



PENNSYLVANIA HOUSE CONSUMER PROTECTION, TECHNOLOGY & UTILITIES COMMITTEE

**Statement of Asim Z. Haque on behalf of PJM
Interconnection, L.L.C.**

June 20, 2023

For Public Use

I. Introduction

Good morning, Chair Matzie, Chair Marshall and members of the committee. Thank you for the opportunity to appear before you today. My name is Asim Haque, and I am the Vice President of State and Member Services for PJM.

PJM Interconnection (PJM) is a regional transmission organization (RTO) responsible for the reliable operation of the electric grid serving 65 million customers in 13 states and the District of Columbia, including all of Pennsylvania. Ensuring a safe and reliable bulk power system – keeping the lights on – is PJM’s most important priority. This requires constant system monitoring by skilled operators and real-time coordination with other operating entities and industry sectors. PJM also strives to utilize its scale and competitive processes to keep costs low for consumers.

Reliability and affordability are cornerstones for what PJM does on a day-to-day basis.

My testimony today provides an introduction to PJM and its role as an RTO, addresses PJM’s perspectives on the reliability and resilience of the bulk power system and makes five key points. In summary:

- **The U.S. electric grid is experiencing an accelerating transition toward the use of intermittent renewable generation.** This transition is primarily driven by local, state and federal policies, combined with consumer decisions, aimed at mitigating the critical risk posed by climate change. This transition is evident in PJM’s interconnection queue, where we currently have more than 250,000 MW of generation to be studied for interconnection, 97% of which is either renewable or batteries or a hybrid of both.
- **PJM has sufficient generation to meet the needs of our system today. However, as we look further out, we are concerned by the trends we see.** Specifically, the generation fueled by fossil fuels (mostly coal and natural gas) that we rely upon to balance the grid is retiring at a significant rate. Electrification of the transportation, industrial and building sectors is poised to create material load growth. Our region is also experiencing significant data center construction, which is creating major pockets of increasing demand on the system. New generation in the queue is largely intermittent, so we need multiple megawatts to replace one megawatt of retiring generation. And, new generation is coming online slower than anticipated. If these trends continue, our models show increased risk of having insufficient resources later in this decade to maintain the reliable electric service that consumers expect.
- **This is not a concern unique to the PJM grid.** Indeed, as the North American Electric Reliability Corporation’s (NERC) recent summer assessment shows, roughly two-thirds of the U.S. (but not the PJM region) already faces increased resource adequacy risk this summer.¹
- **Industry and policymakers can take steps now to de-risk the transition.** These steps include implementation of policies that accelerate the pace of new generation and transmission entry, such as permitting reform, further interconnection reform and policies that reduce backlog in the supply chain. They also include adoption of policies that slow down the retirement or restriction of existing generation until replacement generation is deployed and operational at scale. We also encourage an approach to policymaking that expressly considers reliability impacts in the development phase of the policy and not after the fact.

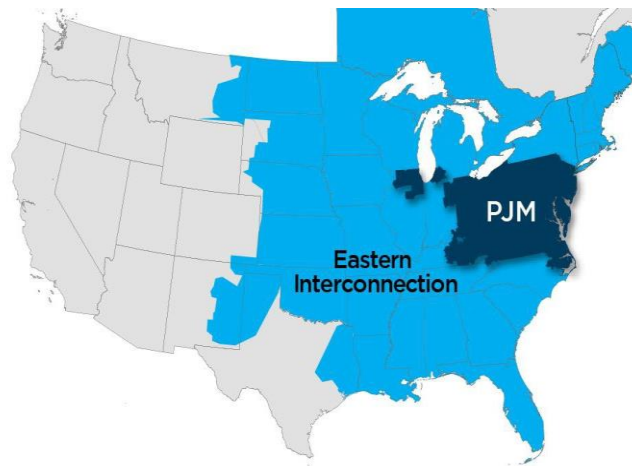
¹ [2023 Summer Reliability Assessment](#), North American Electric Reliability Corporation, May 2023.

- **PJM embraces its role to help reliably facilitate this industry transition while using competitive markets to drive efficiencies.** We have already taken significant steps toward this goal, including interconnection queue reform, which is expected to result in the processing of over 200,000 MW of new generation requests in the next three years and coordination with state and federal governments on maintaining system reliability while developing and implementing their specific energy policies. PJM, our members and our stakeholders continue to work on additional steps toward this goal, which currently include and/or will include efforts to further accelerate the interconnection of new generation, enhance our forward-looking transmission planning process, and appropriately value the reliability attributes needed to support a system that is more reliant on just-in-time fuel resources. PJM is also launching an initiative to bring all of its activities targeted at ensuring a reliable transition under a single umbrella.²

II. The Role of PJM

PJM ensures the reliable flow of power to all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and Washington, D.C., as shown in **Figure 1**. As such, we are responsible for ensuring reliable and efficient delivery of electricity over the bulk electric system to one-fifth of the nation. **We are fuel-neutral in carrying out this function, valuing resources using different fuel types based on their reliability value and cost-effectiveness.**

Figure 1. PJM Service Territory

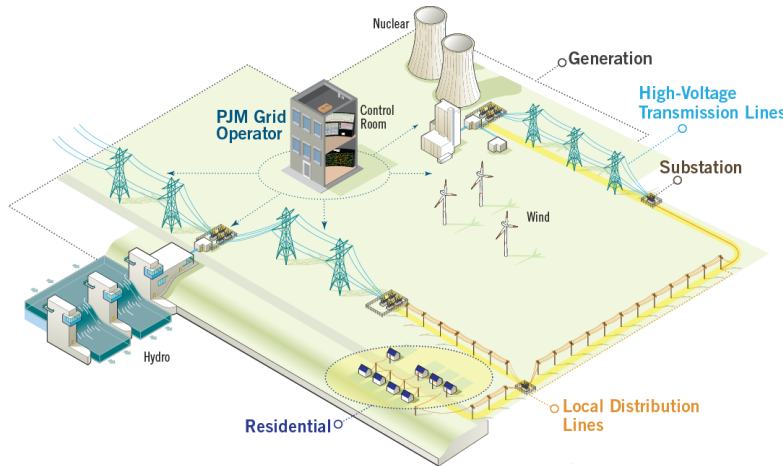


The PJM grid consists of 88,115 miles of transmission lines and approximately 1,400 generation sources of all types, including coal, natural gas, nuclear, wind, solar, batteries and hydro facilities, along with more than 500 demand response and energy efficiency resources. We are interconnected with our neighboring systems in the Eastern Interconnection, which geographically includes over two-thirds of the United States and Canada. **PJM is independent of the various market participants, and we do not own nor do we profit from any particular type of resource.**

² See PJM's [Ensuring a Reliable Energy Transition](#) web page at PJM.com.

PJM is responsible for a portion of the infrastructure necessary to serve customers in its footprint. **Figure 2** is a basic diagram of how the power grid functions. Electricity is generated, then transmitted across high voltage transmission lines, and then to distribution substations where Pennsylvania’s local utilities distribute it to consumers. **PJM oversees the generation and transmission of power, which is generally referred to as the “bulk” electric system.**

Figure 2. The Distribution of Power



The scale of the PJM system provides tremendous value for grid reliability. Electrons do not know state boundaries and travel across a vast network of interstate transmission. PJM plans for and operates this system in a manner that is both reliable and cost-effective. PJM has a diverse portfolio of resources and a footprint that spans multiple states and time zones. Operating our region as one cohesive system affords us the flexibility to rely on these resources across different locations and allows us to better absorb abrupt disturbances to the system. Further, using competitive processes for the construction of transmission and competitive markets for the procurement of power, PJM is able to derive significant cost savings for consumers. **All in all, through the use of our regional scale and competition, PJM is able to save consumers approximately \$3.2–\$4.0 billion annually as seen in Figure 3³.**

Figure 3. PJM Value Proposition



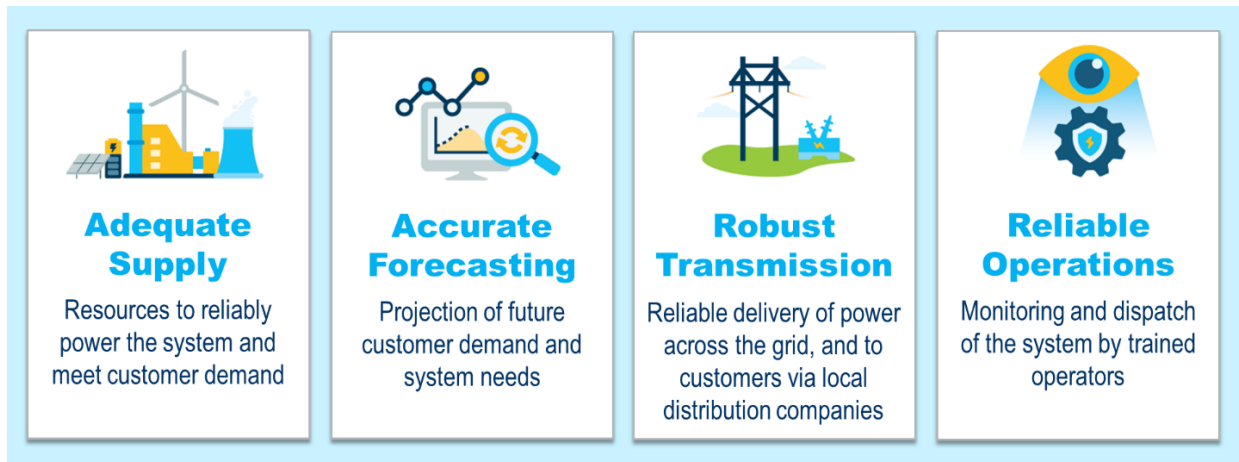
³ All numbers are estimates.

The Building Blocks of Reliability

Regardless of resource mix, illustrated in **Figure 4**, the four building blocks of bulk power system reliability remain the same:

- **Adequate Supply:** There must be sufficient generation and other resources, including demand response, available on the system to meet customer demand at all times.
- **Accurate Forecasting:** Accurately predicting the demand for electricity for the next hours and days, as well as years into the future, enables reliable planning and operation of the system. Forecasts consider multiple drivers, including weather, economics and customer behavior.
- **Robust Transmission:** At its most fundamental purpose, the transmission system ensures that electricity can be delivered reliably across the grid to customers the instant it is needed. This reliability is a function of thermal, stability and short-circuit power system fundamentals. The standards for these are set by the North American Electric Reliability Corporation (NERC).
- **Reliable Operations:** Grid operators work around the clock to monitor and control the system, directing how much energy should be supplied by generators to match the demand, ensuring transmission lines and facilities stay within their safe operating limits, and constantly preparing for the unexpected.

Figure 4. Four Basic Building Blocks of Reliability



PJM Markets, Planning and Operations Work Together To Maintain a Reliable Grid

PJM's competitive wholesale markets provide a powerful tool to support reliability by providing financial incentives and encouraging competition to provide electricity where and when it's needed. The markets serve to attract investment in new generation and technology at the lowest cost. PJM's comprehensive Regional Transmission Expansion Plan (RTEP) process identifies the need for changes and additions to the system up to 15 years into the future. This approach makes the transmission planning process more efficient by considering the region as a whole, rather than as individual states or separate transmission zones. Operationally, the system enhancements arising out of the RTEP process reduce emergency procedures and alerts, increase operating margins, and improve the ability to import or export power with neighboring grid systems.

Figure 5. Markets, Planning and Operations for Reliability



PJM Is Mission Driven

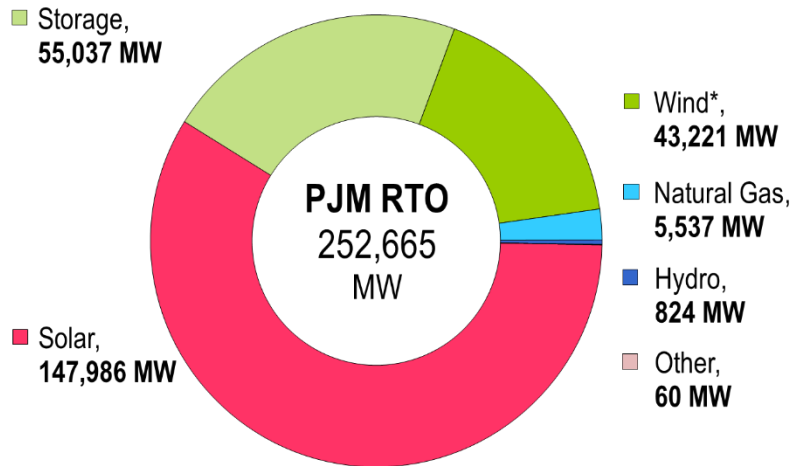
PJM is a “public utility” under the Federal Power Act and is regulated by the Federal Energy Regulatory Commission (FERC). It is also effectively a nonprofit in that we are mission driven with predetermined rates that do not allow for PJM to retain earnings. **PJM has no profit motive, and its mission is clear: to ensure reliable power delivery on the bulk system and keep costs affordable for the 65 million consumers in our footprint.**

III. Accelerating Transition Toward Intermittent Renewable Generation

As with the entire U.S. electric grid, PJM is experiencing an accelerating transition toward intermittent renewable generation. Policies, economics and consumer choices are shifting the grid away from dispatchable, emitting-generation resources toward intermittent generation with little-to-no carbon emissions. A look at PJM’s interconnection queue for new generation requesting access to the transmission system is evidence that we are, in fact, in a transition. As generation retires, the PJM queue represents immediate options for replacement.

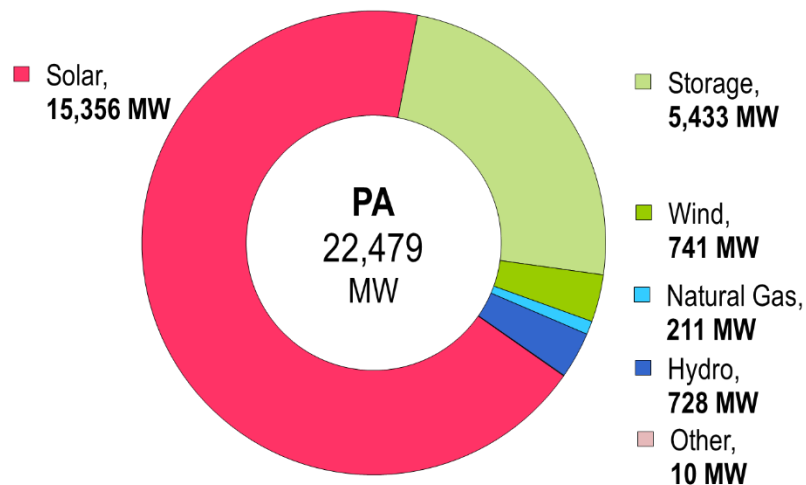
New requests to connect to the PJM grid are almost exclusively – approximately 97% – coming from renewable resources and batteries, including 59% solar resources and 17% wind resources, as shown in **Figure 6**. An additional 22% of interconnection requests are from storage resources, which are mostly lithium ion batteries co-located at the site of the aforementioned solar or wind resources under study.

Figure 6. PJM Queued Capacity (Nameplate as of April 1, 2023)



New interconnection requests for projects in Pennsylvania are made up of a similar combination of solar, storage and other renewables. This includes 68% solar resources and 24% storage resources, as shown in **Figure 7**.

Figure 7. Pennsylvania Queued Capacity (Nameplate as of April 1, 2023)



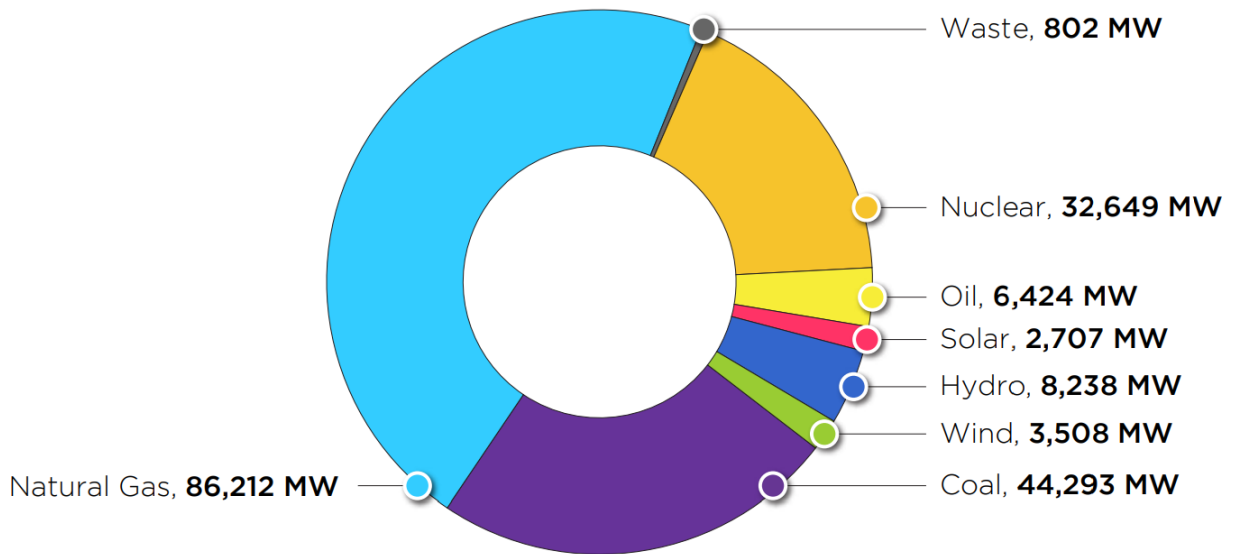
IV. Sufficient Generation Exists Today; Current Trends Raise Concerns Further Out

The current PJM fuel mix is balanced and diversified between different fuel types, as shown in **Figure 8** below, and we have adequate generation resources to serve the anticipated needs of our system today. Indeed, NERC in its 2023 Summer Assessment represented the PJM region as one of the regions in the country projected to have adequate reserves for this summer.

However, as we look further out, maintaining an adequate level of generation resources, with the right operational and physical characteristics, will be essential for PJM’s ability to reliably serve electrical demand through the energy transition. Our recent analysis observed the following four trends that, in the collective, increase the risk that we may have difficulty maintaining such an adequate level of generation resources with the necessary attributes over time.

- 1 | The rate of electricity demand is likely to continue to increase from electrification and increasing deployment of high-demand data centers in the region.
- 2 | Dispatchable generators are retiring at a rapid, date-certain pace largely due to government and private sector policies.
- 3 | Replacement generation is primarily intermittent and limited-duration resources, requiring multiple megawatts of these resources to replace one megawatt of dispatchable generation.
- 4 | Retirements are at risk of outpacing the construction of new resources, due to a combination of industry forces, including siting and supply chain, whose long-term impacts are not fully known.

Figure 8. PJM Existing Installed Capacity (Nameplate as of Dec. 31, 2022)



The pace of retirements is being driven in large part by state laws and federal environmental initiatives that create a clear near-term, date-certain requirement for generation to comply or retire. On the other hand, the pace of additions of new renewable generation is currently slower than anticipated. We are hopeful that the technological development of longer-duration batteries and other storage technologies that can address the challenges created by a large fleet of intermittent generation will create new grid management tools, but timing of commercial availability of these tools is uncertain.

This analysis is further detailed in our most recent paper in the Energy Transition in PJM series.⁴ This analysis clearly highlights our concern that, if current trends continue, we will be at elevated risk of resource adequacy shortfalls later in this decade. However, we believe this risk is avoidable through policies that accelerate the rate of entry of new generation (such as through permitting reform) and stop or slow down the exit of traditional thermal generation we currently use to balance the grid until replacement generation is installed and operating at the required scale.

The reliability challenge from prematurely losing resources we need to manage a grid dominated by intermittent renewable generation is concerning. Identifying this possible outcome now affords us an opportunity to manage this transition in an orderly and coordinated fashion that ensures the continued supply of reliable electric power.

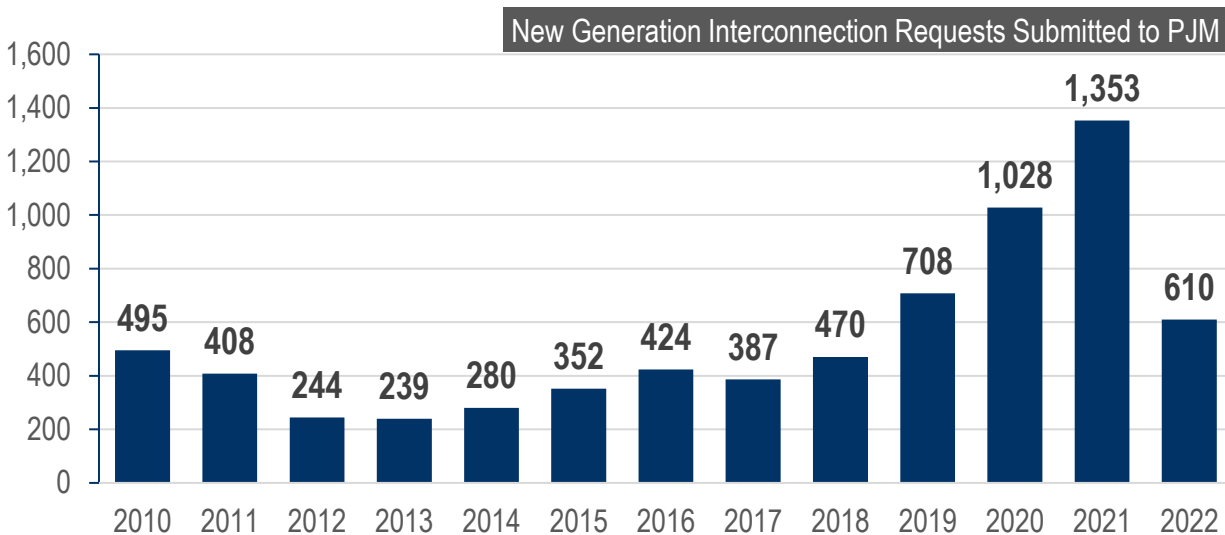
To the industry’s credit, we have managed energy transitions before, such as the fleet turnover driven by the shale gas revolution and the U.S. Environmental Protection Agency’s Mercury and Air Toxics Standard Rule issued in December 2011. However, the current energy transition to a cleaner and greener fleet is much larger and affects virtually every aspect of energy supply and delivery.

If the rate of premature retirements continues to outpace the installation of replacement generation with the attributes necessary to maintain grid reliability, the nation may well face challenges with maintaining adequate supply to meet electric power demand, at the very time we are moving aggressively to electrify the transportation and home heating sectors. On the other hand, if we proactively address these challenges now, we believe we can achieve an orderly and coordinated transition that ensures the continued supply of reliable electric power.

Interconnection Queue Reform

As renewable generation development has soared, the type of new projects has shifted from a limited number of large resources to hundreds of smaller, more dispersed, renewable energy projects. As a result, **Figure 9** shows the number of projects entering PJM’s New Services Queue has significantly increased over the past four years.

Figure 9. New Generation Interconnection Requests Submitted to PJM



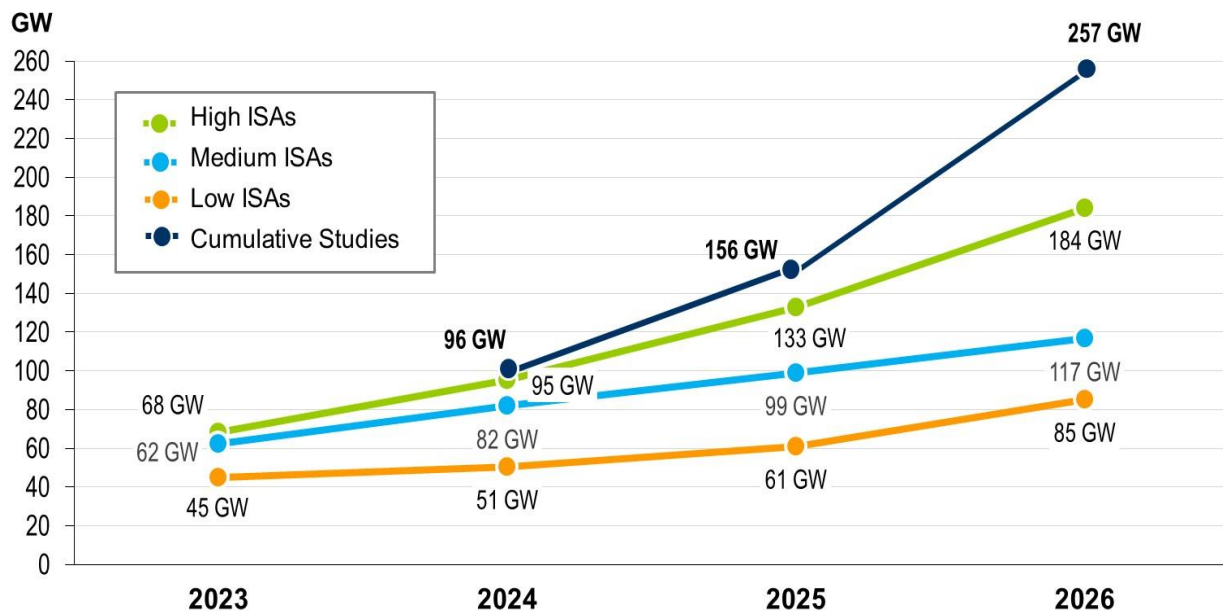
⁴ Energy Transition in PJM: [Resource Retirements, Replacements and Risks](#) (PDF), Feb. 24, 2023.

Recognizing the recent tripling of projects entering its queue, in October 2020, PJM and stakeholders began working together to create a plan that streamlines generation interconnection requests, improves project cost certainty, and significantly improves the process by which new and upgraded generation resources are introduced onto the electrical grid. The PJM Planning Committee held four workshops, and the Interconnection Process Reform Task Force held 21 meetings during which PJM and stakeholders worked through solutions for these problems.

This work culminated in a vote on a proposal for reform with overwhelming stakeholder support. That proposal was approved by FERC on November 29, 2022, and the transition to the new rules will begin in July as PJM continues to clear the backlog of projects. Moreover, to tackle this work, PJM has invested significantly in tools and automation, as well as in the staffing of both employees and outside contractors.

The transition that starts in the third quarter is expected to process interconnection applications that cumulatively represent about 260,000 MW worth of resources over the next three years. PJM anticipates having about 100,000 MW of projects complete the PJM study process by the end of 2025. Further, there are about 44,000 MW of projects that have come through the study process with either signed or pending Interconnection Service Agreements (ISAs) and should be moving to construction; that should grow to about 62,000 MW by year's end.

Figure 10. Study Projections



However, PJM continues to be concerned about the rate of new build actually coming online. In 2022, there were only 2,000 MW of projects built, of which only 700 MW were renewables, when there were over 30,000 MW of generation with signed ISAs. In 2023 thus far, only about 300 MW (all renewables) have been built. PJM continues to work with developers to understand what is holding these projects back. External variables potentially affecting build-out include local opposition, cost of capital, developer financing challenges, supply chain issues, siting and permitting, and market signals. We need to solve that problem together as an industry if we want to preserve reliability amid this transition.

PJM and stakeholders continue to look at measures to improve queue throughput and efficiencies in the Interconnection Process Subcommittee. On June 6, 2023, stakeholders approved an issue charge to examine how to enhance the transfer of Capacity Interconnection Rights, the rights to input generation as a capacity resource, from resources that are deactivating to new projects.

V. Steps Industry and Policymakers Can Take Now To De-Risk the Transition

Potential Areas for Action – PJM

PJM is working with its members and stakeholders on several initiatives focused on ensuring a reliable transition, including:

- Implementing interconnection process reform that was recently approved by FERC and is expected to significantly accelerate interconnection queue throughput. PJM will also consider additional potential interconnection policy reforms with its members.
- Calibrating our reliability risk modeling and capacity market rules and generator requirements to the changing needs of the grid as we go through this transition.
- Continuing to support state policies through creative and innovative solutions, such as cooperative planning between PJM and states to meet their public policy needs under PJM's State Agreement Approach. By way of example, we recently planned targeted transmission projects with the state of New Jersey to support their offshore wind policy goals.
- Working with FERC as well as the gas pipeline industry to improve the coordination of the natural gas and electricity markets.

To capture these actions in a central location, PJM is launching an initiative to bring all of its activities targeted at [Ensuring a Reliable Energy Transition](#) under a single umbrella, as stated in the body of this testimony.

Potential Areas for Action – Policymakers

PJM cannot address these issues alone. Because policies at the state and federal level are a key factor in driving the disparate pace of retirements and replacements, the solutions require a coordinated approach to effectuating the transition. Along these lines, our conclusions and recommendation are as follows:

- Supply chain issues are plaguing many different segments of the industry, ranging from shortages of transformers to solar panels. The Inflation Reduction Act creates important incentives that will help to spur domestic manufacturing of these critical components of electricity supply and delivery. Until that domestic manufacturing develops, we will need to ensure that new federal and state policies across agencies are coordinated to take into account whether the particular policy initiative is helpful in addressing these immediate infrastructure needs.

- There is a critical need for integrating analysis of the reliability impact of specific state and federal policies prior to those policies being adopted. We remain concerned that compliance dates that impact the generation fleet are being chosen without such a rigorous analysis always being undertaken. From a process standpoint, it would be appropriate for a more thorough reliability analysis to become a standing requirement for federal and state actions that could impact reliability.
- Instead of date-certain “retire or comply” policies or policies that limit generator output on a fixed, pre-determined date, policies should tie such retirement signals or generator output restrictions to the demonstration that adequate replacement capacity is installed and operating. Currently, the nation is developing environmental and reliability policy in separate silos with limited and not very transparent coordination between the environmental and reliability regulators. Increased coordination and synchronization of the nation’s environmental and reliability needs may require discrete changes to the statutes governing each agency’s mission to embrace this effort.
- Balanced permitting reform is needed. We are becoming increasingly dependent on natural gas. Additional pipelines will need to be sited to meet our reliability needs. Also, EPA’s greenhouse gas proposal calls for a vast increase in co-firing of natural gas or hydrogen, or sequestration of carbon dioxide; if the rule stands, a new transportation network for hydrogen and a transportation and storage network for carbon dioxide will need to be sited, permitted and built.
- Finally, the electric grid is one of our most important infrastructure assets. It is critical to the economy, health and security of all Americans. We need to give protection and enhancement of the grid the same level of focus that we give to our equally important environmental goals. Policies need to continually be crafted in a manner that ensures that the reliability and affordability of the grid can be maintained and enhanced as we transition to a cleaner and greener generation fleet.

VI. Proven Benefits: Using Markets and Competition To Reinforce Grid Reliability

PJM’s markets exist to reinforce grid reliability by ensuring that market signals work in tandem with regional reliability requirements and those of the North American Electric Reliability Corporation (NERC). For example, our capacity market is designed to procure resources available to meet projected peak demand and other contingencies three years ahead of time. Through our Day-Ahead and Real-Time energy markets, we produce a security constrained economic dispatch across our footprint, ensuring that the most efficient and cost-effective mix of resources is called on each hour of each day to achieve reliability at the least cost to customers. In addition, based on economics and needs, in any given hour, we either export excess power supplies to our neighbors or import power from those neighbors. This helps to support reliable and cost-effective operations throughout the entire Eastern Interconnection.

Congress set the country on a path toward the development of competitive markets through the Energy Policy Act of 1992. As demonstrated by the PJM value proposition and in countless independent economic analyses, that choice has proven to be a success in ensuring a more reliable and cost-effective grid.

This quote is from a letter penned by the Clean Energy Buyers Association (CEBA), a diverse set of over 350 energy customers, including nearly one-fifth of the Fortune 500:

“Organized wholesale electricity markets (OWMs) are fundamental to advancing CEBA’s vision and goals. By leveraging the power of competition and balancing clean energy generation over large geographic regions, OWMs produce billions of dollars in benefits annually. These markets expand purchasing options and support reliable clean energy integration...”⁵

We have seen this same recognition from those on both sides of the aisle who have served as FERC commissioners. A bipartisan group of former FERC commissioners wrote to FERC in June 2021, stating:

“As former FERC Commissioners and Chairs, appointed by both Republican and Democratic Presidents over the past three decades, we are united in our strongly held view that organized regional wholesale power markets, known as RTOs and ISOs, provide compelling platforms for renewable energy development and are achieving considerable consumer benefit.”⁶

The market has opened up opportunities for the export of electricity from resource-rich states like Pennsylvania to net-consuming states. This results in economic development and consumer cost savings on both sides of the transaction. The market has also allowed for the development of innovative and promising new technologies being deployed in our footprint, ranging from batteries to Smart Wires technology to opportunities for customers to receive the value of their rooftop solar devices in the market. And retail customers can receive the benefit of some or all of this activity at the wholesale level. Competitive markets are a proven tool that can deliver a more efficient energy transition.

VII. PJM Reliability Initiative: Ensuring a Reliable Energy Transition

As mentioned above, PJM has embarked on research to evaluate the anticipated changes to the system and any challenges they may present. Building on a foundation of this research, analysis and stakeholder exchange over the past several years, and further informed by lessons learned from Winter Storm Elliott in December 2022, PJM recently outlined a set of emerging risks to reliable electrical supply.



⁵ [Organized Wholesale Electricity Markets, Clean Energy Buyers Association](#) website.

⁶ Letter of Nine Former Federal Energy Regulatory Commissioners and Chairs to FERC Re: Organized Wholesale Power Markets (June 2, 2021), <https://www.rstreet.org/wp-content/uploads/2021/06/Former-FERC-Commissioners-Advocate-for-Expansion-of-Organized-Power-Markets-6-2-21-1.pdf>

From purely a reliability perspective, PJM is well-positioned today. We have enough resources and enough essential reliability services. However, Winter Storm Elliott presented challenges for our generator fleet, and we need to support better performance of our generators going forward. This is the **immediate concern: support resource performance**.

Our near-term concern relates to a paper we released this year entitled “Energy Transition in PJM: Resource Retirements, Replacements & Risks.” That paper concludes, based upon specific and quantifiable trends,⁷ that we may not have supply to power homes and businesses toward the end of this decade. This is the **near-term concern: ensure resource adequacy**.

Finally, all generating resources do not have the same physical properties. We need our thermal resources (nuclear, gas, coal) to provide what NERC calls essential reliability services. This includes properties like inertia, flexibility and a host of other physics and grid engineering properties that we need to deliver electrons. Currently, these essential reliability services can only be provided by our thermal resources. We will continue to need these thermal resources until a replacement technology is deployable at scale. Currently, solely renewable resources cannot provide these attributes. This is the **upcoming concern: maintain and attract essential reliability services**.

PJM has launched a multiyear reliable energy transition initiative to address the identified challenges and potential solutions. The initiative proposes an initial set of actions to support reliability that PJM can take with its stakeholders, government and industry over the immediate, near-term and upcoming time frames to keep pace with these trends. **Ensuring a Reliable Energy Transition** is the name of this multiyear effort, and we encourage you to visit PJM’s website where you can see PJM’s initial proposed set of actions to try and help alleviate the immediate, near-term and upcoming reliability concerns identified.

VIII. Conclusion

PJM is a mission-driven organization whose primary focus is reliability. PJM and the entire U.S. electric grid are experiencing an accelerating transition toward intermittent renewable generation. PJM has embraced this transition through its five-year strategy, producing intensive research and analysis on the opportunities and challenges presented by such a seismic shift.

The PJM system as it stands today is a reliable system with an adequate capacity reserve margin. Despite PJM’s healthy reserve margins, however, recent winter storms (Uri 2021, Elliott 2022) have provided a sobering reminder of the critical role that resource adequacy will play through the energy transition. Further, for the first time in recent history, PJM could be at risk of facing resource adequacy challenges should these trends – high load growth, increasing rates of generator retirements, and slower entry of new resources – continue. This situation is not unique to the PJM system – roughly two-thirds of North America is rated by NERC at being at elevated resource adequacy risk this summer.

⁷ These trends include: (i) increased demand due to data centers and electrification; (ii) significant generation plant retirements due primarily to policy drivers; and (iii) new entry of mostly renewable resources not matching the pace of these retirements. See *Energy Transition in PJM: Resource Retirements, Replacements & Risks* <https://www.pjm.com/-/media/library/reports-notices/special-reports/2023/energy-transition-in-pjm-resource-retirements-replacements-and-risks.ashx>.

This risk is not a forgone conclusion. Rather, we believe a reliable energy transition is achievable through policies that accelerate the rate of entry of new generation and stop or slow down the exit of traditional thermal generation we currently use to balance the grid, until replacement generation is installed and operating at the required scale. We at PJM are working on a range of initiatives to help achieve a reliable transition. In our judgment, a reliable transition will also require policy changes aimed at accelerating new generation entry and slowing exits.

As we continue on this transition, it is important to recall that the grid has successfully endured energy transitions in the past. PJM has reliably and effectively weathered these transitions due in large part to the value that comes with being a regional transmission organization with a robust planning process, efficient capacity market design, access to fuel and geographically diverse generating resources, and a highly resilient network of transmission facilities.

PJM embraces the challenge ahead. Working together with our governmental partners such as the Pennsylvania Public Utility Commission and utility transmission and generation owners, PJM is committed to facilitating the energy transition reliably and cost-effectively for the 65 million consumers in our footprint.

I thank you for the opportunity to present my testimony today. I look forward to any questions you may have.