

LS POWER COMMENTS – PJM FUEL SECURITY

LS Power is pleased to present the following comments in response to the PJM Proposal for Fuel Security (the “Proposal”) as presented in the “Valuing Fuel Security” scoping document released by PJM on April 30, 2018 as supplemented by our meeting with PJM on June 8, 2018 and the “Update on Fuel Security Initiative” presentation dated June 28, 2018. LS Power commends PJM for addressing this issue within the construct of the competitive markets.

I.

IDENTITY OF LS POWER

LS Power is a power generation and transmission group that owns and operates over 8,000 MW of power generation facilities in PJM consisting of simple and combined cycle combustion turbines, pumped storage hydro, and solar facilities. LS Power has invested billions of dollars in PJM over the past several years through the construction of new power generation and the acquisition of existing generation. Since the 2014 Polar Vortex, LS Power-owned facilities have spent approximately \$90 million¹ in firm gas transport and supply costs and also made significant capital investments in winterization and improvements to our generation fleet, including the addition of insulation, heat tracing, heaters and shelters for equipment after the 2014 Polar Vortex. With the market implementation of Capacity Performance, operating performance is of paramount importance to LS Power and LS Power’s PJM fleet availability² has significantly improved following the fuel supply enhancements and operational improvements,. LS Power’s power

¹ Reflects total 2015 – 2018 budget for firm gas transport, supply and storage costs for PJM assets currently owned by LS Power.

² The average EFORd rate of PJM assets currently owned by LS Power has improved from above 8% in calendar 2014 to 1% for Jan-May 2018

generation fleet in PJM relies predominately, if not wholly, on revenues from PJM's market products including capacity, energy and ancillary services.

II.

BACKGROUND

LS Power's investment in PJM has been influenced by the competitive market foundation of the PJM system. With various externalities³ currently challenging the ability of the market to remain competitive, it is refreshing that PJM has taken the initiative and is working toward a market-based solution for Fuel Security.

PJM has presented their initial thoughts and plan for ensuring Fuel Security through its recently released Scoping Document, "Valuing Fuel Security" and the "Update on Fuel Security Initiative" presentation. LS Power reviewed these documents and met with PJM to provide feedback on PJM's process. LS Power hereby provides these comments to PJM to help inform PJM during the analysis phase.

IV.

LS POWER COMMENTS

LS Power supports PJM's focus on resilience in general and Fuel Security in particular and welcomes PJM's reliance on market-based signals to incentivize action by generators to enhance Fuel Security. LS Power is pleased to provide the following comments to assist PJM in its effort

³ These externalities include recent state actions to provide out-of-market subsidies to select generators and the Department of Energy investigating the possibility of providing additional out-of-market subsidies to certain generators in PJM.

to analyze the impact of extreme winter conditions on the market and supply and to define “Fuel Secure” resources.

1. PJM is performing their analysis based upon historical winter weather and load conditions. LS Power believes this is an appropriate approach as these prior years were some of the worst winters PJM has experienced. However, LS Power believes PJM needs to incorporate the current capabilities of PJM’s fleet of generators in the analysis to reflect the investments by gas-fired and dual-fuel generators since winter 2014 aimed at increasing availability as well as improved load forecasting and communications between PJM and gas pipelines, which has enabled better generator performance than during winter of 2014. As a result, PJM’s analysis should reflect the winter of 2017/2018 generator outage rates and incorporate further improvement as all capacity resources starting in the 2020/2021 delivery year will be subject to the Capacity Performance obligations (whereas over 54,000 MW or 33%) of resources committed for the winter of 2017/2018 were Base Capacity (non-Capacity Performance resources)⁴. The total PJM forced outage rate decreased from 22% during the 2014 Polar Vortex to 13.4% during winter of 2015, which saw new record peak load and record low temperatures, to 12.1% during the 2017/2018 Cold Snap that saw prolonged cold temperatures. PJM confirmed the improvement in generator performance in their recently released report “Strengthening Reliability: An Analysis of Capacity Performance” that concluded, among other things:

- Overall generator performance has improved from the inception of Capacity Performance to the present day,

⁴ According to PJM’s “Strengthening Reliability: An Analysis of Capacity Performance” report, issued on June 20, 2018, Capacity Performance gas-fired generators outperformed non-Capacity Performance units during the Cold Snap days of January 2018. The Capacity Performance resources’ EFORD rate was approx. 13% below that of non-Capacity Performance resources on January 5, 2018.

- Positive indicators of the effectiveness of Capacity Performance include: decrease in restrictive generator operating parameters, reported investment in major reliability work for existing resources, and new resources investing in firm gas and transportation contracts.
 - PJM observed improvements of over 50 percent in many operating parameters after the implementation of Capacity Performance.
 - During the 2017/2018 Cold Snap, Capacity Performance resources' forced outage rates were significantly lower than the same resources' outage rates during the 2014 Polar Vortex (5.5 percent vs. 12.4 percent).
 - Reflecting the post-2014 Polar Vortex forced outage rate improvements, PJM has not called an Emergency Action, and Performance Assessment Hours/Intervals during winter periods remain zero despite a new record winter peak load set in February 2015 and the unusually extended duration of the December 2017 – January 2018 cold snap not experienced during the 2014 Polar Vortex.
 - Importantly, the significant improvement reflected in the winter 2017/2018 performance took place with only ~67% of total capacity commitments coming from Capacity Performance. In winter 2022/2023, 100% of total commitment is expected to be provided by Capacity Performance resources, which should further reduce gas supply-related generator outage rates.
2. PJM should recognize the benefits of firm transportation and/or supply agreements in its analysis and its definition of Fuel Secure resources. On prior years' peak winter days, natural gas pipeline Operational Flow Orders ("OFO") and Forced Majeure events affected only Interruptible Transportation customers and certain generators located behind and dependent upon Local Distribution Companies ("LDC") unless they have alternative arrangements. To our knowledge, gas-fired generators with firm transportation and/or supply agreements were not interrupted during such peak winter days, which shows the diversity and flexibility of the natural gas pipeline system and its ability to supply Firm customers. Firm transportation and supply agreements

provide the same priority of service to gas-fired generators as to LDCs delivering winter heating gas to the households.

As attested to by industry survey data, firm pipeline transportation service historically is extremely reliable; in an April 2017 INGAA survey of 51 interstate pipelines, over the ten-year period 2006-2016, pipelines delivered 99.79% of “firm” contractual commitments to firm transportation customers at primary delivery points specified in their contract. Also, according to the July 2017 “Natural Gas Systems: Reliable & Resilient” report by the Natural Gas Council:

“Other characteristics of the natural gas system contribute to its historical operational reliability and system resilience. The natural gas transportation network is composed of an extensive network of interconnected pipelines that offer multiple pathways for rerouting deliveries in the unlikely event of a physical disruption. In addition, pipeline capacity is often increased by installing two or more parallel pipelines in the same right-of-way (called pipeline loops), making it possible to shut off one loop while keeping the other in service. In the event of one or more compressor failures, natural gas pipelines can usually continue to operate at pressures necessary to maintain deliveries to pipeline customers, at least outside the affected segment.”

Based on the historical reliability of gas pipelines generally, and firm transportation service in particular, PJM should base any modeled reductions to interruptible and firm transportation capacity on an assessment of probable and realistic pipeline events and impacts rather than an arbitrary 50% or 100% reduction in firm transportation capacity on a pipeline.

3. PJM needs to consider the actual peak load durations based on historical data in its analysis of extreme winter events and its definition of Fuel Secure resources. As demonstrated by PJM’s historical hourly load datasets for recent winter events, the average peak load duration for the historical period under consideration is typically limited to ten hours or less on a peak day and fewer hours on adjacent days. Therefore,

- a requirement that a “Fuel Secure” generator have sufficient fuel onsite for “XX hours or min output for YY hours to mitigate a ZZ-day duration risk”⁵ needs to consider the actual peak load durations during such events and expected generator dispatch during such period (e.g., dispatch may be different for a 12.0 MMBtu/MWh heat rate plant than a 7.0 MMBtu/MWh heat rate plant). Additionally, the definition of “onsite fuel” should be applied broadly to account for secure fuel supply sources that are not limited to a finite duration by on-site space or inventory constraints, including firm transportation/supply, dual pipeline connections or the ability to interconnect with a second pipeline, and pump-storage hydro (as further discussed in the paragraphs above and below). Otherwise, the “onsite fuel” requirement could be overly conservative, may be impractical at sites where available space is limited and would not account for the other fuel supply sources that PJM is relying on in its analysis to operate the grid.
4. PJM should recognize the high degree of gas supply and infrastructure diversity within its footprint and consider this diversity as qualifying for “fuel security.” Specifically, for some generator locations having or adding a redundant interconnection to a second pipeline can be an effective and relatively low-cost way to improve fuel deliverability and security while taking advantage of this diversity⁶ A second interconnection

⁵ From PJM “Update on Fuel Security Initiative”, June 28, 2018, Special MRC – Update on Fuel Security Initiative.

⁶ According to “Natural Gas System: Reliable and Resilient,” Natural Gas Council, July 2017, the natural gas network has few single points of failure that can lead to a system wide propagating failure, is not vulnerable to weather-related events and are far more resilient in the face of extreme weather events than electric systems. The gas transmission system can continue to operate at high pressure even with the failure of half of the compressors, and the distribution network can run unattended and without power. The extensive network of interconnected pipelines and redundant pipeline loops offers multiple pathways for rerouting in an unlikely event of physical disruption. The ability to control, manage, adjust and redirect gas flows around an outage, the availability of line pack to provide operational flexibility, and the existence of geographically dispersed production and storage allow operators to maintain service in the event of a disturbance of parts of the gas transportation system.

mitigates the impact of an event on a single pipeline and, therefore, such resources should be defined as “Fuel Secure.”

5. PJM should take into account any coal, oil or dual-fuel facilities that rely on natural gas to start-up in its definition of “Fuel Secure” resources. Even though these facilities may have many days of fuel on the ground or in storage, if natural gas is modeled not to be available in certain locations during an extreme event, then PJM needs to assess the ability of coal, oil or dual-fuel plants in the same area to start with natural gas unavailable. PJM should further consider that during winter conditions, the quality and reliability of the coal onsite can be impacted, that logistical constraints may limit resupply, that frozen coal when crushed can impact boiler and balance of plant availability, and that weather conditions immediately preceding the extreme cold weather days may require cycling and restart of coal-fired units, resulting in increased failure rates and forced outages. As evidenced in PJM’s Winter Reports, during peak cold weather days coal units continued to exhibit high forced outage rates, consistently accounting for between 30% and 50% of total forced outage capacity, not only during January 2014 but also during winter 2015 and January 3 through January 7, 2018⁷. Even during the most recent winter, years after marked improvement in availability by gas-fired and dual fuel plants, coal-fired units continued to account for a greater share of total PJM forced outage MW than gas supply issues. According to PJM’s data, during January 3 to January 6, 2018 gas supply issues accounted for between 1.16GW and 3.98GW or 7% and 17% of total forced outage on that day while coal units

⁷ “PJM Cold Snap Performance: Dec 28, 2017 to Jan 7, 2018,” PJM Interconnection, Feb 26, 2018 and “2015 Winter Report,” PJM Interconnection, May 13, 2015

contributed between 5.2GW and 8GW or 31% and 50% of daily forced outage MW during those days.⁸ Given the potential for performance issues during cold weather events, even for facilities with on-site fuel storage, PJM should incentivize performance of “Fuel Secure” resources through bonus and penalty payments similar to its Capacity Performance construct.

6. PJM should include Pumped Storage Hydro (“PSH”) resources in its definition of “Fuel Secure” resources and account for their ability to store water (fuel) and replenish its water storage through pumping while providing fuel diversity and other important reliability benefits to PJM’s grid, such as quick start, fast ramp, and reliable regulation on a large scale. PSH resources do not rely on any fossil fuel to start-up and provide an available and ready source of energy and ancillary services, including Black Start, under peak load and other system (fuel-stressed) conditions. Unlike run-of-river hydro, PSH is able to operate even during low flow conditions due to its ability to store and pump water between the lower and upper reservoirs. They are also among the most reliable and resilient resources on the PJM system with some of the lowest EFORd’s.
7. While LS Power supports a market based solution as part of the capacity market to ensure resilience and fuel secure resources as being considered by PJM, LS Power believes that PJM needs to propose a market construct that provides for capital recovery of high cost, long-lead time investments necessary to support a fuel secure system. Given the high costs of conversion of gas-fired facilities to dual-fuel and long-lead time permitting required, a single year capacity clear for Fuel Secure resources

⁸ PJM should consider that during the analysis’ winter periods, over 20,000 MW retired increasing the reliance on natural gas fired resources and yet there were no reliability issues or Performance Assessment Intervals (Hours) during the same period.

may not be sufficient to secure the necessary investments in the system in addition to permitting and siting concerns⁹. PJM should ensure that recovery of capital and operating costs are supported by the market mechanism that is ultimately implemented.

8. In light of the FERC order on PJM's Capacity Repricing and MOPR-Ex proposals issued June 29, 2018 ("FERC Order"), PJM should consider how the FERC Order will impact its Fuel Security analysis and its proposed changes to the capacity market to implement Fuel Security provisions. Specifically, the FERC Order proposed potential revisions to the PJM capacity market to allow certain resources and load to operate outside the capacity market through a resource-specific version of PJM's Fixed Resource Requirement ("FRR"). As a result, a capacity market-based solution to Fuel Security may not be effective if resources and load are bifurcated into two different constructs – the PJM capacity market and resource-specific FRRs – and PJM may need to propose alternative mechanisms to procure and compensate Fuel Secure resources:
 - a. Fuel Security is being implemented to address Resilience issues and not Reliability issues. Therefore, it is a different product than Capacity and there is no need to change the Capacity Market to include a Resilience product.
 - b. Generator owners need a market construct that will allow them to reliably recover the capital-intensive, long-term investments in Fuel Security. While the PJM Capacity Market has been successful at attracting new plant investment to ensure reliability, PJM should consider alternate competitive processes to attract investments in Fuel Security. One such process is to emulate the Black

⁹ LS Power has determined that the cost of dual fuel conversions would require upfront costs in the range of \$100 - \$300/kW with an average of ~\$165/kW. There also are additional variable operating and maintenance and inventory carrying costs associated with dual fuel that need to be considered and recovered.

Start procurement which procures resources for a similar, low-probability, low-frequency, and high-impact events. PJM could conduct periodic RFP processes to procure the necessary investments in Fuel Security while assuring owners the recovery of their investment over the appropriate investment horizon. This is superior to the only 1-year revenue assurance provided by the PJM Capacity Market. It also recognizes the difference in the two products and doesn't complicate the price signals coming out of the Capacity Market.

V.

CONCLUSION

LS Power suggests PJM consider the comments above as they move forward with the Fuel Security analysis to ensure resilience of the PJM system in a competitive manner that will be least impactful to the current markets already in place.

LS Power appreciates the opportunity to comment on the Proposal and looks forward to continue to work with PJM to improve resilience and Fuel Security while creating the proper incentives to generation owners to make the necessary investments.