UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Grid Reliability and Resilience Pricing	)	**Docket No. RM18-1-000**

COMMENTS OF POTOMAC ECONOMICS, LTD.

Pursuant to the above-captioned Rulemaking initiated by the Federal Energy Regulatory Commission (the "Commission"), Potomac Economics hereby submits these comments. The Commission issued a Notice Inviting Comments on the proposed rule ("NOPR") on October 2, 2017 directing that comments on the proposed rule be submitted by October 23, 2017. The NOPR is in response to the directive issued on September 29, 2017 by the Secretary of the Department of Energy (DOE) direction that the Commission Issue Grid Resiliency Rules "requiring its organized markets to develop and implement market rules that accurately price generation resources necessary to maintain the reliability and resiliency of our Nation's bulk power system".[1]

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[1] Letter from Secretary of Energy, Honorable Rick Perry to Neil Chatterjee, Chairman, FERC, September 28, 2017, P.7.

As explained in the comments herein, Potomac Economics recommends that the Commission take a different approach to the resilience concerns raised by the DOE.

Potomac Economics is the Independent Market Monitor ("IMM") for the Midcontinent ISO ("MISO") and the external Market Monitoring Unit ("MMU") for the New York ISO ("NYISO") and ISO New England. In these roles, Potomac Economics is responsible for monitoring and evaluating the performance of each RTO/ISO's energy and operating reserve markets. We also are required to recommend market design changes to improve the performance of the markets and evaluate design changes proposed by the RTOs, market participants, or other parties.

The NOPR published in the Federal Register will likely impact one or more of the RTO/ISO markets we are charged with monitoring and evaluating. In addition, since all these markets are in the Eastern Interconnection, they will all be impacted by changes required in neighboring RTO markets. All three RTOs/ISOs in the Eastern Interconnection that we monitor have both Capacity and Energy markets and at least some resources that could qualify as resilience resources.

The generation mix in both ISO New England and NYISO is very different than that of MISO. Both NYISO and New England have high shares of natural gas-fueled resources and both these ISOs and their member Local Transmission Operators ("TOs") have historically been very active in analyzing and addressing fuel-security issues and both have special reliability requirements addressing fuel security. Nonetheless, the NOPR could substantially and adversely affect each of the RTO markets that we monitor as we describe in these comments.

I. NOTICE AND COMMUNICATIONS

All communications, correspondence, and documents related to this proceeding should be directed to the following persons and such persons should be placed on the official service list maintained by the Commission's Secretary for this proceeding:

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II. COMMENTS

The NOPR issued by DOE raises concerns that the electric system may not be adequately prepared to address conditions or contingencies that could result in extended power outages. Having articulated a general concern, the NOPR then calls for a very specific solution that will result in substantial out-of-market compensation for a very narrow class of generating resources.

The Commission's request for comments poses a wide array of questions that focus on many of the core issues underlying the need for the NOPR and the specific solution proposed by DOE. We provide the following comments organized by key areas or topics. Although these

comments address most of the questions posed by the Commission, we do not provide answers to individual questions.

A. Reliability and Resilience Requirements

The stated purpose of the NOPR is enhanced resilience and to ensure that certain resources deemed to enhance resilience do not retire. Resiliency is not defined in the NOPR but the DOE Staff Report defines resilience as:[2]

> *"Infrastructure resilience is the ability to reduce the magnitude and/or duration of disruptive events. The effectiveness of a resilient infrastructure or enterprise depends upon its ability to anticipate, absorb, adapt to, and/or rapidly recover from a potentially disruptive event".*[3]

While resilience as defined above arguably addresses other issues, the issues addressed by the NOPR are entirely reliability issues. Fortunately, RTOs are experts in addressing reliability issues, which generally involves:

- Defining contingencies that their systems must be prepared to address;
- Identifying the resources and system capabilities needed to address to contingencies;
- Translating these needs into specific reliability requirements; and
- Defining market requirements and products that embody the reliability requirements.

This approach allows the RTO markets to procure the resources necessary satisfy the system's reliability requirements at the lowest cost. The markets are extremely powerful in coordinating the myriad of decisions that must be made by market participants to invest in and maintain the resources and network facilities necessary to ensure reliability. We agree that there may be fuel supply contingencies or other contingencies that have not been fully considered by

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2 Department of Energy, Staff Report To The Secretary on Electricity Markets and Reliability (DOE Staff Report), August 2017.

3 DOE Staff Report, page 63.

RTO planners or by the North American Reliability Corporation ("NERC"), the organization that establishes reliability standards for the electricity industry. However, to the extent that these contingencies raise credible concerns, the process described above should be employed to specify market requirements that will address the concerns. To turn immediately to an out-of-market compensation scheme without considering the alternatives for addressing these issues through the RTO planning and market framework is both inefficient and ultimately unreasonable.

Therefore, we recommend that the Commission initiate a process to define the contingencies that DOE seeks to address through its NOPR. The NOPR does not provide details on the nature of the fuel-security contingencies or other contingencies it is seeking to address. Without first identifying in detail the contingencies and associated reliability risks to the system, there is no way to quantify a resilience requirements. Regardless of the approach the Commission chooses to adopt, out-of-market as proposed by DOE or an efficient market-based approach, no approach can be reasonably adopted without a quantified requirement the approach seeks to satisfy. Identifying the "resilience" contingencies is the first step in this process.

Once credible contingencies have been identified, it requires the expertise of planners and reliability analysts to determine the reliability requirements necessary to respond to the contingencies. Further, it requires the expertise of FERC, the RTO/ISOs, and the industry to develop changes in the market rules and products to set prices that reflect these requirements and facilitate market outcomes that satisfy the requirements.

Some RTOs have already been engaging in the types of analyses that would need to be performed to quantify a resilience requirement. For example, MISO and ISO New England have conducted planning studies related to fuel security. MISO's evaluations of the adequacy of the gas pipeline infrastructure found the MISO North and Central regions to be "favorably located at

the crossroads of pipeline corridors extending from many supply basins…with more than 20 interstate pipelines and significant gas storage resources."[4] Hence, MISO's potential exposure to natural gas supply contingencies is relatively low and the need for the payments called for under the NOPR is similarly low.

This conclusion may not hold in New York and New England, who are both more vulnerable to natural gas system contingencies. Fuel security concerns are not a new reliability issue for the RTOs in the northeast. These are issues that have been and will continue to be evaluated and addressed by planners in this region. It is highly unlikely that the proposal in the NOPR is a feasible or reasonable means to address these vulnerabilities. Reliance on dual-fuel capability (generally the ability to switch from natural gas to on-site oil), has been the most effective and cost-effective means to address natural gas system contingencies.

This illustrates the problems that arise when one starts with a very specific answer, rather than starting with a clearly defined issue or objective and allowing the markets to provide the most efficient answer. Given that the resilience concerns addressed by the NOPR are simply reliability concerns that the industry is well equipped to evaluate and address, we encourage the Commission not to adopt the premature prescription proposed by DOE.

B. Comments on Proposed Eligibility Criteria

As discussed in the preceding section, it is impossible to develop reasonable and efficient market rules or non-market mechanisms to address a reliability concern without first specifying the contingencies or conditions to be addressed. The NOPR specifies no clear contingencies (other than a discussion of the Polar Vortex that we address in the next section) or analytic support for its proposal, including the eligibility requirements.

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[4] Midcontinent ISO Fuel Assurance Report, FERC AD13-7, AD14-8, February 18, 2015, Page 6.

This is particularly important for the 90-day on-site fuel-security requirement. Absent clear credible contingencies or system conditions of concern, it is not possible to defend a 90-day requirement as reasonable versus a 30-day requirement or a 2-week requirement. In fact, we are not aware of a credible contingency that would support the 90-eligibility requirement:

- Major pipeline repairs have generally been completed within a few weeks;
- Extreme weather conditions typically last from 3 to 10 days. Even under the extremely unusual conditions during the Polar Vortex, the severe weather still only persisted for roughly one week, although they occurred more than once in January and February of 2014;
- On-site fuel supplies of oil or LNG can often be re-supplied within a few weeks;
- To the extent MISO has had long-duration fuel security-issues, the issues have been with coal supply limitations due to railway congestion.[5]

In fact, it is not clear that such a fixed duration criteria should be an eligibility requirement. In addition to the characteristics of the contingencies, the quantity and characteristics of the other resources in the region would play a key role in determining the resilience requirements. For example, some of the regions affected by the NOPR have substantial excess supply and are, therefore, inherently much more resilient. In these regions, compensating the NOPR's proposed resilience resources outside of the market would provide little if any reliability value.

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[5] In the summer of 2008 flooding in Midwest contributed to disruption of coal deliveries from the Powder River Basin to coal resources throughout the Midwest prompting coal-fired generation capacity restrictions. In the winter of 2014 coal deliveries to resources in Michigan were limited by barge navigation issues due to anomalous ice conditions on Lake Superior prompting coal-fired generation capacity restrictions. In the summer and fall of 2014 coal shipments from the Powder River Basin were limited by capacity and competition with Bakken crude oil deliveries prompting coal-fired generation capacity restrictions.

Additionally, there are a number of potential contingencies that would render the NOPR's proposed resilience resources as unreliable as other types of resources. For example, flooding, extreme weather, and other contingencies can cause a coal resource that meets the NOPR's on-site fuel eligibility criteria to be unavailable during a major power outage.

Therefore, we recommend that the Commission not adopt arbitrary eligibility criteria without first specifying the reliability concerns and contingencies it is attempting to address. This will allow FERC to leverage the power of the RTO markets to efficiently satisfy these concerns, rather than undermining the markets by initiating an out-of-market compensation scheme.

As discussed in the next section, the references to the Polar Vortex and other experience from recent storms as a primary basis for concerns would not obviously point to long-term fuel security as a primary cause for concern, and certainly not specifically 90-days. Nor would a survey of all the significant large-scale outages since 1965. Not one of these outages was impacted by lack of long-term fuel-security.

However, past may not be prologue and additional contingencies could be needed and evaluated. If evaluated and deemed to be credible, requirements should be developed by NERC/RTOs/RTOS/TOs. Once requirements are specified, experts such as FERC and the RTO/ISOs, TOs, and their stakeholders can prudently develop approaches to minimize the cost of meeting those requirements, which may, and likely would include market mechanisms.

C. Polar Vortex as Evidence of the Need for a New Resilience Product

The NOPR points to the 2014 Polar Vortex as exposing issues with resiliency. The fuel supply contingencies that arose during the Polar Vortex gave rise to extensive discussion and study among the affected RTOs and ISOs. In addition, NERC generated an outage assessment of

the Polar Vortex to create lessons learned and recommendations.[6] More recently, we have conducted a fuel security analysis in our State of the Market Report for ISO – New England. Below are summaries of the studies and findings of these analyses. We do not find that the results of any of these studies of the Polar Vortex support the specific proposed actions prescribed by the NOPR as we discuss in this section.

In both PJM and MISO during the Polar Vortex, natural gas fuel supply challenges generally fell into one of three categories:[7]

- In some cases, generators were able to obtain gas at very high prices, but offer price caps prevented the resources from full cost recovery, leading them to be unwilling to run (i.e., to take economic outages).
- Gas pipeline restrictions mandated that some gas-fired resources obtain "ratable takes" that severely limited the flexibility of their operations.
- Lastly, some gas-fired generation outages were due to the inability to obtain gas at any price, although we believe that this was rare based on our monitoring of the RTO markets during the Polar Vortex.

FERC has begun taking actions to address the first issue, which was the most prevalent problem. FERC has required that RTOs raise their offer caps and implement other settlement rule changes to ensure that resources can recover their costs of running during severe conditions and have the incentive to be available.

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6 North American Electric Reliability Corporation. Polar Vortex Review, (NERC Study), September 2014. http://www.nerc.com/pa/rrm/January%202014%20Polar%20Vortex%20Review/Polar_Vortex_Review_29_Sept_2014_Final.pdf

7 Kormos, Michael. PJM Response to Consumer Questions on 2014 Winter Pricing, September 2014. http://www.pjm.com/-/media/documents/reports/20140919-pjm-response-to-consumer-reports-on-2014-winter-pricing.ashx?la=en;

MISO. ENGCTF Issue Summary Paper: MISO and Stakeholder Polar Vortex Experiences with Natural Gas Availability and Enhanced RTO/Pipeline Communication, September 23, 2014. https://www.misoenergy.org/Library

Additionally, we observed that resources with dual-fuel capability generally switched to burn on-site oil inventories during the tight natural gas conditions that prevailed during the Polar Vortex. This capability allowed them to be available and operate reliably, to satisfy the needs of the system, and to profit from having invested in the dual-fuel capability. Although this capability was critical during the Polar Vortex, these resources would not qualify as resilience resources under the NOPR proposal.

In contrast, the resources that would qualify as resilience resources under the NOPR were not found to be essential during the Polar Vortex. MISO's study of the Polar Vortex included a scenario examining MISO's dependency on coal resources scheduled for retirement and whether MISO would have been able to satisfy system requirements without them. MISO's study concluded:

> *"the combined effects of high, weather-related gas restrictions and high coal retirements may pose reliability concerns. However, even under the worst-case-scenario conditions envisioned in the study — 8 GW of coal retirements coupled with weather-related restrictions on 90% of the gas-fired generation in MISO's footprint — MISO would be able to maintain grid reliability by utilizing its emergency procedures. Specifically, MISO found that it could successfully manage such worst-case-scenario conditions by declaring a "Maximum Generation Emergency Event Step 2" event, which would allow MISO to utilize the Load Modifying Resources, or LMRs, within its footprint."*[8]

The study highlights that existing market-based procedures were sufficient to manage the extreme weather conditions during the Polar Vortex and the associated fuel contingencies.

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[8] MISO. January 2014 Polar Vortex Analysis: Impact of Potential Generator Retirements and Natural Gas Availability, June 2014, p. 6.

Based on MISO's analysis, the market signals and emergency procedures were adequate to operate the system reliably.

MISO has continued to work on and refine its emergency pricing and offer cap rules in response to the Polar Vortex. The design goals are to send market signals that provide strong incentives for suppliers to provide electricity during fuel-related contingencies and for demand response to reduce consumption and help alleviate pressure on the grid. The high prices that result from emergency conditions and operating reserve shortages also provide valuable revenues to resources that have adequate fuel supplies during these contingencies.

In addition to MISO's study of the Polar Vortex, the outage data during the Polar Vortex similarly fails to support the NOPR's eligibility criteria. NERC's review of outages that occurred during the Polar Vortex found that while more than 55 percent of Polar Vortex outages were gas-fired generators, coal-fired outages constituted 26 percent of the total outages.[9] The NERC study identified contingencies that arose due to extreme cold that affected the coal units. The most notable issues were equipment failures by resources that were not designed for the extreme temperatures, particularly in the southern part of the United States.[10]

In our role as IMM for ISO New England, we also evaluated fuel supply contingencies and their impact on reliability in our *2016 Assessment of the ISO New England Electricity Markets*.[11] Overall, our analysis revealed the essential role that both oil inventories and LNG play in ensuring fuel supply adequacy in winter. Any major reduction in the availability of either LNG or oil inventories could result in energy shortages in 2024. Unlike natural gas, the supply

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9 NERC Study, p. 13.

10 Id. p. 19.

11 See 2016 Assessment of the ISO New England Electricity Markets, Section II.C. (https://www.iso-ne.com/static-assets/documents/2017/08/iso-ne-2016-som-report-full-report-final.pdf)

of these two fuels needs to be secured in advance, and they are stored on site. Although these resources are critical for responding to a major natural gas system contingency, they do not qualify as resilience resources under the NOPR.

While the NOPR focuses on fuel supply contingencies as its primary motivation, it also attributes the urgency of the rulemaking to recent events such as "the devastation from Superstorm Sandy and Hurricanes Harvey, Irma, and Maria".[12] In general, hurricanes are more likely to damage distribution and transmission systems and cause flooding at power stations,[13] impacting resource types in specific locations rather than certain fuel types. In other words, these contingencies will generally affect all resources is certain areas, regardless of fuel type, even the resources that qualify as resilience resources under the NOPR.

Noticeably absent from the NOPR are references to other weather-related contingencies that pose significant challenges to grid resilience, including:

- Ice storms that tend to destroy transmission elements,
- Wildfires that threaten the transmission system and generating resources,
- Droughts that affect the availability of cooling water, and river levels and temperatures, both of which can result in deratings or outages of resilience resources as defined under the NOPR; and
- Earthquakes that interfere with the safe operation of nuclear-powered generators.

In summary, the conditions and contingencies that occurred during the Polar Vortex do not support the NOPR proposal. Additionally, the NOPR does not identify or evaluate other credible contingencies that could potentially justify taking some actions to improve the reliability

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[12] Grid Resilience Pricing Rule, 82 Fed. Reg. 46,940 [Docket No. RM18-1-000; Notice of Proposed Rulemaking] (October 10, 2017).

[13] NAS Report, p. 62.

of the electric system, and it is highly unlikely that the specific directives proposed by DOE would constitute a reasonable and efficient strategy for addressing the contingencies.

D. The Role of Markets in Achieving Resilience and the Market Effects of the NOPR

In the 1999 Order No. 2000, FERC "strongly encourage[d] transmission owners to participate voluntarily in RTOs,"[14] recognizing that competitive, organized electricity markets provided "the benefits of lower prices and enhanced reliability."[15] Furthermore, FERC explicitly claimed that the benefits of RTOs and ISOs include "more efficient planning for transmission and generation investments,"[16] as market prices provide important signals that govern participants' long-run investment, retirement, and maintenance decisions. FERC recognized, as do we, that markets inherently address a host of unlikely contingencies that may occur, including fuel supply contingencies that the NOPR expressly attempts to address. The markets address many of the contingencies through planning and operating requirements that reflect the contingencies. Others are addressed through shortage pricing that promises substantial revenues for those generators that remain available during shortages caused by any contingency. In other words, the markets are designed to reward generators with on-site fuel that will remain available when contingencies occur that affect the supply of other fuels.

More broadly, the long-run economic signals that govern investment and allow existing resources to remain in operation include shortage pricing and revenues described above, energy and ancillary services revenues during non-shortage periods, and capacity market revenues. Together, these sources provide the "net revenues" existing generators receive in excess of their

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[14] 89 FERC ¶ 61,285 [Docket No. RM99-2-000; Order No. 2000] Regional Transmission Organizations (December 1999).

[15] Id. p. 3.

[16] Id. p. 89.

production costs that must be sufficient to cover their going-forward costs ("GFCs"). Due to low energy prices in recent years, baseload resources have had to increasingly rely on revenues from shortage-pricing periods and capacity markets to cover their GFCs. In well-functioning markets, the revenues from shortages and capacity markets should be sufficient to signal when these generators are no longer needed and where new investment is warranted.

Market design issues in some markets, however, can impair price formation and cause baseload resources that are needed to not cover their GFCs. This can cause them to retire prematurely and undermine reliability. Fundamental problems in the design of the capacity market in MISO, for instance, have substantially reduced the net revenues of coal-fired and nuclear resources.[17] This has caused some to announce retirements and others to export their capacity to neighboring markets. In a case like this, the best approach is to address the market design and price-formation issues to provide better incentives to all resources that are contributing to the resilience of the electricity system, rather than to circumvent the market in the manner proposed in the NOPR.

In addition to improvements in the capacity market, we have recommended changes in MISO's shortage pricing by improving the operating reserve demand curve. This improvement would involve basing the slope of the curve on the probability of losing load at different reserve levels and increasing the assumed Value of Lost Load ("VOLL") to better reflect the actual value of keeping the lights on. Together, these changes would provide better price signals when MISO enters shortage conditions and more revenues for resources that continue to serve the load during the shortages.

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[17] The most notable flaw in the MISO capacity market is that the demand for capacity in the planning resource auction does not reflect the reliability value of the capacity. To remedy this flaw, MISO must implement a sloped demand curve the reflects the rising value of capacity as the capacity margin falls.

Making these changes to ensure that the markets provide efficient revenues and incentives to key resources needed to maintain the reliability of the electric system is extremely important. Additional improvements could be contemplated that would address specific resilience objectives or contingencies. In making these changes, the markets become a powerful tool for achieving these objectives at the lowest cost.

The Adverse Effects of the NOPR on Markets

In sharp contrast, pursuing objectives that change the supply and demand outside of the markets will undermine and potentially destabilize the wholesale electricity markets. In the short run, significant changes in supply resulting from government intervention will substantially affect prices and revenues for all other generators in the market. Energy and capacity market prices will be artificially depressed if uneconomic supply is retained, which can be extremely damaging to existing resources that are not subsidized.

Beyond these short-term market disruptions, the out-of-market intervention will likely have more damaging effects on the market in the long-term. Markets must facilitate long-term investment, retirement and maintenance decisions. The market disruption of the intervention will raise regulatory risks associated with all of the long-term decisions listed above. In other words, investors and other market participants may no longer respond efficiently to the market signals because of the risk of future out-of-market intervention. Ultimately, this promises to raise prices for consumers by eroding the core benefits of competitive electricity markets.

Lastly, the NOPR includes no assessment of costs or benefits of the proposed mandates. All reliability standards and RTO markets recognize that the value of reliability is not infinite. The question of how to value reliability and how cost should be incurred to address a given contingency is a difficult and complex question. Ideally the answer to this question should be guided by the VOLL, which reflects the value of electricity to consumers or their willingness to

pay to keep the lights on. Sound planning and market design should not procure additional reliability at costs that exceed electricity customers' VOLL.

The NOPR's government-mandate to guarantee full cost recovery of selected resources that may be economic to retire will likely generate costs that vastly exceed any reasonable estimate of VOLL. At the same time, the NOPR may degrade reliability by causing unsubsidized resources to retire prematurely and retarding new investment in generating resources.

Oversight and Other Issues

The DOE Staff Report quotes the Congressional Research Service as stating "the service life of coal-fired generators reportedly 'averages between 35 and 50 years, and varies according to boiler type, maintenance practices, and the type of coal burned, among other factors.'"[18] The report further states that the average age of existing coal-fired plants in 2016 was 38 years.[19] This means that on average, the primary class of resources that the NOPR proposes to guarantee full cost recovery and a reasonable rate of return are already well into their expected life spans. Given the average age of that class of resources, it is likely that hefty capital expenditures will be incurred to extend the operation of the resources. Consumers will be burdened with increasingly expensive projects, and it is unclear from the NOPR who would oversee and approve the expenditures.

In the worst case, aging coal and nuclear resources could essentially be rebuilt from the ground up at existing locations, even when the generation is not needed and exists in pockets of oversupply. Full cost recovery mutes any value that locational pricing provides, and this could

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[18] DOE Staff Report, pp. 22-23.

[19] Id. p. 23.

have the unintended effect of preventing resources that are actually harmful to the system, based on their location, from retiring.

Finally, the full cost recovery proposed in the NOPR is unreasonable. A generator in the market need only recover its going forward costs to have the incentive to remain in operation. All other costs are sunk and not relevant to the decision to retire. In other words, these sunk costs cannot be avoided. Compensation in excess of GFCs should be provided by the market based on the value a resource is providing to the system.

III. CONCLUSION

As the market monitor for a number of the markets that could be adversely affected by the NOPR, we have profound concerns about the mandates it contains. As described in these comments, very little support is provided for the mandates in the NOPR, although it does raise resilience concerns that merit evaluation. If credible contingencies can be identified that are not currently being considered or addressed by the RTOs through their markets, new reliability requirements and associated market requirements could be defined that would allow the markets to price and efficiently satisfy the requirements. This process would likely require the expertise of NERC, FERC, and RTO/ISOs, and the transmission owners.

As described in these comments, attempting to address resilience concerns by subsidizing a narrow class of generators through out-of-market compensation is costly, likely to not be very effective, and will likely undermine the RTO's wholesale markets and the substantial benefits they provide. Such an approach cannot be either just or reasonable.

Therefore, we urge the Commission to reject the specific proposal advanced by DOE in the NOPR and, instead, begin a process to identify the credible contingencies that the current RTO planning processes and markets may not be fully considering. The RTOs will then be in a position to specify any new reliability requirements and objectives that are reasonable. By

allowing the markets to facilitate the innovation and long-term decisions necessary to achieve these resilience objectives, the RTOs can achieve greater reliability improvements a much lower cost.

Respectfully submitted,

/s/ David B. Patton

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CERTIFICATE OF SERVICE

I hereby certify that I have this day e-served a copy of this document upon all parties listed on the official service list compiled by the Secretary in the above-captioned proceeding, in accordance with the requirements of Rule 2010 of the Commission's Rules of Practice and Procedure (18 C.F.R. § 385.2010).

Dated this 20th day of October 2017 in Fairfax, VA.

/s/ David B. Patton

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