | 60.0 | 0.0 | 1,446.7 | 200.0 | 0.0 | 0.0 | 224.0 | 10.0 | 780.5 | 87.0 | 121.1 | 327.3 | 987.9 | 0.0 | 6,668.4 |
| Under Construction | New Generation | 453.5 | 1,417.0 | 954.4 | 800.0 | 1.3 | 0.0 | 0.0 | 513.0 | 2,855.1 | 0.0 | 205.0 | 0.0 | 0.4 | 0.0 | 760.5 | 590.0 | 755.0 | 3,074.0 | 570.0 | 0.0 | 12,949.2 |
| | Upgrade | 34.0 | 6.0 | 0.0 | 161.0 | 0.0 | 32.6 | 0.0 | 0.0 | 225.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 241.0 | 0.0 | 64.5 | 524.0 | 254.0 | 0.0 | 1,542.1 |
| Suspended | New Generation | 606.0 | 585.0 | 554.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 291.0 | 0.0 | 0.0 | 440.0 | 0.0 | 0.0 | 126.9 | 894.0 | 0.0 | 0.0 | 0.0 | 3,497.7 |
| | Upgrade | 0.0 | 0.0 | 20.0 | 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 | 144.1 | 0.0 | 0.0 | 0.0 | 365.7 |
| Withdrawn | New Generation | 6,923.8 | 9,575.0 | 15,544.0 | 5,420.7 | 3,122.1 | 4,533.0 | 0.0 | 134.5 | 10,475.0 | 4,551.4 | 665.0 | 991.8 | 11,286.2 | 13,001.0 | 23,120.0 | 17,011.0 | 20,414.2 | 16,451.7 | 23,518.7 | 6.9 | 186,746.0 |
| | Upgrade | 122.8 | 711.0 | 579.0 | 111.0 | 0.0 | 75.0 | 0.0 | 36.0 | 305.3 | 668.0 | 0.0 | 0.0 | 253.0 | 1,742.0 | 205.0 | 1,040.6 | 85.0 | 480.0 | 2,404.9 | 0.0 | 8,818.6 |
| Active | New Generation | 805.4 | 6,307.0 | 5,180.8 | 4,047.0 | 0.0 | 6,779.2 | 1,150.0 | 0.0 | 3,544.5 | 508.0 | 0.0 | 0.0 | 1,267.2 | 450.0 | 220.0 | 1,755.7 | 0.0 | 1,898.8 | 2,399.8 | 0.2 | 36,313.6 |
| | Upgrade | 239.6 | 387.0 | 424.7 | 145.0 | 0.0 | 2,527.0 | 0.0 | 0.0 | 885.7 | 60.0 | 0.0 | 0.0 | 20.0 | 99.1 | 35.0 | 91.0 | 0.0 | 301.0 | 98.1 | 0.0 | 5,313.2 |
| Total Projects | New Generation | 9,805.0 | 19,499.0 | 23,935.0 | 11,083.2 | 3,513.4 | 11,941.2 | 1,150.0 | 667.5 | 20,885.6 | 6,472.6 | 870.0 | 991.8 | 15,064.1 | 15,503.0 | 26,564.5 | 20,750.7 | 22,903.2 | 24,251.4 | 29,293.4 | 7.1 | 265,151.6 |
| | Upgrade | 662.1 | 1,498.0 | 1,881.4 | 457.0 | 2.5 | 3,498.6 | 60.0 | 36.0 | 2,862.7 | 928.0 | 0.0 | 0.0 | 697.0 | 1,851.1 | 1,261.5 | 1,220.2 | 414.7 | 1,632.3 | 3,744.9 | 0.0 | 22,708.0 |

## Wind Project Analysis

Table 12-25 shows the status of all wind generation projects that entered PJM generation queues from January 1, 1997 through June 30, 2017, by zone. Of the 76 wind projects to achieve in service status, 67 projects, 88.2 percent are located within ComEd, AEP, AP and PENELEC. Of the 49 wind projects currently active in the PJM generation queue, 41 projects, 83.7 percent are located within AEP, ComEd and AP.

### Table 12-25 Status of all wind generation queue projects: January 1, 1997 through June 30, 2017

| | Project | Number of Projects | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Status | 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 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 4 | 0 | 0 | 61 |
| | 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 | 0 | 6 | 5 | 0 | 0 | 4 | 0 | 0 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 22 |
| | 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 | 10 | 2 | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 20 |
| | Upgrade | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| Withdrawn | New Generation | 15 | 81 | 38 | 6 | 0 | 94 | 13 | 0 | 16 | 7 | 0 | 1 | 0 | 0 | 0 | 61 | 0 | 40 | 1 | 0 | 373 |
| | Upgrade | 1 | 0 | 6 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 2 | 0 | 0 | 15 |
| Active | New Generation | 0 | 19 | 2 | 2 | 0 | 12 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 42 |
| | Upgrade | 0 | 0 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 7 |
| Total Projects | New Generation | 17 | 124 | 58 | 9 | 0 | 128 | 15 | 0 | 23 | 10 | 0 | 1 | 0 | 0 | 0 | 85 | 0 | 47 | 1 | 0 | 518 |
| | Upgrade | 2 | 1 | 13 | 0 | 0 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 6 | 0 | 0 | 40 |

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, 2017, by zone. Of the 6,680.9 MW of wind generation capacity to achieve in service status, 6,446.9 MW, or 96.5 percent of nameplate capacity is located within ComEd, AEP, AP and PENELEC. Of the 8,387.3 MW of wind generation capacity currently active in the PJM generation queue, 7,179.2 MW of generation capacity or 85.6 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, 2017

| | Project | Project MW | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Status | 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 | 980.0 | 0.0 | 0.0 | 2,413.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 995.0 | 0.0 | 199.2 | 0.0 | 0.0 | 6,647.2 |
| | 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 | 0.0 | 0.0 | 0.0 | 6.4 | 0.0 | 27.3 | 0.0 | 0.0 | 33.7 |
| Under Construction | New Generation | 0.0 | 838.3 | 572.6 | 0.0 | 0.0 | 978.5 | 0.0 | 0.0 | 818.5 | 150.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 70.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3,427.9 |
| | 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 | 1,678.3 | 151.1 | 500.0 | 0.0 | 500.0 | 300.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 180.0 | 0.0 | 100.0 | 0.0 | 0.0 | 3,429.4 |
| | Upgrade | 5.0 | 100.0 | 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 | 175.0 |
| Withdrawn | New Generation | 3,626.4 | 15,048.1 | 2,835.1 | 645.6 | 0.0 | 22,115.8 | 1,828.0 | 0.0 | 2,361.5 | 2,255.0 | 0.0 | 150.3 | 0.0 | 0.0 | 0.0 | 5,059.0 | 0.0 | 2,766.3 | 20.0 | 0.0 | 58,711.1 |
| | Upgrade | 0.0 | 0.0 | 100.0 | 0.0 | 0.0 | 4.0 | 0.0 | 0.0 | 78.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 192.6 | 0.0 | 6.0 | 0.0 | 0.0 | 380.6 |
| Active | New Generation | 0.0 | 4,765.5 | 217.0 | 315.7 | 0.0 | 1,798.0 | 0.0 | 0.0 | 226.6 | 499.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 138.0 | 0.0 | 166.2 | 0.0 | 0.0 | 8,126.5 |
| | 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 | 70.8 | 0.0 | 0.0 | 0.0 | 0.0 | 260.8 |
| Total Projects | New Generation | 3,653.9 | 24,382.2 | 4,755.8 | 1,461.3 | 0.0 | 27,805.8 | 2,128.0 | 0.0 | 3,406.6 | 2,904.6 | 0.0 | 150.3 | 0.0 | 0.0 | 0.0 | 6,442.0 | 0.0 | 3,231.7 | 20.0 | 0.0 | 80,342.1 |
| | Upgrade | 5.0 | 100.0 | 190.0 | 0.0 | 0.0 | 174.0 | 0.0 | 0.0 | 78.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 269.7 | 0.0 | 33.3 | 0.0 | 0.0 | 850.0 |

## Solar Project Analysis

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, 2018, by zone. Of a total of 1,255 solar projects ever to enter the PJM generation queue, 506 projects, or 40.3 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 5.1 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, 42.3 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 323 active new generation solar projects, 120 projects, or 37.2 percent of all currently active new generation solar projects are located in Dominion. Out of 323 active new generation solar projects, 65, or 20.1 percent of all currently active new generation solar projects are located in AEP.

### Table 12-27 Status of all solar generation queue projects: January 1, 1997 through June 30, 2017

| | Project | Number of Projects | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Status | 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 | 4 | 3 | 0 | 1 | 1 | 1 | 0 | 7 | 9 | 0 | 0 | 38 | 0 | 1 | 0 | 0 | 2 | 37 | 0 | 109 |
| | Upgrade | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| Under Construction | New Generation | 3 | 2 | 4 | 0 | 2 | 0 | 1 | 0 | 13 | 6 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 47 |
| | Upgrade | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Suspended | New Generation | 0 | 5 | 14 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 5 | 1 | 0 | 1 | 0 | 0 | 3 | 0 | 33 |
| | 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 | 148 | 33 | 48 | 6 | 4 | 7 | 6 | 10 | 77 | 93 | 0 | 1 | 160 | 12 | 6 | 10 | 9 | 27 | 57 | 0 | 714 |
| | Upgrade | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| Active | New Generation | 10 | 64 | 9 | 4 | 6 | 15 | 10 | 3 | 112 | 50 | 1 | 4 | 4 | 3 | 1 | 1 | 3 | 2 | 7 | 0 | 309 |
| | Upgrade | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 14 |
| Total Projects | New Generation | 166 | 108 | 78 | 10 | 13 | 23 | 19 | 13 | 210 | 160 | 1 | 5 | 216 | 16 | 8 | 12 | 12 | 31 | 111 | 0 | 1,212 |
| | Upgrade | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 15 | 10 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 43 |

Table 12-28 shows the status of all solar generation project MW that have entered the PJM generation queue from January 1, 1997 through June 30, 2017, by zone. Of a total of 30,626.1 MW of solar nameplate capacity ever to enter the PJM generation queue, 4,204.7 MW, or 13.7 percent, have been located in JCPL, AECO and PSEG, all of which are zones in New Jersey. Solar projects in Dominion have accounted for 12,042.2 MW or 39.3 percent of all solar project nameplate capacity in the PJM queue from January 1, 1997 through June 30, 2017. Solar projects in DPL have accounted for 2,901.5 MW or 9.5 percent of all solar project nameplate capacity in the PJM queue from January 1, 1997 through June 30, 2017.

### Table 12-28 Current status of all solar generation capacity (MW) in the PJM generation queue: January 1, 1997 through June 30, 2017

| | Project | Project MW | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Status | 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 | 14.7 | 44.0 | 0.0 | 1.1 | 9.0 | 2.5 | 0.0 | 172.0 | 118.4 | 0.0 | 0.0 | 244.9 | 0.0 | 3.3 | 0.0 | 0.0 | 15.0 | 188.0 | 0.0 | 851.4 |
| | 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 | 16.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 19.4 |
| Under Construction | New Generation | 20.8 | 30.0 | 33.2 | 0.0 | 22.0 | 0.0 | 3.4 | 0.0 | 533.0 | 49.0 | 0.0 | 0.0 | 133.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 34.6 | 0.0 | 858.9 |
| | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.5 |
| Suspended | New Generation | 0.0 | 59.9 | 183.3 | 0.0 | 0.0 | 0.0 | 20.0 | 0.0 | 5.0 | 25.5 | 0.0 | 0.0 | 57.7 | 3.0 | 0.0 | 13.5 | 0.0 | 0.0 | 19.7 | 0.0 | 387.6 |
| | 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 | 1,614.5 | 1,395.3 | 892.1 | 60.1 | 9.2 | 84.8 | 171.5 | 159.4 | 3,097.5 | 1,285.5 | 0.0 | 80.0 | 1,291.8 | 467.0 | 51.4 | 34.3 | 122.1 | 283.7 | 398.1 | 0.0 | 11,498.3 |
| | Upgrade | 10.0 | 6.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 73.0 | 0.0 | 0.0 | 0.0 | 23.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 112.8 |
| Active | New Generation | 72.7 | 4,346.2 | 388.1 | 482.0 | 22.1 | 387.0 | 718.5 | 215.0 | 7,365.1 | 1,403.1 | 11.7 | 209.9 | 15.0 | 155.0 | 20.0 | 50.0 | 62.5 | 30.0 | 24.0 | 0.0 | 15,977.9 |
| | Upgrade | 0.0 | 20.0 | 10.0 | 0.0 | 0.0 | 0.0 | 0.0 | 75.0 | 788.9 | 20.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 0.0 | 915.2 |
| Total Projects | New Generation | 1,746.5 | 5,846.1 | 1,540.7 | 542.1 | 54.4 | 480.8 | 915.9 | 374.4 | 11,172.7 | 2,881.5 | 11.7 | 289.9 | 1,742.3 | 625.0 | 74.7 | 97.8 | 184.6 | 328.7 | 664.5 | 0.0 | 29,574.1 |
| | Upgrade | 10.0 | 26.0 | 10.0 | 0.0 | 0.0 | 0.0 | 0.0 | 75.0 | 869.5 | 20.0 | 0.0 | 0.0 | 40.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 0.0 | 1,051.9 |

## Relationship Between Project Developer and Transmission Owner

Table 12-29 shows the relationship between the project developer and Transmission Owner for all project MW that have entered the PJM generation queue from January 1, 1997 through June 30, 2017 by zone and technology type. A project where the developer is or is affiliated with the Transmission Owner is classified as related. A project where the developer is not affiliated with the Transmission Owner is classified as unrelated. For example, 36.0 MW of natural gas fired generation projects that have entered the PJM generation queue in DEOK were projects developed by Duke Energy or subsidiaries of Duke Energy, the Transmission Owner for DEOK. These project MW are classified as related. There have been 154.5 MW of natural gas fired projects that have entered the PJM generation queue in DEOK by developers not affiliated with Duke Energy. These project MW are classified as "unrelated."

## Table 12-29 Relationship between project developer and Transmission Owner for all interconnection queue projects MW by fuel type: January 1, 1997 through June 30, 2017

| | | | | MW by Fuel Type | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Parent Company | Transmission Owner | Related To Developer | Number of Projects | Biomass | Coal | Diesel | Hydro | Landfill Gas | Natural Gas | Nuclear | Other | Solar | Wind | Total MW |
| AEP | AEP | Related | 49 | 0.0 | 3,965.0 | 0.0 | 34.0 | 3.0 | 3,027.0 | 214.0 | 0.0 | 74.7 | 0.0 | 7,317.7 |
| | | Unrelated | 382 | 501.1 | 10,292.0 | 7.5 | 448.4 | 83.8 | 22,356.0 | 0.0 | 66.0 | 6,008.7 | 25,178.8 | 64,942.3 |
| AES | DAY | Related | 16 | 0.0 | 1,347.5 | 0.0 | 0.0 | 0.0 | 51.0 | 0.0 | 0.0 | 24.0 | 0.0 | 1,422.5 |
| | | Unrelated | 36 | 1.9 | 0.0 | 0.0 | 0.0 | 10.0 | 9.0 | 0.0 | 0.0 | 571.9 | 2,128.0 | 2,720.8 |
| DLCO | DLCO | Related | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 22 | 0.0 | 2,810.0 | 0.0 | 106.0 | 19.2 | 870.0 | 1,879.0 | 0.0 | 55.0 | 0.0 | 5,739.2 |
| Dominion | Dominion | Related | 83 | 64.0 | 301.0 | 0.0 | 340.0 | 0.0 | 13,215.0 | 1,944.0 | 0.0 | 251.4 | 142.0 | 16,257.4 |
| | | Unrelated | 316 | 343.7 | 20.0 | 10.0 | 29.5 | 184.0 | 12,105.1 | 0.0 | 156.3 | 14,778.0 | 3,063.0 | 30,689.6 |
| Duke | DEOK | Related | 4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 36.0 | 0.0 | 0.0 | 0.0 | 0.0 | 36.0 |
| | | Unrelated | 25 | 0.0 | 120.0 | 0.0 | 112.0 | 4.8 | 154.5 | 0.0 | 0.0 | 499.3 | 0.0 | 890.6 |
| EKPC | EKPC | Related | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2,141.8 | 0.0 | 0.0 | 240.0 | 150.3 | 2,532.1 |
| Exelon | AECO | Related | 3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 730.0 | 0.0 | 0.0 | 0.0 | 0.0 | 730.0 |
| | | Unrelated | 273 | 29.8 | 15.0 | 13.0 | 0.0 | 31.0 | 9,791.8 | 0.0 | 0.0 | 1,786.3 | 3,808.9 | 15,475.8 |
| | BGE | Related | 14 | 0.0 | 10.0 | 0.0 | 0.0 | 0.0 | 1,037.0 | 3,373.3 | 0.0 | 20.0 | 0.0 | 4,440.3 |
| | | Unrelated | 59 | 0.0 | 0.0 | 29.0 | 140.4 | 9.5 | 4,152.9 | 0.0 | 132.0 | 34.4 | 0.0 | 4,498.2 |
| | ComEd | Related | 18 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1,185.0 | 0.0 | 9.0 | 396.0 | 1,590.0 |
| | | Unrelated | 259 | 90.0 | 1,926.0 | 42.0 | 22.7 | 112.9 | 15,544.4 | 0.0 | 20.0 | 521.8 | 27,379.8 | 45,659.6 |
| | DPL | Related | 10 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1,716.0 | 0.0 | 0.0 | 31.4 | 0.0 | 1,747.4 |
| | | Unrelated | 263 | 84.0 | 653.0 | 0.0 | 0.0 | 58.4 | 6,773.6 | 0.0 | 30.0 | 2,986.9 | 2,809.6 | 13,395.5 |
| | PECO | Related | 29 | 0.0 | 7.0 | 0.0 | 45.0 | 0.0 | 6,420.0 | 437.8 | 0.0 | 0.0 | 0.0 | 6,909.8 |
| | | Unrelated | 78 | 0.0 | 0.0 | 12.1 | 220.0 | 18.7 | 21,490.8 | 0.0 | 0.0 | 73.4 | 0.0 | 21,815.0 |
| | Pepco | Related | 1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1,640.0 | 0.0 | 0.0 | 0.0 | 1,640.0 |
| | | Unrelated | 67 | 0.0 | 0.0 | 0.0 | 0.0 | 12.5 | 22,623.9 | 0.0 | 0.0 | 178.1 | 0.0 | 22,814.5 |
| First Energy | AP | Related | 14 | 0.0 | 1,745.0 | 0.0 | 252.0 | 0.0 | 4,790.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6,787.0 |
| | | Unrelated | 308 | 177.2 | 4,057.0 | 53.8 | 371.3 | 125.8 | 22,568.4 | 0.0 | 96.0 | 1,625.7 | 5,282.7 | 34,357.8 |
| | ATSI | Related | 8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1,678.0 | 16.0 | 0.0 | 0.6 | 0.0 | 1,694.6 |
| | | Unrelated | 53 | 0.0 | 0.0 | 0.0 | 0.0 | 35.3 | 9,046.7 | 0.0 | 135.0 | 544.5 | 1,461.3 | 11,222.8 |
| | JCPL | Related | 2 | 0.0 | 0.0 | 0.0 | 20.0 | 0.0 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 120.0 |
| | | Unrelated | 321 | 30.0 | 0.0 | 0.0 | 1.6 | 24.4 | 15,781.1 | 0.0 | 0.0 | 1,821.4 | 90.6 | 17,749.0 |
| | Met-Ed | Related | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 90 | 90.4 | 0.0 | 8.0 | 0.0 | 57.9 | 16,839.6 | 93.0 | 11.0 | 625.0 | 70.0 | 17,794.9 |
| | PENELEC | Related | 8 | 0.0 | 1,860.0 | 0.0 | 32.0 | 0.0 | 1,174.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3,066.0 |
| | | Unrelated | 215 | 0.0 | 561.0 | 8.0 | 53.3 | 50.9 | 20,396.8 | 0.0 | 621.0 | 177.8 | 6,454.1 | 28,322.8 |
| PPL | PPL | Related | 36 | 0.0 | 139.0 | 0.0 | 0.0 | 7.7 | 2,294.0 | 1,988.0 | 0.0 | 0.0 | 0.0 | 4,428.7 |
| | | Unrelated | 188 | 28.5 | 6,868.6 | 10.4 | 2.6 | 95.4 | 21,666.5 | 0.0 | 152.5 | 329.8 | 3,205.0 | 32,359.2 |
| PSEG | PSEG | Related | 101 | 0.0 | 24.0 | 0.0 | 0.0 | 11.7 | 12,802.1 | 381.0 | 0.0 | 125.2 | 0.0 | 13,344.0 |
| | | Unrelated | 180 | 0.0 | 0.0 | 0.0 | 1,000.0 | 24.4 | 18,676.0 | 0.0 | 45.5 | 560.1 | 20.0 | 20,325.9 |
| Consolidated Edison, Inc. | RECO | Related | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7.1 | 0.0 | 0.0 | 0.0 | 0.0 | 7.1 |
| Total | | Related | 396 | 64.0 | 9,398.5 | 0.0 | 723.0 | 22.4 | 49,070.1 | 11,179.1 | 0.0 | 536.3 | 538.0 | 71,531.4 |
| | | Unrelated | 3,146 | 1,376.6 | 27,322.6 | 193.8 | 2,507.8 | 958.8 | 242,995.9 | 1,972.0 | 1,465.3 | 33,418.0 | 81,102.0 | 393,312.7 |

Table 12-30 shows the relationship between the project developer and Transmission Owner for all solar project MW that have entered the PJM generation queue from January 1, 1997 through June 30, 2017, by zone and project status. Of the 1,319.1 solar project MW that have achieved in service or under construction status during this time period, 186.9 MW, or 14.2 percent have been developed by Transmission Owners building in their own service territory. Of that 186.9 MW of solar projects, 115.8 MW or 62.0 percent have been developed by PSEG in the PSEG Zone and 20.0 MW or 10.7 percent have been developed by Dominion in the Dominion Zone.

### Table 12-30 Relationship between project developer and Transmission Owner for all solar projects MW in PJM interconnection queue: January 1, 1997 through June 30, 2017

| | | | MW by Project Status | | | | | |
|---|---|---|---|---|---|---|---|---|
| Parent Company | Transmission Owner | Related To Developer | In Service | Under Construction | Suspended | Withdrawn | Active | Total MW |
| AEP | AEP | Related | 2.5 | 12.2 | 0.0 | 0.0 | 60.0 | 74.7 |
| | | Unrelated | 0.0 | 20.0 | 51.7 | 1,011.5 | 4,675.6 | 5,758.7 |
| AES | DAY | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 2.5 | 23.4 | 0.0 | 151.5 | 418.5 | 595.9 |
| DLCO | DLCO | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 0.0 | 0.0 | 0.0 | 0.0 | 40.0 | 40.0 |
| Dominion | Dominion | Related | 20.0 | 0.0 | 0.0 | 7.0 | 224.4 | 251.4 |
| | | Unrelated | 140.1 | 122.9 | 205.0 | 2,072.5 | 11,662.5 | 14,203.0 |
| Duke | DEOK | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 0.0 | 0.0 | 0.0 | 159.4 | 290.0 | 449.4 |
| EKPC | EKPC | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 0.0 | 0.0 | 0.0 | 80.0 | 160.0 | 240.0 |
| Exelon | AECO | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 38.5 | 20.8 | 0.0 | 1,638.8 | 88.1 | 1,786.3 |
| | BGE | Related | 0.0 | 20.0 | 0.0 | 0.0 | 0.0 | 20.0 |
| | | Unrelated | 1.1 | 2.0 | 0.0 | 9.2 | 22.1 | 34.4 |
| | ComEd | Related | 9.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.0 |
| | | Unrelated | 0.0 | 0.0 | 0.0 | 84.8 | 247.0 | 331.8 |
| | DPL | Related | 7.4 | 0.0 | 0.0 | 24.0 | 0.0 | 31.4 |
| | | Unrelated | 21.0 | 159.5 | 0.0 | 1,126.5 | 1,679.9 | 2,986.9 |
| | PECO | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 3.3 | 0.0 | 0.0 | 50.1 | 20.0 | 73.4 |
| | Pepco | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 0.0 | 0.0 | 0.0 | 118.1 | 60.0 | 178.1 |
| First Energy | AP | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 34.0 | 32.5 | 38.9 | 806.0 | 714.3 | 1,625.7 |
| | ATSI | Related | 0.0 | 0.0 | 0.0 | 0.6 | 0.0 | 0.6 |
| | | Unrelated | 0.0 | 0.0 | 0.0 | 59.5 | 485.0 | 544.5 |
| | JCPL | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 204.1 | 175.5 | 92.9 | 1,259.0 | 89.7 | 1,821.2 |
| | Met-Ed | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 0.0 | 0.0 | 3.0 | 367.0 | 255.0 | 625.0 |
| | PENELEC | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 0.0 | 0.0 | 13.5 | 34.3 | 50.0 | 97.8 |
| PPL | PPL | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 15.0 | 16.0 | 0.0 | 268.8 | 30.0 | 329.8 |
| PSEG | PSEG | Related | 105.8 | 10.0 | 0.0 | 8.2 | 1.2 | 125.2 |
| | | Unrelated | 53.8 | 46.2 | 9.7 | 387.5 | 52.9 | 550.1 |
| Consolidated Edison, Inc. | RECO | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | | Related | 144.7 | 42.2 | 0.0 | 39.8 | 285.6 | 512.3 |
| | | Unrelated | 513.4 | 618.8 | 414.7 | 9,684.3 | 21,040.7 | 32,271.9 |

Table 12-31 shows the relationship between the project developer and Transmission Owner for all natural gas fired project MW that have entered the PJM generation queue from January 1, 1997 through June 30, 2017, by zone and project status. Of the 46,198.0 natural gas project MW that have achieved in service or under construction status during this time period, 10,382.0 MW, or 22.5 percent have been developed by Transmission Owners building in their own service territory. Of that 10,382.0 MW of natural gas projects, 5,571.0 MW or 53.7 percent have been developed by Dominion in the Dominion zone and 1,972.0 MW or 19.0 percent have been developed by PSEG in the PSEG Zone.

### Table 12-31 Relationship between project developer and Transmission Owner for all natural gas project MW in PJM interconnection queue: January 1, 1997 through June 30, 2017

| | | | MW by Project Status | | | | | |
|---|---|---|---|---|---|---|---|---|
| Parent Company | Transmission Owner | Related To Developer | In Service | Under Construction | Suspended | Withdrawn | Active | Total MW |
| AEP | AEP | Related | 717.0 | 0.0 | 0.0 | 0.0 | 2,310.0 | 3,027.0 |
| | | Unrelated | 1,142.0 | 3,355.0 | 525.0 | 9,008.0 | 8,326.0 | 22,356.0 |
| AES | DAY | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 60.0 | 0.0 | 0.0 | 0.0 | 0.0 | 60.0 |
| DLCO | DLCO | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 0.0 | 205.0 | 0.0 | 665.0 | 0.0 | 870.0 |
| Dominion | Dominion | Related | 3,823.0 | 1,748.0 | 0.0 | 7,476.0 | 168.0 | 13,215.0 |
| | | Unrelated | 771.7 | 1,799.1 | 0.0 | 3,949.3 | 5,585.0 | 12,105.1 |
| Duke | DEOK | Related | 0.0 | 0.0 | 0.0 | 36.0 | 0.0 | 36.0 |
| | | Unrelated | 20.0 | 0.0 | 0.0 | 134.5 | 0.0 | 154.5 |
| EKPC | EKPC | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 0.0 | 0.0 | 0.0 | 377.8 | 1,764.0 | 2,141.8 |
| Exelon | AECO | Related | 0.0 | 0.0 | 0.0 | 730.0 | 0.0 | 730.0 |
| | | Unrelated | 1,281.9 | 460.5 | 606.0 | 6,325.4 | 1,118.0 | 9,791.8 |
| | BGE | Related | 367.0 | 0.0 | 0.0 | 670.0 | 0.0 | 1,037.0 |
| | | Unrelated | 29.5 | 1.3 | 0.0 | 4,122.1 | 0.0 | 4,152.9 |
| | ComEd | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 1,478.5 | 112.6 | 0.0 | 4,023.0 | 9,930.3 | 15,544.4 |
| | DPL | Related | 411.0 | 0.0 | 0.0 | 1,305.0 | 0.0 | 1,716.0 |
| | | Unrelated | 900.2 | 0.0 | 291.0 | 5,014.4 | 568.0 | 6,773.6 |
| | PECO | Related | 5.0 | 0.0 | 0.0 | 6,415.0 | 0.0 | 6,420.0 |
| | | Unrelated | 3,174.3 | 892.5 | 0.0 | 17,060.0 | 364.0 | 21,490.8 |
| | Pepco | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 160.1 | 2,498.5 | 0.0 | 19,854.2 | 111.1 | 22,623.9 |
| First Energy | AP | Related | 701.0 | 0.0 | 0.0 | 4,089.0 | 0.0 | 4,790.0 |
| | | Unrelated | 1,796.7 | 962.5 | 70.1 | 13,533.6 | 6,205.5 | 22,568.4 |
| | ATSI | Related | 0.0 | 0.0 | 0.0 | 1,678.0 | 0.0 | 1,678.0 |
| | | Unrelated | 40.0 | 961.0 | 0.0 | 3,833.8 | 4,211.9 | 9,046.7 |
| | JCPL | Related | 0.0 | 0.0 | 0.0 | 100.0 | 0.0 | 100.0 |
| | | Unrelated | 2,294.3 | 440.0 | 200.0 | 10,879.2 | 1,967.6 | 15,781.1 |
| | Met-Ed | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 2,062.0 | 0.0 | 0.0 | 14,216.5 | 561.1 | 16,839.6 |
| | PENELEC | Related | 5.0 | 0.0 | 0.0 | 1,169.0 | 0.0 | 1,174.0 |
| | | Unrelated | 1,267.8 | 88.7 | 59.7 | 16,426.7 | 2,553.9 | 20,396.8 |
| PPL | PPL | Related | 633.0 | 0.0 | 0.0 | 1,661.0 | 0.0 | 2,294.0 |
| | | Unrelated | 2,420.9 | 3,924.0 | 0.0 | 12,575.7 | 2,745.9 | 21,666.5 |
| PSEG | PSEG | Related | 1,972.0 | 0.0 | 0.0 | 9,871.1 | 959.0 | 12,802.1 |
| | | Unrelated | 1,047.8 | 167.6 | 0.0 | 14,906.0 | 2,554.6 | 18,676.0 |
| Consolidated Edison, Inc. | RECO | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 0.0 | 0.0 | 0.0 | 6.9 | 0.2 | 7.1 |
| Total | | Related | 8,634.0 | 1,748.0 | 0.0 | 35,200.1 | 3,437.0 | 49,019.1 |
| | | Unrelated | 19,947.7 | 15,868.3 | 1,751.8 | 156,912.0 | 48,567.2 | 243,046.9 |

Table 12-32 shows the relationship between the project developer and Transmission Owner for all wind project MW that have entered the PJM generation queue from January 1, 1997 through June 30, 2017, by zone and project status. Of the 10,584.3 wind project MW that have achieved in service or under construction status during this time period, 408.0 MW, or 3.9 percent have been developed by Transmission Owners building in their own service territory. Of that 408.0 MW of wind projects, 396.0 MW or 97.1 percent have been developed by Exelon in the ComEd Zone.

### Table 12-32 Relationship between project developer and Transmission Owner for all wind project MW in PJM interconnection queue: January 1, 1997 through June 30, 2017

| | | | MW by Project Status | | | | | |
|---|---|---|---|---|---|---|---|---|
| Parent Company | Transmission Owner | Related To Developer | In Service | Under Construction | Suspended | Withdrawn | Active | Total MW |
| AEP | AEP | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 2,052.0 | 966.6 | 1,650.0 | 14,383.8 | 6,126.4 | 25,178.8 |
| AES | DAY | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 0.0 | 0.0 | 300.0 | 1,828.0 | 0.0 | 2,128.0 |
| DLCO | DLCO | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Dominion | Dominion | Related | 0.0 | 12.0 | 0.0 | 130.0 | 0.0 | 142.0 |
| | | Unrelated | 0.0 | 673.9 | 300.0 | 1,880.9 | 208.2 | 3,063.0 |
| Duke | DEOK | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| EKPC | EKPC | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 0.0 | 0.0 | 0.0 | 150.3 | 0.0 | 150.3 |
| Exelon | AECO | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 7.5 | 150.0 | 25.0 | 3,626.4 | 0.0 | 3,808.9 |
| | BGE | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | ComEd | Related | 396.0 | 0.0 | 0.0 | 0.0 | 0.0 | 396.0 |
| | | Unrelated | 2,238.5 | 802.5 | 710.0 | 20,859.8 | 2,769.0 | 27,379.8 |
| | DPL | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 0.0 | 100.0 | 0.0 | 2,210.0 | 499.6 | 2,809.6 |
| | PECO | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Pepco | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| First Energy | AP | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 1,031.4 | 426.0 | 130.0 | 3,027.5 | 667.8 | 5,282.7 |
| | ATSI | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 0.0 | 500.0 | 0.0 | 645.6 | 315.7 | 1,461.3 |
| | JCPL | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 30.6 | 0.0 | 0.0 | 60.0 | 0.0 | 90.6 |
| | Met-Ed | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 70.0 | 0.0 | 0.0 | 0.0 | 0.0 | 70.0 |
| | PENELEC | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 862.5 | 38.3 | 150.0 | 4,927.6 | 475.8 | 6,454.1 |
| PPL | PPL | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 226.5 | 0.0 | 100.0 | 2,443.8 | 434.7 | 3,205.0 |
| PSEG | PSEG | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 0.0 | 0.0 | 0.0 | 20.0 | 0.0 | 20.0 |
| Consolidated Edison, Inc. | RECO | Related | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | Unrelated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | | Related | 396.0 | 12.0 | 0.0 | 130.0 | 0.0 | 538.0 |
| | | Unrelated | 6,519.0 | 3,657.3 | 3,365.0 | 56,063.7 | 11,497.1 | 81,102.0 |

# 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.[32] 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. The specific timeline is shown in Table 12-34.[33]

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.[34] Table 12-33 shows that 76.3 percent of the requested outages were planned for less than or equal to five days and 7.9 percent of requested outages were planned for greater than 30 days in the first six months of 2017. 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 2016 and 2017, regardless of when they were initially submitted.[35] The outage data in the analysis for the FTR market are for outages scheduled to occur in the planning periods 2016 to 2017 and 2017 to 2018.

### Table 12-33 Transmission facility outage request summary by planned duration: January 1 through June 30, 2016 and 2017

| | 2016 (Jan - Jun) | | 2017 (Jan - Jun) | |
|---|---|---|---|---|
| Planned Duration (Days) | Outage Requests | Percent | Outage Requests | Percent |
| <=5 | 6,909 | 75.9% | 6,855 | 76.3% |
| >5 & <=30 | 1,472 | 16.2% | 1,426 | 15.9% |
| >30 | 724 | 8.0% | 707 | 7.9% |
| Total | 9,105 | 100.0% | 8,988 | 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 and outage planned duration. The received status can be On Time or Late, as defined in Table 12-34.[36]

The purpose of the rules defined in Table 12-34 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.[37]

### Table 12-34 PJM transmission facility outage request received status definition

| Planned Duration (Calendar Days) | Request Submitted | Received Status |
|---|---|---|
| <=5 | Before the first of the month one month prior to the starting month of the outage | On Time |
| | After or on the first of the month one month prior to the starting month of the outage | Late |
| > 5 & <=30 | Before the first of the month six months prior to the starting month of the outage | On Time |
| | After or on the first of the month six months prior to the starting month of the outage | Late |
| >30 | The earlier of 1) February 1, 2) the first of the month six months prior to the starting month of the outage | On Time |
| | After or on the earlier of 1) February 1, 2) the first of the month six months prior to the starting month of the outage | Late |

32 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 12 (September 30, 2016).

33 See PJM. "Manual 3: Transmission Operations," Revision 51 (June 1, 2017), p.69.

34 See PJM. "Manual 3: Transmission Operations," Revision 51 (June 1, 2017), p.70.

35 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.

36 See PJM. "Manual 3: Transmission Operations," Revision 51 (June 1, 2017), p.69 and p.70.

37 See "Report of PJM Interconnection, L.L.C. on Transmission Oversight Procedures," Docket No. EL01-122-000 (November 2, 2001).

Table 12-35 shows a summary of requests by received status. In the first six months of 2017, 48.9 percent of outage requests received were late.

### Table 12-35 Transmission facility outage request summary by received status: January 1 through June 30, 2016 and 2017

| | 2016 (Jan - Jun) | | | | 2017 (Jan - Jun) | | | |
|---|---|---|---|---|---|---|---|---|
| Planned Duration (Days) | On Time | Late | Total | Percent Late | On Time | Late | Total | Percent Late |
| <=5 | 3,622 | 3,287 | 6,909 | 47.6% | 3,733 | 3,122 | 6,855 | 45.5% |
| >5 & <=30 | 705 | 767 | 1,472 | 52.1% | 650 | 776 | 1,426 | 54.4% |
| >30 | 219 | 505 | 724 | 69.8% | 206 | 501 | 707 | 70.9% |
| Total | 4,546 | 4,559 | 9,105 | 50.1% | 4,589 | 4,399 | 8,988 | 48.9% |

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 late unless the request is an emergency.

Outages with emergency status will be approved even if submitted late 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.[38] Table 12-36 is a summary of outage requests by emergency status. Of all outage requests scheduled to occur in the first six months of 2017, 12.8 percent were for emergency outages. Of all outage requests scheduled to occur in the first six months of 2016, 12.6 percent were for emergency outages.

### Table 12-36 Transmission facility outage request summary by emergency: January 1 through June 30, 2016 and 2017

| | 2016 (Jan - Jun) | | | | 2017 (Jan - Jun) | | | |
|---|---|---|---|---|---|---|---|---|
| Planned Duration (Days) | Emergency | Non Emergency | Total | Percent Emergency | Emergency | Non Emergency | Total | Percent Emergency |
| <=5 | 882 | 6,027 | 6,909 | 12.8% | 867 | 5,988 | 6,855 | 12.6% |
| >5 & <=30 | 174 | 1,298 | 1,472 | 11.8% | 176 | 1,250 | 1,426 | 12.3% |
| >30 | 88 | 636 | 724 | 12.2% | 104 | 603 | 707 | 14.7% |
| Total | 1,144 | 7,961 | 9,105 | 12.6% | 1,147 | 7,841 | 8,988 | 12.8% |

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 are not expected to cause congestion on the PJM system and do not jeopardize the reliability of the PJM system. Each outage is studied and if it is expected to cause a constraint to exceed a limit, PJM will flag the outage ticket as "congestion expected."[39]

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 12-37 is a summary of outage requests by congestion status. Of all outage requests submitted to occur in the first six months of 2017, 7.9 percent were expected to cause congestion. Of all the outage requests that were expected to cause congestion, 2.0 percent (14 out of 707) were denied by PJM in the first six months of 2017 and 17.4 percent (123 out of 707) were cancelled (Table 12-39).

### Table 12-37 Transmission facility outage request summary by congestion: January 1 through June 30, 2016 and 2017

| | 2016 (Jan - Jun) | | | | 2017 (Jan - Jun) | | | |
|---|---|---|---|---|---|---|---|---|
| Planned Duration (Days) | Congestion Expected | No Congestion Expected | Total | Percent Congestion Expected | Congestion Expected | No Congestion Expected | Total | Percent Congestion Expected |
| <=5 | 507 | 6,402 | 6,909 | 7.3% | 497 | 6,358 | 6,855 | 7.3% |
| >5 & <=30 | 172 | 1,300 | 1,472 | 11.7% | 154 | 1,272 | 1,426 | 10.8% |
| >30 | 55 | 669 | 724 | 7.6% | 56 | 651 | 707 | 7.9% |
| Total | 734 | 8,371 | 9,105 | 8.1% | 707 | 8,281 | 8,988 | 7.9% |

Table 12-38 shows the outage requests summary by received status, congestion status and emergency status. In the first six months of 2017, 36.2 percent of requests were submitted late and were nonemergency while 1.7 (153 out of 8,988) percent of requests were late, nonemergency, and expected to cause congestion.

38 PJM. "Manual 3: Transmission Operations," Revision 51 (June 1, 2017), p. 81.

39 PJM added this definition to Manual 38 in February 2017. PJM. "Manual 38: Operations Planning," Revision 10 (February 1, 2017), p. 17.

Table 12-38 Transmission facility outage request summary by received status, emergency and congestion: January 1 through June 30, 2016 and 2017

| | | 2016 (Jan - Jun) | | | | 2017 (Jan - Jun) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Received Status | | Congestion Expected | No Congestion Expected | Total | Percent | Congestion Expected | No Congestion Expected | Total | Percent |
| Late | Emergency | 24 | 1,112 | 1,136 | 12.5% | 38 | 1,104 | 1,142 | 12.7% |
| | Non Emergency | 141 | 3,282 | 3,423 | 37.6% | 153 | 3,104 | 3,257 | 36.2% |
| On Time | Emergency | 0 | 8 | 8 | 0.1% | 0 | 5 | 5 | 0.1% |
| | Non Emergency | 569 | 3,969 | 4,538 | 49.8% | 516 | 4,068 | 4,584 | 51.0% |
| Total | | 734 | 8,371 | 9,105 | 100.0% | 707 | 8,281 | 8,988 | 100.0% |

Once PJM processes an outage request, the outage request is labelled as Submitted, Received, Denied, Approved, Cancelled by Company, PJM Admin Closure, Revised, Active or Complete according to the processed stage of a request.[40] Table 12-39 shows the detailed process status for outage requests only for the outage requests that are expected to cause congestion. Status Submitted and status Received are in the In Process category and status Cancelled by Company and status PJM Admin Closure are in the Cancelled category in Table 12-39. Table 12-39 shows that of all the outage requests that were expected to cause congestion, 2.0 percent (14 out of 707) were denied by PJM in the first six months of 2017, 79.2 percent were complete and 17.4 percent (123 out of 707) were cancelled.

Table 12-39 Transmission facility outage requests that might cause congestion status summary: January 1 through June 30, 2016 and 2017

| | | 2016 (Jan - Jun) | | | | | | 2017 (Jan - Jun) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Submission Status | | Cancelled | Complete | In Process | Denied | Congestion Expected | Percent Complete | Cancelled | Complete | In Process | Denied | Congestion Expected | Percent Complete |
| Late | Emergency | 0 | 24 | 0 | 0 | 24 | 100.0% | 6 | 32 | 0 | 0 | 38 | 84.2% |
| | Non Emergency | 30 | 100 | 0 | 11 | 141 | 70.9% | 23 | 119 | 3 | 8 | 153 | 77.8% |
| On Time | Emergency | 0 | 0 | 0 | 0 | 0 | 0.0% | 0 | 0 | 0 | 0 | 0 | 0.0% |
| | Non Emergency | 138 | 423 | 0 | 8 | 569 | 74.3% | 94 | 409 | 7 | 6 | 516 | 79.3% |
| Total | | 168 | 547 | 0 | 19 | 734 | 74.5% | 123 | 560 | 10 | 14 | 707 | 79.2% |

There are clear rules defined for assigning On Time or Late status for submitted outage requests in both the PJM Tariff and PJM Manuals.[41] However, the On Time or Late status only affects the priority that PJM assigns for processing the outage request. Many (77.8 percent or 119 out of 153) outages that were nonemergency, expected to cause congestion, and 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 12-40 is a summary of all the outage requests planned for the first six months of 2016 and 2017 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 2017, 9.1 percent of transmission outage requests were approved by PJM and then rescheduled by the TOs, and 5.4 percent of the transmission outages were approved by PJM and subsequently cancelled by the TOs.

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

41 OA Schedule 1 § 1.9.2 (Planned Outages).

Table 12-40 Rescheduled and cancelled transmission outage request summary: January 1 through June 30, 2016 and 2017

| | 2016 (Jan - Jun) | | | | | 2017 (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 | 6,909 | 478 | 6.9% | 708 | 10.2% | 6,855 | 380 | 5.5% | 723 | 10.5% |
| >5 & <=30 | 1,472 | 57 | 3.9% | 65 | 4.4% | 1,426 | 81 | 5.7% | 68 | 4.8% |
| >30 | 724 | 32 | 4.4% | 24 | 3.3% | 707 | 20 | 2.8% | 23 | 3.3% |
| Total | 9,105 | 567 | 6.2% | 797 | 8.8% | 8,988 | 481 | 5.4% | 814 | 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 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.[42] 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.[43] 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 nine 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.

42 PJM. "Manual 3: Transmission Operations," Revision 51 (June 7, 2017), p. 70.
43 PJM. "Manual 3: Transmission Operations," Revision 51 (June 7, 2017), p. 70.

## Long Duration Transmission Facility Outage Requests

PJM rules (Table 12-34) 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 12-41 shows that there were 6,765 transmission equipment planned outages in the first six months of 2017, of which 691 were planned outages longer than 30 days, and of which 49 or 0.7 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 12-41 Transmission outage summary: January 1 through June 30, 2016 and 2017

| | | 2016 (Jan - Jun) | | 2017 (Jan - Jun) | |
|---|---|---|---|---|---|
| Duration | Divided into Shorter Periods | Number of Outages | Percent | Number of Outages | Percent |
| > 30 Days | No | 664 | 10.0% | 642 | 9.5% |
| | Yes | 57 | 0.9% | 49 | 0.7% |
| <= 30 Days | | 5,912 | 89.1% | 6,074 | 89.8% |
| Total | | 6,633 | 100.0% | 6,765 | 100.0% |

Table 12-42 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 2017, there would have been 15 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 12-42 Summary of potentially long duration (> 30 days) outages: January 1 through June 30, 2016 and 2017

| | 2016 (Jan - Jun) | | 2017 (Jan - Jun) | |
|---|---|---|---|---|
| Days | Number of Outages | Percent | Number of Outages | Percent |
| <=31 | 2 | 3.5% | 3 | 6.1% |
| >31 & <=62 | 15 | 26.3% | 15 | 30.6% |
| >62 & <=93 | 11 | 19.3% | 15 | 30.6% |
| >93 | 29 | 50.9% | 16 | 32.7% |
| Total | 57 | 100.0% | 49 | 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 governing outage reporting is to ensure that outages are known with enough lead time prior to FTR auctions so that market participants can understand market conditions and so that PJM can accurately model market conditions.

There are Long Term, Annual and Monthly Balance of Planning Period auctions in the FTR market. For each type of auction, PJM includes a set of outages to be modeled.

When determining transmission outages to be modeled in the annual ARR allocation and FTR auction, PJM considers all outages with planned duration longer than or equal to two months and may consider outages with planned durations shorter than two months. PJM may exercise significant discretion in selecting outages to be modeled. PJM posts an FTR outage list to the FTR web page usually at least one week before the auction bidding opening day.[44]

44 PJM Financial Transmission Rights, "Annual ARR Allocation and FTR Auction Transmission Outage Modeling," <http://www.pjm.com/~/media/markets-ops/ftr/annual-ftr-auction/2017-2018/2017-2018-annual-outage-modeling.ashx> (February 21, 2017).

Table 12-43 shows that 2.1 percent of the outage requests modeled in the FTR annual auction for the planning period 2017/2018 had a planned duration of less than two weeks and that 7.2 percent of the outage requests modeled in the FTR annual auction for the planning period were submitted late according to outage submission rules.

Table 12-43 FTR market modeled transmission facility outage requests by received status: Planning periods 2016 to 2017 and 2017 to 2018

| | 2016/2017 | | | | 2017/2018 | | | |
|---|---|---|---|---|---|---|---|---|
| Planned Duration | On Time | Late | Total | Percent | On Time | Late | Total | Percent |
| <2 weeks | 10 | 1 | 11 | 5.2% | 4 | 1 | 5 | 2.1% |
| >=2 weeks & <2 months | 78 | 2 | 80 | 37.7% | 91 | 3 | 94 | 39.7% |
| >=2 months | 98 | 23 | 121 | 57.1% | 125 | 13 | 138 | 58.2% |
| Total | 186 | 26 | 212 | 100.0% | 220 | 17 | 237 | 100.0% |

Table 12-44 shows modeled outage requests summary by emergency status and received status. All the FTR market modeled outages expected to occur in the 2017/2018 planning year were nonemergency outages.

Table 12-44 FTR market modeled transmission facility outage requests by emergency and received status: Planning periods 2016 to 2017 and 2017 to 2018

| | | 2016/2017 | | | | 2017/2018 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Planned Duration | Emergency | Non Emergency | Total | Percent Non Emergency | Emergency | Non Emergency | Total | Percent Non Emergency |
| On Time | <2 weeks | 0 | 10 | 10 | 100.0% | 0 | 4 | 4 | 100.0% |
| | >=2 weeks & <2 months | 0 | 78 | 78 | 100.0% | 0 | 91 | 91 | 100.0% |
| | >=2 months | 0 | 98 | 98 | 100.0% | 0 | 125 | 125 | 100.0% |
| | Total | 0 | 186 | 186 | 100.0% | 0 | 220 | 220 | 100.0% |
| Late | <2 weeks | 0 | 1 | 1 | 100.0% | 0 | 1 | 1 | 100.0% |
| | >=2 weeks & <2 months | 0 | 2 | 2 | 100.0% | 0 | 3 | 3 | 100.0% |
| | >=2 months | 2 | 21 | 23 | 91.3% | 0 | 13 | 13 | 100.0% |
| | Total | 2 | 24 | 26 | 92.3% | 0 | 17 | 17 | 100.0% |

PJM determines 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 12-45 shows a summary of requests by expected congestion and received status. Overall, 5.9 percent (1 out of 17) of all the FTR market modeled outages expected to occur in the 2017/2018 planning year and submitted late were expected to cause congestion.

Table 12-45 FTR modeled transmission facility outage requests by congestion and received status: Planning periods 2016 to 2017 and 2017 to 2018

| | | 2016/2017 | | | | 2017/2018 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Planned Duration | Congestion Expected | No Congestion Expected | Total | Percent Congestion Expected | Congestion Expected | No Congestion Expected | Total | Percent Congestion Expected |
| On Time | <2 weeks | 2 | 8 | 10 | 20.0% | 0 | 4 | 4 | 0.0% |
| | >=2 weeks & <2 months | 17 | 61 | 78 | 21.8% | 25 | 66 | 91 | 27.5% |
| | >=2 months | 25 | 73 | 98 | 25.5% | 20 | 105 | 125 | 16.0% |
| | Total | 44 | 142 | 186 | 23.7% | 45 | 175 | 220 | 20.5% |
| Late | <2 weeks | 0 | 1 | 1 | 0.0% | 0 | 1 | 1 | 0.0% |
| | >=2 weeks & <2 months | 0 | 2 | 2 | 0.0% | 1 | 2 | 3 | 33.3% |
| | >=2 months | 3 | 20 | 23 | 13.0% | 0 | 13 | 13 | 0.0% |
| | Total | 3 | 23 | 26 | 11.5% | 1 | 16 | 17 | 5.9% |

Table 12-46 shows that 40.0 percent of outage requests modeled in the FTR auction for the 2016/2017 planning year with a duration of two weeks or longer but shorter than two months were cancelled during the 2016/2017 planning year. Table 12-46 shows that 9.6 percent of outage requests modeled in the FTR auction for the 2017/2018 planning year with a duration of two weeks or longer but shorter than two months were cancelled during the 2017/2018 planning year. Table 12-46 also shows that 23.1 percent of outage requests modeled in the FTR auction for the 2016/2017 planning year with a duration of two months or longer were cancelled during the 2016/2017 planning year and that 5.8 percent of outages requests modeled in the FTR auction for the 2017/2018 planning year were cancelled during the 2017/2018 planning year.

### Table 12-46 FTR modeled transmission facility outage requests by processed status and processed status: Planning periods 2016 to 2017 and 2017 to 2018

| | | 2016/2017 | | 2017/2018 | |
|---|---|---|---|---|---|
| Planned Duration | Processed Status | Outage Requests | Percent | Outage Requests | Percent |
| <2 weeks | In Progress | 0 | 0.0% | 4 | 80.0% |
| | Approved | 0 | 0.0% | 0 | 0.0% |
| | Cancelled | 1 | 9.1% | 1 | 20.0% |
| | Revised | 0 | 0.0% | 0 | 0.0% |
| | Active | 0 | 0.0% | 0 | 0.0% |
| | Completed | 10 | 90.9% | 0 | 0.0% |
| Total Submission | | 11 | 100.0% | 5 | 100.0% |
| >=2 weeks & <2 months | In Progress | 0 | 0.0% | 82 | 87.2% |
| | Approved | 0 | 0.0% | 0 | 0.0% |
| | Cancelled | 32 | 40.0% | 9 | 9.6% |
| | Revised | 0 | 0.0% | 0 | 0.0% |
| | Active | 2 | 2.5% | 2 | 2.1% |
| | Completed | 46 | 57.5% | 1 | 1.1% |
| Total Submission | | 80 | 100.0% | 94 | 100.0% |
| >=2 months | In Progress | 0 | 0.0% | 112 | 81.2% |
| | Approved | 0 | 0.0% | 1 | 0.7% |
| | Cancelled | 28 | 23.1% | 8 | 5.8% |
| | Revised | 0 | 0.0% | 1 | 0.7% |
| | Active | 10 | 8.3% | 15 | 10.9% |
| | Completed | 83 | 68.6% | 1 | 0.7% |
| Total Submission | | 121 | 100.0% | 138 | 100.0% |

### Table 12-47 Transmission facility outage requests that are not modeled by FTR market by received status and bidding opening date: Planning periods 2016 to 2017 and 2017 to 2018

| | 2016/2017 | | | | | | 2017/2018 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | 1,311 | 7,507 | 85.1% | 267 | 8,530 | 97.0% | 1,437 | 1,662 | 53.6% | 115 | 1,075 | 90.3% |
| >=2 weeks & <2 months | 415 | 331 | 44.4% | 157 | 908 | 85.3% | 578 | 151 | 20.7% | 69 | 190 | 73.4% |
| >=2 months | 83 | 19 | 18.6% | 171 | 311 | 64.5% | 103 | 5 | 4.6% | 161 | 62 | 27.8% |
| Total | 1,809 | 7,857 | 81.3% | 595 | 9,749 | 94.2% | 2,118 | 1,818 | 46.2% | 345 | 1,327 | 79.4% |

More outage requests were not modeled in the FTR annual auction than were modeled in the FTR annual auction. In the 2017/2018 planning year, 237 outage requests were modeled in the FTR annual auction and 5,608 outage requests were not modeled in the FTR annual auction. In the 2016/2017 planning year, 212 outage requests were modeled in the FTR annual auction and 20,010 outage requests were not modeled in the FTR annual auction.

Table 12-47 shows that 20.7 percent of outage requests not modeled by the FTR market with duration longer than or equal to two months labelled On Time according to the rules were submitted after the Annual FTR Auction bidding opening date for the 2017/2018 planning year. Table 12-47 also shows that 73.4 percent of outage requests not modeled in the FTR market with duration longer than or equal to two months labelled Late according to the rules were submitted after the Annual FTR Auction bidding opening date in the 2017 to 2018 planning year.

Table 12-48 shows that 11.3 percent of late outage requests which were not modeled in the FTR market with duration longer than or equal to two months and submitted after the Annual FTR Auction bidding opening date were approved and complete in the 2017 to 2018 planning period.

**Table 12-48 Late transmission facility outage requests that are not modeled by FTR market and submitted after annual bidding opening date: Planning periods 2016 to 2017 and 2017 to 2018**

| | 2016/2017 | | | 2017/2018 | | |
|---|---|---|---|---|---|---|
| Planned Duration | Completed Outages | Total | Percent | Completed Outages | Total | Percent |
| <2 weeks | 7,365 | 8,530 | 86.3% | 721 | 1,075 | 67.1% |
| >=2 weeks & <2 months | 820 | 908 | 90.3% | 78 | 190 | 41.1% |
| >=2 months | 203 | 311 | 65.3% | 7 | 62 | 11.3% |
| Total | 8,388 | 9,749 | 86.0% | 806 | 1,327 | 60.7% |

Although the definition of late outages was developed in order to prevent outages for the planning period being submitted after the opening of bidding in the Annual FTR Auction, the rules have not functioned effectively because the rule has no direct connection to the date on which bidding opens for the Annual FTR Auction. 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 outages but also include outages shorter than 30 days. In those cases, PJM outage submission rules failed to prevent long duration transmission outages from being submitted late. The MMU recommends that PJM modify the rules to eliminate the approval of outage requests submitted or rescheduled after the opening of bidding in the Annual FTR Auction.

## Transmission Facility Outage Analysis in the Day-Ahead Energy 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 so that market participants can understand market conditions and so that PJM can accurately model market conditions in the day-ahead market. PJM requires transmission owners to submit changes to outages scheduled for the next two days no later than 09:30 am.[45]

In order to analyze the market impact, the outage requests that affect the operating day are compared: before the day-ahead market is closed; when the day-ahead market save cases are created; and during the operating day. The list of approved or active outage requests before the day-ahead market is closed is the view of outages available to market participants. The day-ahead market model uses a list of outages as an input. The list of outages that actually occurred during the operating day are the outages that affect the real-time market. If the three sets of outages are the same, there is no potential impact on markets. If the three sets of outages differ, there is a potential impact on markets.

For example for the operating day of November 23, 2016, Figure 12-4 shows that: there were 421 approved or active outages seen by market participants before the day-ahead market was closed; there were 282 outage requests included in the day-ahead market model; there were 273 outage request included in both sets of outage; there were 148 outage requests approved or active before the day-ahead market was closed but not included as inputs in day-ahead market model; and there were 9 outage requests included in day-ahead market model but not available to market participants prior to the day-ahead market.

45 PJM. "Manual 3: Transmission Operations," Revision 51 (June 7, 2017), p. 74

**Figure 12-4 Illustration of day-ahead market analysis on November 22, 2016**

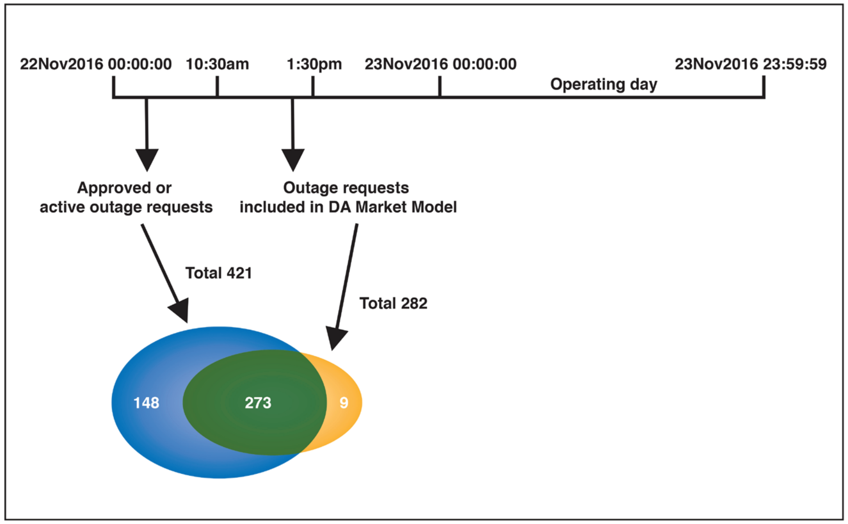



Figure 12-5 compares the weekly average number of active or approved outages available to market participants prior to the close of the day-ahead market with the outages included as inputs to the day-ahead market by PJM.

**Figure 12-5 Weekly average number of approved or active outage requests comparing day-ahead market model outages: January 1, 2015 through June 30, 2017**

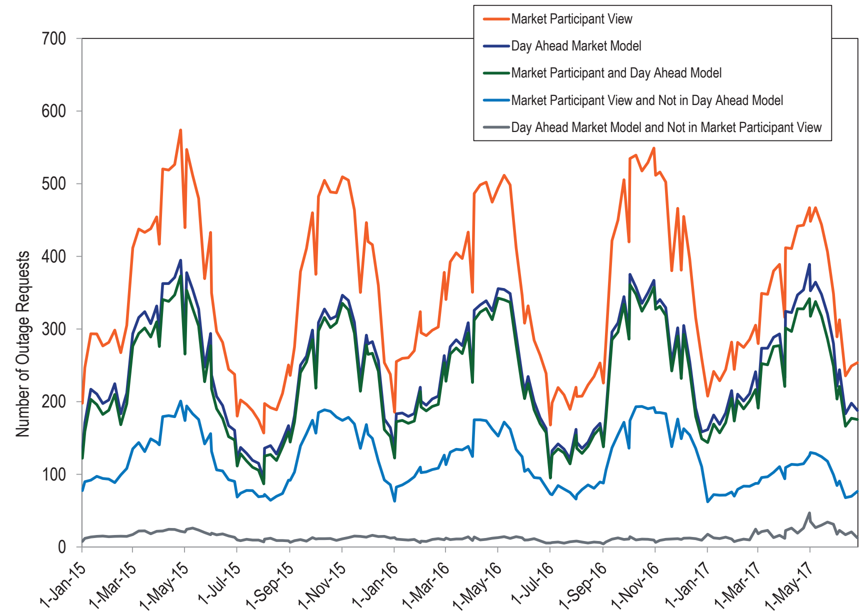



Figure 12-6 compares the weekly average number of outages included as inputs to the day-ahead market by PJM with the outages that actually occurred during the operating day.

**Figure 12-6 Weekly average number of day-ahead market model outages comparing outages occurred on operating day: January 1, 2015 through June 30, 2017**

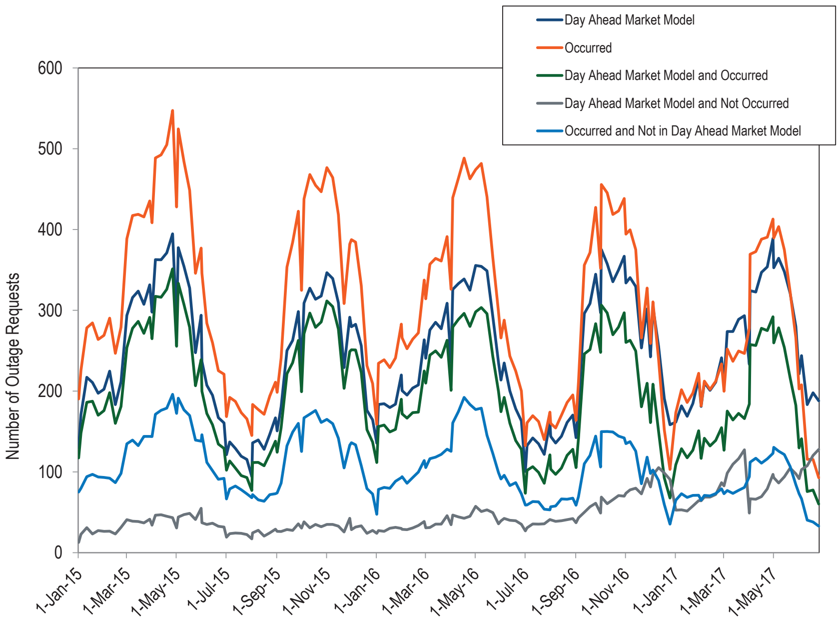



Figure 12-7 compares the weekly average number of active or approved outages available to market participants prior to the close of the day-ahead market with the outages that actually occurred during the operating day.

**Figure 12-7 Weekly average number of approved or active outage requests comparing outages occurred on operating day: January 1, 2015 through June 30, 2017**

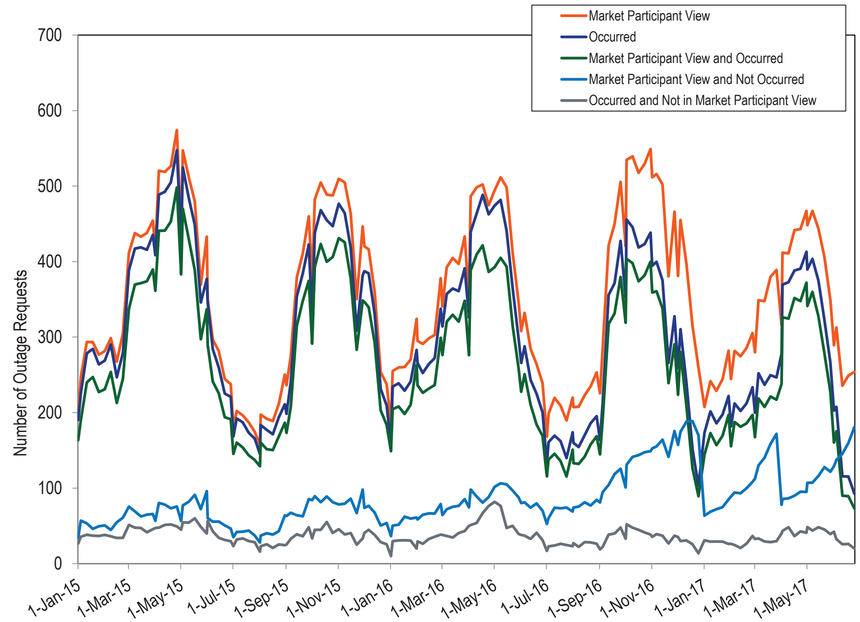



Figure 12-5, Figure 12-6, and Figure 12-7 show that on a weekly average basis, the active or approved outages available to day-ahead market participants, the outages included as inputs in the day-ahead market model and the outages that actually occurred in real time are not consistent. The active or approved outages available to day-ahead market participants are more consistent with the outages that actually occurred in real time than with the outages included in the day-ahead market model.