



UNITED STATES SENATE COMMITTEE ON ENERGY & NATURAL RESOURCES

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For Public Use

Executive Summary

Chairman Manchin, Ranking Member Barrasso, and members of the Committee: Thank you for the invitation to participate in this hearing and share PJM's perspective on the reliability, resilience and affordability of the bulk power system.

Based in Valley Forge, Pennsylvania, PJM Interconnection operates as the “air traffic controller” of the electric grid, ensuring the reliable flow of power to 65 million customers in all or parts of 13 states and the District of Columbia. Additionally, PJM plans necessary enhancements to the grid to ensure reliability into the future, and operates electricity markets within its region to competitively procure capacity and to efficiently dispatch generation to meet load in real time.

My testimony today addresses PJM's perspectives on the reliability and resilience of the bulk power system and makes six 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 on the system of increasing demand. 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.

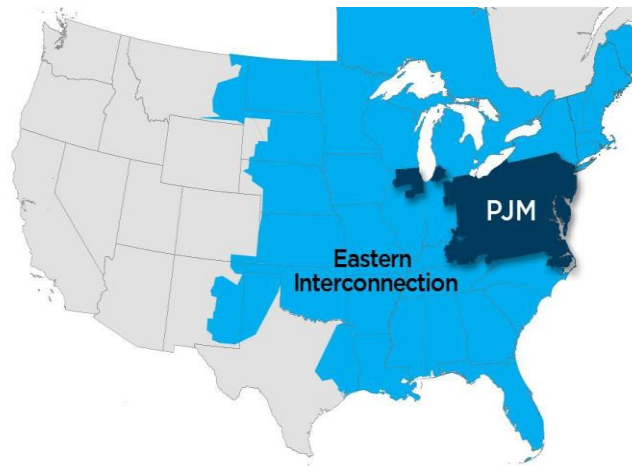
- **Competition at the wholesale electricity level has been embodied in the law since passage of the Energy Policy Act of 1992. At PJM, we have used the power of competition to reinforce short- and long-term grid reliability** by using market signals to incentivize both investment in new generation and replacement of older, less efficient generation. These efficiencies result in \$3.2 billion to \$4 billion in annual value to customers and significantly enhanced reliability, which is vital to the region. Competitive markets are a proven tool that can deliver a more efficient energy transition.
- **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, deployment of the State Agreement Approach to facilitate 7,500 MW of offshore wind in New Jersey, and coordination with state and federal governments on maintaining system reliability while developing and implementing their specific energy policies. We, our members and 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

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

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. As a regional transmission organization (known as an RTO), PJM delivers power from the high-voltage transmission grid to local distribution utilities, who then are responsible for the delivery of power to end-use customers. We are independent of the various market participants and do not profit from any particular type of resource.

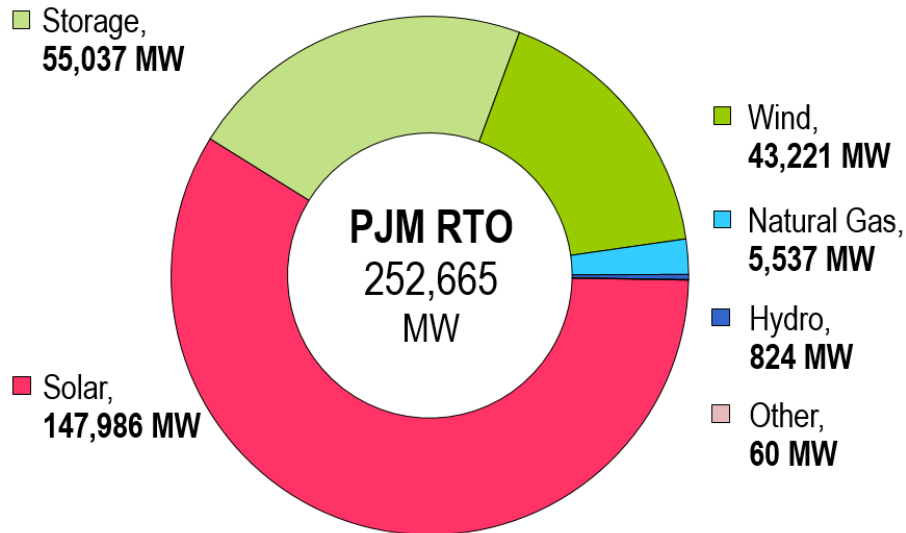
Testimony

Experiencing an 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 2**. 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 2. PJM Queued Capacity (Nameplate as of April 1, 2023)



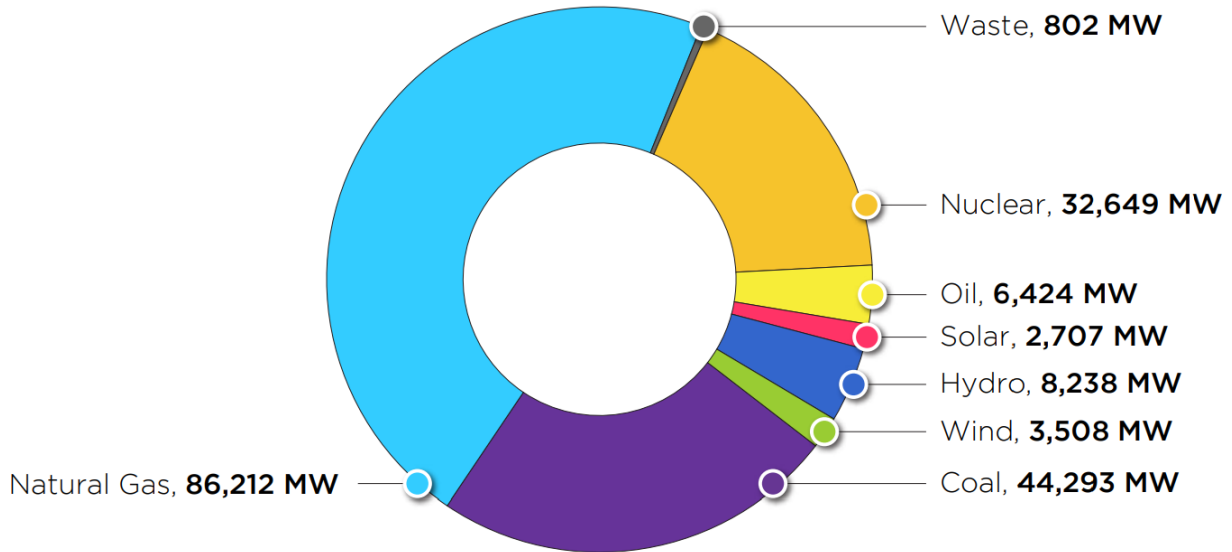
Sufficient Generation Exists Today; Current Trends Raise Concerns Further Out

The PJM fuel mix is balanced and diversified between different fuel types, as shown in **Figure 3** 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 3. 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.³ 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.

³ There are a number of reasons for a lag in development of new resources. The large increase in renewable generation project development has led to rapidly expanding interconnection queues across the U.S., increasing the time it takes for a project to be approved for interconnection to the grid. Developers report delays with project siting and permitting combined with significant supply chain backlogs. This is a multifactorial problem that will require solutions to each of the barriers to new generation development.

I am pleased that we have underway a significant reform of the interconnection process targeted at moving new projects through our interconnection process much more rapidly. This process will clear the existing interconnection backlog by moving from a "first-come/first-served" paradigm to a "first-ready/first-served" paradigm. The transition to this new interconnection process will begin this summer.

Concerningly, we are finding that even projects that have completed our interconnection queue are still not undertaking construction at an adequate rate. For example, in 2022, we had only 2,000 MW of projects get built, of which only 700 MW were renewables, when there were over 30,000 MW of generation with signed interconnection agreements. Today, we currently have about 44,000 MW of projects that have come through our study process with either signed or pending final agreement and should be moving to construction; that should grow to about 62,000 MW by year's end. And thus far in 2023, we recently had a 1,900 MW combined-cycle gas plant come online, but we have seen only 250 MW of renewable generation start up this year.

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

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, I believe we can achieve an orderly and coordinated transition that ensures the continued supply of reliable electric power.

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

Potential Areas for Action – PJM

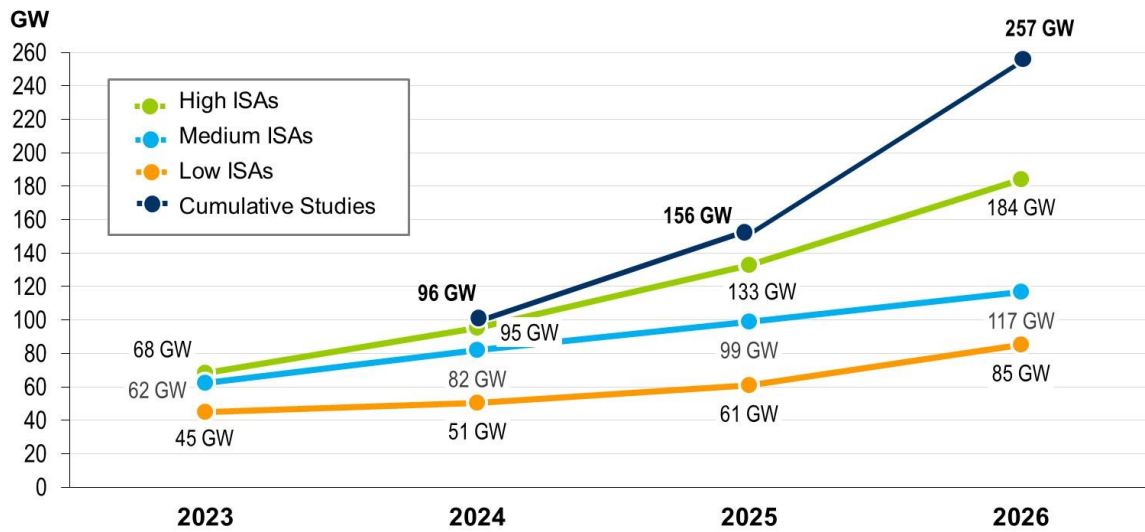
PJM is working with its members and stakeholders on several initiatives focused on ensuring a reliable transition, including:

- Implementing interconnection process reform that was recently approved by FERC and is expected to significantly accelerate interconnection queue throughput, as shown in **Figure 4** below. 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.

Figure 4 shows PJM's current estimates for the total capacity of interconnection studies (in gigawatts) that will be completed through 2026 and high, medium and low scenarios for projects expected to have completed all necessary studies to ensure reliability of the grid, including signed interconnection service agreements, in the same time frame.

Figure 4. Study Projection



Potential Areas for Action – Congress

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. Although EPA does undertake a limited analysis in certain rulemakings, its analysis does not take into account the reliability attributes needed by system operators or the feasibility and cost of the compliance alternatives proposed in the particular rulemaking. From a process standpoint, it would be appropriate for a more thorough reliability analysis to become a standing requirement for federal actions that could impact reliability. And although EPA has entered into a Memorandum of Understanding with the Department of Energy to consider reliability issues as part of EPA rulemaking deliberations, the reliability analysis and consultation should be undertaken with those entities that actually operate the grid in addition to, and not as a replacement for, coordination with DOE.
- 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. But the time may be ripe to initiate these statutory changes so that each regulator has both the authority and ability to develop policies that harmonize and meet both the nation's reliability and environmental goals.

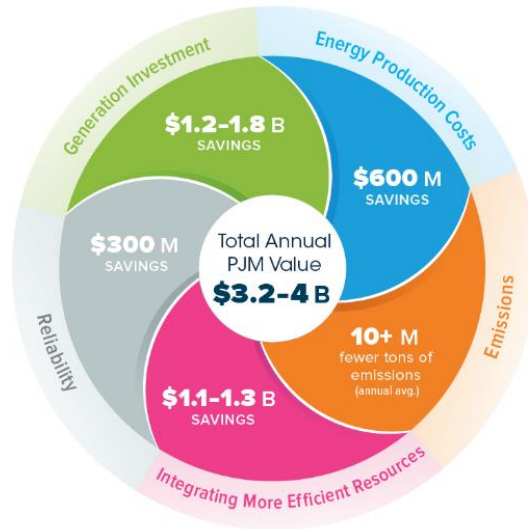
- We are cognizant of the Committee's interest in permitting reform. We agree that balanced reform in this area is needed. By the same token, we are becoming increasingly dependent on natural gas. Additional pipelines will need to be sited to meet our reliability needs. Also, EPA's greenhouse gas proposal 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. For all these reasons, we would ask that permitting reforms undertaken include an element that would ensure timely permitting of infrastructure needed to maintain and enhance reliability of the electric grid.
- Finally, the electric grid is one of our most important infrastructure assets. It is critical to both 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.

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.

The efficiencies of this market-based approach to reliability have resulted in real savings to customers. We have examined those savings, which we categorize into the following segments reflected in **Figure 5**.

Figure 5. PJM Value Proposition



Of late there have been, in some quarters, attacks on the use of competitive markets as a tool to ensure reliability. Congress set the country on a path toward the development of competitive markets through the work of this very Committee in crafting the Energy Policy Act of 1992. As demonstrated above and in countless independent economic analyses, that choice has proven to be a success in ensuring a more reliable and cost-effective grid. You don't have to take my word for it – the benefits of the competitive market model have been analyzed and proven over and over again.

I want to highlight this quote from a letter from 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:

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

“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 West Virginia, Ohio, Pennsylvania and Indiana 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. Depending on the rules established by the state utility commission, the revenues received by utilities from the export of power from resource-rich states are credited back to customers in those states through their electric bills. Competitive markets are a proven tool that can deliver a more efficient energy transition.

Conclusion

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.

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. We stand ready to roll up our sleeves and work with all of you on these challenging questions.

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

⁶ [Letter of Nine Former Federal Energy Regulatory Commissioners and Chairs to FERC Re: Organized Wholesale Power Markets](#) (PDF), June 2, 2021.