

Comments of the American Wind Energy Association, American Council on Renewable Energy, Solar Energy Industries Association, Solar RTO Coalition and Energy Storage Association Regarding PJM’s Fuel Security Initiative

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The American Wind Energy Association, American Council on Renewable Energy, Solar Energy Industries Association, Solar RTO Coalition and Energy Storage Association (collectively, “Clean Energy Advocates”) appreciate the opportunity to provide PJM with additional thoughts and perspectives on PJM’s fuel security study and broader initiative that PJM is currently undertaking. The Clean Energy Advocates support efforts that will lead to a more reliable and resilient grid, and appreciate PJM’s desire to achieve this goal. As PJM has recognized, the RTO is uniquely positioned to see the bigger picture of the many factors that affect the resilience of the grid, but the Clean Energy Advocates believe that PJM is artificially limiting its examination in a manner that fails to account for the substantial value offered by “fuelless” resources such as solar, wind, and energy storage. The Clean Energy Advocates agree with PJM’s definition of fuel security as “the ability of the system’s supply portfolio, given its fuel supply dependencies, to continue serving electricity demand through credible disturbance events, such as coordinated physical or cyberattacks or extreme weather that could lead to disruptions in fuel delivery systems, which would impact the availability of generation over extended periods of time.” The Clean Energy Advocates are concerned, however, that many of the underlying assumptions that PJM is looking to use in its study will produce results that will not in fact lead to a more fuel-secure grid because the study will not fully account for the value of energy generated or made available from wind, solar and energy storage that can create a more reliable, resilient and fuel secure grid. The Clean Energy Advocates submit these comments herein urging PJM to incorporate the value of “fuelless” resources into the methodologies employed in Phase II, as such resources constitute a growing portion of the system’s supply portfolio and are capable of generating electricity in the event there is a disruption of the delivery of coal, natural gas, or nuclear fuel. The Clean Energy Advocates encourage PJM to consider the value of all generators, including solar, wind, and storage providers, when developing a recommendation for a cost-effective, fuel-secure fleet of resources.

PJM’s Study Fails to Capture the Value of Renewable Resources and Advanced Technologies

PJM’s fuel security analysis is intended to look “at the whole system,” but then defines fuel security “as risks in fuel delivery to critical generators”¹ and generally seeks to analyze fuel security on a generator-by-generator basis without taking into account the ability of renewable energy resources to mitigate fuel delivery infrastructure risk. The Clean Energy Advocates suggest that PJM’s attempt to establish a “fuel secure” definition for generating resources in this manner fails to accurately capture the impact of a disruption in the fuel supply chain. As recent events have shown, no resource individually is secure or resilient, but instead, it is a *portfolio of*

¹ “Update on Fuel Security Initiative”, Special MRC, at 6, June 28, 2018, (available at <http://pjm.com/-/media/committees-groups/committees/mrc/20180628-special/20180628-fuel-security-analysis-approach-assumptions.ashx>) (“Update on Fuel Security Initiative”).

resources that collectively can be secure and resilient – a key part of which are renewable energy resources such as wind and solar, particularly when paired with advanced technologies such as battery storage or smart inverters.

PJM’s limited focus on generators that are dependent on a fuel supply chain, and particularly analyzing generators with onsite fuel storage, does not correlate with the fact that fuel supply disruption has not been the largest cause of generator forced outages during extreme cold weather events (the primary focus of PJM’s fuel security initiative). For example, during the 2018 Bomb Cyclone and 2014 Polar Vortex events, most power plant forced outages were due to equipment failures and other events unrelated to fuel supply. As a result, coal power plants made up a large share of the forced outages during each event.² This is not unique to the PJM region. Coal power plants have also accounted for a large share of forced outages during other extreme events outside of PJM, including the 2011 ERCOT cold snap (equipment failures) and Hurricane Harvey (coal piles flooding). Coal plants are also vulnerable to coal delivery disruptions due to rail traffic congestion, drought and other extreme weather restricting coal barge deliveries. Meanwhile, solar and wind generators were able to perform at levels well above the capacity value PJM credits them with, providing key grid resilience to the PJM Region during these extreme cold weather events.³

Moreover, the threats to resilience of continued reliance on large-scale resources, such as nuclear units, should not be overlooked. The loss of large central station generators due to physical or cyberattack would pose a larger threat to grid, potentially making them a more likely target for such an attack compared to small and dispersed resources such as wind and solar. Notably, in 2017, the U.S. Department of Homeland Security (“DHS”) and FBI issued a joint report providing details of malware attacks targeting employees of companies that operate nuclear power plants in the U.S., and provided an “amber” alert to the nuclear industry—the second-highest level of severity for these types of reports from the FBI and DHS.⁴

Given the foregoing risks, Clean Energy Advocates are concerned that PJM’s narrow focus on fuel security – and particularly the availability of onsite fuel – does not address the foregoing risks, and does not *appropriately* consider the role of renewable resources to mitigate risks under weather-induced and man-made fuel delivery disruptions. As a result, PJM’s study is likely to overstate the fuel security and other resilience values of coal and nuclear resources, even though these resources have key performance-related shortcomings that PJM should consider if its true goal is to ensure that the PJM Region is more resilient during low frequency, high impact events. The Clean Energy Advocates encourage PJM to consider the role of renewable resources and

² See “PJM Cold Snap Performance Dec. 28, 2017 to Jan. 7, 2018”, at 15-16, Feb. 26, 2018 (available at <http://www.pjm.com/-/media/library/reports-notice/weather-related/20180226-january-2018-cold-weather-event-report.ashx>) (“Feb. 2018 Cold Weather Report”).

³ See Into the Wind Blog, “How Did Wind Energy Perform During the Bomb Cyclone?”, March 30, 2018 (available at <https://www.aweablog.org/wind-energy-perform-bomb-cyclone/>).

⁴ See e.g. ARS Technica, “FBI-DHS ‘amber’ alert warns energy industry of attacks on nuke plant operator”, July 6, 2017 (available at <https://arstechnica.com/information-technology/2017/07/dhs-fbi-warn-of-attempts-to-hack-nuclear-plants/>).

advanced technologies in mitigating the triggering thresholds that indicate locations on the system where additional fuel security assurance is needed.

Specific Recommendations

The Clean Energy Advocates strongly urge PJM to change some of its study assumptions to reflect more reasonable and credible scenarios, not a perfect storm of all worst-case contingencies happening simultaneously. The Clean Energy Advocates had understood that the intent of PJM was to “stress-test” the system under various extended fuel supply disruption scenarios, but that such stress-test would fully and accurately consider the resilience contributions from renewable resources and advanced technologies. Many of the measures that offer the highest value for reliability and resilience delivery address the provision, operation and maintenance of distribution and transmission assets (*e.g.*, tree trimming, back-up communications, strategic spare equipment, etc), because those are the power system elements that are most frequently damaged by routine events and severe weather. Generation and fuel supply shortages rarely cause customer outages, and when they do it is almost always due to an extreme weather event or operational failure that may also affect T&D assets. Grid planners have correctly recognized that it is not prudent or economic to try to prevent loss of load in all possible scenarios, hence planning criteria like n-1 (not n-2 or more) and the one day in ten years standard for acceptable loss of load. Such compromises are reasonable and prudent, as protecting against the simultaneous occurrence of all extreme scenarios result in exorbitant costs for consumers. The Clean Energy Advocates understand that PJM’s current approach assumes worst case occurrences across many fuel sources and other factors simultaneously, which will undervalue the benefits of a diverse generation mix. The Clean Energy Advocates believe that the odds of each generation type experiencing an outlier event simultaneously are quite low; moreover, in such a rare event, the value of “fuelless” resources would be incredibly high. If PJM is to effectively create new planning standards to account for “fuel security”, it must promulgate a clear, quantifiable, well-reasoned and unambiguous standard similar to the “one-in-ten” industry standard rather than a qualitative standard. There is a great risk that if there is not a change in course, the region could end up committing significant amounts of money and effort to improving resilience through fuel security, yet have little constructive impact on the probabilities or actual levels of future customer outages.

The Clean Energy Advocates raise the following concerns and request that PJM take action to address:

- **Improper Limitation of External Imports.** PJM’s assumption of “No external imports beyond long-term, full path firm transactions (includes pseudo ties)” is too limiting.⁵ Based on historical wind and load patterns, PJM should be able to assume a reasonably high level of MISO wind imports, as well as imports from other regions during periods of extreme cold weather. Cold weather events are unlikely to simultaneously affect all of PJM’s neighbors with the same intensity as they affect PJM. PJM has already developed

⁵ Update on Fuel Security Initiative at 25.

methods to account for load diversity between PJM and its neighbors⁶ and these models should also be developed to account for the effect of geographic weather diversity on conventional generator forced outage rates and renewable output in order to more accurately predict how renewable energy and other resources from regions outside of PJM are likely to perform and provide inputs to PJM during periods of extreme system conditions.

- **Data Inputs from Extreme Wind Chill Events.** PJM’s Fuel Security analysis correctly proposes to use “Hourly winter profiles for wind and solar.”⁷ However, to appropriately capture correlations between renewable output, load, and conventional generator failures, PJM must ensure that it is using wind and solar output profiles from extreme wind chill events, not just typical winter periods. Events with low wind chill that cause high load and above-average conventional generator failures also tend to have above average wind and solar output. Wind energy output is higher during the high wind speeds that cause low wind chill events, and a secondary effect is that colder air is denser and therefore increases wind plant output. Likewise, solar PV plant output increases significantly due to higher operating efficiencies when modules and other plant electrical equipment are cooled by colder temperatures and higher wind speeds. The significant contribution of wind and solar to system resilience in extreme cold snap events was reflected in the results of PJM’s 2017 “Evolving Resource Mix” study.⁸ Further, PJM’s analysis should not just examine renewables’ contribution to system needs during the peak demand hour, but also their role in providing greater benefits to the system during extended periods of extreme weather. For example, PJM’s study should also recognize the value of renewable energy for conserving scarce fuel resources, such as oil reserves, during prolonged periods of extreme cold.
- **Improper Limitation on Fuel Replenishment.** Assuming no or limited replenishment of oil supplies is an unrealistic assumption and should not be utilized by PJM.⁹ Most extreme cold weather events are not characterized by extreme precipitation that would limit refueling deliveries. If electricity market prices rise, fuel markets will work efficiently to ensure that demand is met.
- **Overreliance on Historical Weather Data.** PJM utilizes excessively extreme assumptions for the severity of future cold events and resulting demand and forced outage rates.¹⁰ The Clean Energy Advocates encourage PJM to consider the degree to

⁶ See “PJM Reserve Requirement Study,” at 25-26, Oct. 12, 2017 (available at <http://www.pjm.com/~media/planning/res-adeq/2017-pjm-reserve-requirement-study.ashx>).

⁷ Update on Fuel Security Initiative at 25.

⁸ See e.g. Into the Wind Blog, “PJM Study Quantifies Wind’s Value for Building a Reliable, Resilient Power System”, Apr. 4, 2017 (available at <https://www.aweablog.org/pjm-study-quantifies-winds-value-building-reliable-resilient-power-system/>).

⁹ Update on Fuel Security Initiative at 26.

¹⁰ Update on Fuel Security Initiative at 17-20.

which extrapolating from historical cold weather patterns remains a valid assumption. Climate change has led to an increase in the frequency of extreme weather events like the 2014 Polar Vortex and 2018 Bomb Cyclone event, and this impact should be considered since PJM is focusing on cold weather events and the minimum temperature associated with those events is increasing dramatically due to the underlying warming of polar air.¹¹

- **Unreasonable Retirement Projections.** PJM should ensure that projections for future retirements are reasonable. For predicting future coal and nuclear retirements, the methodology should recognize that units that are still online are likely to have more favorable economic characteristics than those that have already retired, simply by virtue of the fact that the units have not already retired. The retirements seen to date have been almost entirely one-unit nuclear plants and coal plants in the east (where coal costs are uncompetitive with gas), and most of the coal and nuclear plants that are left have much more favorable economics than the retired plants and PJM should ensure that the retirement projects are based on reasonable assumptions. For coal, plant age and size are not alone sufficient to predict retirements, and the Clean Energy Advocates encourage PJM to also consider the impact of coal cost (generally much lower in western PJM than eastern PJM), heat rate, local competition from low-cost gas generation, presence of a long-term contract for generation off-take or coal supply with a mine or railroad, environmental equipment, and location in a load pocket or area with local reliability needs are also important factors. Notably, across nearly all scenarios the Energy Information Administration ran in its latest Annual Energy Outlook, it saw relatively few coal and nuclear retirements through 2030, and most of those retirements were driven by assumptions that forced retirements based on plant age, not economics.¹²
- **Unreasonably High Reserve Margin.** Actual system conditions suggest that PJM’s reserve margin moving forward will not be the 16.6% target reserve margin assumed in the study.¹³ PJM’s fuel security analysis period is close enough in the future that current capacity market results are the best indicator of the expected reserve margin. The most recent Base Residual Auction procured a 21.5% reserve margin – 5.7% higher than the target reserve margin.¹⁴ This figure does not even include over 22,800 MW of resources that offered into the most recent BRA but did not clear.¹⁵ Given that capacity oversupply has

¹¹ Inside Climate News, “Polar Vortex: How the Jet Stream and Climate Change Bring on Cold Snaps”, Feb. 2, 2018 (available at <https://insideclimatenews.org/news/02022018/cold-weather-polar-vortex-jet-stream-explained-global-warming-arctic-ice-climate-change>).

¹² See EIA.gov, “Annual Energy Outlook 2018”, (available at <https://www.eia.gov/outlooks/aeo/data/browser/#/?id=9-AEO2018&cases=ref2018&sourcekey=0>). EIA’s base case saw nationwide coal capacity decline from 242.4 GW in 2018 to 190 GW in 2030, while nuclear capacity declined from 98.6 GW to 87 GW.

¹³ Update on Fuel Security Initiative at 27.

¹⁴ PJM, *2012/2022 RPM Base Residual Auction Results 1*, (available at <http://www.pjm.com/-/media/markets-ops/rpm/rpm-auction-info/2021-2022/2021-2022-base-residual-auction-report.ashx>).

¹⁵ See *id.* at 15, Table 4 (noting that 186,505.8 MW of capacity resources offered into the BRA compared to 163,627.3 MW that cleared the BRA).

persisted through the last several Delivery Years, and the aforementioned fact that economics at the remaining coal and nuclear plants are more favorable than those have retired, it is unlikely that the market will rapidly revert to the target reserve margin.

- **Update to Forced Outage Data.** PJM’s proposed use of “Historic cold-snap forced outage rates” and “Five-year unit average EFORD” in the extreme and base cases, respectively, should be adjusted to account for recent improvements in forced outage performance relative to the 2014 Polar Vortex event, as PJM’s 2018 Bomb Cyclone analysis showed.¹⁶ The PJM generation fleet’s 2018 Bomb Cyclone performance better reflects expected performance going forward than the 2014 Polar Vortex event. This is likely partially due to the performance incentives provided by PJM’s Capacity Performance policy, as documented by PJM’s 2018 Bomb Cyclone report,¹⁷ and partially because units that have retired and are retiring have a higher forced outage rate than new units that are replacing them. PJM’s own October 2017 filing to FERC on Grid Resilience shows that retiring units have a three times higher forced outage rate than the generation that is being added to the grid.¹⁸

Other Overarching Concerns

Lastly, Clean Energy Advocates believe that PJM should be aware of the following overarching concerns, and also suggest that PJM incorporate the following topics into its study. PJM’s acknowledgment of these concerns will lead to a study result that is more fair, accurate and reasonable, and will ultimately move PJM closer to its goal of providing a more fuel secure and resilient electric grid:

- Clean Energy Advocates have serious concerns that the U.S. Department of Energy will be supplying some of the underlying data and assumptions to PJM’s fuel security study that will not be generally available to the public and/or stakeholder for comment. While Clean Energy Advocates certainly respect and acknowledge that certain information classified as CEII, or similar generally non-public information, may be used by PJM in its study and analysis, as is routinely the case, the use of this type of information should be minimized to give all parties the right to comment and provide insight on underlying assumptions that may be the basis for future market rules and compensation structures for resources providing some form of fuel security attributes to the PJM Region. Further, the PJM tariff provides for the handling of confidential material by stakeholders and should be sufficient to facilitate access. Minimizing such non-public assumptions supplied to

¹⁶ Update on Fuel Security Initiative at 26.

¹⁷ Feb. 2018 Cold Weather Report at 21.

¹⁸ See Initial Comments of PJM Interconnection, L.L.C. On the United States Department of Energy Proposed Rule, Docket No. RM18-1-000, at 9 (Oct. 23, 2017); see e.g. Feb. 2018 Cold Weather Report (noting 13.7 GW of coal outages during 2014 Polar Vortex compared to 6.9 GW of coal outages during 2018 Bomb Cyclone).

PJM by the U.S. Department of Energy, or any other source of data, is particularly crucial to producing well-reasoned, just and reasonable, and non-discriminatory rules related to fuel security.

- PJM should examine fuel security risks during summer-peaking scenarios. In order to understand a complete picture of the PJM Region’s fuel-related vulnerabilities on a portfolio-basis, PJM should examine any summer-related vulnerabilities. Further, the failure to examine the summer season significantly discounts the value that solar resources provide to the system from a grid-resilience and fuel-security standpoint, and is particularly discriminatory towards solar resources.
- PJM should study the expected growth of energy storage (both in terms of deployments and durations) in the PJM Region and how energy storage can provide fuel-security attributes to the PJM Region, particularly when paired with renewable energy resources like wind and solar. Renewable resources paired with energy storage have the potential to be the most fuel secure of any potential energy sources because solar and wind resources do not rely on conventional fuel with associated deliverability risks, but instead are powered by renewable energy, which in a diverse fleet such as PJM’s have a high availability rate.
- PJM should examine the resilience and reliability of the grid under high-renewable penetration levels. As PJM has explained, “PJM could maintain reliability with unprecedented levels of wind and solar resources, assuming a portfolio of other resources that provides a sufficient amount of reliability services.”¹⁹ Given this, PJM should look to see how its bulk power system can be fuel secure under high penetrations of renewable energy, and how under such circumstances relatively large amounts of wind, solar, storage and conventional generation resources can work together to provide a more resilient and fuel secure grid.

Conclusion

The Clean Energy Advocates urge PJM to consider their comments herein and look forward to working with PJM and all stakeholders as PJM continues its fuel security initiative.

¹⁹ “PJM’s Evolving Resource Mix,” at 5, March 30, 2017 (available at <http://www.pjm.com/~media/library/reports-notices/special-reports/20170330-pjms-evolving-resource-mix-and-system-reliability.ashx>).