Resource Retirements, Replacements & Risks

Frequently Asked Questions

April 21, 2023

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Contents

Overview

The third phase of PJM's ongoing study of impacts associated with the energy transition explores the pace of resource retirements and replacements through 2030 and highlights potential reliability risks to meeting growing electricity demand across 13 states and the District of Columbia.

Energy Transition in PJM: Resource Retirements, Replacements and Risks is the latest study in a multiyear, multiphase effort undertaken in light of industry trends and PJM's strategic focus on helping to facilitate state and federal decarbonization policies reliably and cost-effectively.

This document addresses frequently asked questions that were discussed during the February 23 Markets & Reliability Committee (MRC) meeting and March 28 Energy Transition in PJM workshop.

Administrative

1. ***Does PJM intend to update this report?***

   PJM does not intend to provide updates to the Energy in Transition: Resource Retirements, Replacements and Risks paper. PJM will continue to analyze and monitor risks related to the changing resource mix, such as legislative and regulatory developments, and conduct additional studies as warranted.

2. ***Will PJM be providing a data annex with more of the numerical values behind the report?***

   A data annex will not be provided given market-sensitive and licensing issues related to the content of the study. The published white paper contains references to public source material and other reports that can be used for external analysis.

Retirements

3. ***What percentage of each (fuel) fleet are assumed to retire?***

   Based on study assumptions, PJM estimates that 49% of the coal fleet, 14% of the natural gas fleet and 44% of the oil fleet will retire. [March 28 Workshop, Slide 16]

4. ***How much energy did the assumed retirements produce?***

   The study did not include annual energy production or capacity factors in the analysis.

5. ***Did PJM consider natural gas retirements broken down by level of "fuel security" – including which units have dual fuel?***

   The study did not include fuel assurance or security in the analysis. In the economic retirement analysis, resources were assumed to operate on the cheaper fuel, and physical fuel supply was not constrained.

6. ***Is the 40 GW of retirements in ICAP terms or ELCC (accredited) terms? [March 28 Workshop, Slide 6]***

   This study reflects megawatts of retirements in Installed Capacity (ICAP) terms. The 27 GW of policy and economic retirement resources are composed of fossil fuel resources, which under today's capacity resource business rules are accredited in ICAP terms.

7. ***What would the impact be if PJM were to find that specific retirements reduced reserve margins below targets?***

   PJM conducts a generator retirement analysis when an announcement is made to address timing. If the analysis determines a retirement could reduce the reserve margin below the target level, PJM would take necessary action as described in Manual 18 and Section 16 of Attachment DD of the Open Access Transmission Tariff.

8. ***If a generator announces a retirement and PJM analysis identifies a reliability issue, will PJM delay the retirement even if the state has a policy intent to retire?***

   Plant owners considering retirement must notify PJM within the quarter that is at least two quarters before the proposed deactivation date. Transmission owners will then complete a reliability analysis in the subsequent quarter. This process looks five years ahead, using standard criteria to identify any resulting potential transmission system problems in the surrounding area. PJM may order transmission upgrades or additions to be built by transmission owners to accommodate the loss of generation. PJM has no authority to order plants to continue operating. However, in certain cases, to maintain reliability, it may formally request that a plant owner continue operating, subject to FERC-authorized rates, while the transmission upgrades are completed.

9. ***Why do the MW totals in the Total Forecasts by Year and Annual Policy Retirement graphics appear not to align?***

   - ***In the paper, comparing Figure 1 and Figure 3***
   - ***In the workshop presentation, comparing Slide 8 and Slide 16***

   The Potential Policy Retirements graphic reflects only policy retirement resources, by policy cause, aligned by the policy exit year. If a policy resource is also affected by the economic study, it will be included in the stack of the policy exit year. The majority of policies are expected to go into effect in the latter half of the decade.

   The Total Forecast Retirement by Year graphic reflects totals for 2022 actual, announced, policy and economic retirement resources, aligned by the study exit year.

   Economic retirement resources are assumed to exit in 2023 or 2024 depending on capacity commitments for the 2023/2024 Delivery Year, which was the last Base Residual Auction (BRA) that was executed prior to the study. Policy retirement resources that are also economic retirement resources will reflect the megawatts exiting in 2023 or 2024; otherwise they are aligned to their policy exit year.

   These economic retirements reduce the policy retirements in 2026 and 2027, but the net retirement by 2030 is preserved.

The timeline of these potential quantities of resource retirements does not factor in any reliability "off-ramps" that may be included in established policies.

Policy Retirement Assumptions

10. How is PJM allocating responsibilities for retirement between specific policies?

If more than one policy impacts a unit, the attribution will be to the policy that is estimated to result in the earliest retirement date.

11. Which of the policies studied in the report have reliability safety valve provisions, and were they considered in the report?

The IL CEJA, NJ CO_2, EPA GNR, and EPA CCR contain reliability safety valve provisions (provisions which enable units to operate for reliability purposes). PJM considers reliability safety valve conditions as temporary measures to allow for the reliable transition of resources, and not as provisions that would allow for unlimited retirement deferral. The study did not consider potential reliability safety valves, as they mainly address timing of retirements to maintain reliability.

12. How will final changes in the Good Neighbor Rule impact the projected retirements? Were there any other changes to policy retirements?

The final Good Neighbor Rule moved the requirement that would necessitate the installation of NOx controls or selective catalytic reduction from 2026 to 2030. This moves the estimated retirement date of 4,400 MW from 2026 to 2030. The NJ CO_2 rule analysis was also updated since the MRC presentation, with about 1,100 MW of estimated retirements moving from 2027 to 2035 and beyond.

13. What impact do recent EPA actions have on the study?

On March 29, 2023, EPA published a final rule to extend the date for existing coal-fired power plants to submit a notice of planned participation (NOPP) for the permanent cessation of coal combustion subcategory in the 2020 Steam Electric Reconsideration. This rule extends the deadline for units that wish to participate in permanently ceasing coal combustion by December 31, 2028, from October 13, 2021, to June 27, 2023.

Additionally, on March 29, 2023, EPA proposed Supplemental Effluent Limitation Guidelines and Standards for electric generating units. The proposal updates limitations on flue gas desulfurization wastewater, bottom ash transport water, and combustion residual leachate at existing sources. This proposal is not included in the study.

On April 5, 2023, EPA proposed an update to the Mercury and Air Toxics Standards rule. The proposal requires coal-fired units to meet a filterable particulate standard and install particulate continuous emissions monitors. The proposal is expected to be finalized in March of 2024, with three years from the promulgation date to achieve compliance. This proposal is not included in the study.

14. ***Are any of the 5,800 MW of identified Illinois CEJA retirements eligible to avoid retirement through refueling to hydrogen?***

    Illinois CEJA requires zero emissions of CO_2 and co-pollutants. Combusting hydrogen, while potentially addressing CO_2, does not address co-pollutants such as nitrogen oxides.

Economic Retirement Assumptions

15. ***Does the report base its economic retirement projection on the assumption that 2023/24 capacity prices continue through 2030?***

    PJM evaluated resource exit from economic factors using 2023/2024 BRA capacity clearing prices, forward energy prices and forward fuel for 2023 and 2024. If a resource showed net negative revenue in those years, it was assumed to exit. The study did not execute an interleaved entry/exit model for each year through 2030. The intent of the study was to provide a simple analysis that compared potential exits, entry and demand requirements to inform discussions. Future capacity market prices reflect the additional capital required beyond energy revenues for the reliable operation of capacity resources, and are cleared against demand curves indexed against the Net Cost of New Entry (Net CONE). The energy transition over the next decade has many potential paths as resources enter and exit the wholesale energy markets, and this analysis explored two of those potential future outcomes.

16. ***How is PJM allocating responsibility for retirements between policy and economic?***

    If a retirement is estimated to be based on the economic impact of a policy, then the retirement is attributed to policy. If the economic analysis shows the retirement of a unit that is also a policy unit, the retirement is attributed to economic, if the economic retirement is prior to the policy retirement. If the economic retirement is after the policy retirement, it is attributed to policy.

17. ***In a footnote, it states that RGGI and RECs are "implicitly" included. How are they addressed in the model?***

    In the economic analysis, the energy and ancillary service revenues reflect the incorporation of RGGI carbon emission costs in the short-run marginal cost (SRMC) used to commit and dispatch the resources in a production cost simulation. At the time of the study (Fall 2022), fossil resources in Pennsylvania were not considered part of the RGGI program.

Effective Load Carrying Capability (ELCC) Treatment

18. ***Why is ELCC included in the Workshop Forecasted Retirements slide?***

    In the workshop, this slide was describing resource exit analyzed within the study. The study assumed that the current intermittent capacity resources (renewables) will continue operating through 2030, but their accredited capacity (ICAP) will reduce approximately 1.2 GW (from 3.5 GW to 2.3 GW) due to the introduction of other intermittent capacity resources. While this reduction is not driven by policy or economics, the ELCC methodology is a form of capacity exit that was appropriate for this point of the discussion.

19. How was ELCC determined and applied in the study?

The ELCC factors were taken from previously published PJM studies, as the nameplate capacity in the December 2021 Effective Load Carrying Capability (ELCC) Report reasonably aligns with the nameplate in the High New Entry scenario. The study did not recalculate ELCC resource class factors for the specific portfolios used in the study. The study did not consider potential revisions to ELCC under tighter reserve margin scenarios. The factors that result from the ELCC methodology are calculated to a 1-in-10-year risk, which is not affected by declining margin (% IRM). While the study did not consider ELCC methodologies applied to non-intermittent capacity resources, PJM will be evaluating thermal performance in future analysis.

New Entry

Generating Resource Assumptions

20. How were the New Entry Scenarios created?

The study aligns new entry with the S&P Global Planning and Fast Transition models' renewable entry expectations, but modifies the fossil entry with assumptions specific to this study. The study's High New Entry scenario was generated from a blend of the commercial probability analysis and the S&P Global forecast, with modified assumptions on rates of fossil entry and ELCC accreditation. The High New Entry scenario accounts for IRP-based development of renewable energy projects. The commercial probability assessment in the study used a combination of resource type, fuel type and physical location, derived from the most recent 10-year history of the New Services Queue Withdraw/In-Service records.

21. How did PJM integrate other dynamics that can accelerate project completion, such as state permitting requirements?

The study incorporates future accelerating rates of new entry from forecasts generated by S&P Global, which take into account a number of costs and state laws that impact completion rates and assume accelerated transmission expansion. Completion rates are only applicable to PJM queue projects in estimating the potential Withdraw/In-Service completion of proposed capacity. The nameplate provided in the S&P Global forecasts are those that are assumed to go In Service in the targeted year, without information on potential future queue growth.

22. Does this report consider the price-signaling function of the capacity market?

This study did not intend to forecast future capacity prices and its retention of existing capacity in the 2025–2030 time period as capacity margins are forecast to tighten.

23. Does this report account for the impacts of the Inflation Reduction Act (IRA)?

Referencing footnote 20 from the report, S&P Global, North American Power Market Outlook, Sept. 2022, Fast Transition mode: This planning case assumes carbon net neutrality by 2050 through the IRA and additional policies, such as state clean energy policies, and as such assumes adjustments for increased electrification of heating, tax credits for renewable generation and higher levels of fossil retirements.

24. How are state offshore wind targets considered?

The study assumes up to 10 GW of offshore wind will commercialize by 2030 consistent with state targets as of the fall of 2022.

Demand Side Response Assumptions

25. How were demand response (DR) and other demand-side resources treated in the study?

The study assumed that DR participation would remain constant at current levels, consistent with the 2023/2024 BRA, through the study period. In PJM's energy market, the majority of DR participate as emergency products with capacity commitments, and this is assumed to continue. The study did not consider additional distribution-side (behind the meter) or price responsive demand (PRD) resources as new capacity. PJM did not attempt to determine the impacts of FERC Order 2222 in this study.

Load

26. How were Fixed Resource Requirement (FRR) areas addressed in the study?

The study did not evaluate the proportion of FRR to BRA installed capacity that would be utilized by a given Locational Deliverability Area (LDA), nor did PJM evaluate adjustments to FRR demand levels.

27. How was data-center load growth addressed in the study?

Data center load growth is presented as an increase to the RTO total peak demand, which must be served from other installed capacity within the RTO. PJM annually solicits information from its members to help bring awareness to trends in load growth (or decline) of substantive factors. Data centers have been a prominent instance of that in recent years.

28. Under the electrification load growth scenario, how much additional demand response is projected from the 17 million EVs and 11 million heat pumps?

The study uses electrification load growth consistent with the Energy Transition in PJM: Emerging Characteristics of a Decarbonizing Grid report. The contribution of additional electrification demand is applied each year, with a 2.1 GW contribution by 2030.

29. What are the report's assumptions regarding Distributed Energy Resources (DER)?

DER that are in the PJM interconnection queue would be considered. The report does not make any assumption regarding DER that participate in PJM markets via aggregation through FERC Order 2222. The PJM load forecast makes assumptions for DER that are behind the meter and net with load. PJM contracts with S&P Global to provide a solar capacity additions forecast, which is then translated to production estimates based on capacity factor data from UL Solutions. The starting point for the analysis were the assumptions used for capacity additions in the PJM Solar and Battery Forecast 2021 by IHS Markit/S&P Global.

30. What energy efficiency forecast is used in the report?

PJM does not create an explicit energy efficiency forecast. Energy efficiency is implicitly captured through calibration in the models used to produce the load forecast. Data from the U.S. Energy Information

Administration's Annual Energy Outlook is used in the calibration to reflect the continued improvement in end-use efficiency.

31. ***The report states that under the electrification scenario, resource adequacy risks shifts from summer to winter (p. 15). Can you provide the winter peaks under this scenario? Was the change in load profile considered in projecting future ELCC values?***

    The reference on page 15 to a shift in resource adequacy risk from summer to winter was based on a finding in the PJM report Energy Transition in PJM: Emerging Characteristics of a Decarbonizing Grid.

    Baseline expectations are for 50/50 winter peaks to be a little more than 90% of the summer 50/50 by 2035, whereas the electrification sensitivity modeled would narrow that peak delta to 97%. Ultimately, the rate of electrification could be more or less depending on numerous factors, and this sensitivity was intended to show the potential impact of untapped end-uses.

    This study does not address increased winter risk, as winter peak demand is projected to be less than summer peak demand through 2030. Changes in the ratio of winter to summer load changes will be reflected in resource adequacy analysis such as reserve margin calculations and effective load carrying capability analysis.

32. ***In context of demand, summer demand is used as a proxy, but winter demand is increasingly becoming an issue – have we considered ability to meet demand on an 8,760 (all hours of the year) basis?***

    Resource adequacy analysis considers the whole year and the demand profile, and also has consideration for winter forced outage rates during the winter peak week. This topic is also in discussion at the Resource Adequacy Senior Task Force (now Critical Issue Fast Path – Resource Adequacy), where PJM is seeking improvements to further capture winter risk.

Risks

33. ***How are existing resources that don't have a capacity obligation treated?***

    Resources without a capacity obligation were included in the economic analysis and were treated as if they had no capacity revenues. Fossil resources with projected net negative revenues relative to class Avoidable Cost Rates were assumed to exit, and renewable resources were assumed to remain.

34. ***Are the reserve margins in Table 1 in the report reflecting only cleared capacity from modeled capacity market results incorporating the forecasted retirements, supply additions, demand growth and renewables impact?***

    The reserve margins in Table 1 reflect the net entry and exit described in the study, relative to the specified load forecast, and account for reduced capacity accreditation from the intermittent renewable resources.

Study Takeaways and Path Forward

35. Why did PJM publish this study at this time?

The study identifies risks to resource adequacy on the horizon and highlights the importance of:

- PJM's ongoing stakeholder initiatives in the Resource Adequacy Senior Task Force, Critical Issue Fast Path – Resource Adequacy, Clean Attribute Procurement Senior Task Force and Interconnection Process Subcommittee
- Continued efforts between PJM and state and federal agencies to manage reliability impacts of policies and regulations
- The urgency for coordinated actions needed to maintain resource adequacy

36. Are you also going to look at resilience or reliability attributes lost (onsite fuel, etc.) and their impact in the future? Has PJM identified problems with the changing resource mix not being able to provide these services?

PJM has discussed operational attributes in its first paper in the Energy Transition in PJM series, Frameworks for Analysis (March 2022), as well as previous studies: Reliability in PJM: Today and Tomorrow (March 2021) and PJM's Evolving Resource Mix and System Reliability (March 2017). In 2022, PJM and stakeholders assessed the need for reliability products and services through an Operating Committee process as an offshoot of the Resource Adequacy Senior Task Force. This effort resulted in a number of recommendations for immediate action in various stakeholder groups. Moving forward, PJM will continue to monitor and take action on evolving needs for essential reliability services.

37. What geographic component is PJM assessing with these retirements? If none, will you consider it in the future?

This study did not consider geographic impacts of retiring resources, but instead used a "copper-plate" RTO, which assumes no congestion, for supply. Retirement assumptions included in this study are being analyzed in the next phase of the Energy Transition in PJM study, which is expected to be released in late summer 2023.

38. What is the impact of Winter Storm Elliott on retirements?

This study did not consider the impact of Winter Storm Elliott. The most up-to-date information on Winter Storm Elliott can be found on PJM's Winter Storm Elliott page.

39. Is there another study that focused on transmission impacts?

PJM has previously published studies focused on transmission impacts of the evolving grid, including the Illinois Generation Retirement Study (August 2022), Grid of the Future: PJM's Regional Planning Perspective (May 2022), and the Offshore Wind Transmission Study (October 2021). PJM studies requested generation deactivation, as described in the response to Question 8. PJM is also continuing to develop its scenario analysis framework for Long-Term Regional Transmission Planning (RTEP) and targeting to engage stakeholder discussions in 2023.

40. Is PJM able to roll these anticipated reliability problems into RTEP, or would changes need to be made to consider these anticipated retirements and queue scenarios?

PJM is working to identify and support key initiatives for special studies, including the development of new scenarios for the RTEP process. Any potential process changes resulting from these studies will be discussed in collaboration with PJM stakeholders.

41. Is PJM's interconnection process, with reforms, expected to be able to keep pace with either of the new entry scenarios?

PJM expects up to 60 GW of new resources (more than 200 GW nameplate) to clear the queue through 2026, which, if built, would keep pace with the high new entry scenario.