# Generation and Transmission Planning

## Overview

### Planned Generation and Retirements

- **Planned Generation.** As of September 30, 2016, 82,767.7 MW of capacity were in generation request queues for construction through 2024, compared to an average installed capacity of 192,875.5 MW as of September 30, 2016. Of the capacity in queues, 6,986.4 MW, or 8.4 percent, are uprates and the rest are new generation. Wind projects account for 14,505.3 MW of nameplate capacity or 17.5 percent of the capacity in the queues. Combined cycle projects account for 57,344.0 MW of capacity or 69.3 percent of the capacity in the queues.
- **Generation Retirements.** As shown in Table 12-5, 29,192.0 MW have been, or are planned to be, retired between 2011 and 2020. Of that, 5,014.3 MW are planned to retire after 2016. In the first six months of 2016, 381.0 MW were retired. Of the 5,014.3 MW pending retirement, 1,885.0 MW are coal units. The coal unit retirements were a result of low gas prices, and the EPA's Mercury and Air Toxics Standards (MATS) for some units.
- **Generation Mix.** A significant shift in the distribution of unit types within the PJM footprint continues as natural gas fired units enter the queue and steam units retire. There are 1,957.0 MW of coal fired steam capacity and 57,344.0 MW of gas fired capacity are in the queue. The replacement of coal steam units by units burning natural gas will significantly affect future congestion, the role of firm and interruptible gas supply, and natural gas supply infrastructure.

### Generation and Transmission Interconnection Planning Process

- Any entity that requests interconnection of a new generating facility, including increases to the capacity of an existing generating unit, or that requests interconnection of a merchant transmission facility, must follow the process defined in the PJM tariff to obtain interconnection service.[1] The process is complex and time consuming at least in part as a result of the required analyses. The cost, time and uncertainty associated with interconnecting to the grid may create barriers to entry for potential entrants.
- The queue contains a substantial number of projects that are not likely to be built. Excluding currently active projects and projects currently under construction, 2,526 projects, representing 353,317.5 MW, have entered the queue process since its inception. Of those, 661 projects, 46,026.3 MW, went into service. Of the projects that entered the queue process, 85.5 percent of the MW withdrew prior to completion. Such projects may create barriers to entry for projects that would otherwise be completed by taking up queue positions, increasing interconnection costs and creating uncertainty.
- Feasibility, impact and facilities studies may be delayed for reasons including disputes with developers, circuit and network issues and retooling as a result of projects being withdrawn. The Earlier Queue Submittal Task Force (EQSTF) was established in August 2015 to address delays.[2]
- As defined in the tariff, a transmission owner (TO) is an "entity that owns, leases or otherwise has a possessory interest in facilities used for the transmission of electric energy in interstate commerce under the tariff."[3] Where the transmission owner is a vertically integrated company that also owns generation, there is a potential conflict of interest when the transmission owner evaluates the interconnection requirements of new generation which is a competitor to the generation of the parent company and when the transmission owner evaluates the interconnection requirements of new generation which is part of the same company as the transmission owner. There is also a potential conflict of interest when the transmission owner evaluates the interconnection requirements of a merchant transmission developer which is a competitor of the transmission owner.

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

## Regional Transmission Expansion Plan (RTEP)

- Artificial Island is an area in southern New Jersey that includes nuclear units at Salem and at Hope Creek in the PSEG Zone. On April 29, 2013, PJM issued a request for proposal (RFP), seeking technical solutions to improve stability issues and operational performance under a range of anticipated system conditions, and the elimination of potential planning criteria violations in this area. On July 30, 2015, the PJM Board of Managers accepted PJM's recommendation to assign the project to LS Power, a merchant developer, PSEG, and PHI with a total cost estimate between $263M and $283M.[4] [5] On August 5, 2016, PJM announced that the Artificial Island project was to be suspended immediately due to unanticipated project complexities and significant cost overruns. The PJM Board of Managers called for a new review of the project to be completed by PJM by February 2017 in order to assess how to proceed with the project.[6]
- 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.[7]

## 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.[8]

## 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.[9]
- There were 14,056 transmission outage requests submitted for the first nine months of 2016. Of the requested outages, 82.2 percent were planned for five days or shorter and 3.7 percent were planned for longer than 30 days. Of the requested outages, 51.5 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

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

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

6 See "PJM Board Statement on Artificial Island Project Suspension." <http://pjm.com/~/media/documents/reports/20160805-artificial-island-update.ashx> Accessed November 7, 2016.

7 *See Delaware PSC v. PJM Interconnection, L.L.C.*, 155 FERC ¶ 61,090 (2016); *PJM Interconnection, L.L.C.*, 155 FERC ¶ 61,089 (2016); *Consolidated Edison Company of New York, Inc. v. PJM Interconnection*, 155 FERC ¶ 61,088 (2016); *see also Transmission Planning and Cost Allocation by Transmission Owning and Operating Public Utilities*, 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.* S.C. Pub. Serv. Auth. v. FERC, 762 F.3d 41, 412 (D.C. Cir. 2014); *PJM Interconnection, L.L.C.*, 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); *PJM Interconnection, L.L.C.*, 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).

8 See "2016 RTEP Process Scope and Input Assumptions White Paper," page 23. <http://www.pjm.com/~/media/documents/reports/2016-rtep-process-scope-and-input-assumptions.ashx> Accessed November 7, 2016.

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

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.[10] (Priority: Low. First reported 2013. Status: Not adopted.)
- The MMU recommends outsourcing interconnection studies to an independent party to avoid potential conflicts of interest. Currently, these studies are performed by incumbent transmission owners under PJM's direction. This creates potential conflicts of interest, particularly when transmission owners are vertically integrated and the owner of transmission also owns generation. (Priority: Low. First reported 2013. Status: Not adopted.)
- The MMU recommends improvements in queue management including that PJM establish a review process to ensure that projects are removed from the queue if they are not viable, as well as a process to allow commercially viable projects to advance in the queue ahead of projects which have failed to make progress, subject to rules to prevent gaming. (Priority: Medium. First reported 2013. Status: Partially adopted.)
- The MMU recommends an analysis of the study phase of PJM's transmission planning to reduce the need for postponements of study results, to decrease study completion times, and to improve the likelihood that a project at a given phase in the study process will successfully go into service. (Priority: Medium. First reported 2014. Status: Partially adopted.)
- The MMU recommends that PJM establish fair terms of access to rights of way and property, such as at substations, in order to remove any barriers to entry and permit competition between incumbent transmission providers and merchant transmission providers in the RTEP. (Priority: Medium. First reported 2014. Status: Not adopted.)
- The MMU recommends that PJM enhance the transparency and queue management process for merchant transmission investment. Issues related to data access and complete explanations of cost impacts should be addressed. The goal should be to remove barriers to competition from merchant transmission. (Priority: Medium. First reported 2015. Status: Not adopted.)
- The MMU recommends consideration of changing the minimum distribution factor in the allocation from 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.)
- 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.)

10 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 not permit transmission owners to divide long duration outages into smaller segments to avoid complying with the requirements for long duration outages. (Priority: Low. First reported 2015. Status: Not adopted.)

## Conclusion

The goal of PJM market design should be to enhance competition and to ensure that competition is the driver for all the key elements of PJM markets. But transmission investments have not been fully incorporated into competitive markets. The construction of new transmission facilities has significant impacts on the energy and capacity markets. But when generating units retire 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 September 30, 2016, 82,767.7 MW of capacity were in generation request queues for construction

through 2024, compared to an average installed capacity of 192,875.5 MW as of September 30, 2016. Although it is clear that not all generation in the queues will be built, PJM has added capacity.[11] In the first nine months of 2016, 5,307.7 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 AC1 is currently open.

All projects that have been entered in a queue have a status assigned. Projects listed as active are undergoing one of the studies (feasibility, system impact, facility) required to proceed. Other status options are under construction, suspended, and in service. Withdrawn projects are removed from the queue and listed separately. A project cannot be suspended until it has reached the status of under construction. Any project that entered the queue before February 1, 2011, can be suspended for up to three years. Projects that entered the queue after February 1, 2011, face an additional restriction in that the suspension period is reduced to one year if they affect any project later in the queue.[12] 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.[13]

Table 12-1 shows MW in queues by expected completion date and MW changes in the queues between December 31, 2015 and September 30, 2016, for ongoing projects, i.e. projects with the status active, under construction or suspended.[14] Projects that are already in service are not included here. The total MW in queues decreased by 2,555.4 MW, or 3.0 percent, from 85,323.1 MW at the end of 2015.

**Table 12-1 Queue comparison by expected completion year (MW): December 31, 2015 to September 30, 2016[15]**

| | | | Nine Month Change | |
|---|---|---|---|---|
| Year | As of 12/31/2015 | As of 9/30/2016 | MW | Percent |
| 2015 | 9,641.9 | 0.0 | NA | NA |
| 2016 | 15,085.7 | 9,334.7 | (5,751.0) | (61.6%) |
| 2017 | 12,442.3 | 14,059.3 | 1,617.0 | 11.5% |
| 2018 | 13,403.6 | 23,015.8 | 9,612.2 | 41.8% |
| 2019 | 21,461.3 | 18,651.9 | (2,809.4) | (15.1%) |
| 2020 | 11,444.3 | 13,090.1 | 1,645.8 | 12.6% |
| 2021 | 0.0 | 3,751.9 | 3,751.9 | NA |
| 2022 | 250.0 | 250.0 | 0.0 | 0.0% |
| 2023 | 0.0 | 614.0 | 614.0 | 100.0% |
| 2024 | 1,594.0 | 0.0 | (1,594.0) | 0.0% |
| Total | 85,323.1 | 82,767.7 | (2,555.4) | (3.0%) |

Table 12-2 shows the yearly project status changes in more detail and how scheduled queue capacity has changed between December 31, 2015, and September 30, 2016. For example, 4,279.2 MW entered the queue in the first nine months of 2016, all of which are currently active. Of the total 52,350.1 MW marked as active at the beginning of the first nine months of 2016, 1,560.7 MW were withdrawn, 50.0 MW were suspended, 144.3 MW started construction, and 144.3 MW went into service by the end of the quarter. The Under Construction column shows that 510.0 MW came out of suspension and 2,569.9 MW began construction in the first nine months of 2016, in addition to the 22,953.1 MW of capacity that maintained the status under construction from the previous year.

11 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> Accessed November 7, 2016.

12 See PJM. Manual 14C. "Generation and Transmission Interconnection Process," Revision 10 (October 1, 2016), Section 3.7, <http://www.pjm.com/~/media/documents/manuals/m14c.ashx>.

13 PJM does not track the duration of suspensions or PJM termination of projects.

14 Expected completion dates are entered when the project enters the queue. Actual completion dates are generally different than expected completion dates.

15 Wind and solar capacity in Table 12-2 through Table 12-5 have not been adjusted to reflect derating.

### Table 12-2 Change in project status (MW): December 31, 2015 to September 30, 2016

| | | Status at 9/30/2016 | | | | |
|---|---|---|---|---|---|---|
| Status at 12/31/2015 | Total at 12/31/2015 | Active | Suspended | Under Construction | In Service | Withdrawn |
| (Entered in Q3 2016) | | 4,279.2 | 0.0 | 0.0 | 0.0 | 0.0 |
| Active | 52,350.1 | 46,965.9 | 50.0 | 2,569.9 | 144.3 | 1,560.7 |
| Suspended | 4,698.9 | 0.0 | 4,735.3 | 510.0 | 0.0 | 327.0 |
| Under Construction | 28,274.1 | 0.0 | 534.3 | 22,953.1 | 887.0 | 14.0 |
| In Service | 41,021.9 | 0.0 | 0.0 | 0.0 | 44,995.0 | 0.0 |
| Withdrawn | 286,258.0 | 160.0 | 0.0 | 0.0 | 0.0 | 300,069.9 |
| Total at 9/30/2016 | | 51,405.1 | 5,319.6 | 26,033.0 | 46,026.3 | 301,971.6 |

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 September 30, 2016, there are 82,757.7 MW of capacity in queues that are not yet in service, of which 6.4 percent are suspended, 31.5 percent are under construction and 62.1 percent have not begun construction.

### Table 12-3 Capacity in PJM queues (MW): At September 30, 201616

| Queue | Active | In-Service | Under Construction | Suspended | Withdrawn | Total |
|---|---|---|---|---|---|---|
| A Expired 31-Jan-98 | 0.0 | 8,103.0 | 0.0 | 0.0 | 17,252.0 | 25,355.0 |
| B Expired 31-Jan-99 | 0.0 | 4,645.5 | 0.0 | 0.0 | 15,656.7 | 20,302.2 |
| C Expired 31-Jul-99 | 0.0 | 531.0 | 0.0 | 0.0 | 3,474.8 | 4,005.8 |
| D Expired 31-Jan-00 | 0.0 | 850.6 | 0.0 | 0.0 | 7,369.0 | 8,219.6 |
| E Expired 31-Jul-00 | 0.0 | 795.2 | 0.0 | 0.0 | 8,033.8 | 8,829.0 |
| F Expired 31-Jan-01 | 0.0 | 52.0 | 0.0 | 0.0 | 3,092.5 | 3,144.5 |
| G Expired 31-Jul-01 | 0.0 | 1,189.6 | 0.0 | 0.0 | 17,980.8 | 19,170.4 |
| H Expired 31-Jan-02 | 0.0 | 702.5 | 0.0 | 0.0 | 8,421.9 | 9,124.4 |
| I Expired 31-Jul-02 | 0.0 | 103.0 | 0.0 | 0.0 | 3,738.3 | 3,841.3 |
| J Expired 31-Jan-03 | 0.0 | 40.0 | 0.0 | 0.0 | 846.0 | 886.0 |
| K Expired 31-Jul-03 | 0.0 | 98.9 | 0.0 | 0.0 | 485.3 | 584.2 |
| L Expired 31-Jan-04 | 0.0 | 256.5 | 0.0 | 0.0 | 4,033.7 | 4,290.2 |
| M Expired 31-Jul-04 | 0.0 | 504.8 | 0.0 | 0.0 | 3,705.6 | 4,210.4 |
| N Expired 31-Jan-05 | 0.0 | 2,398.8 | 38.0 | 0.0 | 8,090.3 | 10,527.0 |
| O Expired 31-Jul-05 | 0.0 | 1,668.2 | 437.0 | 0.0 | 5,466.8 | 7,572.0 |
| P Expired 31-Jan-06 | 0.0 | 3,064.7 | 253.0 | 210.0 | 5,110.5 | 8,638.2 |
| Q Expired 31-Jul-06 | 0.0 | 3,147.9 | 0.0 | 0.0 | 11,385.7 | 14,533.6 |
| R Expired 31-Jan-07 | 0.0 | 1,886.4 | 600.0 | 848.3 | 19,420.6 | 22,755.3 |
| S Expired 31-Jul-07 | 0.0 | 3,374.5 | 295.0 | 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 | 400.0 | 837.3 | 649.9 | 620.0 | 30,829.6 | 33,336.8 |
| V Expired 31-Jan-10 | 590.0 | 2,020.6 | 770.1 | 555.0 | 12,877.6 | 16,813.3 |
| W Expired 31-Jan-11 | 944.0 | 2,001.5 | 1,484.5 | 831.7 | 18,818.6 | 24,080.3 |
| X Expired 31-Jan-12 | 1,689.0 | 3,722.9 | 6,222.7 | 344.8 | 18,365.0 | 30,344.5 |
| Y Expired 30-Apr-13 | 1,276.5 | 676.8 | 4,048.6 | 1,307.5 | 18,469.3 | 25,778.5 |
| Z Expired 30-Apr-14 | 1,348.0 | 419.7 | 5,764.1 | 82.2 | 6,696.7 | 14,310.7 |
| AA1 Expired 31-Oct-14 | 5,963.9 | 111.7 | 3,058.1 | 56.3 | 2,812.4 | 12,002.4 |
| AA2 Expired 30-Apr-15 | 8,518.5 | 1.1 | 299.3 | 84.0 | 7,170.4 | 16,073.3 |
| AB1 Expired 31-Oct-15 | 13,398.6 | 7.7 | 704.7 | 9.9 | 6,352.9 | 20,473.8 |
| AB2 Expired 31-Mar-16 | 12,788.2 | 0.0 | 0.0 | 0.0 | 605.1 | 13,393.3 |
| AC1 Through 30-Sep-16 | 4,488.4 | 0.0 | 0.0 | 0.0 | 0.0 | 4,488.4 |
| Total | 51,405.1 | 46,026.3 | 26,033.0 | 5,319.6 | 301,971.7 | 430,755.6 |

16 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.[17] As of September 30, 2016, 82,741.7 MW of capacity were in generation request queues for construction through 2024, compared to 85,323.1 MW at December 31, 2015.[18] Table 12-4 also shows the planned retirements for each zone.

A significant shift in the distribution of unit types within the PJM footprint continues to develop as natural gas fired units enter the queue and steam units retire. While 55,901.2 MW of gas fired capacity are in the queue, there are only 1,790.0 MW of coal fired steam capacity in the queue. There are only two new coal projects currently in the queue both of which are under construction and the actual status of the only significant coal unit is unclear. With respect to retirements, 1,885.0 MW of coal fired steam capacity and 661.8 MW of natural gas capacity are slated for deactivation between now

**Table 12-4 Queue capacity by LDA, control zone and fuel (MW): At September 30, 2016[19]**

| LDA | Zone | BioMass | CC | CT | Diesel | Fuel Cell | Hydro | Nuclear | Solar | Steam | Storage | Wind | Total Queue Capacity | Planned Retirements |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EMAAC | AECO | 0.0 | 1,706.0 | 469.0 | 0.0 | 1.5 | 0.0 | 0.0 | 63.2 | 0.0 | 20.0 | 175.0 | 2,434.7 | 0.0 |
| | DPL | 3.8 | 742.0 | 0.0 | 2.0 | 0.0 | 0.0 | 0.0 | 1,381.0 | 0.0 | 24.0 | 599.6 | 2,752.4 | 34.0 |
| | JCPL | 0.0 | 2,567.2 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 302.7 | 0.0 | 145.1 | 0.0 | 3,015.4 | 616.0 |
| | PECO | 0.0 | 1,221.0 | 0.0 | 6.6 | 0.0 | 0.0 | 94.0 | 0.0 | 0.0 | 40.0 | 0.0 | 1,361.6 | 50.8 |
| | PSEG | 0.0 | 2,659.5 | 788.0 | 10.6 | 0.0 | 0.0 | 0.0 | 111.7 | 24.0 | 2.5 | 0.0 | 3,596.3 | 611.0 |
| | RECO | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | EMAAC Total | 3.8 | 8,895.7 | 1,257.0 | 19.2 | 1.9 | 0.0 | 94.0 | 1,858.6 | 24.0 | 231.6 | 774.6 | 13,160.4 | 1,311.8 |
| SWMAAC | BGE | 0.0 | 0.0 | 0.0 | 5.3 | 0.0 | 0.4 | 19.2 | 44.1 | 0.0 | 20.1 | 0.0 | 89.1 | 135.0 |
| | Pepco | 0.0 | 2,498.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2,498.5 | 0.0 |
| | SWMAAC Total | 0.0 | 2,498.5 | 0.0 | 5.3 | 0.0 | 0.4 | 19.2 | 44.1 | 0.0 | 20.1 | 0.0 | 2,587.6 | 135.0 |
| WMAAC | Met-Ed | 0.0 | 485.0 | 34.1 | 0.0 | 0.0 | 0.0 | 0.0 | 103.0 | 30.0 | 0.0 | 0.0 | 652.1 | 0.0 |
| | PENELEC | 0.0 | 1,283.0 | 560.9 | 158.9 | 0.0 | 17.0 | 0.0 | 13.5 | 590.0 | 20.0 | 358.3 | 3,001.6 | 0.0 |
| | PPL | 16.0 | 5,760.0 | 19.9 | 0.0 | 0.0 | 0.0 | 0.0 | 6.0 | 0.0 | 30.0 | 266.2 | 6,098.1 | 0.0 |
| | WMAAC Total | 16.0 | 7,528.0 | 614.9 | 158.9 | 0.0 | 17.0 | 0.0 | 122.5 | 620.0 | 50.0 | 624.5 | 9,751.8 | 0.0 |
| Non-MAAC | AEP | 0.0 | 9,659.0 | 394.0 | 9.4 | 0.0 | 146.5 | 102.0 | 636.6 | 504.0 | 102.0 | 6,527.0 | 18,080.5 | 0.0 |
| | AP | 0.0 | 4,590.4 | 30.0 | 122.8 | 0.0 | 0.0 | 0.0 | 413.4 | 1,710.0 | 182.5 | 1,123.8 | 8,172.8 | 0.0 |
| | ATSI | 0.0 | 5,148.0 | 25.0 | 23.9 | 0.0 | 0.0 | 0.0 | 326.0 | 16.5 | 12.5 | 518.0 | 6,069.9 | 0.0 |
| | ComEd | 0.0 | 6,203.3 | 940.0 | 47.4 | 0.0 | 22.7 | 0.0 | 2.0 | 0.0 | 109.1 | 3,593.3 | 10,917.8 | 2,329.0 |
| | DAY | 0.0 | 1,150.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 123.2 | 12.0 | 20.0 | 300.0 | 1,605.2 | 0.0 |
| | DEOK | 0.0 | 0.0 | 0.0 | 4.8 | 0.0 | 0.0 | 0.0 | 125.0 | 0.0 | 29.8 | 0.0 | 159.6 | 0.0 |
| | DLCO | 0.0 | 205.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.0 | 0.0 | 225.0 | 0.0 |
| | Dominion | 62.5 | 5,981.0 | 167.4 | 26.0 | 0.0 | 0.0 | 0.0 | 4,002.1 | 0.0 | 34.0 | 1,044.1 | 11,317.1 | 412.0 |
| | EKPC | 0.0 | 614.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 80.0 | 0.0 | 0.0 | 0.0 | 694.0 | 0.0 |
| | Non-MAAC Total | 62.5 | 33,550.7 | 1,556.4 | 234.2 | 0.0 | 169.2 | 102.0 | 5,708.3 | 2,242.5 | 509.9 | 13,106.2 | 57,241.9 | 2,741.0 |
| Total | | 82.3 | 52,472.9 | 3,428.3 | 417.6 | 1.9 | 186.6 | 215.2 | 7,733.5 | 2,886.5 | 811.6 | 14,505.3 | 82,741.7 | 4,187.8 |

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

18 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 14,505.3 MW of wind resources and 7,7335 MW of solar resources, the 82,741.7 MW currently active in the queue would be reduced to 65,327.3 MW.

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

and 2020. The replacement of coal steam units by units burning natural gas could significantly affect future congestion, the role of firm and interruptible gas supply, and natural gas supply infrastructure.

## Planned Retirements

As shown in Table 12-5, 29,192.0 MW have been, or are planned to be, retired between 2011 and 2020.[20] Of that, 5,014.3 MW are planned to retire after 2016. In the first nine months of 2016, 381.0 MW were retired. Of the 5,014.3 MW pending retirement, 1,885.0 MW are coal units. The coal unit retirements were a result of low gas prices and the EPA's Mercury and Air Toxics Standards (MATS) for some units.

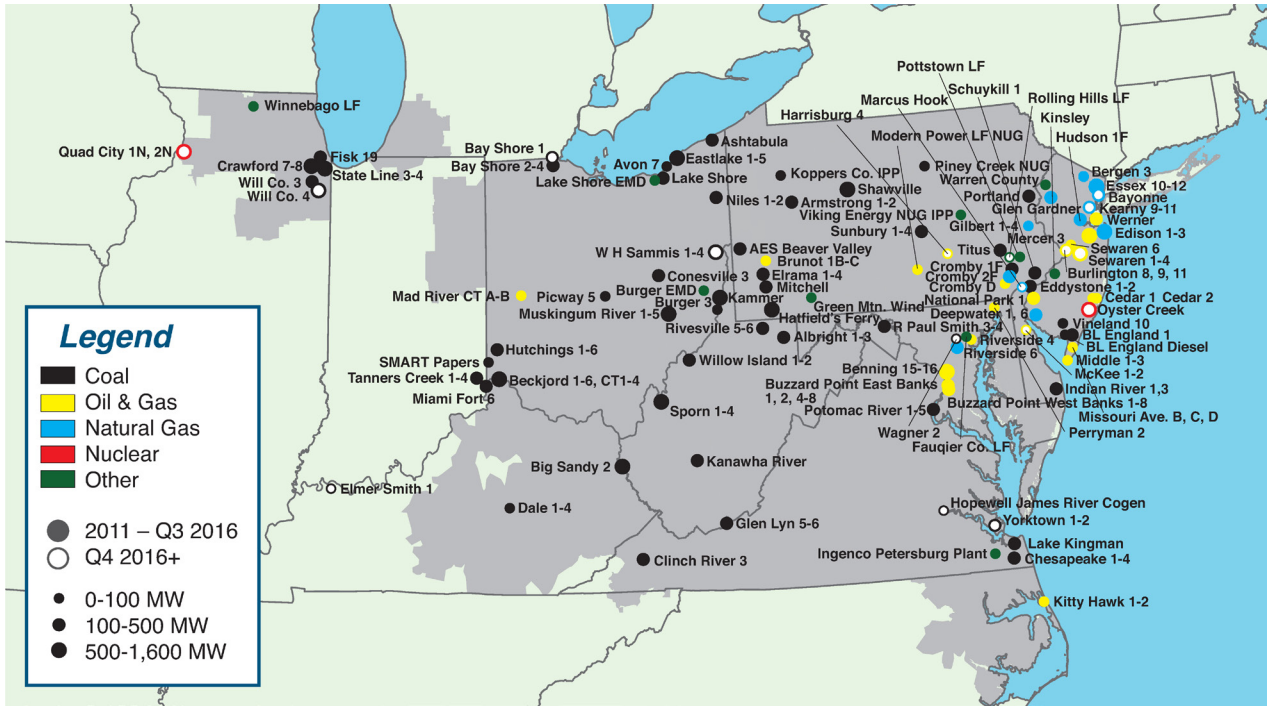
### Table 12-5 Summary of PJM unit retirements by fuel (MW): 2011 through 2020

| | Coal | Diesel | Heavy Oil | Kerosene | Landfill Gas | Light Oil | Natural Gas | Nuclear | Wind | Wood Waste | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Retirements 2011 | 543.0 | 0.0 | 0.0 | 0.0 | 0.0 | 63.7 | 522.5 | 0.0 | 0.0 | 0.0 | 1,129.2 |
| Retirements 2012 | 5,907.9 | 0.0 | 0.0 | 0.0 | 0.0 | 788.0 | 250.0 | 0.0 | 0.0 | 16.0 | 6,961.9 |
| Retirements 2013 | 2,589.9 | 2.9 | 166.0 | 0.0 | 3.8 | 85.0 | 0.0 | 0.0 | 0.0 | 8.0 | 2,855.6 |
| Retirements 2014 | 2,427.0 | 50.0 | 0.0 | 184.0 | 15.3 | 0.0 | 294.0 | 0.0 | 0.0 | 0.0 | 2,970.3 |
| Retirements 2015 | 7,661.8 | 10.3 | 0.0 | 644.2 | 2.0 | 212.0 | 1,319.0 | 0.0 | 10.4 | 0.0 | 9,859.7 |
| Retirements 2016 | 243.0 | 59.0 | 74.0 | 0.0 | 11.0 | 14.0 | 0.0 | 0.0 | 0.0 | 0.0 | 401.0 |
| Planned Retirements 2016 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Planned Retirements Post-2016 | 1,885.0 | 0.0 | 34.0 | 0.0 | 0.0 | 0.0 | 661.8 | 2,433.5 | 0.0 | 0.0 | 5,014.3 |
| Total | 21,257.6 | 122.2 | 274.0 | 828.2 | 32.1 | 1,162.7 | 3,047.3 | 2,433.5 | 10.4 | 24.0 | 29,192.0 |

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

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

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




The list of pending retirements is shown in Table 12-6.

## Table 12-6 Planned retirement of PJM units: as of September 30, 2016

| Unit | Zone | ICAP (MW) | Fuel | Unit Type | Projected Deactivation Date |
|---|---|---|---|---|---|
| Harrisburg 4 CT | PPL | 14.0 | Light Oil | Combustion Turbine | 17-Nov-16 |
| Rolling Hills Landfill Generator | Met-Ed | 6.0 | LFG | Diesel | 07-Dec-16 |
| Yorktown 1-2 | Dominion | 323.0 | Coal | Steam | 15-Apr-17 |
| McKee 1-2 | DPL | 34.0 | Heavy Oil | Combustion Turbine | 31-May-17 |
| Hopewell James River Cogen | Dominion | 89.0 | Coal | Steam | 31-May-17 |
| Sewaren 1-4 | PSEG | 453.0 | Kerosene | Combustion Turbine | 01-Jun-18 |
| Quad Cities 1-2 | ComEd | 1,819.0 | Nuclear | Nuclear | 01-Jun-18 |
| Bayonne Cogen Plant (CC) | PSEG | 158.0 | Natural gas | Steam | 01-Nov-18 |
| MH50 Marcus Hook Co-gen | PECO | 50.8 | Natural gas | Steam | 13-May-19 |
| Elmer Smith U1 | External | 52.0 | Coal | Steam | 01-Jun-19 |
| Oyster Creek | JCPL | 614.5 | Nuclear | Nuclear | 31-Dec-19 |
| Will County 4 | ComEd | 510.0 | Coal | Steam | 31-May-20 |
| W H Sammis 1-4 | ATSI | 640.0 | 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 |
| Total | | 5,034.3 | | | |

## Table 12-7 Retirements by fuel type: 2011 through 2020

| | Number of Units | Avg. Size (MW) | Avg. Age at Retirement (Years) | Total MW | Percent |
|---|---|---|---|---|---|
| Coal | 131 | 162.3 | 56.0 | 21,257.6 | 72.8% |
| Diesel | 7 | 17.5 | 42.7 | 122.2 | 0.4% |
| Heavy Oil | 4 | 68.5 | 57.5 | 274.0 | 0.9% |
| Kerosene | 20 | 41.4 | 45.5 | 828.2 | 2.8% |
| Landfill Gas | 9 | 3.6 | 14.0 | 32.1 | 0.1% |
| Light Oil | 16 | 72.7 | 44.1 | 1,162.7 | 4.0% |
| Natural Gas | 51 | 59.8 | 46.4 | 3,047.3 | 10.4% |
| Nuclear | 3 | 811.2 | 47.7 | 2,433.5 | 8.3% |
| Wind | 1 | 10.4 | 15.0 | 10.4 | 0.0% |
| Wood Waste | 2 | 12.0 | 23.5 | 24.0 | 0.1% |
| Total | 244 | 119.6 | 49.9 | 29,192.0 | 100.0% |

Table 12-7 shows the capacity, average size, and average age of units retiring in PJM, from 2011 through 2020, while Table 12-8 shows these retirements by state. The majority, 72.8 percent, of all MW retiring during this period are coal steam units. These units have an average age of 56.0 years and an average size of 162.3 MW. Over half of them, 54.9 percent, are located in either Ohio or Pennsylvania. Retirements have generally consisted of smaller subcritical coal steam units and those without adequate environmental controls to remain viable beyond 2016.

### Table 12-8 Retirements (MW) by fuel type and state: 2011 through 2020

| State | Coal | Diesel | Heavy Oil | Kerosene | Landfill Gas | Light Oil | Natural Gas | Nuclear | Wind | Wood Waste | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 788.0 | 0.0 | 0.0 | 0.0 | 0.0 | 788.0 |
| DE | 254.0 | 0.0 | 34.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 288.0 |
| IL | 2,134.0 | 0.0 | 0.0 | 0.0 | 6.4 | 0.0 | 0.0 | 1,819.0 | 0.0 | 0.0 | 3,959.4 |
| IN | 982.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 982.0 |
| KY | 1,047.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1,047.0 |
| MD | 250.0 | 51.0 | 74.0 | 0.0 | 0.0 | 0.0 | 115.0 | 0.0 | 0.0 | 0.0 | 490.0 |
| NC | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 31.0 | 0.0 | 0.0 | 0.0 | 0.0 | 31.0 |
| NJ | 136.0 | 8.0 | 0.0 | 828.2 | 7.7 | 212.0 | 2,680.5 | 614.5 | 0.0 | 0.0 | 4,486.9 |
| OH | 6,528.6 | 60.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6,588.9 |
| PA | 5,145.0 | 0.0 | 166.0 | 0.0 | 16.0 | 131.7 | 251.8 | 0.0 | 10.4 | 24.0 | 5,744.9 |
| VA | 2,140.0 | 2.9 | 0.0 | 0.0 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2,144.9 |
| WV | 2,641.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2,641.0 |
| Total | 21,257.6 | 122.2 | 274.0 | 828.2 | 32.1 | 1,162.7 | 3,047.3 | 2,433.5 | 10.4 | 24.0 | 29,192.0 |

## Actual Generation Deactivations in 2016

Table 12-9 shows the units that were deactivated in 2016.

### Table 12-9 Unit deactivations in 2016

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

## Generation Mix

As of June 30, 2016, PJM had an installed capacity of 192,875.5 MW (Table 12-10). 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 12-10 Existing PJM capacity: At September 30, 2016 (By zone and unit type (MW))[21]

| Zone | CC | CT | Diesel | Fuel Cell | Hydroelectric | Nuclear | Solar | Steam | Storage | Wind | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AECO | 901.9 | 570.7 | 22.6 | 0.0 | 0.0 | 0.0 | 41.7 | 815.9 | 0.0 | 7.5 | 2,360.3 |
| AEP | 6,100.0 | 3,682.2 | 77.1 | 0.0 | 1,071.9 | 3,211.0 | 10.1 | 18,897.8 | 4.0 | 2,103.2 | 35,157.3 |
| APS | 1,129.0 | 1,226.9 | 47.9 | 0.0 | 129.2 | 0.0 | 36.1 | 5,409.0 | 47.4 | 1,088.5 | 9,114.0 |
| ATSI | 685.0 | 1,618.3 | 67.7 | 0.0 | 0.0 | 2,134.0 | 0.0 | 5,719.0 | 0.0 | 0.0 | 10,224.0 |
| BGE | 0.0 | 789.0 | 18.4 | 0.0 | 0.0 | 1,716.0 | 0.0 | 2,995.5 | 0.0 | 0.0 | 5,518.9 |
| ComEd | 3,146.1 | 7,244.0 | 93.8 | 0.0 | 0.0 | 10,473.5 | 9.0 | 5,166.1 | 107.5 | 2,606.9 | 28,846.9 |
| DAY | 0.0 | 1,368.5 | 47.5 | 0.0 | 0.0 | 0.0 | 1.1 | 2,908.0 | 40.0 | 0.0 | 4,365.1 |
| DEOK | 47.2 | 654.0 | 0.0 | 0.0 | 112.0 | 0.0 | 0.0 | 3,567.0 | 20.0 | 0.0 | 4,400.2 |
| DLCO | 244.0 | 15.0 | 0.0 | 0.0 | 6.3 | 1,777.0 | 0.0 | 660.0 | 0.0 | 0.0 | 2,702.3 |
| Dominion | 6,851.6 | 3,761.7 | 151.8 | 0.0 | 3,589.3 | 3,581.3 | 157.8 | 7,775.0 | 0.0 | 0.0 | 25,868.5 |
| DPL | 1,498.5 | 1,820.4 | 96.1 | 30.0 | 0.0 | 0.0 | 20.0 | 1,620.0 | 0.0 | 0.0 | 5,085.0 |
| EKPC | 0.0 | 774.0 | 0.0 | 0.0 | 70.0 | 0.0 | 0.0 | 1,687.0 | 0.0 | 0.0 | 2,531.0 |
| JCPL | 2,682.5 | 763.1 | 19.9 | 0.0 | 400.0 | 614.5 | 154.2 | 10.0 | 0.0 | 0.0 | 4,644.2 |
| Met-Ed | 2,111.0 | 406.5 | 41.4 | 0.0 | 19.0 | 805.0 | 0.0 | 200.0 | 0.0 | 0.0 | 3,582.9 |
| PECO | 3,209.0 | 834.0 | 2.9 | 0.0 | 1,642.0 | 4,546.8 | 3.0 | 979.1 | 1.0 | 0.0 | 11,217.8 |
| PENELEC | 850.0 | 407.5 | 110.2 | 0.0 | 512.8 | 0.0 | 0.0 | 6,793.5 | 10.4 | 930.9 | 9,615.3 |
| Pepco | 230.0 | 1,091.7 | 9.9 | 0.0 | 0.0 | 0.0 | 0.0 | 3,649.1 | 0.0 | 0.0 | 4,980.7 |
| PPL | 2,657.9 | 616.2 | 55.5 | 0.0 | 706.6 | 2,520.0 | 15.0 | 5,169.9 | 20.0 | 219.7 | 11,980.8 |
| PSEG | 3,846.3 | 1,132.0 | 11.1 | 0.0 | 5.0 | 3,493.0 | 140.8 | 2,050.1 | 2.0 | 0.0 | 10,680.3 |
| RECO | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 36,190.0 | 28,775.7 | 873.8 | 30.0 | 8,264.1 | 34,872.1 | 588.8 | 76,072.0 | 252.3 | 6,956.7 | 192,875.5 |

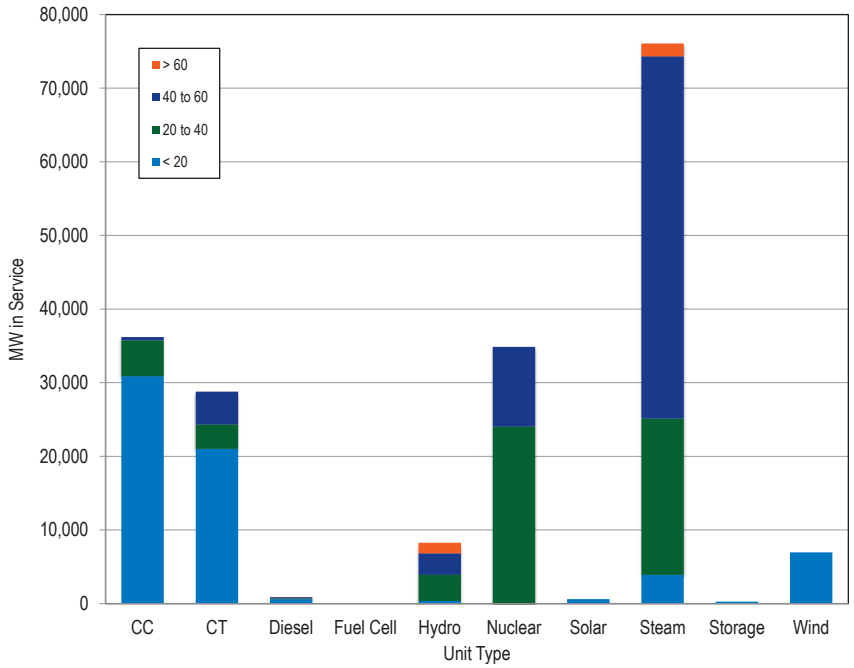
Figure 12-2 and Table 12-11 show the age of PJM generators by unit type. Units older than 40 years comprise 71,186.4 MW, or 36.9 percent, of the total capacity of 192,875.5 MW.

## Table 12-11 PJM capacity (MW) by age (years): At September 30, 2016

| Age (years) | CC | CT | Diesel | Fuel Cell | Hydroelectric | Nuclear | Solar | Steam | Storage | Wind | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Less than 20 | 30,893.5 | 21,016.2 | 609.4 | 30.0 | 344.8 | 0.0 | 588.8 | 3,905.5 | 252.3 | 6,956.7 | 64,597.1 |
| 20 to 40 | 4,854.5 | 3,315.5 | 98.8 | 0.0 | 3,557.2 | 24,033.9 | 0.0 | 21,232.0 | 0.0 | 0.0 | 57,091.9 |
| 40 to 60 | 442.0 | 4,444.0 | 163.6 | 0.0 | 2,915.0 | 10,838.2 | 0.0 | 49,188.5 | 0.0 | 0.0 | 67,991.3 |
| More than 60 | 0.0 | 0.0 | 2.0 | 0.0 | 1,447.1 | 0.0 | 0.0 | 1,746.0 | 0.0 | 0.0 | 3,195.1 |
| Total | 36,190.0 | 28,775.7 | 873.8 | 30.0 | 8,264.1 | 34,872.1 | 588.8 | 76,072.0 | 252.3 | 6,956.7 | 192,875.5 |

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

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




## Generation and Transmission Interconnection Planning Process

PJM made changes to the queue process in May 2012.[22] 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.[23] The Earlier Queue Submittal Task Force (EQSTF) was established in August 2015, to further address the issue.[24]

### Interconnection Study Phase

In the study phase of the interconnection planning process, a series of studies are performed to determine the feasibility, impact, and cost of projects in the queue. Table 12-12 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.

22 See letter from PJM to Secretary Kimberly Bose, Docket No. ER12-1177-000, <http://www.pjm.com/~/media/documents/ferc/2012-filings/20120229-er12-1177-000.ashx>.
23 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>.
24 See Earlier Queue Submittal Task Force at <http://www.pjm.com/committees-and-groups/task-forces/eqstf.aspx>.

### Table 12-12 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.[25] 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 12-13 and Table 12-14.

### Table 12-13 Last milestone at time of withdrawal: January 1, 1997 through September 30, 2016

| Milestone Completed | Projects Withdrawn | Percent |
|---|---|---|
| Never Started | 94 | 5.2% |
| Feasibility Study | 797 | 44.2% |
| System Impact Study | 436 | 24.2% |
| Facilities Study | 248 | 13.8% |
| Construction Service Agreement (CSA) or beyond | 227 | 12.6% |
| Total | 1,802 | 100.0% |

Table 12-13 shows the milestone status when projects were withdrawn, for all withdrawn projects. Of the projects withdrawn, 49.4 percent were withdrawn before the system impact study was completed. Once an Interconnection Service Agreement (ISA) or a Wholesale Market Participation Agreement (WMPA) is executed, the financial obligation for any necessary transmission upgrades cannot be retracted.[26] [27] Withdrawing at or beyond this point is uncommon; only 227 projects, or 12.6 percent, of all projects withdrawn were withdrawn after reaching this milestone.

Table 12-14 and Table 12-15 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 967 days, or 2.6 years, between entering a queue and going into service. For withdrawn projects, there is an average time of 644 days between entering a queue and withdrawing.

### Table 12-14 Average project queue times (days): At September 30, 2016

| Status | Average (Days) | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|
| Active | 927 | 627 | 3 | 3,745 |
| In-Service | 967 | 698 | 1 | 4,024 |
| Suspended | 2,116 | 1,117 | 550 | 5,108 |
| Under Construction | 1,667 | 991 | 339 | 4,652 |
| Withdrawn | 644 | 667 | 1 | 4,249 |

Table 12-15 presents information on the time in the stages of the queue for those projects not yet in service. Of the 687 projects in the queue as of

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

26 "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 10 (October 1, 2016), p.8.

27 See PJM. "Manual 14C: Generation and Transmission Interconnection Facility Construction," Revision 10 (October 1, 2016), p.22.

September 30, 2016, 104 had a completed feasibility study and 211 were under construction.

### Table 12-15 PJM generation planning summary: At September 30, 2016

| Milestone Reached | Number of Projects | Percent of Total Projects | Average Days | Maximum Days |
|---|---|---|---|---|
| Never Started | 183 | 26.6% | 709 | 2,540 |
| Feasibility Study | 104 | 15.1% | 802 | 1,828 |
| System Impact Study | 96 | 14.0% | 1,027 | 3,651 |
| Facilities Study | 93 | 13.5% | 1,709 | 4,260 |
| Construction Service Agreement (CSA) or beyond | 211 | 30.7% | 1,928 | 5,108 |
| Total | 687 | 100.0% | | |

The time it takes to complete a study depends on the backlog and the number of projects in the queue, but not on the size of the project. Table 12-16 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 717 projects entered in 2014, 2015, and 2016, 494, 68.9 percent, were renewable. Of the 221 projects entered in the first nine months of 2016, 180, 81.4 percent, were renewable.

### Table 12-16 Number of projects entered in the queue as of September 30, 2016

| | Fuel Group | | | |
|---|---|---|---|---|
| Year Entered | Nuclear | Renewable | Traditional | Grand Total |
| 1997 | 2 | 0 | 11 | 13 |
| 1998 | 0 | 0 | 18 | 18 |
| 1999 | 1 | 5 | 85 | 91 |
| 2000 | 2 | 3 | 79 | 84 |
| 2001 | 4 | 6 | 83 | 93 |
| 2002 | 3 | 14 | 33 | 50 |
| 2003 | 1 | 35 | 17 | 53 |
| 2004 | 4 | 17 | 32 | 53 |
| 2005 | 3 | 78 | 51 | 132 |
| 2006 | 9 | 78 | 70 | 157 |
| 2007 | 9 | 68 | 142 | 219 |
| 2008 | 3 | 114 | 99 | 216 |
| 2009 | 10 | 113 | 50 | 173 |
| 2010 | 5 | 381 | 55 | 441 |
| 2011 | 6 | 265 | 78 | 349 |
| 2012 | 2 | 73 | 80 | 155 |
| 2013 | 1 | 78 | 73 | 152 |
| 2014 | 0 | 122 | 68 | 190 |
| 2015 | 0 | 192 | 114 | 306 |
| 2016 | 2 | 180 | 39 | 221 |
| Total | 67 | 1,822 | 1,277 | 3,166 |

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 29.1 percent of the nameplate MW currently active in the queue (Table 12-17).

### Table 12-17 Queue details by fuel group: At September 30, 2016

| Fuel Group | Number of Projects | Percent of Projects | MW | Percent MW |
|---|---|---|---|---|
| Nuclear | 7 | 1.0% | 215.2 | 0.3% |
| Renewable | 466 | 66.5% | 24,480.7 | 29.1% |
| Traditional | 228 | 32.5% | 59,415.5 | 70.6% |
| Total | 701 | 100.0% | 84,111.4 | 100.0% |

Table 12-18 shows the current status of all generation queue projects by fuel type and project classification from January 1, 1997, through September 30, 2016. For example, between January 1, 1997 and September 30, 2016, 134 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 3,166 projects in PJM generation queues. A total of 2,584 projects have been classified as new generation and 582 projects have been classified as upgrades. Wind, solar and natural gas projects have accounted for 2,434 projects, or 76.9 percent, of all 3,166 generation queue projects. A total of 234 new projects from either project classification entered the generation queue in the first nine months of 2016.

### Table 12-18 Status of all generation queue projects: January 1, 1997 through September 30, 2016

| | | Number of Projects | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Status | Project Classification | Natural Gas | Wind | Coal | Solar | Nuclear | Hydro | Oil | Biomass | Storage | Other | LFG | Diesel | TOTAL |
| In Service | New Generation | 86 | 59 | 9 | 95 | 1 | 9 | 4 | 8 | 13 | 3 | 70 | 6 | 363 |
| | Upgrade | 134 | 15 | 45 | 6 | 41 | 17 | 14 | 4 | 3 | 4 | 13 | 2 | 298 |
| Under Construction | New Generation | 35 | 27 | 2 | 60 | 0 | 4 | 0 | 1 | 30 | 0 | 10 | 0 | 169 |
| | Upgrade | 34 | 0 | 5 | 10 | 1 | 0 | 0 | 2 | 5 | 0 | 2 | 0 | 59 |
| Suspended | New Generation | 13 | 16 | 0 | 22 | 0 | 0 | 0 | 0 | 4 | 0 | 1 | 0 | 56 |
| | Upgrade | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| Withdrawn | New Generation | 399 | 360 | 53 | 614 | 9 | 40 | 9 | 32 | 55 | 10 | 74 | 12 | 1,667 |
| | Upgrade | 65 | 13 | 12 | 8 | 9 | 2 | 13 | 1 | 3 | 2 | 7 | 2 | 137 |
| Active | New Generation | 67 | 39 | 0 | 191 | 0 | 1 | 0 | 1 | 26 | 2 | 2 | 0 | 329 |
| | Upgrade | 46 | 6 | 2 | 9 | 6 | 2 | 0 | 0 | 8 | 2 | 0 | 2 | 83 |
| Total Projects | New Generation | 600 | 501 | 64 | 982 | 10 | 54 | 13 | 42 | 128 | 15 | 157 | 18 | 2,584 |
| | Upgrade | 282 | 36 | 64 | 33 | 57 | 21 | 27 | 7 | 19 | 8 | 22 | 6 | 582 |

Table 12-19 shows the MW in Table 12-18 by share by classification as new generation or upgrade. Within a fuel type the shares of upgrades add to 100 percent and the shares of new generation add to 100 percent. For example, 81.0 percent of all hydro projects classified as upgrades are currently in service in PJM, 9.5 percent of hydro upgrades were withdrawn and 9.5 percent are active in the queue. From January 1, 1997, through September 30, 2016, 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 12-19 Status of all generation queue projects as percent of total projects by classification: January 1, 1997 through September 30, 2016

| | | Percent of Total Project MW by Classification | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Status | Project Classification | Natural Gas | Wind | Coal | Solar | Nuclear | Hydro | Oil | Biomass | Storage | Other | LFG | Diesel |
| In Service | New Generation | 14.3% | 11.8% | 14.1% | 9.7% | 10.0% | 16.7% | 30.8% | 19.0% | 10.2% | 20.0% | 44.6% | 33.3% |
| | Upgrade | 47.5% | 41.7% | 70.3% | 18.2% | 71.9% | 81.0% | 51.9% | 57.1% | 15.8% | 50.0% | 59.1% | 33.3% |
| Under Construction | New Generation | 5.8% | 5.4% | 3.1% | 6.1% | 0.0% | 7.4% | 0.0% | 2.4% | 23.4% | 0.0% | 6.4% | 0.0% |
| | Upgrade | 12.1% | 0.0% | 7.8% | 30.3% | 1.8% | 0.0% | 0.0% | 28.6% | 26.3% | 0.0% | 9.1% | 0.0% |
| Suspended | New Generation | 2.2% | 3.2% | 0.0% | 2.2% | 0.0% | 0.0% | 0.0% | 0.0% | 3.1% | 0.0% | 0.6% | 0.0% |
| | Upgrade | 1.1% | 5.6% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Withdrawn | New Generation | 66.5% | 71.9% | 82.8% | 62.5% | 90.0% | 74.1% | 69.2% | 76.2% | 43.0% | 66.7% | 47.1% | 66.7% |
| | Upgrade | 23.0% | 36.1% | 18.8% | 24.2% | 15.8% | 9.5% | 48.1% | 14.3% | 15.8% | 25.0% | 31.8% | 33.3% |
| Active | New Generation | 11.2% | 7.8% | 0.0% | 19.5% | 0.0% | 1.9% | 0.0% | 2.4% | 20.3% | 13.3% | 1.3% | 0.0% |
| | Upgrade | 16.3% | 16.7% | 3.1% | 27.3% | 10.5% | 9.5% | 0.0% | 0.0% | 42.1% | 25.0% | 0.0% | 33.3% |

Table 12-20 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 September 30, 2016 listed in Table 12-18 constitute 56,863.9 MW of nameplate capacity. The 464 new generation and upgrade natural gas projects that have been withdrawn in the same time period constitute 187,986.1 MW of nameplate capacity.

## Table 12-20 Status of all generation capacity (MW) in the PJM generation queue: January 1, 1997 through September 30, 2016

| | | Project MW | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Status | Project Classification | Natural Gas | Wind | Coal | Solar | Nuclear | Hydro | Oil | Biomass | Storage | Other | LFG | Diesel | TOTAL |
| In Service | New Generation | 22,609.8 | 6,485.3 | 1,378.0 | 686.6 | 9.0 | 465.6 | 607.0 | 255.7 | 139.0 | 50.0 | 367.4 | 69.5 | 33,122.8 |
| | Upgrade | 6,224.4 | 33.7 | 755.5 | 9.4 | 3,810.8 | 1,260.6 | 125.8 | 28.8 | 36.4 | 547.5 | 45.3 | 25.3 | 12,903.4 |
| Under Construction | New Generation | 16,486.2 | 4,496.0 | 1,790.0 | 896.4 | 0.0 | 123.1 | 0.0 | 16.0 | 73.1 | 0.0 | 65.1 | 0.0 | 23,945.9 |
| | Upgrade | 1,701.1 | 0.0 | 120.0 | 4.5 | 102.0 | 0.0 | 0.0 | 62.5 | 89.0 | 0.0 | 8.0 | 0.0 | 2,087.1 |
| Suspended | New Generation | 2,002.2 | 2,738.3 | 0.0 | 227.7 | 0.0 | 0.0 | 0.0 | 0.0 | 54.0 | 0.0 | 0.9 | 0.0 | 5,023.0 |
| | Upgrade | 221.6 | 75.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 296.6 |
| Withdrawn | New Generation | 179,394.7 | 56,574.8 | 31,721.6 | 8,010.1 | 8,161.0 | 1,988.0 | 1,721.0 | 1,027.7 | 608.1 | 843.8 | 416.2 | 63.9 | 290,531.0 |
| | Upgrade | 8,591.4 | 289.0 | 815.0 | 47.8 | 916.0 | 56.0 | 589.0 | 12.1 | 32.0 | 24.0 | 39.4 | 29.0 | 11,440.7 |
| Active | New Generation | 33,544.3 | 6,986.0 | 0.0 | 7,212.2 | 0.0 | 12.5 | 0.0 | 3.8 | 362.9 | 26.2 | 8.2 | 0.0 | 48,156.1 |
| | Upgrade | 3,388.6 | 210.0 | 47.0 | 554.2 | 113.2 | 51.0 | 0.0 | 0.0 | 232.6 | 0.0 | 0.0 | 6.1 | 4,602.7 |
| Total Projects | New Generation | 254,037.2 | 77,280.4 | 34,889.6 | 17,033.0 | 8,170.0 | 2,589.2 | 2,328.0 | 1,303.2 | 1,237.1 | 920.0 | 857.7 | 133.4 | 400,778.8 |
| | Upgrade | 20,127.1 | 607.7 | 1,737.5 | 615.9 | 4,942.0 | 1,367.6 | 714.8 | 103.4 | 390.0 | 571.5 | 92.7 | 60.4 | 31,330.5 |

Table 12-21 shows the MW in Table 12-20 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, 43.5 percent of all coal projects classified as upgrades are currently in service in PJM, 5.1 percent are under construction, 46.9 percent were withdrawn and 2.7 percent are active.

## Table 12-21 Status of all generation queue projects as percent of total MW in project classification: January 1, 1997 through September 30, 2016

| | | Percent of Total Project MW by Classification | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Status | Project Classification | Natural Gas | Wind | Coal | Solar | Nuclear | Hydro | Oil | Biomass | Storage | Other | LFG | Diesel |
| In Service | New Generation | 8.9% | 8.4% | 3.9% | 4.0% | 0.1% | 18.0% | 26.1% | 19.6% | 11.2% | 5.4% | 42.8% | 52.1% |
| | Upgrade | 30.9% | 5.5% | 43.5% | 1.5% | 77.1% | 92.2% | 17.6% | 27.9% | 9.3% | 95.8% | 48.9% | 41.9% |
| Under Construction | New Generation | 6.5% | 5.8% | 5.1% | 5.3% | 0.0% | 4.8% | 0.0% | 1.2% | 5.9% | 0.0% | 7.6% | 0.0% |
| | Upgrade | 8.5% | 0.0% | 6.9% | 0.7% | 2.1% | 0.0% | 0.0% | 60.4% | 22.8% | 0.0% | 8.6% | 0.0% |
| Suspended | New Generation | 0.8% | 3.5% | 0.0% | 1.3% | 0.0% | 0.0% | 0.0% | 0.0% | 4.4% | 0.0% | 0.1% | 0.0% |
| | Upgrade | 1.1% | 12.3% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Withdrawn | New Generation | 70.6% | 73.2% | 90.9% | 47.0% | 99.9% | 76.8% | 73.9% | 78.9% | 49.2% | 91.7% | 48.5% | 47.9% |
| | Upgrade | 42.7% | 47.6% | 46.9% | 7.8% | 18.5% | 4.1% | 82.4% | 11.7% | 8.2% | 4.2% | 42.5% | 48.0% |
| Active | New Generation | 13.2% | 9.0% | 0.0% | 42.3% | 0.0% | 0.5% | 0.0% | 0.3% | 29.3% | 2.8% | 1.0% | 0.0% |
| | Upgrade | 16.8% | 34.6% | 2.7% | 90.0% | 2.3% | 3.7% | 0.0% | 0.0% | 59.6% | 0.0% | 0.0% | 10.1% |

Table 12-22 shows the status of all natural gas projects by number of projects that entered PJM generation queues from January 1, 1997 through September 30, 2016, by zone. Of the 113 natural gas projects classified either as new generation or upgrade currently active in the PJM generation queue, 48 projects, 42.5 percent, are located within AEP, ComEd and PENELEC.

## Table 12-22 Status of all natural gas generation queue projects: January 1, 1997 through September 30, 2016

| | | Number of Projects | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Status | Project Classification | AECO | AEP | AP | ATSI | BGE | ComEd | DAY | DEOK | Dominion | DPL | DLCO | EKPC | JCPL | Met-Ed | PECO | PENELEC | Pepco | PPL | PSEG | RECO | TOTAL |
| In Service | New Generation | 7 | 2 | 7 | 0 | 6 | 2 | 0 | 1 | 4 | 7 | 0 | 0 | 8 | 3 | 7 | 6 | 6 | 9 | 11 | 0 | 86 |
| | Upgrade | 7 | 9 | 6 | 1 | 3 | 9 | 6 | 0 | 27 | 13 | 0 | 0 | 5 | 1 | 8 | 6 | 3 | 6 | 24 | 0 | 134 |
| Under Construction | New Generation | 2 | 5 | 1 | 2 | 1 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 1 | 0 | 2 | 5 | 4 | 5 | 3 | 0 | 35 |
| | Upgrade | 1 | 3 | 4 | 1 | 0 | 6 | 0 | 0 | 6 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 2 | 3 | 4 | 0 | 34 |
| Suspended | New Generation | 3 | 1 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 13 |
| | Upgrade | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 3 |
| Withdrawn | New Generation | 23 | 11 | 37 | 12 | 11 | 8 | 0 | 1 | 17 | 18 | 2 | 2 | 22 | 25 | 41 | 46 | 32 | 34 | 55 | 2 | 399 |
| | Upgrade | 5 | 1 | 4 | 3 | 0 | 1 | 0 | 1 | 7 | 4 | 0 | 0 | 5 | 7 | 2 | 4 | 3 | 4 | 14 | 0 | 65 |
| Active | New Generation | 3 | 9 | 7 | 5 | 0 | 11 | 1 | 0 | 3 | 1 | 0 | 1 | 4 | 1 | 1 | 10 | 0 | 5 | 5 | 0 | 67 |
| | Upgrade | 2 | 11 | 6 | 2 | 0 | 6 | 0 | 0 | 4 | 0 | 0 | 0 | 1 | 3 | 2 | 1 | 0 | 4 | 4 | 0 | 46 |
| Total Projects | New Generation | 38 | 28 | 57 | 19 | 18 | 21 | 1 | 2 | 27 | 27 | 3 | 3 | 35 | 29 | 51 | 70 | 42 | 53 | 74 | 2 | 600 |
| | Upgrade | 15 | 25 | 20 | 7 | 3 | 22 | 6 | 1 | 44 | 17 | 0 | 0 | 13 | 11 | 15 | 12 | 8 | 17 | 46 | 0 | 282 |

Table 12-23 shows the status of all gas projects by MW that entered PJM generation queues from January 1, 1997 through September 30, 2016, by zone.

## Table 12-23 Status of all natural gas generation capacity (MW) in the PJM generation queue: January 1, 1997 through September 30, 2016

| | | Project MW | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Status | Project Classification | AECO | AEP | AP | ATSI | BGE | ComEd | DAY | DEOK | Dominion | DPL | DLCO | EKPC | JCPL | Met-Ed | PECO | PENELEC | Pepco | PPL | PSEG | RECO | TOTAL |
| In Service | New Generation | 1,016.2 | 1,615.0 | 1,701.0 | 0.0 | 390.0 | 629.0 | 0.0 | 20.0 | 3,211.0 | 1,122.2 | 0.0 | 0.0 | 2,070.3 | 1,397.0 | 2,464.3 | 1,227.3 | 115.0 | 3,576.6 | 2,054.9 | 0.0 | 22,609.8 |
| | Upgrade | 265.7 | 244.0 | 796.7 | 40.0 | 6.5 | 849.5 | 60.0 | 0.0 | 1,383.7 | 189.0 | 0.0 | 0.0 | 224.0 | 10.0 | 715.0 | 103.0 | 45.1 | 327.3 | 964.9 | 0.0 | 6,224.4 |
| Under Construction | New Generation | 1.5 | 3,314.0 | 930.0 | 816.5 | 1.3 | 0.0 | 0.0 | 0.0 | 3,315.1 | 0.0 | 205.0 | 0.0 | 440.0 | 0.0 | 760.5 | 678.7 | 2,374.0 | 3,074.0 | 575.6 | 0.0 | 16,486.2 |
| | Upgrade | 7.0 | 21.0 | 61.0 | 161.0 | 0.0 | 112.6 | 0.0 | 0.0 | 600.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 206.0 | 0.0 | 124.5 | 154.0 | 254.0 | 0.0 | 1,701.1 |
| Suspended | New Generation | 1,058.0 | 525.0 | 70.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 291.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 58.1 | 0.0 | 0.0 | 0.0 | 0.0 | 2,002.2 |
| | Upgrade | 0.0 | 20.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 200.0 | 0.0 | 0.0 | 1.6 | 0.0 | 0.0 | 0.0 | 0.0 | 221.6 |
| Withdrawn | New Generation | 6,932.0 | 5,535.0 | 15,915.1 | 5,400.8 | 4,792.1 | 3,948.0 | 0.0 | 134.5 | 11,066.0 | 5,651.4 | 665.0 | 377.8 | 10,726.0 | 12,486.5 | 23,270.0 | 16,537.1 | 19,769.2 | 13,576.7 | 22,604.7 | 6.9 | 179,394.7 |
| | Upgrade | 122.8 | 610.0 | 567.0 | 86.0 | 0.0 | 10.0 | 0.0 | 36.0 | 305.3 | 668.0 | 0.0 | 0.0 | 253.0 | 1,730.0 | 205.0 | 1,040.6 | 85.0 | 480.0 | 2,392.7 | 0.0 | 8,591.4 |
| Active | New Generation | 963.0 | 5,897.0 | 3,355.9 | 4,066.9 | 0.0 | 6,123.3 | 1,150.0 | 0.0 | 2,051.9 | 451.0 | 0.0 | 614.0 | 1,827.6 | 450.0 | 220.0 | 1,813.4 | 0.0 | 2,058.9 | 2,501.4 | 0.0 | 33,544.3 |
| | Upgrade | 147.0 | 569.0 | 315.0 | 165.0 | 0.0 | 936.0 | 0.0 | 0.0 | 181.4 | 0.0 | 0.0 | 0.0 | 100.0 | 99.1 | 35.0 | 41.0 | 0.0 | 673.0 | 127.1 | 0.0 | 3,388.6 |
| Total Projects | New Generation | 9,970.7 | 16,886.0 | 21,972.1 | 10,284.2 | 5,183.4 | 10,700.3 | 1,150.0 | 154.5 | 19,644.0 | 7,515.6 | 870.0 | 991.8 | 15,063.9 | 14,333.5 | 26,714.8 | 20,314.6 | 22,258.2 | 22,286.2 | 27,736.6 | 6.9 | 254,037.2 |
| | Upgrade | 542.5 | 1,464.0 | 1,739.7 | 452.0 | 6.5 | 1,908.1 | 60.0 | 36.0 | 2,470.4 | 857.0 | 0.0 | 0.0 | 777.0 | 1,839.1 | 1,161.0 | 1,186.2 | 254.6 | 1,634.3 | 3,738.7 | 0.0 | 20,127.1 |

Table 12-24 shows the status of all wind generation projects that entered PJM generation queues from January 1, 1997 through September 30, 2016, by zone. Of the 74 wind projects to achieve in service status, 55 projects, 74.3 percent are located within ComEd, AP and PENELEC. Of the 45 wind projects currently active in the PJM generation queue, 34 projects, 75.6 percent are located within AEP, ComEd and AP.

## Table 12-24 Status of all wind generation queue projects: January 1, 1997 through September 30, 2016

| | | Number of Projects | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Status | Project Classification | AECO | AEP | AP | ATSI | BGE | ComEd | DAY | DEOK | Dominion | DPL | DLCO | EKPC | JCPL | Met-Ed | PECO | PENELEC | Pepco | PPL | PSEG | RECO | TOTAL |
| In Service | New Generation | 1 | 8 | 11 | 0 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 17 | 0 | 4 | 0 | 0 | 59 |
| | Upgrade | 0 | 0 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 4 | 0 | 0 | 15 |
| Under Construction | New Generation | 1 | 9 | 5 | 1 | 0 | 5 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 27 |
| | Upgrade | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Suspended | New Generation | 1 | 7 | 1 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 16 |
| | Upgrade | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Withdrawn | New Generation | 15 | 76 | 39 | 6 | 0 | 91 | 13 | 0 | 12 | 8 | 0 | 1 | 1 | 0 | 0 | 58 | 0 | 39 | 1 | 0 | 360 |
| | Upgrade | 1 | 0 | 7 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 13 |
| Active | New Generation | 0 | 16 | 4 | 1 | 0 | 9 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 39 |
| | Upgrade | 0 | 0 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 6 |
| Total Projects | New Generation | 18 | 116 | 60 | 8 | 0 | 123 | 15 | 0 | 19 | 11 | 0 | 1 | 2 | 1 | 0 | 80 | 0 | 46 | 1 | 0 | 501 |
| | Upgrade | 2 | 0 | 14 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 6 | 0 | 0 | 36 |

Table 12-25 shows the wind project capacity in MW of all wind generation projects that have entered the PJM generation queue from January 1, 1997 through September 30, 2016, by zone. Wind projects in ComEd, AEP and PENELEC accounted for 56,132.4 MW, or 72.1 percent of all nameplate wind generation capacity in the PJM generation queue. Of the 6,519.0 MW of wind generation capacity to complete the generation queue process and achieve in service status, 6,519.0 MW, or 94.9 percent of nameplate capacity is located within ComEd, AEP, AP and PENELEC. Of the 7,196.0 MW of wind generation capacity currently active in the PJM generation queue, 5,984.0 MW of generation capacity or 83.2 percent is located within AEP, ComEd and AP.

## Table 12-25 Status of all wind generation capacity (MW) in the PJM generation queue: January 1, 1997 through September 30, 2016

| | | Project MW | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Status | Project Classification | AECO | AEP | AP | ATSI | BGE | ComEd | DAY | DEOK | Dominion | DPL | DLCO | EKPC | JCPL | Met-Ed | PECO | PENELEC | Pepco | PPL | PSEG | RECO | TOTAL |
| In Service | New Generation | 7.5 | 2,052.0 | 1,031.4 | 0.0 | 0.0 | 2,238.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.6 | 70.0 | 0.0 | 856.1 | 0.0 | 199.2 | 0.0 | 0.0 | 6,485.3 |
| | Upgrade | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.4 | 0.0 | 27.3 | 0.0 | 0.0 | 33.7 |
| Under Construction | New Generation | 150.0 | 1,218.3 | 650.0 | 500.0 | 0.0 | 1,153.5 | 0.0 | 0.0 | 685.9 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 38.3 | 0.0 | 0.0 | 0.0 | 0.0 | 4,496.0 |
| | 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 | 1,398.3 | 60.0 | 0.0 | 0.0 | 710.0 | 300.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 150.0 | 0.0 | 100.0 | 0.0 | 0.0 | 2,738.3 |
| | Upgrade | 5.0 | 0.0 | 70.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 75.0 |
| Withdrawn | New Generation | 3,626.4 | 14,263.4 | 2,828.5 | 645.6 | 0.0 | 21,305.8 | 1,828.0 | 0.0 | 2,082.9 | 2,210.0 | 0.0 | 150.3 | 60.0 | 0.0 | 0.0 | 4,847.6 | 0.0 | 2,706.3 | 20.0 | 0.0 | 56,574.8 |
| | Upgrade | 0.0 | 0.0 | 199.0 | 0.0 | 0.0 | 4.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 80.0 | 0.0 | 6.0 | 0.0 | 0.0 | 289.0 |
| Active | New Generation | 0.0 | 3,910.4 | 323.8 | 18.0 | 0.0 | 1,559.8 | 0.0 | 0.0 | 358.2 | 499.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 150.0 | 0.0 | 166.2 | 0.0 | 0.0 | 6,986.0 |
| | Upgrade | 0.0 | 0.0 | 20.0 | 0.0 | 0.0 | 170.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.0 | 0.0 | 0.0 | 0.0 | 0.0 | 210.0 |
| Total Projects | New Generation | 3,803.9 | 22,842.4 | 4,893.7 | 1,163.6 | 0.0 | 26,967.6 | 2,128.0 | 0.0 | 3,127.0 | 2,809.6 | 0.0 | 150.3 | 90.6 | 70.0 | 0.0 | 6,042.0 | 0.0 | 3,171.7 | 20.0 | 0.0 | 77,280.4 |
| | Upgrade | 5.0 | 0.0 | 289.0 | 0.0 | 0.0 | 174.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 106.4 | 0.0 | 33.3 | 0.0 | 0.0 | 607.7 |

Table 12-26 shows the status of all solar generation projects that have entered the PJM generation queue from January 1, 1997 through September 30, 2016, by zone. Solar projects have been highly concentrated in several zones as of September 30, 2016. Out of a total of 1015 solar projects in the PJM generation queue, 495 projects or 48.8 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, 43.6 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 200 active new generation projects, 88 projects, or 44.0 percent of all currently active new generation solar projects are located in Dominion.

## Table 12-26 Status of all solar generation queue projects: January 1, 1997 through September 30, 2016

| | | Number of Projects | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Status | Project Classification | AECO | AEP | AP | ATSI | BGE | ComEd | DAY | DEOK | Dominion | DPL | DLCO | EKPC | JCPL | Met-Ed | PECO | PENELEC | Pepco | PPL | PSEG | RECO | TOTAL |
| In Service | New Generation | 5 | 3 | 2 | 0 | 1 | 1 | 1 | 0 | 6 | 5 | 0 | 0 | 33 | 0 | 1 | 0 | 0 | 2 | 35 | 0 | 95 |
| | Upgrade | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| Under Construction | New Generation | 3 | 3 | 6 | 0 | 2 | 0 | 2 | 0 | 6 | 12 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 2 | 9 | 0 | 60 |
| | Upgrade | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| Suspended | New Generation | 0 | 4 | 7 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 6 | 1 | 0 | 1 | 0 | 0 | 2 | 0 | 22 |
| | Upgrade | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Withdrawn | New Generation | 147 | 16 | 43 | 6 | 4 | 7 | 4 | 4 | 45 | 78 | 0 | 0 | 148 | 11 | 5 | 10 | 6 | 25 | 55 | 0 | 614 |
| | Upgrade | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| Active | New Generation | 8 | 13 | 14 | 2 | 6 | 1 | 2 | 1 | 82 | 42 | 0 | 2 | 9 | 1 | 0 | 0 | 0 | 0 | 8 | 0 | 191 |
| | Upgrade | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 9 |
| Total Projects | New Generation | 163 | 39 | 72 | 8 | 13 | 9 | 9 | 5 | 140 | 137 | 0 | 2 | 211 | 13 | 6 | 11 | 6 | 29 | 109 | 0 | 982 |
| | Upgrade | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 9 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 33 |

Table 12-27 shows the MW for solar projects in the generation queue. Solar project MW have been highly concentrated in several zones as of September 30, 2016. Out of a total of 17,648.9 MW of solar nameplate capacity in the PJM generation queue since 1997, 4,181.5 MW or 23.7 percent have been located in JCPL, AECO and PSEG, all zones in New Jersey. Solar projects in Dominion have accounted for 6,148.9 MW or 34.8 percent of all solar project nameplate capacity in the PJM queue from January 1, 1997 through September 30, 2016. Solar projects in DPL have accounted for 2,567.9 MW or 14.5 percent of all solar project nameplate capacity in the PJM queue from January 1, 1997 through September 30, 2016.

**Table 12-27 Current status of all solar generation capacity (MW) in the PJM generation queue: January 1, 1997 through September 30, 2016**

| | | Project MW | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Status | Project Classification | AECO | AEP | AP | ATSI | BGE | ComEd | DAY | DEOK | Dominion | DPL | DLCO | EKPC | JCPL | Met-Ed | PECO | PENELEC | Pepco | PPL | PSEG | RECO | TOTAL |
| In Service | New Generation | 38.5 | 10.1 | 34.0 | 0.0 | 1.1 | 9.0 | 2.5 | 0.0 | 157.0 | 38.4 | 0.0 | 0.0 | 211.3 | 0.0 | 3.3 | 0.0 | 0.0 | 15.0 | 166.4 | 0.0 | 686.6 |
| | 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 | 6.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.4 |
| Under Construction | New Generation | 20.8 | 34.6 | 88.5 | 0.0 | 22.0 | 0.0 | 23.4 | 0.0 | 318.4 | 154.5 | 0.0 | 0.0 | 172.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.0 | 56.2 | 0.0 | 896.4 |
| | 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 | 51.7 | 68.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.0 | 0.0 | 0.0 | 0.0 | 75.9 | 3.0 | 0.0 | 13.5 | 0.0 | 0.0 | 9.7 | 0.0 | 227.7 |
| | Upgrade | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Withdrawn | New Generation | 1,628.8 | 330.5 | 761.7 | 60.1 | 9.2 | 84.8 | 51.5 | 63.0 | 1,466.2 | 1,148.5 | 0.0 | 0.0 | 1,228.1 | 367.0 | 50.1 | 34.3 | 58.1 | 277.7 | 390.6 | 0.0 | 8,010.1 |
| | Upgrade | 10.0 | 6.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 8.0 | 0.0 | 0.0 | 0.0 | 23.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 47.8 |
| Active | New Generation | 42.4 | 1,100.3 | 256.0 | 326.0 | 22.1 | 2.0 | 99.8 | 125.0 | 3,652.8 | 1,226.5 | 0.0 | 160.0 | 54.8 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 44.5 | 0.0 | 7,212.2 |
| | Upgrade | 0.0 | 19.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 533.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 0.0 | 554.2 |
| Total Projects | New Generation | 1,730.5 | 1,527.2 | 1,209.0 | 386.1 | 54.4 | 95.8 | 177.2 | 188.0 | 5,599.4 | 2,567.9 | 0.0 | 160.0 | 1,742.1 | 470.0 | 53.4 | 47.8 | 58.1 | 298.7 | 667.5 | 0.0 | 17,033.0 |
| | Upgrade | 10.0 | 25.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 549.5 | 0.0 | 0.0 | 0.0 | 30.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 0.0 | 615.9 |

# 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.[28] 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.[29]

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.[30] Table 12-28 shows that 82.2 percent of the requested outages were planned for less than or equal to five days and 3.7 percent of requested outages were planned for greater than 30 days in the first nine months of 2016. All of the outage data in this section except in the analysis

28 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).

29 See PJM. "Manual 3: Transmission Operations," Revision 49 (June 1, 2016), p.61.

30 See PJM. "Manual 3: Transmission Operations," Revision 49 (June 1, 2016), p.62.

for the FTR market are for outages scheduled to occur in the first nine months of 2015 and 2016, regardless of when they were initially submitted.[31] The outage data in the analysis for the FTR market are for outages scheduled to occur in the planning periods 2015 to 2016 and 2016 to 2017.

### Table 12-28 Transmission facility outage request summary by planned duration: January through September, 2015 and 2016

| | 2015 (Jan - Sep) | | 2016 (Jan - Sep) | |
|---|---|---|---|---|
| Planned Duration (Days) | Outage Requests | Percent | Outage Requests | Percent |
| <=5 | 11,433 | 79.1% | 11,555 | 82.2% |
| >5 & <=30 | 2,209 | 15.3% | 1,978 | 14.1% |
| >30 | 812 | 5.6% | 523 | 3.7% |
| Total | 14,454 | 100.0% | 14,056 | 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 12-29.[32]

The purpose of the rules defined in Table 12-29 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.[33]

### Table 12-29 PJM transmission facility outage request received status definition

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

Table 12-30 shows a summary of requests by received status. In the first nine months of 2016, 51.5 percent of outage requests received were late.

### Table 12-30 Transmission facility outage request summary by received status: January through September, 2015 and 2016

| | 2015 (Jan - Sep) | | | | 2016 (Jan - Sep) | | | |
|---|---|---|---|---|---|---|---|---|
| Planned Duration (Days) | On Time | Late | Total | Percent Late | On Time | Late | Total | Percent Late |
| <=5 | 5,964 | 5,469 | 11,433 | 47.8% | 5,763 | 5,792 | 11,555 | 50.1% |
| >5 & <=30 | 1,063 | 1,146 | 2,209 | 51.9% | 886 | 1,092 | 1,978 | 55.2% |
| >30 | 299 | 513 | 812 | 63.2% | 163 | 360 | 523 | 68.8% |
| Total | 7,326 | 7,128 | 14,454 | 49.3% | 6,812 | 7,244 | 14,056 | 51.5% |

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

31 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.
32 See PJM. "Manual 3: Transmission Operations," Revision 49 (June 1, 2016), p.62 and p.63.
33 See "Report of PJM Interconnection, L.L.C. on Transmission Oversight Procedures," Docket No. EL01-122-000 (November 2, 2001).

Procedures.[34] Table 12-31 is a summary of outage requests by emergency status. Of all outage requests scheduled to occur in the first nine months of 2016, 14.5 percent were for emergency outages. Of all outage requests scheduled to occur in the first nine months of 2015, 14.2 percent were for emergency outages.

### Table 12-31 Transmission facility outage request summary by emergency: January through September, 2015 and 2016

| | 2015 (Jan - Sep) | | | | 2016 (Jan - Sep) | | | |
|---|---|---|---|---|---|---|---|---|
| Planned Duration (Days) | Emergency | Non Emergency | Total | Percent Emergency | Emergency | Non Emergency | Total | Percent Emergency |
| <=5 | 1,654 | 9,779 | 11,433 | 14.5% | 1,692 | 9,863 | 11,555 | 14.6% |
| >5 & <=30 | 314 | 1,895 | 2,209 | 14.2% | 287 | 1,691 | 1,978 | 14.5% |
| >30 | 87 | 725 | 812 | 10.7% | 57 | 466 | 523 | 10.9% |
| Total | 2,055 | 12,399 | 14,454 | 14.2% | 2,036 | 12,020 | 14,056 | 14.5% |

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

After PJM determines that a late request may cause congestion, PJM informs the Transmission Owner of solutions available to eliminate the congestion. For example, if a generator planned or maintenance outage request is contributing to the congestion, PJM can request that the Generation Owner defer the outage. If no solutions are available, PJM may require the Transmission Owner to reschedule or cancel the outage. Table 12-32 is a summary of outage requests by congestion status. Of all outage requests submitted to occur in the first nine months of 2016, 8.9 percent were expected to cause congestion. Of all the outage requests that were expected to cause congestion, 3.1 percent (39 out of 1,257) were denied by PJM in the first nine months of 2016 (Table 12-34).

34 PJM. "Manual 3: Transmission Operations," Revision 49 (June 1, 2016), p. 73.

### Table 12-32 Transmission facility outage request summary by congestion: January through September, of 2015 and 2016

| | 2015 (Jan - Sep) | | | | 2016 (Jan - Sep) | | | |
|---|---|---|---|---|---|---|---|---|
| Planned Duration (Days) | Congestion Expected | No Congestion Expected | Total | Percent Congestion Expected | Congestion Expected | No Congestion Expected | Total | Percent Congestion Expected |
| <=5 | 1,102 | 10,331 | 11,433 | 9.6% | 985 | 10,570 | 11,555 | 8.5% |
| >5 & <=30 | 251 | 1,958 | 2,209 | 11.4% | 228 | 1,750 | 1,978 | 11.5% |
| >30 | 86 | 726 | 812 | 10.6% | 44 | 479 | 523 | 8.4% |
| Total | 1,439 | 13,015 | 14,454 | 10.0% | 1,257 | 12,799 | 14,056 | 8.9% |

Table 12-33 shows the outage requests summary by received status, congestion status and emergency status. In the first nine months of 2016, 37.1 percent of requests were submitted late and were nonemergency while 1.7 (258 out of 14,056) percent of requests were late, nonemergency, and expected to cause congestion.

### Table 12-33 Transmission facility outage requests that by received status, congestion and emergency: January through September, 2015 and 2016

| | | 2015 (Jan - Sep) | | | | 2016 (Jan - Sep) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Submission Status | | Congestion Expected | No Congestion Expected | Total | Percent | Congestion Expected | No Congestion Expected | Total | Percent |
| Late | Emergency | 95 | 1,948 | 2,043 | 14.1% | 83 | 1,941 | 2,024 | 14.4% |
| | Non Emergency | 253 | 4,832 | 5,085 | 35.2% | 258 | 4,962 | 5,220 | 37.1% |
| On Time | Emergency | 3 | 9 | 12 | 0.1% | 0 | 12 | 12 | 0.1% |
| | Non Emergency | 1,088 | 6,226 | 7,314 | 50.6% | 916 | 5,884 | 6,800 | 48.4% |
| Total | | 1,439 | 13,015 | 14,454 | 100.0% | 1,257 | 12,799 | 14,056 | 100.0% |

Once PJM processes an outage request, the outage request is labelled as Submitted, Received, Denied, Approved, Cancelled by Company, Revised, Active or Complete according to the processed stage of a request.[35] Table 12-34 shows the detailed process status for outage requests only for the outage requests that are expected to cause congestion. All process status categories except Cancelled, Complete or Denied are in the In Process category in Table 12-34. Table 12-34 shows that 13.8 (173 out of 1,257) percent outage requests which were expected to cause congestion were nonemergency, late,

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

but approved and completed and 3.1 percent (39 out of 1,257) of the outage requests which were expected to cause congestion were nonemergency, late and denied in the first nine months of 2016.

requests were approved by PJM and then rescheduled by the TOs, and 1.5 percent of the transmission outages were approved by PJM and subsequently cancelled by the TOs.

**Table 12-34 Transmission facility outage requests that might cause congestion status summary: January through September, 2015 and 2016**

| | | 2015 (Jan - Sep) | | | | | | 2016 (Jan - Sep) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Submission Status | | Cancelled | Complete | In Process | Denied | Congestion Expected | Percent Complete | Cancelled | Complete | In Process | Denied | Congestion Expected | Percent Complete |
| Late | Emergency | 10 | 84 | 0 | 1 | 95 | 5.8% | 2 | 79 | 0 | 2 | 83 | 6.3% |
| | Non Emergency | 48 | 178 | 2 | 25 | 253 | 12.4% | 44 | 173 | 2 | 39 | 258 | 13.8% |
| On Time | Emergency | 0 | 0 | 0 | 0 | 0 | 0.0% | 0 | 0 | 0 | 0 | 0 | 0.0% |
| | Non Emergency | 292 | 745 | 2 | 49 | 1,088 | 68.5% | 218 | 670 | 0 | 28 | 916 | 73.1% |
| Total | | 350 | 1,007 | 4 | 75 | 1,436 | 70.1% | 264 | 922 | 2 | 69 | 1,257 | 73.3% |

There are clear rules defined for assigning On time or Late status for submitted outage requests in both the PJM Tariff and PJM Manuals.[36] However, the On time or Late status only affects the priority that PJM assigns for processing the outage request. Many (67.1 percent or 173 out of 258) nonemergency, expected to cause congestion, late transmission outages were approved and completed. The expected impact on congestion is the basis for PJM's treatment of late outage requests. But there is no rule or clear definition of this congestion analysis in the PJM Manuals. The MMU recommends that PJM draft a clear definition of the congestion analysis required for transmission outage requests to include in Manual 3 after appropriate review.

## Rescheduling Transmission Facility Outage Requests

A TO can reschedule or cancel an outage after initial submission. Table 12-35 is a summary of all the outage requests planned for the first nine months of 2015 and 2016 which were approved and then cancelled or rescheduled by TOs at least once. If an outage request was submitted, approved and subsequently rescheduled at least once, the outage request will be counted as Approved and Rescheduled. If an outage request was submitted, approved and subsequently cancelled at least once, the outage request will be counted as Approved and Cancelled. In the first nine months of 2016, 5.2 percent of transmission outage

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

**Table 12-35 Rescheduled and cancelled transmission outage request summary: January through September, 2015 and 2016**

| | 2015 (Jan - Sep) | | | | | 2016 (Jan - Sep) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 | 79,347 | 3,360 | 4.2% | 1,833 | 2.3% | 74,571 | 2,796 | 3.7% | 1,385 | 1.9% |
| >5 & <=30 | 17,244 | 2,364 | 13.7% | 141 | 0.8% | 20,554 | 1,668 | 8.1% | 88 | 0.4% |
| >30 | 7,545 | 1,357 | 18.0% | 51 | 0.7% | 5,424 | 740 | 13.6% | 19 | 0.4% |
| Total | 104,136 | 7,081 | 6.8% | 2,025 | 1.9% | 100,549 | 5,204 | 5.2% | 1,492 | 1.5% |

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

A transmission outage ticket with a duration of five days or less with an On Time status can retain its on time status if the outage is rescheduled within the original scheduled month.[37] 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.[38] 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.

37 PJM. "Manual 3: Transmission Operations," Revision 49 (June 1, 2016), p. 68.
38 PJM. "Manual 3: Transmission Operations," Revision 49 (June 1, 2016), p. 68.

## Long Duration Transmission Facility Outage Requests

PJM rules (Table 12-29) 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 12-36 shows that there were 9,423 transmission equipment planned outages in the first nine months of 2016, of which 475 were planned outages longer than 30 days, and of which 103 or 1.1 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 12-36 Transmission outage summary: January through September of 2015 and 2016**

| | | 2015 (Jan - Sep) | | 2016 (Jan - Sep) | |
|---|---|---|---|---|---|
| Duration | Divided into Shorter Periods | Number of Outages | Percent | Number of Outages | Percent |
| > 30 Days | No | 732 | 8.0% | 475 | 5.0% |
| | Yes | 117 | 1.3% | 103 | 1.1% |
| <= 30 Days | | 8,255 | 90.7% | 8,845 | 93.9% |
| Total | | 9,104 | 100.0% | 9,423 | 100.0% |

Table 12-37 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 nine months of 2016, there would have been one outages with a combined duration longer than 30 days that were instead scheduled to occur as shorter outages within a period of less than or equal to 31 days. In the first nine months of 2016, there would have been 19 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 12-37 Summary of potentially long duration (> 30 days) outages: January through September, of 2015 and 2016**

| | 2015 (Jan - Sep) | | 2016 (Jan - Sep) | |
|---|---|---|---|---|
| Days | Number of Outages | Percent | Number of Outages | Percent |
| <=31 | 5 | 4.3% | 1 | 1.0% |
| >31 & <=62 | 13 | 11.1% | 19 | 18.4% |
| >62 and <=93 | 18 | 15.4% | 15 | 14.6% |
| >93 | 81 | 69.2% | 68 | 66.0% |
| Total | 117 | 100.0% | 103 | 100.0% |

## Transmission Facility Outage Analysis for the FTR Market

Transmission facility outages affect the price and quantity outcomes of FTR auctions. The purpose of the rules is to ensure that outages are known with enough lead time prior to FTR auctions so that market participants can understand market conditions and so that PJM can accurately model market conditions. Outage requests must be submitted according to rules based on planned outage duration (Table 12-29). The rules defining when an outage is late are based on the timing of FTR auctions. When an outage request is submitted late, the outage will be marked as Late and may be denied if it is expected to cause congestion. Table 12-41 shows that 479 outage requests with a duration of two weeks or longer but shorter than two months were late, and only one of them were denied by PJM. Table 12-41 also shows that 117 outage requests with a duration of two months or longer were late and only one of them were denied by PJM in the 2016 to 2017 planning year.

There are Long Term, Annual and Monthly Balance of Planning Period auctions in the FTR market. When determining transmission outages to be modeled in the annual ARR allocation and FTR auction, PJM does not consider outages with planned durations shorter than two weeks, does consider some outages with planned duration longer than two weeks but shorter than two months, and does consider all outages with planned duration longer than or equal to two months. PJM 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.[39]

Table 12-38 shows that 86.3 percent of the outage requests for outages expected to occur during the planning period 2016 to 2017 had a planned duration of less than two weeks and that 40.4 (4,365 out of 10,805) percent of all outage requests for the planning period were submitted late according to outage submission rules.

**Table 12-38 Transmission facility outage requests by received status: Planning periods 2015 to 2016 and 2016 to 2017**

| | 2015/2016 | | | | 2016/2017 | | | |
|---|---|---|---|---|---|---|---|---|
| Planned Duration | On Time | Late | Total | Percent | On Time | Late | Total | Percent |
| <2 weeks | 8,782 | 8,777 | 17,559 | 88.6% | 5,551 | 3,769 | 9,320 | 86.3% |
| >=2 weeks & <2 months | 815 | 946 | 1,761 | 8.9% | 757 | 479 | 1,236 | 11.4% |
| >=2 months | 172 | 329 | 501 | 2.5% | 132 | 117 | 249 | 2.3% |
| Total | 9,769 | 10,052 | 19,821 | 100.0% | 6,440 | 4,365 | 10,805 | 100.0% |

Table 12-39 shows outage requests summary by emergency status. Of all outage requests for outages expected to occur in the 2016 to 2017 planning year and submitted late, 73.5 percent were for nonemergency outages.

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

### Table 12-39 Transmission facility outage requests by received status and emergency: Planning periods 2015 to 2016 and 2016 to 2017

| | | 2015/2016 | | | | 2016/2017 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Planned Duration | Emergency | Non Emergency | Total | Percent Non Emergency | Emergency | Non Emergency | Total | Percent Non Emergency |
| On Time | <2 weeks | 16 | 8,766 | 8,782 | 99.8% | 6 | 5,545 | 5,551 | 99.9% |
| | >=2 weeks & <2 months | 4 | 811 | 815 | 99.5% | 0 | 757 | 757 | 100.0% |
| | >=2 months | 0 | 172 | 172 | 100.0% | 0 | 132 | 132 | 100.0% |
| | Total | 20 | 9,749 | 9,769 | 99.8% | 6 | 6,434 | 6,440 | 99.9% |
| Late | <2 weeks | 2,392 | 6,385 | 8,777 | 72.7% | 1,054 | 2,715 | 3,769 | 72.0% |
| | >=2 weeks & <2 months | 160 | 786 | 946 | 83.1% | 80 | 399 | 479 | 83.3% |
| | >=2 months | 57 | 272 | 329 | 82.7% | 22 | 95 | 117 | 81.2% |
| | Total | 2,609 | 7,443 | 10,052 | 74.0% | 1,156 | 3,209 | 4,365 | 73.5% |

PJM analyzes expected congestion for both on time and late outage requests. A late outage request may be denied or cancelled if it is expected to cause congestion. Table 12-40 shows a summary of requests by expected congestion and received status. Overall, 5.8 percent of all outage requests for outages expected to occur in the 2016 to 2017 planning year and submitted late were requests that were expected to cause congestion.

### Table 12-40 Transmission facility outage requests by submission status and congestion: Planning periods 2015 to 2016 and 2016 to 2017

| | | 2015/2016 | | | | 2016/2017 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Planned Duration | Congestion Expected | No Congestion Expected | Total | Percent Congestion Expected | Congestion Expected | No Congestion Expected | Total | Percent Congestion Expected |
| On Time | <2 weeks | 1,143 | 7,639 | 8,782 | 13.0% | 695 | 4,856 | 5,551 | 12.5% |
| | >=2 weeks & <2 months | 165 | 650 | 815 | 20.2% | 107 | 650 | 757 | 14.1% |
| | >=2 months | 40 | 132 | 172 | 23.3% | 24 | 108 | 132 | 18.2% |
| | Total | 1,348 | 8,421 | 9,769 | 13.8% | 826 | 5,614 | 6,440 | 12.8% |
| Late | <2 weeks | 369 | 8,408 | 8,777 | 4.2% | 210 | 3,559 | 3,769 | 5.6% |
| | >=2 weeks & <2 months | 47 | 899 | 946 | 5.0% | 34 | 445 | 479 | 7.1% |
| | >=2 months | 14 | 315 | 329 | 4.3% | 7 | 110 | 117 | 6.0% |
| | Total | 430 | 9,622 | 10,052 | 4.3% | 251 | 4,114 | 4,365 | 5.8% |

Table 12-41 shows that 62.7 percent of late outage requests with a duration of two weeks or longer but shorter than two months were active or completed, 0.2 percent were denied by PJM and 10.9 percent of late outage requests with a duration of two weeks or longer but shorter than two months were cancelled by company in the 2016 to 2017 planning year. The table also shows that 65.0 percent of late outage requests with duration of two months or longer were active or completed, one of them were denied, and 9.4 percent were cancelled by company in the 2016 to 2017 planning year.

### Table 12-41 Transmission facility outage requests by received status and processed status: Planning periods 2015 to 2016 and 2016 to 2017

| | | 2015/2016 | | | | 2016/2017 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Planned Duration | Processed Status | On Time | Percent | Late | Percent | On Time | Percent | Late | Percent |
| <2 weeks | In Progress | 16 | 0.2% | 143 | 1.6% | 2,187 | 39.4% | 375 | 9.9% |
| | Denied | 70 | 0.8% | 54 | 0.6% | 45 | 0.8% | 48 | 1.3% |
| | Approved | 0 | 0.0% | 0 | 0.0% | 23 | 0.4% | 47 | 1.2% |
| | Cancelled by Company | 2,383 | 27.1% | 1,041 | 11.9% | 1,038 | 18.7% | 384 | 10.2% |
| | Revised | 0 | 0.0% | 0 | 0.0% | 11 | 0.2% | 2 | 0.1% |
| | Active | 0 | 0.0% | 1 | 0.0% | 77 | 1.4% | 60 | 1.6% |
| | Completed | 6,313 | 71.9% | 7,538 | 85.9% | 2,170 | 39.1% | 2,853 | 75.7% |
| Total Submission | | 8,782 | 100.0% | 8,777 | 100.0% | 5,551 | 100.0% | 3,769 | 100.0% |
| >=2 weeks & <2 months | In Progress | 0 | 0.0% | 12 | 1.3% | 419 | 55.4% | 122 | 25.5% |
| | Denied | 1 | 0.1% | 4 | 0.4% | 9 | 1.2% | 1 | 0.2% |
| | Approved | 0 | 0.0% | 0 | 0.0% | 1 | 0.1% | 3 | 0.6% |
| | Cancelled by Company | 231 | 28.3% | 82 | 8.7% | 112 | 14.8% | 52 | 10.9% |
| | Revised | 0 | 0.0% | 0 | 0.0% | 1 | 0.1% | 1 | 0.2% |
| | Active | 0 | 0.0% | 0 | 0.0% | 87 | 11.5% | 109 | 22.8% |
| | Completed | 583 | 71.5% | 848 | 89.6% | 128 | 16.9% | 191 | 39.9% |
| Total Submission | | 815 | 100.0% | 946 | 100.0% | 757 | 100.0% | 479 | 100.0% |
| >=2 months | In Progress | 0 | 0.0% | 8 | 2.4% | 48 | 36.4% | 29 | 24.8% |
| | Denied | 1 | 0.6% | 0 | 0.0% | 6 | 4.5% | 1 | 0.9% |
| | Approved | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% |
| | Cancelled by Company | 36 | 20.9% | 23 | 7.0% | 32 | 24.2% | 11 | 9.4% |
| | Revised | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% |
| | Active | 6 | 3.5% | 36 | 10.9% | 40 | 30.3% | 49 | 41.9% |
| | Completed | 129 | 75.0% | 262 | 79.6% | 6 | 4.5% | 27 | 23.1% |
| Total Submission | | 172 | 100.0% | 329 | 100.0% | 132 | 100.0% | 117 | 100.0% |

Table 12-42 shows that there were 479 outage requests with a duration of two weeks or longer but shorter than two months submitted late, of which 32 were nonemergency and expected to cause congestion in the 2016 to 2017 planning year. Of the 32 such requests, 12 were in process, one was denied, three were cancelled by company, and 16 were active or complete. For the outages planned for two months or longer, there were 117 total outages submitted late, of which six requests were nonemergency. Of those requests, three were in process, two were cancelled by company and one was active.

## Table 12-42 Transmission facility outage requests by received status, processed status, emergency and congestion: Planning periods 2015 to 2016 and 2016 to 2017

| | | 2015/2016 | | | | | | 2016/2017 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | On Time | | | Late | | | On Time | | | Late | | |
| Planned Duration | Processed Status | Non Emergency and Congestion Expected | Total | Percent | Non Emergency and Congestion Expected | Total | Percent | Non Emergency and Congestion Expected | Total | Percent | Non Emergency and Congestion Expected | Total | Percent |
| <2 weeks | In Progress | 0 | 16 | 0.0% | 1 | 143 | 0.7% | 246 | 2,187 | 11.2% | 16 | 375 | 4.3% |
| | Denied | 32 | 70 | 45.7% | 18 | 54 | 33.3% | 23 | 45 | 51.1% | 28 | 48 | 58.3% |
| | Approved | 0 | 0 | 0.0% | 0 | 0 | 0.0% | 3 | 23 | 13.0% | 1 | 47 | 2.1% |
| | Cancelled by Company | 304 | 2,383 | 12.8% | 60 | 1,041 | 5.8% | 111 | 1,038 | 10.7% | 22 | 384 | 5.7% |
| | Revised | 0 | 0 | 0.0% | 0 | 0 | 0.0% | 0 | 11 | 0.0% | 0 | 2 | 0.0% |
| | Active | 0 | 0 | 0.0% | 0 | 1 | 0.0% | 8 | 77 | 10.4% | 1 | 60 | 1.7% |
| | Completed | 804 | 6,313 | 12.7% | 204 | 7,538 | 2.7% | 304 | 2,170 | 14.0% | 82 | 2,853 | 2.9% |
| Total Submission | | 1,140 | 8,782 | 13.0% | 283 | 8,777 | 3.2% | 695 | 5,551 | 12.5% | 150 | 3,769 | 4.0% |
| >=2 weeks & <2 months | In Progress | 0 | 0 | 0.0% | 1 | 12 | 8.3% | 51 | 419 | 12.2% | 12 | 122 | 9.8% |
| | Denied | 1 | 1 | 100.0% | 0 | 4 | 0.0% | 1 | 9 | 11.1% | 1 | 1 | 100.0% |
| | Approved | 0 | 0 | 0.0% | 0 | 0 | 0.0% | 0 | 1 | 0.0% | 0 | 3 | 0.0% |
| | Cancelled by Company | 30 | 231 | 13.0% | 4 | 82 | 4.9% | 5 | 112 | 4.5% | 3 | 52 | 5.8% |
| | Revised | 0 | 0 | 0.0% | 0 | 0 | 0.0% | 1 | 1 | 100.0% | 0 | 1 | 0.0% |
| | Active | 0 | 0 | 0.0% | 0 | 0 | 0.0% | 20 | 87 | 23.0% | 6 | 109 | 5.5% |
| | Completed | 134 | 583 | 23.0% | 39 | 848 | 4.6% | 29 | 128 | 22.7% | 10 | 191 | 5.2% |
| Total Submission | | 165 | 815 | 20.2% | 44 | 946 | 4.7% | 107 | 757 | 14.1% | 32 | 479 | 6.7% |
| >=2 months | In Progress | 0 | 0 | 0.0% | 0 | 8 | 0.0% | 9 | 48 | 18.8% | 3 | 29 | 10.3% |
| | Denied | 1 | 1 | 100.0% | 0 | 0 | 0.0% | 2 | 6 | 33.3% | 0 | 1 | 0.0% |
| | Approved | 0 | 0 | 0.0% | 0 | 0 | 0.0% | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| | Cancelled by Company | 2 | 36 | 5.6% | 0 | 23 | 0.0% | 2 | 32 | 6.3% | 2 | 11 | 18.2% |
| | Revised | 0 | 0 | 0.0% | 0 | 0 | 0.0% | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| | Active | 0 | 6 | 0.0% | 0 | 36 | 0.0% | 10 | 40 | 25.0% | 1 | 49 | 2.0% |
| | Completed | 37 | 129 | 28.7% | 13 | 262 | 5.0% | 1 | 6 | 16.7% | 0 | 27 | 0.0% |
| Total Submission | | 40 | 172 | 23.3% | 13 | 329 | 4.0% | 24 | 132 | 18.2% | 6 | 117 | 5.1% |

Even if an outage were submitted on time according to the transmission outage rules, it would not be modeled in the FTR model if it were submitted after the Annual FTR Auction bidding opening date. Table 12-43 shows that 82.1 percent of outage requests labelled on time according to rules were submitted or rescheduled after the annual FTR bidding opening date in the 2016 to 2017 planning year.

### Table 12-43 Transmission facility outage requests by received status and bidding opening date: Planning periods 2015 to 2016 and 2016 to 2017

| | 2015/2016 | | | | | | 2016/2017 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | 638 | 8,144 | 92.7% | 10 | 8,767 | 99.9% | 821 | 4,730 | 85.2% | 14 | 3,755 | 99.6% |
| >=2 weeks & <2 months | 204 | 611 | 75.0% | 12 | 934 | 98.7% | 249 | 508 | 67.1% | 21 | 458 | 95.6% |
| >=2 months | 40 | 132 | 76.7% | 6 | 323 | 98.2% | 80 | 52 | 39.4% | 5 | 112 | 95.7% |
| Total | 882 | 8,887 | 91.0% | 28 | 10,024 | 99.7% | 1,150 | 5,290 | 82.1% | 40 | 4,325 | 99.1% |

Table 12-44 shows that 70.4 percent of late outage requests which were submitted or rescheduled after the Annual FTR Auction bidding opening date were approved and complete in the 2016 to 2017 planning.

### Table 12-44 Late transmission facility outage requests that are submitted after annual bidding opening date: Planning periods 2015 to 2016 and 2016 to 2017

| | 2015/2016 | | | 2016/2017 | | |
|---|---|---|---|---|---|---|
| Planned Duration | Completed Outages | Total | Percent | Completed Outages | Total | Percent |
| <2 weeks | 7,538 | 8,777 | 85.9% | 2,853 | 3,769 | 75.7% |
| >=2 weeks & <2 months | 848 | 946 | 89.6% | 191 | 479 | 39.9% |
| >=2 months | 262 | 329 | 79.6% | 27 | 117 | 23.1% |
| Total | 8,648 | 10,052 | 86.0% | 3,071 | 4,365 | 70.4% |

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

## Transmission Facility Outage Analysis in the Day-Ahead Market

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

PJM maintains the history of outage requests including all the processed status changes and all the starting or ending date changes. Any such status change is defined as an instance. For example, if an outage request were submitted, received, approved and completed, there are four instances of the outage request. If an outage request is revised, that is an instance. There may be more than one instance for each outage request due to the change of the processed status. In the day-ahead market transmission outage analysis, all

instances of the outages that are planned to occur in the first nine months of 2015 and 2016 are included.[40]

The MMU analyzed the outage request instances relative to the day-ahead market according to their status, time of status changed, and their planned start or end date.

Table 12-45 shows that in the first nine months of 2016 8.3 percent (7,254 of 87,571) of outage request instances were nonemergency and late for the day-ahead market, and 0.7 percent (626 out of 87,571) of nonemergency outage request instances were submitted late for the day-ahead market, nonemergency and PJM expected them to cause congestion.

**Table 12-45 Transmission facility outage request instance summary by congestion and emergency: January through September, 2015 and 2016**

| | | 2015 (Jan - Sep) | | | | 2016 (Jan - Sep) | | | |
|---|---|---|---|---|---|---|---|---|---|
| For Day-ahead Market | Submission Status | Congestion Expected | No Congestion Expected | Total | Percent | Congestion Expected | No Congestion Expected | Total | Percent |
| Late | Emergency | 134 | 3,048 | 3,182 | 3.1% | 67 | 2,844 | 2,911 | 3.3% |
| | Non Emergency | 1,425 | 8,758 | 10,183 | 10.0% | 626 | 6,628 | 7,254 | 8.3% |
| On Time | Emergency | 454 | 5,262 | 5,716 | 5.6% | 296 | 4,979 | 5,275 | 6.0% |
| | Non Emergency | 9,585 | 72,660 | 82,245 | 81.2% | 6,905 | 65,226 | 72,131 | 82.4% |
| | Total | 11,598 | 89,728 | 101,326 | 100.0% | 7,894 | 79,677 | 87,571 | 100.0% |

In order to analyze the market impact, the status is compared of Approved and Active outages for the operating day: before the day-ahead market is closed; after the day-ahead market is closed; and during the operating day. If the status of these outages was the same for all three periods, the outages are not expected to have a negative market impact because market participants and PJM will have accurate information about outages prior to the close of the day-ahead market. When running the day-ahead model, PJM includes all Submitted, Received, Approved, Revised and Active outages. But these outages may or may not be approved and active during the operating day. As a result, PJM should include only Approved and Active outage instances in the day-ahead market because this will reflect the impact of outages during the operating day more accurately.

A negative impact on the market occurs when market participants do not have accurate information on transmission outages for the operating day prior to the close of the day-ahead market. Not all late outage instances have negative impact on market. For example, if an outage were submitted after the day-ahead market close on the day before its planned start date, it would have a negative impact on market only if it were approved or active for the operating day. The market impact of an outage instance is categorized based on its processed status type and subsequent changes to its status. For Submitted, Received or Revised outage instances, if they were submitted after the day-ahead market is closed and were approved or active during the operating day, those outage instances would have a negative impact on the market because they were not known by market participants. For Approved outage instances, if they were approved after the day-ahead market is closed, for the operating day, they would have a negative impact on market because they were not known by market participants. For Cancelled outage instances, if they were cancelled after the day-ahead market is closed, for the operating day, they would have a negative impact on market because they were not known by market participants.

Active or Complete outage instances are analyzed differently than the other types of outage instances. For Active outage instances, the time when the outage was active is compared with the requested start date of the outage. If the time when the outage became active was not the same as the requested start date/time of the outage, it would have a negative impact on the market because accurate information was not available to market participants. For Complete outage instances, the time when the outage was complete is compared with the requested end date of the outage. If the time when the outage was complete was not the same as the requested end date of the outage, it would have a negative impact on the market because accurate information was not available to market participants.

40 The EMS tripping outage request instances were excluded.

Table 12-46 shows that there were 33,712 outage request instances submitted in the first nine months of 2016, of which 13,933 (41.3 percent) were nonemergency, not expected to cause congestion and might have negative impact on market. Among all the Active outage request instances, 770 (6.6 percent) would have negative impact on market. Among all the Completed outage request instances, 8,246 (69.4 percent) would have negative impact on market.

### Table 12-46 Late, Approved or Completed transmission facility outage request instance status summary by congestion and emergency: January through September, 2015 and 2016

| | 2015 (Jan - Sep) | | | | | | | | 2016 (Jan - Sep) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Emergency | | | | Non Emergency | | | | Emergency | | | | Non Emergency | | | | |
| | Congestion Negative Impact | | Non Congestion Negative Impact | | Congestion Negative Impact | | Non Congestion Negative Impact | | Congestion Negative Impact | | Non Congestion Negative Impact | | Congestion Negative Impact | | Non Congestion Negative Impact | | |
| Processed Status | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Total |
| Submitted | 6 | 1 | 1,206 | 186 | 44 | 14 | 635 | 199 | 5 | 1 | 1,353 | 136 | 19 | 9 | 626 | 121 | 2,270 |
| Received | 41 | 2 | 397 | 95 | 362 | 25 | 1,158 | 256 | 11 | 1 | 349 | 75 | 92 | 13 | 734 | 166 | 1,441 |
| Denied | 0 | 0 | 5 | 0 | 52 | 0 | 63 | 0 | 2 | 0 | 6 | 0 | 18 | 0 | 27 | 0 | 53 |
| Approved | 58 | 0 | 409 | 0 | 499 | 0 | 1,498 | 0 | 32 | 0 | 295 | 0 | 133 | 0 | 966 | 0 | 1,426 |
| Cancelled by Company | 9 | 1 | 35 | 72 | 83 | 18 | 1,064 | 125 | 4 | 0 | 26 | 57 | 98 | 6 | 839 | 88 | 1,118 |
| Revised | 12 | 4 | 347 | 296 | 203 | 125 | 2,089 | 1,671 | 8 | 3 | 320 | 227 | 154 | 84 | 1,725 | 1,336 | 3,857 |
| Active | 8 | 74 | 1,142 | 575 | 69 | 979 | 801 | 7,775 | 7 | 70 | 1,271 | 513 | 31 | 838 | 770 | 8,169 | 11,669 |
| Completed | 82 | 11 | 1,648 | 145 | 937 | 85 | 8,152 | 741 | 73 | 9 | 1,664 | 163 | 800 | 84 | 8,246 | 839 | 11,878 |
| Total | 216 | 93 | 5,189 | 1,369 | 2,249 | 1,246 | 15,460 | 10,767 | 142 | 84 | 5,284 | 1,171 | 1,345 | 1,034 | 13,933 | 10,719 | 33,712 |